FINAL

ATLANTIC HERRING FISHERY MANAGEMENT PLAN

Incorporating the

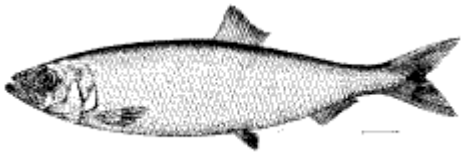
ENVIRONMENTAL IMPACT STATEMENT

and

REGULATORY IMPACT REVIEW

(Including the Regulatory Flexibility Analysis

Volume I



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Draft EIS submitted by NEFMC: June 2, 1998
Final document submitted by NEFMC: March 8, 1999

1.0 Executive Summary

The New England Fishery Management Council (Council, NEFMC) proposes management measures for the Atlantic Herring (*Clupea harengus harengus*) Fishery Management Plan (FMP). These measures are prepared under the authority of the Magnuson-Stevens Fishery Conservation and Management Act. They have been closely coordinated with the Atlantic States Marine Fishery Commission (the Commission, or ASMFC), which is developing complementary measures to manage herring within state waters, and the Mid-Atlantic Fishery Management Council (MAFMC).

The Atlantic herring management unit is defined as all Atlantic sea herring within the U.S. territorial sea and Exclusive Economic Zone (EEZ). The herring resource is in an under-exploited state. Estimates of current stock size are based on the most recent fully–reviewed assessment (NEFSC 1998a) which estimated the 1997 biomass at 2.9 million metric tons (mt) and the spawning stock biomass at 1.8 million mt. The maximum sustainable yield (MSY) for the Atlantic herring coastal stock complex is estimated as 317,000 mt (including Canadian Georges Bank and New Brunswick fixed gear harvest). There is considerable uncertainty, however, about current stock size which could be overestimated. These estimates of a large exploitable biomass have increased commercial interest in developing this fishery, but there are concerns that specific spawning components (notably the Gulf of Maine component) may be unable to sustain current or increased fishing pressure.

The maximum fishing mortality established by this FMP is $F_{Threshold}$=0.30. The minimum biomass level is established as 1/2 the biomass at MSY, or approximately 500,000 mt. This FMP establishes a target fishing mortality of 0.28 when total biomass is larger than biomass at MSY. When biomass is less than the biomass at MSY, the target fishing mortality will be determined based on a five year rebuilding schedule.

The primary management measures recommended include: (1) the adoption of a Total Allowable Catch (TAC) for the herring fishery and distribution of the TAC across time and area (2) closure of the directed herring fishery in an area when the TAC is reached (3) effort controls to limit catches as a TAC is approached (4) the permitting of all participating vessels, operators, dealers, and processors (5) mandatory data reporting for all licensed vessels, dealers, and processors (6) restrictions on size of vessels allowed in the fishery (8) spawning area closures (9) restrictions on joint venture processing activities, (10) adoption of an overfishing definition, and (11) designation of essential fish habitat.

The FMP will allow for the development of a sustainable fishery that targets the entire herring resource. Overfishing will be prevented through the use of effective management controls as the fishery develops. An annual scientific review of the resource will allow for adjustments to the fishery as a result of fluctuations in stock size.

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2.0 History and Purpose of the FMP

2.1 History of Prior Management Actions

Management of U.S. Northwest Atlantic sea herring stocks beyond territorial waters commenced in 1972 through the International Commission for the Northwest Atlantic Fisheries (ICNAF). The international fishery was regulated by ICNAF until U.S. withdrawal from the organization in 1976 with Congressional passage of the Magnuson Fishery Conservation and Management Act (MFCMA). Under the aegis of the MFCMA, the New England Fishery Management Council (Council) developed a fishery management plan (FMP) for sea herring which was approved by the Secretary of Commerce and was implemented on December 28, 1978. Over the interim period (1976-1978) foreign fishing for sea herring in U.S. waters was regulated through a preliminary management Plan (PMP) prepared by the National Marine Fisheries Service (NMFS).

The international fishery for adult herring in the Gulf of Maine began in 1967, principally by the U.S. and Canada with minor catches by the Federal Republic of Germany and the German Democratic Republic during the period 1969-1975. Catches averaged 38,500 mt from 1969 to 1972 as the accumulated stock was heavily exploited by small side trawlers using otter trawls and by purse seiners. Prior to 1975, the fishery primarily targeted spawning fish on spawning grounds in the Jeffreys Ledge – Cape Ann area. Subsequently, reduced catches ranging from 16-24,000 mt through 1979 were taken exclusively by U.S. vessels, including a newly developed pair-trawling system that exploited overwintering and migrating herring on grounds expanded into Massachusetts Bay and the Cape Cod area.

Under management by ICNAF, total allowable catch (TAC) from the Gulf of Maine stock was steadily reduced from 30,000 mt in 1972 to only 7,000 mt in 1976 and 1977. Consistent catch overages occurred however, throughout the period, reducing spawning stocks to low levels such that the fishery became heavily dependent upon the strength of recruiting year classes.

The Georges Bank herring fishery began in 1961 with the USSR taking 68,000 mt with extensive use of gill nets during the first three years of the fishery. Purse seines were later introduced by the USSR and were used from 1968 until the fishery collapsed in 1977. Subsequently, a number of other foreign distant water fleets entered the fishery, most notably the German Democratic Republic, the Federal Republic of Germany and Poland, with catches building rapidly to 374,000 mt in 1968, averaging 283,000 mt from 1967 to 1971. The dominant gear types used in the fishery were large, bottom tending otter trawls deployed from side and stern trawlers until the German Democratic Republic introduced mid-water trawlers in 1971 (Anthony and Waring, 1980).

The history of Georges Bank herring management under ICNAF was characterized by catch quotas which were influenced more by considerations of social disruptions and short term gains than by conservation (Anthony and Waring, 1978). The Commission typically selected the highest catch options provided by assessment scientists and in some cases specified catch quotas one to three times higher than recommended amounts. The result of this policy was that the Georges Bank and Gulf of Maine spawning stocks were reduced to low levels with the expectation that

recruitment would also remain low with potentially disastrous consequences for the fishery and the resource (Clark and Anderson, 1977). The TAC recommended by assessment scientists to the Commission for Georges Bank never exceeded 150,000 mt with the range of options being as low as 50,000 mt. Despite the advice that catch levels should remain in the range 100,000-150,000 mt, provided that a minimum stock constraint of 225,000 mt was met, the allocations approved by the Commission totaled 150,000 mt from 1972 to 1975 even though stock sizes were plummeting to only 65,000 mt (age 4+) in 1975 (Anthony and Waring, 1980). The concern for the future of the resource was so great that scientific advice in 1977 was a zero quota for the Gulf of Maine and 50,000 mt or less for Georges Bank, with only 8,000 mt being recommended for Georges Bank in 1978.

The Sea Herring FMP developed by the Council and implemented on December 28, 1978 sought to manage the Gulf of Maine and Georges Bank adult herring stocks so as to achieve levels of spawning biomass providing continued and relatively stable recruitment. The second objective of the FMP was to manage the Gulf of Maine juvenile herring resource to stabilize and rebuild the sardine industry.

The FMP accepted the ICNAF recommendation of 60,000 mt as the minimum biomass for the Gulf of Maine spawning stock. In the context of the estimated level of spawning stock at the beginning of 1978 of only 68,000 mt, the assessment scientists recommended a 10-year rebuilding schedule whereby annual catches of adult herring (age 3 and older) would initially be restricted to only 1,000 mt so as to achieve an optimum spawning stock size of 100,000 mt. With regard to the Georges Bank resource, ICNAF had recommended a minimum stock constraint of 225,000 mt and an optimum stock size of 500,000 mt. The assessment had indicated that the spawning stock size of 1978 was at least 200,000 mt and that catch levels in the range of 16-26,000 mt in 1978 would result in a spawning stock slightly above the minimum constraint at the beginning of 1979. With the same level of recruitment, and catches remaining in the same range, the stock could be rebuilt at a rate of about 10% per year.

The Council decided to delay rebuilding the Gulf of Maine adult herring resource until at least 1980, choosing instead a maintenance strategy to minimize adverse impacts on the fishing industry. The initial optimum yield (OY) for the Gulf of Maine stock was set at 8,000 mt for the 1978-1979 fishing year, recognizing recent catch levels of adult fish along the coast of Maine but stipulating that such catches should not exceed 7,000 mt. Optimum yield for the Georges Bank stock (1978-1979 fishing year) was set at 10,000 mt. These OY's were split between a winter-spring fishery (December-June) and a summer-fall fishery (July-November) in recognition of information regarding migratory movements of herring recently acquired from tagging studies. Thus, the winter-spring quota in the Georges Bank and South region was only 2,500 mt to minimize impacts on Gulf of Maine fish which overwinter with Georges Bank fish in the Southern New England area. The summer-fall quota in the region was set at 7,500 mt. OY in the Gulf of Maine was evenly split, 4,000 mt in the winter-spring fishery and 4,000 mt in the summer-fall fishery.

The Sea Herring FMP was initially implemented as emergency regulations on December 20, 1978, becoming final regulations effective on March 19, 1979. Amendment #1 to the FMP, published as emergency regulations (reflecting the Council's concern to remain abreast of conditions in the

fishery) on March 28, 1979 (final regulations published on June 26, 1979), was intended to clarify the Council's policy with regard to the quota-setting mechanism for the Georges Bank and South winter-spring fishery. Based on the fact that all of the herring tagging studies had indicated that no Gulf of Maine fish migrate further south and west of the area of Montauk Point, NY, Amendment #1 stipulated that all fish taken west of 71° 50' W. Long. would be counted against the relatively large Georges Bank and South summer-fall quota. Through this action the Council was encouraging fishermen to concentrate fishing pressure on the Gulf of Maine stock wherever found during seasonal migrations.

Amendment #2 to the FMP, implemented under emergency regulation on July 1, 1979 (published under final regulations on September 28, 1979) at the beginning of the 1979-1980 fishing year, extended the OY's and the summer-fall and winter-spring quotas, as established in the FMP. Simultaneously, the Council was engaged in preparation of Amendment #3. Recognizing deficiencies in the scientific basis to the previous stock assessments and the scheme for apportioning seasonal allocation of adult fish by management area, the Council formed a Regional Herring Assessment Working Group to address management of the entire herring resource. The resulting "pooled" assessment of the total herring resource formed the basis for substantial increases in optimum yield and for major changes in the area/period allocation scheme. Perhaps the most significant provision of Amendment #3 was a redefinition of the management unit to include all adult (age 3 and older) herring fisheries from the shoreline of the New England and Mid-Atlantic states out to the limit of the U.S. EEZ. Previously, the adult herring caught in territorial waters of the state of Maine were not explicitly counted against the Gulf of Maine quota. Amendment #3 specified OY's of 30,000 mt for the Gulf of Maine adult fishery and 15,000 mt for Georges Bank and South. Moreover, Amendment #3 subdivided the Gulf of Maine annual quota of adult fish between a traditional "juvenile" fishery (north of Cape Elizabeth) and a traditional "adult" fishery (south of Cape Elizabeth), specifying a 35% - 65% split between the two areas, respectively. Amendment #3, which also specified an area/period allocation system somewhat more complex than that which was modified in Amendment #1, was implemented on August 27, 1980.

Prior to final implementation of Amendment #3, however, the NMFS Regional Director was obliged to close the Gulf of Maine adult fishery on October 1, 1979, when landings reached 17,000 mt (exceeding seasonal quota by 13,000 mt). In retrospect, the original 8,000 mt annual quota (4,000 mt seasonal quota) may have been overly restrictive (in light of the "pooled" assessments which indicated a 30,000 mt OY). Certainly, the assumption that no more than 7,000 mt of adults would be taken in the juvenile fishery along the coast of Maine was tested and found to be wanting. Moreover, the incentives offered by Amendment #1 to shift fishing effort to waters west of 71o 50' W. Long. (i.e., away from Gulf of Maine fish) proved to be ineffective for two reasons. The extent of the collapse of the Georges Bank resource was underestimated by ICNAF. By accepting the final assessment advice provided by ICNAF, the Council compounded the error. Secondly, the Council underestimated the resistance by industry to reduce its dependence on the traditional adult fishery in the Jeffrey's Ledge area.

A far more serious concern to the Council, however, was the regulatory ambiguity associated with catches of adult herring in state waters in the Gulf of Maine. The Maine sardine packers have traditionally employed small purse seiners taking mainly three year old fish to make up any

shortfall in fixed gear catches of two year olds to achieve the total contracted pack. Thus, availability of two year olds plus the world herring market conditions were major factors driving catches of adult fish in the state waters of Maine. Maine regulatory agencies would be very reluctant to enforce catch limitations promulgated by federal agencies since to do so would involve closing down the operation of packing plants which often represented the sole source of employment in many small communities. Despite considerable effort to arrive at an equitable solution to the problem, the Council was unable to resolve the problem. Moreover, Massachusetts fishermen, experiencing higher fish availability than was suggested by the very restrictive catch quotas, and observing apparent wholesale quota busting in Maine waters, were able to bring sufficient pressure to bear on the Massachusetts regulatory agencies such that the latter declined to enforce the quotas in state waters.

Observing an increasingly chaotic situation, NMFS held hearings in May, 1981, to consider whether the Secretary of Commerce should rescind all or portions of the Sea Herring FMP, implement a Secretarial amendment, preempt state management authority, or take no further action. Subsequently, the NOAA Assistant Administrator for Fisheries (AA) requested that the Council develop an amendment by July 1, 1982, which addressed the major flaws in the FMP. It was clear to most observers that catch restrictions were unenforceable. NMFS also asserted that the FMP violated several of the National Standards. In the event, the Council was unable to meet the AA's request. On September 28, 1982, the Department of Commerce announced its initial determination to withdraw Secretarial approval of the Sea Herring FMP and repeal all implementing regulations. Concomitant to this action, sea herring was placed on the prohibited species list, eliminating directed fisheries for sea herring by foreign nationals within the U. S. EEZ and requiring that any herring bycatches by such vessels be discarded.

In the midst of this controversy, fisheries officials from the states of Maine, New Hampshire, Massachusetts, and Rhode Island began a series of meetings on March 12, 1982 to discuss development of an interstate herring management plan. It was recognized that with the fishery occurring predominately in state waters, it was critical that all of the herring-producing states fully embrace an agreed management program. The lack of such a commitment by the states proved to be the most significant flaw in the Sea Herring FMP. The Atlantic States Marine Fisheries Commission (Commission) represented a potential vehicle for production of an interstate herring management plan. However, it was decided that Maine and Massachusetts, with consultation from the other two states, could most expeditiously produce a new plan. That effort was commenced on October 25, 1982 with formation of a Plan Development Team (PDT) tasked with creation of a draft document by April 1983.

The final draft of the "Interstate Sea Herring Management Plan of Maine, New Hampshire, Massachusetts, and Rhode Island" (Plan) was presented by the PDT on November 28, 1983. The Plan was based on one objective and two sub-objectives. These were:

> "To acquire information that will allow development and facilitate implementation of management approaches designed to minimize prospects of a collapse of herring stocks on which New England fishermen depend.
>
> - To protect spawning herring.

- To promote complementary management of all components of sea herring fisheries throughout the range of the stocks of interest to U. S. fishermen, including relevant Canadian waters."

The plan deliberately chose not to embrace the conservative management espoused by the Council's FMP through disenchantment with the state of knowledge of quantitative herring stock assessment. Both the states and the industry had observed lost opportunities in the world herring market in 1979 and 1980 when the NMFS Regional Director was obliged to close the fishery as quota overages occurred. Yet, in retrospect, if more accurate resource assessments had been available, the resulting higher allowable harvest levels might not have necessitated fishery closures. The Plan also rejected quota management due to the issues associated with fairness between the adults and juvenile fisheries. The Plan asserted that barring development of fish recruiting to the juvenile fishery, these issues would continue to undermine concerted action by the states which was critical to successful quota management.

The primary management measure implemented by the Interstate Sea Herring Management Plan was a system of spawning closures. The rationale for a prohibition on fishing during the spawning period was based on a widely held concern that unrestrained fishing on spawning aggregations of pelagic species such as sea herring may lead to stock collapse. The dense schooling behavior of herring immediately prior to and during spawning make fish extremely vulnerable, especially to gear such as pair trawls and purse seines, leading to very excessive levels of fishing mortality. Moreover, with disruption of normal behavior patterns, surviving fish may not necessarily spawn successfully. Accordingly, the Interstate Plan specified that spawning closures be instituted, as appropriate, and that such closures be in the form of fixed periods in time, on an annual basis, or could be based on measured biological criteria. If a state opted to take the former route, the most appropriate period of time was judged to be the 3-week period, October 1-31 for the Jeffreys Ledge spawning area; if the latter, a spawning closure would be declared when the weight of the gonad in adult female herring reaches 18% or more of the total weight of the fish.

An additional important provision of the Interstate Plan was that the Plan Development Team would continue to meet on an annual basis after plan implementation to conduct resource assessments and formulate recommendations regarding Plan amendments, as needed, reporting such activity to the states and to the Council. As part of the consultative process, the PDT also would endeavor to promote cooperative arrangements with Canadian management authorities and assessment scientists.

By 1992, the Interstate Herring Management Plan was no longer adequate to manage herring throughout its range. There was a dramatic increase in the numbers of adult spawning herring on historical spawning grounds on Nantucket Shoals and Georges Bank. This resulted in an increased abundance of herring in coastal waters of southern New England and the Mid-Atlantic states. This stimulated interest in Internal Waters Processing (IWP) operations in Rhode Island, Massachusetts, and Maine, and resulted in increased herring bycatches in the mackerel fishery. Increased numbers of adult herring on Georges Bank provoked interest by the Canadian purse seine fleet for an additional source of roe herring for the Japanese market. Concern grew that development of new markets could lead to an uncontrolled exploitation at a time when the

offshore spawning population was still recovering from heavy foreign fishing pressure.

At the same time, the catch of adult herring in the Gulf of Maine increased as well, in part due to a growth in IWP operations in Maine and Massachusetts. There was a significant, continued shift to mobile gear for a much larger percentage of the catch as juvenile fish became scarce in near shore waters. An increased demand for bait in the burgeoning lobster fishery also helped shift the fishery to a predominantly adult fishery. The fishery shifted from one in which the bulk of the catches were made in state waters to the majority of the catch being taken in federal waters.

The Council and the ASFMC began joint efforts to adopt a new FMP to address these concerns. A joint planning effort was begun that focused on improving the IWP allocation procedure, but also identified the necessity for improvements in US/Canadian cooperation in herring management and the need for better scientific information (particularly with respect to individual stock assessments). It was also recognized that as a trans-boundary stock, both the U. S. and Canada would benefit from the development of complementary management measures. Unfortunately, because of more immediate concerns with the management of groundfish in New England, the Council removed itself from the planning process for the FMP.

The Commission, however, adopted a new fishery management plan in March, 1994. The Commission adopted the following goals and objectives:

> "The goal of this management plan is to manage Atlantic herring as an inter-jurisdictional resource in U.S. Atlantic coast waters for sustained optimum utilization while conserving the resource through complementary management between the New England and Mid-Atlantic Fishery Management Council, the U. S. Atlantic coast states, and Canada in a manner which will provide the greatest benefit to the nation.
>
> The objectives are:
>
> 1) To maintain the U.S. northwest Atlantic sea herring resource at or above 20 percent of its maximum spawning potential for optimum utilization while reducing the risk of stock collapse;
>
> 2) To promote U.S. and Canadian cooperation in order to improve herring assessment procedures and to establish complementary management practices.
>
> 3) To promote research and improve the collection of information in order to better understand the herring population dynamics, biology, and ecology, and to improve assessment practices;
>
> 4) To provide adequate protection for spawning herring and prevent damage to herring egg beds;
>
> 5) To avoid patterns of fishing mortality by age which are inconsistent with the goal;
>
> 6) To establish complementary management of all components of the fishery throughout

the range of the species in U. S. waters of the northwest Atlantic;

7) To promote the utilization of the resource in a manner which maximizes the social and economic benefits to the nation;

8) To promote recovery of the Atlantic herring resource on Georges Bank and to control development of the fishery.

The Commission FMP established three management areas within the U. S. waters of the northwest Atlantic. A procedure was established to annually assess the coastal stock complex and estimate the total adult surplus biomass available for harvest. This procedure included a recommendation on how much of the surplus to hold in reserve and how much to allocate to IWP's. The FMP continued the practice of closures to protect spawning herring (ASMFC, 1994). Because of the lack of a federal plan, however, there was no opportunity for Joint Venture activities in the EEZ.

In 1995, the NMFS implemented a Preliminary Management Plan to regulate joint venture activities in the EEZ. There were indications that the offshore component of the stock was continuing to grow, coupled with concerns over the fairly intense fishing pressure on inshore stocks. The goal of this PMP was to allocate surplus biomass for joint venture utilization in federal waters without depleting the stock or jeopardizing individual spawning components within the stock, in a manner consistent with the Commission FMP. The PMP adopted the Commission definition for overfishing, adopted the three management areas, and established an allocation procedure. Joint venture processing was prohibited in Area 1. Observer and data reporting requirements were adopted for foreign vessels (NMFS, PMP for Atlantic Herring, 1995).

In 1995, the historic practice of transporting U.S. caught herring to Canada in Canadian flag herring carriers came to the attention of fisheries managers. This practice was used to ease shortages of raw materials for sardine canneries on both sides of the border. Technically, the transport of such herring was a foreign fishing activity regulated by the Magnuson Act and subject to the requirements for a governing international fishery agreement between the two countries. This issue was addressed in a provision of the Sustainable Fisheries Act (P.L. 104-297) passed in October, 1996. NMFS was authorized to issue up to fourteen permits to Canadian vessels that would transport U.S. caught herring from identified areas within 12 nautical miles of the Maine coast. In 1997, fourteen permits were issued, and in 1998 a total of 13 permits were issued for this activity.

The Commission and the Council also began to develop a new management plan for herring in 1996. Evidence of the recovery of the George Bank spawning stock, coupled with increased landings from the Gulf of Maine, increased interest in the controlled development of the fishery. Rather than develop a joint FMP, the Council and the Commission decided that the most flexible way to manage the fishery was for the Council to develop an FMP for federal waters, and the Commission to develop an amendment to its existing Atlantic herring management plan for state waters. Recognizing the importance that the two plans complement each other, the Council and the Commission worked closely in developing these two documents. The Council's Herring Oversight Committee and the Commission's Atlantic Herring section met in joint sessions to

discuss proposed management measures. In addition, both the Council and the Commission adopted the same panel of industry advisors, and the Plan Development Teams (PDT) of both bodies were identical and held all their meetings together. This proposed management plan is the result of the joint process begun in 1996.

In early 1997, the Council and Commission became aware of interest from large factory trawler owners in exploiting the herring resource. This led the Commission to adopt an emergency action to prohibit the landing of herring by vessels over 165 feet in length and/or 3000 horsepower and to prohibit the directed mealing of herring. The Council passed a motion supporting the Commission's action and addressed the issue during development of the management plan. One vessel, the F/V *Atlantic Star*, obtained a letter of authorization necessary to use a mid-water trawl to fish for herring in the Gulf of Maine or Georges Bank. Congress also addressed this issue in the NMFS appropriations bill for fiscal year 1998, restricting the agency from using its funds to issue permits or other authorization letters to vessels over 165 feet in length, 750 GRT, and 3,00 shaft horsepower. This bill required NMFS to rescind the letter of authorization it had issued to the *Atlantic Star*, which had not yet begun to fish. The exact impact of the legislation was open to several interpretations. While it clearly prevented NMFS from issuing a permit to large vessels to fish for mackerel, or the required letter of authorization to use a mid-water trawl for herring on Georges Bank and the Gulf of Maine, it was uncertain whether it also prevented the *Atlantic Star* from fishing for herring in area outside the Gulf of Maine or Georges Bank or from processing herring, since at the time there were no existing permit requirements for either of these activities. In any case, the Commission's emergency action, implemented through state legislation, limited the ability of the Atlantic Star to land herring in the coastal New England and mid-Atlantic states.

The language that restricted NMFS from issuing permits to large domestic vessels to fish for mackerel or Atlantic herring was also included in the appropriations bill for fiscal year 1999 (P. L. 105-277). In addition, Title II of this law adopted the American Fisheries Act which, among other provisions, placed additional restrictions on the ownership and documentation of fishing vessels. This Title includes a revision to documentation laws such that vessels greater than 165 feet in registered length, of more than 750 gross registered tons, or that have more have 3,000 shaft horsepower cannot receive a certificate of documentation and a fishery endorsement except under certain conditions. One of these conditions is that the owner must demonstrate that the regional fishery management council of jurisdiction has recommended, and the Secretary of Commerce has approved, management measures that allow such a vessel to be used in fisheries under the Council's authority. Another provision allows vessels that received a fishery endorsement prior to September 25, 1997, to retain that endorsement.

2.2 Purpose and Need for Action

The Council has reviewed the status of the Atlantic herring resource and the condition of the industry which utilizes this resource. The Council determined that sufficient management problems exist to warrant the development and implementation of a complementary federal and interstate program for conservation and management. This review and decision were coordinated with the Atlantic States Marine Fisheries Commission (Commission) and the Mid-Atlantic Fishery Management Council (MAFMC).

The U.S. Atlantic herring fishery is currently managed as one stock complex along the East Coast

from Maine to Cape Hatteras although there is evidence to suggest there are at least two separate biological stocks. Generally, the resource has been divided into an inshore Gulf of Maine (GOM) and an offshore Georges Bank (GB)/Nantucket Shoals (NS) component. The most recent fully reviewed assessment (NEFSC, 1998) concluded that the abundance of the coastal stock complex in 1997 was 2.9 million (mt) while the estimate of spawning stock biomass (SSB) was 1.8 million mt. The current level of abundance has generated competing interests in new and expanded sectors of the herring fishery.

The herring resource is in an under-exploited state and there is increasing commercial interest in developing this fishery. There are, however, concerns that specific spawning components (notably the Gulf of Maine (GOM) component) may be unable to sustain current or increased fishing pressure over the long term. There is also concern that uncontrolled exploitation of this stock may lead to a stock collapse in the future, similar to the collapse experienced on Georges Bank after intense foreign fishing pressure in the mid-1970's. The primary issue facing this FMP is to manage the herring resource in such a way that development of the fishery continues without damaging any specific spawning components.

Absent implementation of this FMP, there is a distinct risk that increased fishing pressure may harm specific spawning components. Reported catches of herring have increased steadily over the last three years, from 53,000 mt in 1994 to 104,000 mt in 1996. The bulk of this catch (84,000 mt in 1996, 70,171 mt in 1997) has been taken from the Gulf of Maine spawning component. While this level of fishing pressure can be supported in the short term due to exceptional stock sizes, if continued over time it will lead to overfishing of the stock and a possible stock collapse. Recent history provides an example: overfishing on Georges Bank in the 1970's led to the complete failure of that fishery for over ten years. Because of the critical nature of this resource for coastal communities and as a prey species, the Council wants to implement controls to ensure its continued viability.

At the same time, the recovery of herring stocks on Georges Bank presents an opportunity for an expanded fishery. With pressure on other species leading to increased regulation, a Georges Bank herring fishery may provide increased economic opportunity for fishermen in those fisheries. Either through directed fishing, joint ventures, or internal waters processing operations, an expanded herring fishery may insure the economic survival of these fishermen until other stocks can be rebuilt. It may also provide an opportunity for the further development of shoreside processing capability and development of the ability to enter the human consumption herring export market for food production

Management of sea herring is complicated by the limited information available on some herring aggregations, and on the mixing of herring spawning components. There is a need for improved scientific information on these issues in order to correctly manage the resource. This FMP identifies specific resource priorities and urges close cooperation between U.S. and Canadian authorities. In addition, through the adoption of mandatory reporting of catch and landing information by fishermen and dealers, a strong base will be laid for future management efforts.

Section 314(c) of the Magnuson-Stevens Act directs the New England Fishery Management Council to develop a fishery management plan for any underutilized species of the northwest

Atlantic Ocean. Herring was identified as an underutilized species by the Northeast Fisheries Science Center in 1996 (NEFSC 1996) and again in 1998 (NEFSC 1998b).

To address these concerns, the Council's Atlantic Herring Fishery Management Plan proposed to establish a continuing management program for the herring resources within the Exclusive Economic Zone (EEZ) of the U.S. The Commission's Amendment One to its Atlantic Herring FMP will modify the existing interstate management program for herring within state waters. Each plan has been developed in coordination with both bodies and its member states/constituents in order to ensure consistency throughout the range of the fishery.

2.3 Goals and Objectives

The Council proposes the following goals for the Herring FMP:

Goals

To achieve, on a continuing basis, optimum yield (OY) for the United States fishing industry and to prevent overfishing of the Atlantic sea herring resource. Optimum yield is the amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, taking into account the protection of marine ecosystems, including maintenance of a biomass that supports the ocean ecosystem, predator consumption of herring, and biologically sustainable human harvest. Optimum Yield is based on the maximum sustainable yield (MSY) as reduced by any relevant economic, social, or ecological factor, and, in the case of an overfished fishery, provides for rebuilding to a level consistent with producing MSY.

To provide for the orderly development of the offshore and inshore fisheries, taking into account the viability of current participants in the fishery.

To provide controlled opportunities for fishermen and vessels in other mid-Atlantic and New England fisheries.

Objectives:

1) To harvest the U. S. Atlantic herring resource consistent with the definition of overfishing contained in the plan.

2) To prevent the overfishing of discrete spawning components consistent with the national standards.

3) To avoid patterns of fishing mortality by age which adversely affect the age structure of the stock.

4) To provide adequate protection for spawning herring and prevent damage to herring egg beds.

5) To promote U.S. and Canadian cooperation in order to establish complementary management practices.

6) To implement management measures in close coordination with other Federal and State FMP's.

7) To promote research and improve the collection of information in order to better understand herring population dynamics, biology and ecology, and to improve assessment procedures and cooperation with Canada, and to move to real time management of herring.

8) To achieve full utilization from the catch of herring, including minimizing waste from discards in the fishery.

9) To maximize domestic use and encourage value added product utilization.

10) To promote the utilization of the resource in a manner which maximizes social and economic benefits to the nation, and taking into account the protection of marine ecosystems.

11) To facilitate the development of biologically and environmentally sound aquaculture projects in the EEZ that are compatible with traditional fisheries in the New England region, given that some projects may not occur in federal waters without modifying one or more NEFMC fishery management plans.

2.4 Management Unit

The management unit for this FMP is defined as the Atlantic sea herring resource (*Clupea harengus harengus*) throughout the range of the species within U.S. waters of the northwest Atlantic Ocean from the shoreline to the seaward boundary of the Exclusive Economic Zone (EEZ). Throughout this document, the words "herring" or "Atlantic herring" refer to this species.

The management unit does not include the entire range of the Atlantic herring stock complex. The stock complex includes herring in Canadian waters, beyond the range of management by this FMP. There is a significant fixed gear fishery in New Brunswick that will complicate management efforts. Atlantic herring are a transboundary resource and effective assessment and management will be enhanced by cooperative efforts with Canada.

2.5 Status of the Stocks

Stock status is described in detail in section E.6.3.1.9. To summarize, the last fully reviewed assessment of the Atlantic Herring coastal stock complex was conducted in the spring of 1998. This assessment estimated the 1997 stock biomass as 2.9 million metric tons (mt). The spawning stock biomass was estimated as 1.8 million mt. There is an 80% probability that the SSB is between 1.4 million and 2.2 million mt. Fishing mortality for ages 3-7 herring has an 80% probability of being between 0.03 and 0.06. There is a considerable positive bias in the estimates

of recent year classes; as a result, stock size may be overestimated (NEFSC, 1998a).

The current conditioned surplus production model MSY estimate for the entire herring complex (including New Brunswick fixed gear harvest and Canadian harvest on Georges bank) is 317,000 mt. (Applegate et al. 1998).

In 1996, U.S. catches of herring totaled 104,000 mt, with about 80,000 mt taken from the Gulf of Maine. In 1997, U.S. herring catches totaled 98,271 mt, and about 70,171 mt were taken from the Gulf of Maine. Based on the stock estimates provided above, the overall herring resource is in an under-exploited state. Within the Gulf of Maine, however, current catch levels may exceed the long term potential yield.

2.6 Overfishing Definition

The Council establishes the following overfishing definition reference points for Atlantic herring. If stock biomass is equal or greater than B_{MSY} , overfishing occurs when fishing mortality exceeds F_{MSY}. If stock biomass is below B_{MSY} , overfishing occurs when fishing mortality exceeds the level that has a 50 percent probability to rebuild stock biomass to B_{MSY} in 5 years ($F_{Threshold}$). The stock is in an overfished condition when stock biomass is below ½BMSY and overfishing occurs when fishing mortality exceeds $F_{Threshold}$. These reference points are thresholds and form the basis for the control rule.

The control rule also specifies risk averse fishing mortality targets, accounting for the uncertainty in the estimate of F_{MSY}. If stock biomass is equal to or greater than $1/2B_{MSY}$, the target fishing mortality will be the lower level of the 80 percent confidence interval about F_{MSY}. When biomass is below B_{MSY} , the target fishing mortality will be reduced consistent with the five-year rebuilding schedule used to determine $F_{Threshold}$.

The M-SFCMA states in section 303(a)(10) that each FMP shall specify objective and measurable criteria for identifying when the fishery regulated by the FMP is overfished. This definition of overfishing must include an analysis of how the criteria were determined, and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery.

NOAA published advisory guidelines for compliance with the National Standards (*Federal Register*, Vol. 63, No. 84). The guidelines for National Standard 1 include definitions for "overfishing" or "to overfish". "Overfishing" occurs when a stock is subject to a rate or level of fishing mortality that jeopardizes the capacity of the stock to produce MSY on a continuing basis. "To overfish" means to fish at a rate or level that jeopardizes the capacity of a stock to produce MSY on a continuing basis. In order to determine if overfishing is occurring, the guidelines state that the FMP should define a maximum fishing mortality threshold. Exceeding this threshold for a period of one year or more constitutes overfishing, In addition, the FMP should have a minimum stock size threshold. Should the actual size of the stock fall below this level, the stock is considered overfished. In both instances, a reasonable proxy can be used to estimate the parameter if necessary.

The Council established an Overfishing Definition Review Panel (ODRP) to conduct a review of

existing overfishing definitions and recommend any changes necessary to comply with the provisions of the Sustainable Fisheries Act. The final report (Applegate et al. 1998) recommended overfishing definition reference points and an MSY control rule for Atlantic (sea) herring. A conditioned surplus production model was used to estimate the maximum sustainable yield to be 317,000 mt. The biomass at maximum sustainable yield (B_{MSY}) and the fishing mortality rate at MSY (F_{MSY}) were estimated to be 1.1 million mt and 0.30, with a carrying capacity (K) of 2.13 million mt and an intrinsic rate of population growth (r) of 0.60. The MSY value produced by the surplus production model is reliable and was therefore used. However, the surplus production estimates of annual biomass and B_{MSY} are not as reliable as the annual ratios of starting biomass to B_{MSY} (Prager 1994, 1995). Therefore, in order to calculate B_{MSY} and F_{MSY} the ODRP applied these ratios to biomass estimates from the 1995 virtual population analysis (VPA) for the years 1973 through 1990 (NEFSC 1995) and averaged the result. VPA stock size estimates for the years 1991 through 1994 were not included in this estimate because or the tendency of the VPA to overestimate the stock abundance in the most recent years. Similarly, B_{MSY} was not calculated for the years prior to 1973 because the surplus production model may not accurately calculate the biomass ratio for early years in the time series. These calculations are shown in Table 2.

When biomass is equal to or larger than B_{MSY}, the recommended upper limit on fishing mortality - $F_{Threshold}$ - is F_{MSY} (0.30). The Panel recommended that herring be harvested such that the target fishing mortality will be F_{Target}(0.28) when biomass is equal to or larger than B_{MSY}. The recommended biomass target is B_{MSY}, or 1.1 million mt. The Panel recommended a minimum biomass threshold (B_{limit}), set at a value of 1/4 B_{MSY}, or approximately 250,000 mt. At 1/4B_{MSY}, the intrinsic rate of population growth indicates Atlantic herring can rebuild to B_{MSY} in five years if F is reduced to 0.15 and held constant during rebuilding. A conditioned surplus production model indicates a maximum five year rebuilding time period if the minimum achievable fishing mortality rate is 0.15. Rebuilding could occur rapidly even from very low biomass levels: from a biomass of one percent of B_{MSY}, the model estimates herring would have a 50 percent chance of rebuilding to B_{MSY} within ten years if fishing mortality is reduced to near zero. Figure 1 summarizes the overfishing reference points as recommended by the Overfishing Definition Review Panel. Figure 2summarizes possible rebuilding schedules for Atlantic herring.

In SAW 27, the Pelagic/Coastal Working Group concurred with these reference points, with one exception. The working group report incorporated the recommendation of the Council's herring plan development team (PDT) that the minimum biomass level be established at ½B_{MSY} because of the key role of herring in the ecosystem and uncertainties over the stock structure within the coastal stock complex. The SARC, however, in its review of the working group report, expressed concern over the application of a surplus stock production model (ASPIC) to estimate MSY for multiple stocks of herring. The SARC believed the results of the ASPIC model were unrealistic since the stock complex had only briefly (1968-1971) supported reported landings of this level and higher. As an alternative approach, the SARC applied a yield-per-recruit (YPR) and biomass-per-recruit values at $F_{0.1}$(0.20) to average recruitment levels estimated by the VPA. Based on geometric mean recruitment, the MSY values ranged from 108,000 mt to 290,000 mt depending on the time period used to determine average recruitment. The SARC recommended that it would not be prudent to consider MSY above 200,000 mt or B_{MSY} to be above 1.5 million mt until the sizes of recent year classes were better estimated (NEFSC 1998b).

The Council's herring PDT and the Commission's technical committee considered the SARC's recommendation and noted the following:

(1) The SARC approach is highly dependent on the VPA estimates of recruitment (age 1 fish). All of the time periods that the SARC considered in computing average recruitment included 15 years when the stock was in a collapsed condition and therefore the YPR approach underestimates recruitment when the stock is at B_{MSY}.

(2) The YPR analysis used by the SARC was done in 1995 and used a dome-shaped exploitation pattern to estimate yield-per-recruit. The New Brunswick weir fishery targets younger fish and may cause a dome-shaped exploitation pattern when stock biomass on Georges bank is low. When Georges Bank biomass is near B_{MSY}, however, a flat-topped exploitation pattern may be more appropriate. This inconsistency was not considered by the SARC.

(3) The SARC used recent mean weights at age to estimate YPR at different F values , i.e., mean weights observed during a period of very high biomass levels. Since biomass is estimated to be well above B_{MSY}, the mean weights may be anomalously low compared to what they might be when the stock is near B_{MSY}.

Finally, the $F_{0.1}$=0.20 reference point as estimated by the SARC is less than F_{MSY} (0.30) and is more conservative. It will, therefore, produce lower maximum yield estimates for a given stock biomass than an approach based on F_{MSY}. Likewise, the SARC approach produced a higher B_{MSY} than that estimated by the surplus production model.

The surplus production model is a generalized approach that estimates population parameters over the observed range of stock conditions. Implicitly it takes into account changes in mean weights, stock-recruit relationships, and exploitation patterns. While the entire MSY estimate should not be removed from a single stock component, the surplus production estimate appears to be consistent with the past history of the fishery, especially if discards and unreported catches are taken into account. For the reasons given above, the PDT continued to recommend adopting the MSY estimate calculated by the surplus production model.

The PDT also examined the target fishing mortality, F_{Target}, when biomass is at or larger than B_{MSY}. The PDT considered the work of Restrepo et al. (1998) in providing technical advice on the setting of reference points based on the quality of information known about a stock. Restrepo et al. (1998) suggest that target fishing mortality should be selected based on an analysis of uncertainty and risk in estimating fishing mortality in a particular fishery. In the absence of such an analysis, they suggest that the target fishing mortality should be established such that the probability of exceeding the maximum fishing mortality is in the range of 20%-30%. Restrepo et al. propose a default target rule that established F_{Target} at 75% of F_{MSY}. In addition, they suggested a default policy for establishing F_{Target} based on the quality of data available. After considering this information, the PDT expressed concern that an F_{Target} of 0.28 was too close to the $F_{Threshold}$ of 0.30. Because of incomplete knowledge about the stock structure of the herring complex, the PDT felt the quality of information was "fair" and F_{Target} should be set at 75% of F_{MSY}, or 0.23.

The Council considered the advice of the SARC, the PDT, and the ODRP before selecting reference points for Atlantic herring. The Council decided to adopt the F_{Target} recommended by the Overfishing Definition Review Panel, F=0.28. This recommended target is based on the lower limit of the 80% confidence interval around the point estimate of F_{MSY} estimated by the surplus production model. The ratio of F at this lower level to F_{MSY} is 0.91. This ratio is applied to the estimate of F_{MSY} determined by dividing MSY by B_{MSY} to obtain the F_{Target} =0.28. The Council believes that given the current robust condition of the herring resource, this target is sufficiently conservative to protect the resource.

The Council also considered the different minimum biomass threshold recommendations. Because of the key role of herring in the ecosystem and uncertainty over stock structure, the Council established $B_{Threshold}$ as $1/2B_{MSY}$, rather than $1/4B_{MSY}$ as recommended by the ODRP. The ODRP recommended ¼ B_{MSY} because of the high intrinsic growth rate of herring and their recommendation that rebuilding begin as soon as stock biomass is less than B_{MSY}. The Council, however, has adopted ½B_{MSY} as $B_{Threshold}$ for the reasons stated above. Coupled with adoption of the ODRP recommendation to reduce F_{Target} when biomass is less than B_{MSY}, this is a more conservative minimum biomass which will provide an early opportunity for the Council to address a declining stock biomass.

B_{MSY} is estimated to be 1.1 million mt, and MSY is estimated to be 317,000 mt. The maximum fishing mortality, $F_{Threshold}$ is equal to F_{MSY}, estimated as 0.30, when stock biomass is equal to or larger than B_{MSY}. The target fishing mortality when biomass is at or larger than B_{MSY} is 0.28. If biomass declines to less than B_{MSY}, the maximum fishing mortality is the mortality that has a 50 percent probability to rebuild stock biomass to B_{MSY} in 5 years. The target fishing mortality when biomass is less than B_{MSY} will be determined by applying the previously determined ratio of F_{MSY} to F at the lower level of the 80% confidence interval (0.91) to the maximum fishing mortality. The minimum biomass level, $B_{Threshold}$, is ½B_{MSY}, or approximately 500,000 mt. These reference points are summarized in Table 1 and are illustrated in Figure 3.

Natural mortality is assumed to be 0.2, and herring are fully recruited to the fishery at age 3. If fishing mortality exceeds $F_{Threshold}$ for one year or more, the herring coastal stock complex will be considered overfished. Similarly, if biomass is less than $B_{Threshold}$ ($1/2B_{MSY}$), the stock is in an overfished condition. In either situation, the Council must act to stop overfishing and rebuild the biomass to B_{MSY} by reducing fishing mortality.

This MSY estimate for the herring stock complex includes catches taken by Canada in the New Brunswick weir fisheries, as well as on Georges Bank east of the Hague line. These catches are included within the MSY estimate because Canadian catches are included in the VPA data. The stock affinity of the New Brunswick weir catches is being reviewed and, in the future, may result in an assessment that provides separate estimates of MSY on a finer scale. This may lead to the development of separate overfishing definitions for individual stock components.

Stock biomass for 1997 is estimated to be 2.9 million mt, 260% of B_{MSY}. There is considerable uncertainty about current stock size, which could be overestimated. Fishing mortality in 1997 is estimated to be less than 0.1 (there is an 80% probability that fishing mortality for age 3-7

herring is between 0.03 and 0.06). Current fishing mortality is, therefore, below the overfishing threshold.

Parameter	Current Estimate
MSY	317,000 mt
Biomass Target (B_{Target}=B_{MSY})	1.1 million mt
FMSY	0.30
Minimum biomass ($B_{Threshold}$)	1/2B_{MSY} = 500,000 mt
Maximum fishing mortality ($F_{Threshold}$)	0.30
Target Fishing Mortality	0.28
Rebuilding period	5 years

Table 1 - Summary of overfishing reference points for Atlantic herring

Year	Biomass (January 1) ('000 mt)	B ratio	Calculated B_{MSY} ('000 mt)
1973	518.6	0.4326	1198.9
1974	434.5	0.3513	1236.9
1975	343.1	0.2996	1145.3
1976	196.5	0.1833	1,071.9
1977	145.5	0.1444	1,007.6
1978	151.8	0.1612	941.9
1979	135.0	0.1651	817.8
1980	118.7	0.1481	801.6
1981	102.3	0.1226	834.1
1982	97.5	0.09633	1,012.0
1983	129.5	0.09008	1,437.1
1984	216.3	0.1279	1,691.2
1985	291.7	0.1946	1,499.2
1986	401.9	0.302	1,330.8
1987	506.4	0.4909	1,031.5
1988	541.8	0.7601	712.8
1989	700.1	1.077	650.1
1990	1,037.8	1.347	770.4
Average			**1,066.2**

FMSY = MSY/B_{MSY} = 317,000 mt/1,066,200 = 0.297
K = 2 (B_{MSY}) = 2(1,066,200 = 2.13 million mt
R = 2(F_{MSY}) = 2)0.297) = 0.60

Table 2 – Estimates of B_{MSY}, F_{MSY}, K and r for the Atlantic herring coastal stock complex derived from VPA estimates of biomass (10^3 mt) and surplus production model estimates of biomass relative to B_{MSY} for the years 1973 – 1990.

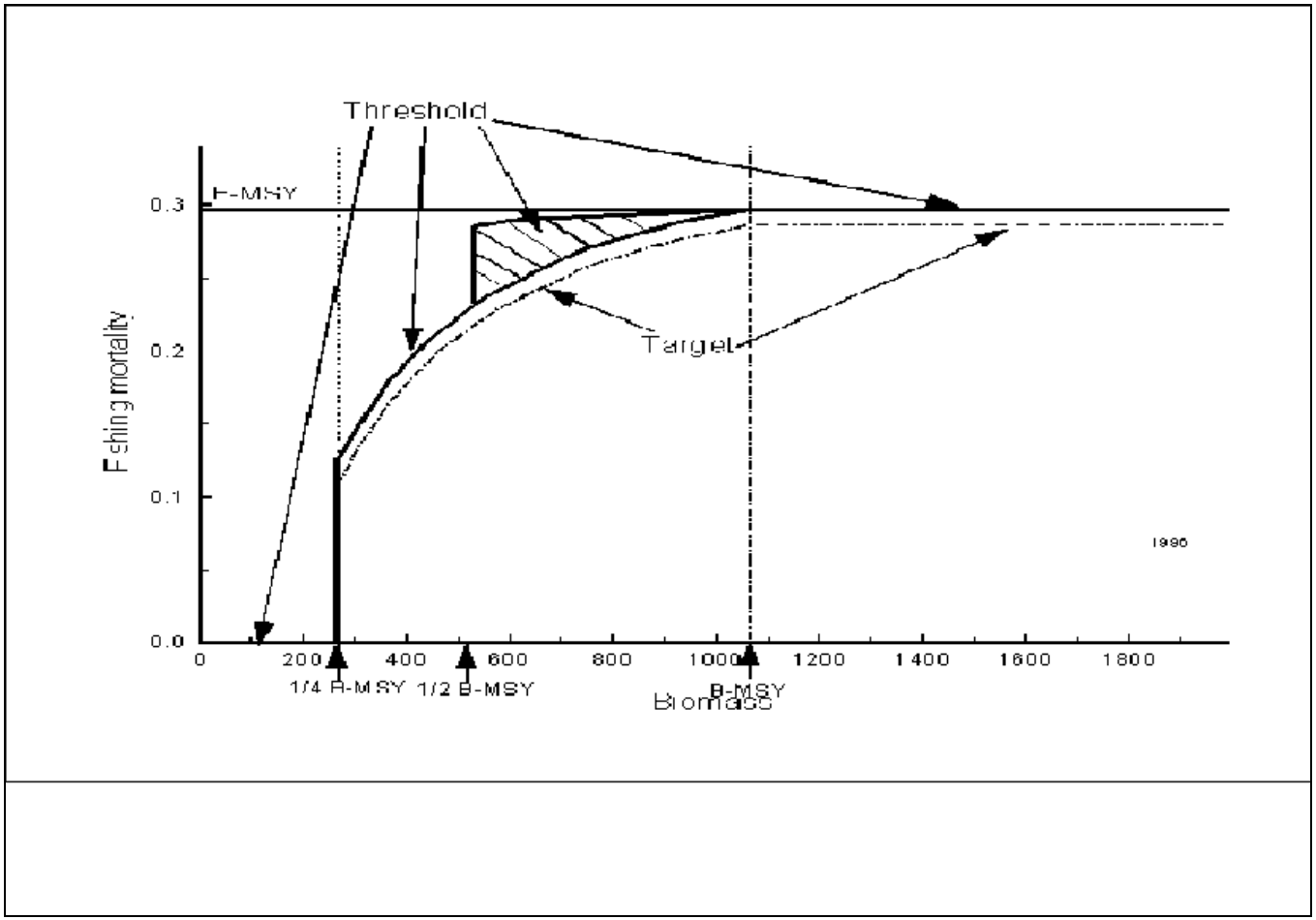

Figure 1 – Recommended herring overfishing definition reference points, from Applegate et al., 1998

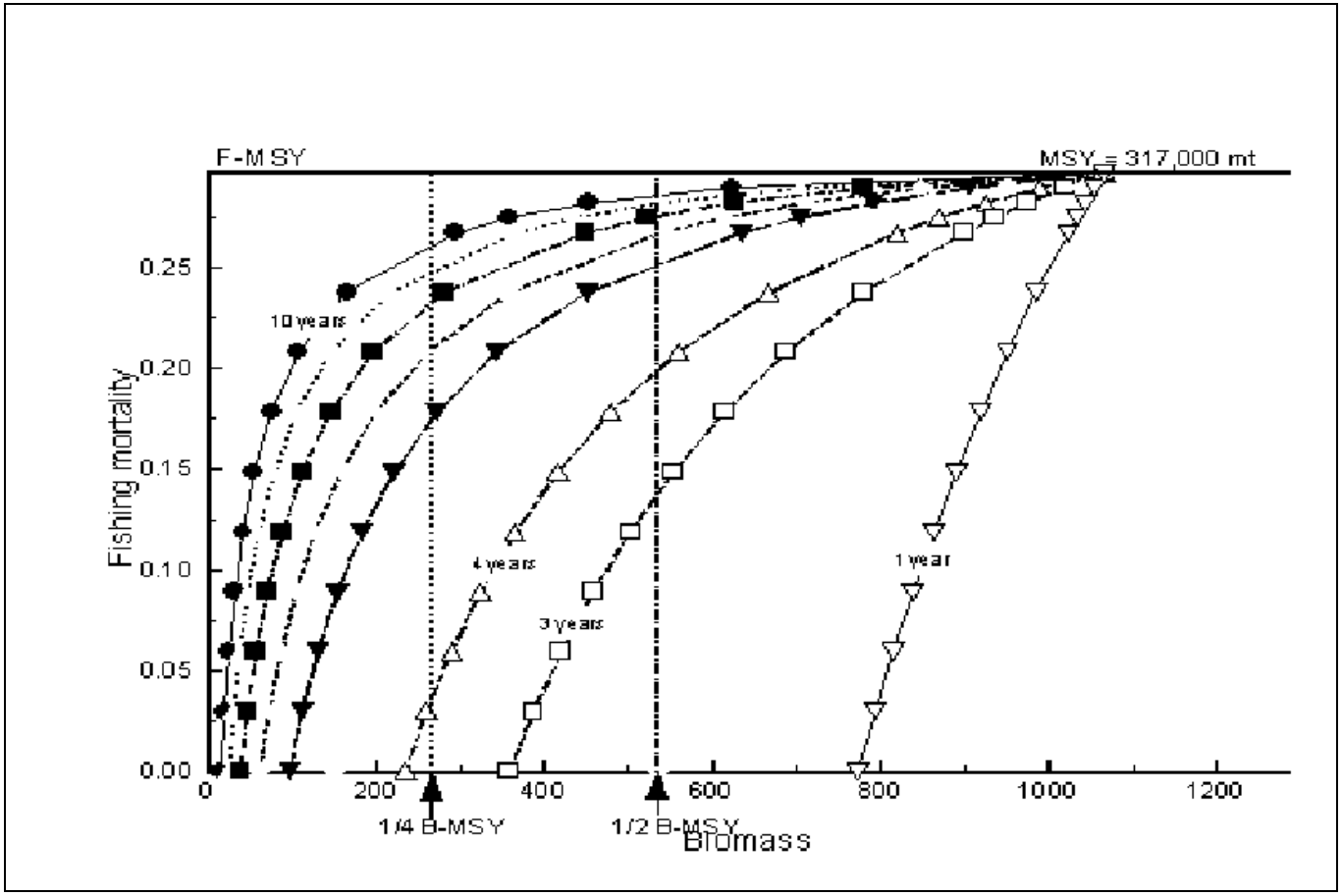

Figure 2 – Rebuilding trajectories for Atlantic herring (from Applegate et al., 1998)

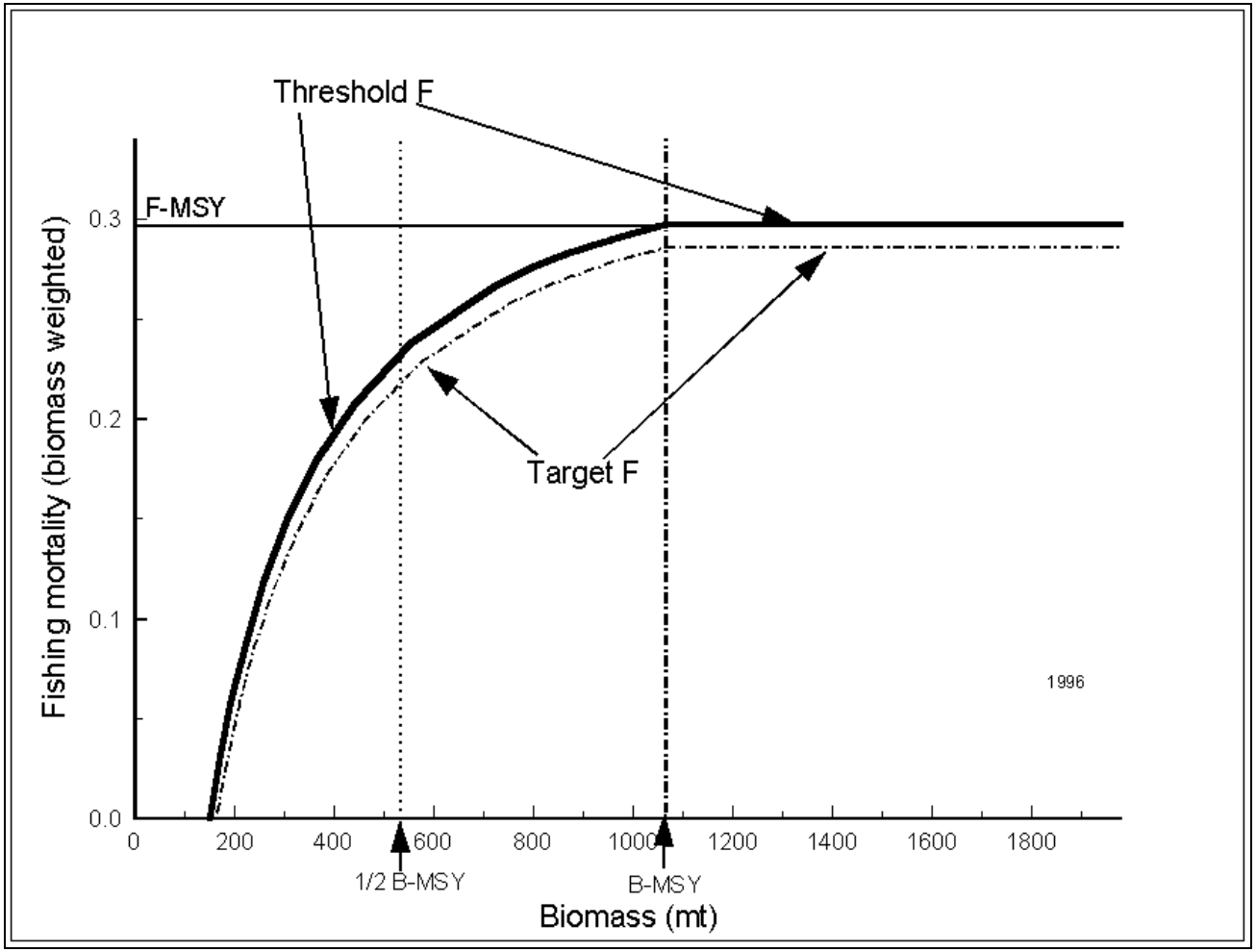

Figure 3 – Overfishing threshold and target fishing mortality

3.0 Proposed Management Action

3.1 Habitat Protection and Preservation

The Council has identified the Essential Fish Habitat (EFH) for herring and other species it manages. EFH provisions were submitted for all Council plans in one document that amends existing Council management plans, and describes the EFH for Atlantic herring. The applicable provisions of this document that relate to Atlantic herring are incorporated into this FMP by reference. This includes the description and identification of herring EFH, the threats to EFH from fishing and non-fishing activities, and the conservation and enhancement measures to protect EFH for Atlantic herring.

3.2 Specifications

The Regional Administrator, after consulting with the Council, determines annual specifications relating to OY, DAH, DAP, JVPt, JVPs, IWP, BT, U.S. at-sea processing (USAP), and the Reserve. The Council and the Regional Administrator will review annually the best available biological data pertaining to the stock. The allowable biological catch (ABC) (based on the target fishing mortality and the estimated biomass) for the coastal stock complex (CSC) will be determined. The fishing mortality rate associated with the ABC will not exceed the overfishing definition. The biomass of herring at the end of the fishing year will not be less than the minimum stock size threshold specified in the overfishing definition.

ABC will be equal to the target fishing mortality (F_{Target}) times the estimated biomass. The current biomass is estimated to be much larger than B_{MSY} and is only lightly exploited. Applying F_{Target} to this biomass results in a quantity greater than F_{MSY} times B_{MSY}. Because estimates of current biomass are very uncertain, the wide fluctuations in stock size often experienced by pelagic resources, uncertainty in the estimate of MSY, and the key role of herring in the ecosystem, ABC will be limited to F_{MSY} times B_{MSY} during an initial "fishing up" period. This will allow for a reasonable expansion of the fishery and preserve the option for larger harvests in the future as the quality of data and assessment information improves.

Optimum yield (OY) will be less than or equal to ABC minus the expected Canadian catch (C) from the stock complex. This formula could result in an unrestricted Canadian catch severely limiting the U. S. harvest; therefore, the estimate of the Canadian catch deducted from ABC will be no more than 20,000 mt for the New Brunswick juvenile harvest, and no more than 10,000 mt for the Georges Bank Canadian harvest. The size of the Canadian harvest and its impact on the U.S. fishery will be monitored by the Council's Herring Committee and the Commission's Herring Section. Successful management of this trans-boundary resource will rely on developing an effective means to coordinate
U. S. and Canadian management decisions.

$$OY \leq ABC - C$$

OY will not exceed MSY.

$$OY \leq MSY$$

This restriction, however, may not preclude the harvest in a specific year from exceeding the harvest associated with MSY. When stock biomass is larger than B_{MSY}, the target fishing mortality may produce a harvest that exceeds the MSY in the short term. This approach will not be taken during the initial period of the plan for the reasons given in the discussion on ABC.

The establishment of OY will include consideration of relevant economic, social, or ecological factors. For this reason, OY may be less than ABC-C. Management of herring in U.S. waters is complicated by historical variations and fluctuations in abundance, questions concerning the intermixing rates of various spawning components, the importance of herring as a prey resource and uncertainties concerning the Canadian harvest. One of the goals of this FMP is to provide controlled opportunities to U.S. fishers to enter the fishery, providing an economic opportunity to vessels under severe restrictions in other fisheries. Estimates of the available domestic harvesting capacity show that the domestic fleet has the capacity to harvest the entire herring resource should fishers choose to do so. This choice is contingent on expanding existing herring markets or developing new markets, and the capabilities of the individual vessels. The complexities of predicting world demand for herring products and the opportunities available in the export market argue for a conservative stance when allocating the herring resource. If part of the OY is assigned to directed foreign fishing, this herring will compete directly with the efforts of US. Processors and harvesters to enter world herring markets. For this reason, there is no opportunity for any part of OY to be made available for directed foreign fishing – TALFF is prohibited. Setting OY equal to DAH (plus a reserve) will help achieve a risk-averse approach to management of the herring stock while it encourages U.S. development of the resource. This will provide the greatest overall benefit to the nation by stimulating further development of an underutilized fishery and diverting effort away from other overfished fisheries.

OY is equal to the expected domestic annual harvest (DAH) plus a reserve.

$$OY = DAH + Reserve$$

Factors to be considered in determining the amount of OY, if any, assigned to the reserve will include:

--uncertainty and variability in the estimates of stock size and ABC;
--uncertainty in the estimates of Canadian harvest from the CSC;
--requirement to insure the availability of herring to provide controlled opportunities for vessels in other fisheries in the mid-Atlantic and New England;
--excess U.S. harvesting capacity available to enter the herring fishery;
--total world export potential by herring producing countries;
--total world import demand by herring consuming countries;
--U.S. export potential based on expected U.S. harvests, expected U.S. consumption, relative prices, exchange rates, and foreign trade barriers;
--increased/decreased revenues to the United States from foreign fees;

--increased/decreased revenues to U.S. harvesters (with/without joint ventures);
--increased/decreased revenues to U.S. processors and exporters;
--increases/decreases in U.S. harvesting productivity due to decreases/increases in foreign harvest;
--increases/decreases in U.S. processing productivity;

The Regional Administrator, after consulting with the Council and the Commission, may transfer any amount from the reserve to the DAH during the fishing year.

Domestic annual harvest (DAH) is composed of domestic annual processing (DAP), the total amount allocated to processing by foreign ships (JVPt) , and the amount of herring that can be taken in U. S. waters and transferred to Canadian herring carriers for transshipment to Canada (BT). When determining JVPt, the Council will consult with the Commission to insure close coordination with the Commission's allocation for Internal Waters Processing (IWP) operations.

$$DAH = DAP + JVPt + BT$$

Part of DAP may be allocated for at-sea processing by domestic vessels that exceed the vessel size limits (see section 3.6.6). This allocation will be called the "U.S. at-sea processing" (USAP) allocation. The term "at-sea processing" refers to processing activities that occur in the exclusive economic zone outside state waters. When determining this specification, the Council will consider the availability of other processing capacity, development of the fishery, status of the resource, and opportunities for vessels to enter the herring fishery.

Rationale: One of the goals of this plan is to provide opportunities to U. S. fishermen displaced from other fisheries in the northeast and mid-Atlantic area. Estimates of U. S. harvesting capacity clearly show existing U. S. fishermen have the capability to catch all of the currently available herring. Whether they choose to do so will depend on the ability of these fishermen to enter existing markets and develop additional markets for herring and the capabilities of their vessels. Any directed foreign fishing will interfere with that goal, and for that reason TALFF is prohibited. Allowing an opportunity for JV's will provide additional opportunities for U.S. catcher vessels to enter the herring fishery.

With the exception of freezer trawlers under the proposed size limits, most existing herring processing capacity is on land. Growing interest in the Atlantic herring fishery has resulted in several initiatives to develop increased processing capacity in communities. These initiatives include plans for increased shoreside processing capability (including the stationing of a processing vessel at a pier) and the entry of several small freezer trawlers into the herring fishery as a supplement to their squid fishing activities. These plans have been based, in part, on the existing business climate in the area. In the last eighteen months, there has been interest expressed by a large domestic processing vessel to enter this fishery. This vessel has been prevented from receiving a permit to catch herring by legislation, but has not yet processed herring at sea. The introduction of a new large vessel at-sea processing sector may create uncertainties in the industry that will hamper shoreside development. By defining an allocation that applies to the at-sea processing sector, the Council can control the development of at-sea processing capacity if necessary. This will help insure a stable business environment for the communities and businesses

that have relied on the herring fishery, and provide an opportunity for fishing communities hurt by increasing regulations in other fisheries to enter the herring fishery.

The specification of BT allows the continuation the historic trade in herring between the U.S. and Canada, while addressing the concerns of other U.S. processors by preventing this trade from being an unlimited transfer that reduces their access to the resource.

3.2.1 IWP/JVP Specifications

Joint Venture Processing (JVP) and Internal Waters Processing (IWP) operations are essentially the same type of operation from a domestic fishermen's perspective. In each, a foreign processing vessel is contracted to process fish which are harvested by domestic vessels. The only difference is where the processing vessel is located and under whose authority the JVP or IWP is granted. JVP vessels process fish in federal waters while IWP vessels process fish in state waters. Currently, both receive fish harvested primarily in federal waters.

All herring harvested by domestic vessels is used in some manner. The DAH is comprised of the amount used by domestic processors, the amount used by foreign processing vessels (regardless whether the processing vessel is located in the EEZ or in state internal waters), and the amount transshipped to Canada on Canadian herring carriers (BT). The amount available for use by foreign processing vessels is the total joint venture allocation—JVPt.

$$DAH = DAP + JVPt + BT$$

The amount expected to be used by domestic processors (DAP) must be estimated and subtracted from the DAH along with herring transported to Canada. If there is any DAH remaining, it is available for joint venture processing activities. According to 50 CFR 600.315(h)(iii), JVP is derived from DAH, indicating that DAH must be determined before establishing a JV allocation.

$$JVPt + BT = DAH - DAP$$

As explained above, JVPt includes all herring available for foreign processing vessels. This includes both joint venture processing in the EEZ and internal waters processing (IWP) within state internal waters. The amount available for processing in the EEZ is called JVPs; the amount available for state internal waters is IWP.

$$JVPt = JVPs + IWP$$

The Council's Herring Committee and the Commission's Herring Section will consult and recommend the breakdown of the JVPt allocation into JVPs and IWP. Factors to be considered include: requests received, demonstrated intent to conduct an operation, and consideration of resource status and potential increases in DAP. Recommendations will be forwarded to the Regional Administrator through the Council and implemented as described in section 3.3.4.

The Commission's Herring Section may allocate the amount available for IWP to individual states. These allocations will be established as a compliance criteria for the states and will include reporting criteria for the processing vessels. Reporting criteria will be established based on the

recommendations developed through the ACCSP (section E.6.1.4).

The total allocations (DAP, JVPt, BT and the Reserve) in any one management area or subarea will not exceed the TAC set for that area or subarea during that fishing year. In the event of a closure to a directed herring fishery in any one management area or subarea, BT, JVPs and IWP operations will cease to receive any herring caught from a closed area or subarea.

Nothing in this section will restrict a state from allowing foreign processing vessels to process herring in state internal waters which were caught in federal waters in conjunction with the M-SFCMA requirements section 306(c) so long as the area or subarea in which they were caught is open to directed herring fishing.

3.2.2 Initial Plan Specifications

The Council, after consulting with the Commission, recommends the following specifications for the initial year of the management plan (1999). To simplify accounting, all catches on or after January 1, 1999, will be applied to the initial specifications and TACs. These specifications form the basis for the area specific TACs for the first year of the plan that are listed in section 3.6.3.1.

Specification	Amount (mt)
ABC	300,000
OY	224,000
DAH	224,000
DAP	180,000
U.S. at-sea processing	0
BT	4,000
JVPt	40,000
JVPs – Total	15,000
JVPs – Area 2	10,000
JVPs – Area 3	5,000
IWP	25,000
Reserve	0

Table 3- Initial recommended Atlantic herring specifications

Rationale: The initial specifications are designed to allow significant growth in the herring fishery, yet take a cautious approach to overall harvest levels. As summarized in section 2.5, the herring resource is in an abundant, under-utilized condition, and biomass exceeds B_{MSY}. This status provides the opportunity for increased landings. As noted in the report for SAW-27, however, "…there is considerable uncertainty about current stock size which could be overestimated" (NEFSC 1998a). The report also notes that "A 5 year retrospective analysis of SSB and F revealed a considerable positive bias in the estimation of recent-year biomass and negative bias in fishing mortality." Rather than use the current biomass, which may be overestimated, as the basis for ABC, the Council is recommending use of an ABC that is based on B_{MSY} and is recommending a conservative OY that is 93,000 mt less than MSY. This precautionary approach will provide additional protection to the resource as the management measures are implemented and their effectiveness evaluated. At the same time, landings can increase from current levels.

DAP and BT are derived from the discussions in section E.6.4.3.1.1. DAP is based on existing processing capacity with the addition of nearly 80,000 mt to account for the introduction of new capacity, possible misreporting in the bait fishery, and increases in processing by existing processors. The amount allocated to BT is about ten percent larger than the highest amount reported transferred to Canadian canneries in any of the last ten years (3,690 mt in 1996 according to Maine DMR). These transfers are part of a traditional cross-border trade in raw herring that helps U.S. sardine canneries obtain herring during periods of low resource abundance in U.S. waters. 40,000 mt is recommended for JVPt after reviewing recent foreign processing

performance. While this level is lower than the 80,000 mt allocated by the Commission for the 1998/1999 IWP season, it is over three times higher than the highest actual combined JVP and IWP performance in the last ten years and allows for substantial temporary participation by foreign vessels in the U.S. fishery. The Council and the Commission agreed on the recommended allocation of JVPt to JVPs and IWP. JVPs can only be harvested in Management Areas 2 and 3 because the resource in Area 1 is needed to supply domestic needs (including support of the two-way trade with Canada that benefits the sardine industry).

The zero amount specified for USAP will prevent large domestic processing vessels from entering the fishery in 1999. Concern has been expressed that this results in unfair treatment for large domestic processing vessels, which cannot participate in an activity (at-sea processing of herring) that is permitted to foreign processing vessels through joint ventures. It was suggested that this action does not support one of the purposes of the M-SFCMA ("…to encourage the development by the United States fishing industry of fisheries which are currently underutilized or not utilized by United States fishermen…"). While the biological, economic, and social impacts of this action are described in detail in the environmental impact statement (section 7.1), the following discussion summarizes the Council's rationale for this action.

Under normal circumstances, foreign vessels are prohibited from catching or processing fish in U.S. waters. In limited circumstances, foreign vessels are permitted to process fish caught by U.S. vessels, both in the EEZ and in the internal waters of a state. Activities in state waters are controlled by the governors and will not be addressed in this rationale. In the EEZ, these vessels are permitted into the fishery only when it suits the needs of the United States, and are limited to processing fish in excess of the capacity needed for domestic processors. Strict permitting requirements are imposed, including, at times, restrictions on markets for the fish so that they do not directly compete with domestic processors. Reporting, recordkeeping, and observer regulations are more stringent than those imposed on U.S. vessels. JV activity is reviewed on an annual basis through the specification process. Each permit request is carefully considered by the Council. The performance of the vessels involved is a consideration for future allocations; future access can be denied based on prior enforcement actions or a failure to meet the permit requirements that are imposed.

A key element in the review of JV activities is the impact on domestic processing activity – specifically, on the east coast, shoreside processors since there have not been any large domestic at-sea processors in east coast fisheries. The underlying concept is that JV activity is only allowed until adequate U.S. processing capacity is developed. In summary, under strictly controlled, rigorously reviewed circumstances, some at-sea processing by large foreign vessels is possible. The reality is that in recent years the actual performance of herring JV's has been insignificant, and has occurred only in connection with mackerel JV's (confidentiality restrictions prevent listing actual JV herring catches in 1997).

The Council may choose to allocate a portion of the Atlantic herring resource to at-sea processors if it determines that will benefit the herring industry. The Council's initial recommendation to specify USAP at 0 is because of a desire to maintain the status quo in the industry until the effectiveness of the management plan can be evaluated. By contrast to JV's, large domestic processing vessels have a great deal of flexibility once allowed into the fishery. They can compete

in the same markets as other processors without restraints. Generally, regulations for domestic vessels are not as restrictive as those for foreign vessels. Once allowed into a fishery, there is the perception that they will have earned permanent "rights" to participate. Unlike the short-term participation of JV's, there is a perception that large domestic processing vessels will seek to become permanent participants in the fishery. In sum, the possible impacts of large at-sea processors in the Atlantic herring fishery are not clearly understood, arguing for a cautious approach to their introduction into the fishery.

Nevertheless, the possibility that a foreign JV may be allowed to process at-sea while a domestic vessel cannot strikes some as inconsistent with the purposes of the M-SFMCA. While the M-SFMCA encourages the development of underutilized species by the U.S. fishing industry, it does not prescribe that all possible sectors must have access to a particular resource. Fishery management councils are allowed considerable discretion in determining the form of the industry that will develop underutilized species and achieve optimum yield. The Council's recommendation to allocate zero metric tons to the at-sea processing sector is consistent with the exercise of that discretion.

The above does not address what some perceive is a fundamental question of fairness. The Council recognizes that in the short term, setting the at-sea processing specification at zero metric tons will appear unfair to some in the industry – particularly while allowing a limited opportunity for foreign JV's. This question must be balanced against the concerns of historic industry participants and their communities, as well as new entrants who have based their investments and business plans on the existing industry structure. These decisions have been based in part on a number of legislative initiatives that have limited the size of vessels that will be allowed in the U.S. fishing industry in the future, and have prevented large domestic vessels from fishing in the mackerel fishery and from catching herring with mid-water trawl gear. From their viewpoint, the sudden entry of large domestic at-sea processors is viewed as an unfair change in the planning environment. The initial judgment of the Council is that a lack of experience with large domestic processors argues for a cautious approach when allowing them into the fishery. For initial implementation of the plan, the Council has chosen to limit domestic participation in the fishery to traditional forms – harvesting vessels and at-sea processing vessels less than the proposed size limits, and shoreside processing facilities – supplemented, if necessary, by the temporary opportunity for short-term joint venture activities. National Standard 8 requires the Council to consider the impact of its actions on the sustained participation of fishing communities. Given the lack of information on the impacts of large at-sea domestic processors, the Council has chosen a cautious approach to protect the interests of those communities that are dependent on the herring fishery.

Finally, the Council is adopting a plan for a species that has not been federally managed for over sixteen years. There is considerable uncertainty in the estimates of DAP and DAH. The plan was crafted in an environment that did not include large domestic processing vessels and only limited participation by JV's. At present, there aren't any large domestic at-sea processing vessels in the Atlantic herring fishery. One vessel indicated an interest in entering the herring fishery but has not done so – prevented, in part, by legislation which restricted NMFS from issuing a permit to the vessel to fish for mackerel or catch herring. Choosing a precautionary approach, the Council wants to evaluate the implementation of the plan and the effectiveness of the chosen measures

without the added complications caused by the rapid introduction of at-sea processing capacity. This provides the opportunity to evaluate actual processing capacity and make future adjustments to the management measures as necessary. It is relatively easy to prevent JV activity if it is determined that DAP has been underestimated and is sufficient to use DAH. It is not easy to eliminate large domestic at-sea processors once they are established in the fishery, as demonstrated by the recently approved $90 million buyout of large catcher-processors in the Bering Sea/Aleutian Islands groundfish fishery.

As the herring fishery develops and the Council evaluates the impacts of its management program, the specification for at-sea processing will be reviewed on an annual basis. In the future, if there is a demonstrated need for additional processing capacity that can best be met by large domestic at-sea processors, the Council may recommend allocation of part of the resource to this sector. Whether this occurs will depend on a careful evaluation of all relevant factors. The Council's action does not eliminate all opportunities for these vessels to enter the herring fishery. There is a possibility that the specification for USAP will be set at a level other than zero mt in the future. In addition, under the Commission's plan, large domestic processing vessels may be allowed to process herring in internal waters, subject to restrictions imposed by the state governors.

3.3 General Administrative Provisions

3.3.1 Permits

Vessel Permits Commercial vessels fishing for, possessing, or landing herring in or from the EEZ are required to obtain a federal permit. This includes vessels that transport herring from catcher vessels for delivery to dealers or processors. Permits will be issued under a vessel's U.S. documentation or state registration number. Vessel owners or operators who apply for a fishing vessel permit under this section must agree, as a condition of the permit, that all the vessel’s herring fishing, catch, and gear (without regard to whether such fishing occurs in the EEZ or landward of the EEZ, and without regard to where such herring, or gear are possessed, taken or landed) will be subject to all the requirements of this part. All such fishing, catch, and gear will remain subject to any applicable state or local requirements. If a requirement of this part and a conservation measure required by state or local law differ, any vessel owner or operator permitted to fish in the EEZ must comply with the more restrictive requirement.

Permits are not required for a vessel that possesses herring solely for its own use as bait (for example, in the lobster and tuna fisheries) and does not have purse seine, mid-water trawl, pelagic gillnet, sink gillnet, or bottom trawl gear on board.

To receive a federal herring permit, vessels must annually declare their intent (by completing a permit application) to participate in the herring fishery. The application period will be defined by the Regional Administrator. Changes in information supplied for the permit must be reported to the Regional Administrator within 15 calendar days of the change. Information required on the application is specified in 50 CFR 648.4. Permits will be valid for the period May 1 through April 30 the following calendar year, or as designated by the Regional Administrator.

Permit holders will be required to carry their permit aboard the fishing vessel during fishing and offloading operations. It must be available for inspection upon request by an authorized officer. The Regional Administrator may, after publication in the *Federal Register*, charge a permit fee for administration and enforcement. In the Northeast Region of NMFS, vessels with a federal permit are required to comply with the vessel identification and marking requirements of 50 CFR 648.8.

For the purposes of this FMP, horsepower is defined as the total maximum continuous shaft horsepower of all the vessel's main propulsion machinery (46 CFR 10.103).

When a vessel is sold or otherwise transferred, the permit is assumed to transfer with the vessel. A written agreement between the buyer and the seller is necessary if the seller wishes to retain the permit. There are no limits (up to any maximum vessel limits adopted by this FMP) on vessel upgrades or replacements unless a limited entry system is adopted in the future.

Operator Permits Operators of commercial vessels permitted to harvest herring will be required to have an operator permit. No performance or competency tests will be required to obtain a permit. The permit may be revoked for violation of fishing regulations. Vessel operators may be permitted as follows:

Any operator of a vessel fishing for herring must have an operator's permit issued by the NMFS Regional Administrator. An operator is defined as the master or other individual on board a vessel who is in charge of the vessel. (Note: This definition is specified in the Code of Federal Regulations, 50 CFR 648.5). The operator will be required to submit an application, supplied by the Regional Administrator, for an Operator's Permit. The permit will be issued for up to three years. The applicant will provide his/her name, mailing address, telephone number, date of birth and physical characteristics (height, weight, hair and eye color, etc.) on the application, and will be requested to provide his/her social security number. In addition to this information, the applicant will be required to provide two passport-size color photos.

Permit holders will be required to carry their permit aboard the fishing vessel during fishing and off-loading operations. It must be available for inspection upon request by an authorized officer. The Regional Administrator may publish notification in the *Federal Register* and charge a permit fee for administrative costs of issuing permits.

Dealer Permits Dealer permits will be issued as follows:

Any dealer (as defined by the Regional Administrator) of herring must have a permit issued by the Regional Administrator. NMFS will determine the final definition of a "dealer", including the extent to which pump operators may be responsible for reporting. The dealer will be required to submit an application, supplied by the Regional Administrator, for a dealer permit that is valid until it expires, is suspended, or revoked. The applicant will provide the business name, the name of the person signing the application, mailing address, telephone number and principal place of business on the application. The permit cannot be transferred and will expire upon change in ownership of the business. The permit must be maintained at the place of business and be available for inspection by an authorized officer. Permits are not transferable.

The Regional Administrator may publish notification in the *Federal Register* and charge a permit fee for administrative costs in issuing permits.

Processor Permits Processor permits will be issued as follows:

Any processor of herring from the EEZ or a federally permitted vessel must have a permit issued by the Regional Administrator. The processor will be required to submit an application, supplied by the Regional Administrator, for a processor permit that is valid until it expires, is suspended, or revoked. The applicant will provide the business name, the name of the person signing the application, mailing address, telephone number and principal place of business on the application. The permit cannot be transferred and will expire upon change in ownership of the business. The permit must be maintained at the place of business and be available for inspection by an authorized officer. Permits are not transferable.

A processor is any individual who receives unprocessed Atlantic herring from a fishing vessel or herring dealer for the purposes of processing. In the Atlantic herring fishery, processing, or to process, means the preparation of Atlantic herring to render it suitable for human consumption, bait, commercial uses, industrial uses, or long-term storage, including but not limited to cooking, canning, smoking, roe extraction, salting , drying freezing, or rendering into meal or oil, but does not include icing, bleeding, heading, or gutting.

Rationale: Permit requirements for vessels, operators, dealers, and processors identify the participants in the fishery. The plan gives some flexibility to the Regional Administrator to define "dealer" for purposes of the herring fishery. In this large volume fishery, some vessels may offload, through a pump, to numerous dealers for each trip. If pump operators are included in the definition of dealer, it may reduce the number of entities required to submit dealer reports, improve the accuracy of reporting, and result in less administrative burden to both the industry and NMFS. Processor permits are required in order to identify those who must submit the Annual Processed Products report described in section 3.3.3.3.

3.3.2 Observers/Sea Samplers

The Regional Administrator may request any vessel holding a permit for herring to carry a NMFS-approved sea sampler/observer. If requested by the Regional Administrator to carry an observer or sea sampler, a vessel may not engage in any fishing operations in the respective fishery unless an observer or sea sampler is on board, or unless the requirement is waived.

If requested by the Regional Administrator to carry an observer or sea sampler, it is the responsibility of the vessel owner to arrange for and facilitate observer or sea sampler placement. Owners of vessels selected for sea sampler/observer coverage must notify the appropriate Regional or Science and Research Director, as specified by the Regional Administrator, before commencing any fishing trip that may result in the harvest of resources of the respective fishery. Notification procedures will be specified in selection letters to vessel owners.

For foreign processing vessels, the costs of observer coverage will be collected through fees established in accordance with 16 U.S.C. 1821(h). For domestic vessels, observers will normally be funded through the NMFS observer program. In the future, innovative methods of funding

observers may include industry sponsored initiatives.

Rationale: Management of the herring fishery relies on accurate estimates of catches, catch rates, and bycatch. This measure provides the Regional Administrator and the states the ability to put observers on board to collect this information if necessary. This measure also recognizes that innovative funding methods may be necessary to fund observer programs that may benefit the industry.

3.3.3 Reporting and Record Keeping Requirements

The reporting requirements for the herring fishery are based on the existing requirements for other fisheries in the Northeast Region. The Commission, NMFS, U.S. Fish & Wildlife Service, the New England, Mid-Atlantic, and South Atlantic Fishery Management Councils, and all the Atlantic coastal states are currently developing a coastwide fisheries statistics program (Atlantic Coastal Cooperative Statistics Program, or ACCSP). A minimum set of reporting requirements based on a trip-level for fishermen and dealers is being developed and once adopted by each state/agency, will become the minimum standard for data collection on the Atlantic coast. Nothing in the proposed program would prohibit a state/agency from requiring more detailed information on a trip basis if so desired. As the ACCSP provisions are adopted in the Northeast Region, they will be incorporated into the reporting requirements for the herring fishery.

3.3.3.1 Domestic Fishermen and Foreign Processing Vessels

The operator of any domestic vessel issued a permit to fish for herring must maintain on board the vessel, and submit, an accurate daily fishing log report for all fishing trips, regardless of species fished for or taken, on forms supplied by or approved by the Regional Administrator. This includes those vessels that transport herring from catcher vessels to a dealer or processor. Fishing vessel log reports must include the following information, and any other information specified by the Regional Administrator:

Vessel name; USCG documentation number (or state registration number, if undocumented); permit number; date/time sailed; date/time landed; trip type; number of crew; number of anglers (if a charter or party boat); gear fished; quantity and size of gear; mesh/ring size; chart area fished; average depth; latitude/longitude (or loran station and bearings); total hauls per area fished; average tow time duration; pounds, by species, of all species landed or discarded; dealer permit number; dealer name; date sold; port and state landed; and vessel operator’s name, signature, and operator permit number. As the provisions of ACCSP are incorporated into the vessel trip report system in the Northeast Region, vessels will be required to report a trip number.

In order to facilitate monitoring of area specific TACs, vessels will be required to report, on a weekly basis, their catch of herring from each management area. This may be accomplished through submittal of vessel trip reports on a weekly basis until an Interactive Voice Response (IVR) system can be implemented. In an IVR system, the vessel owner or operator will place a telephone call and report required information to a computerized database that will facilitate timely tracking of landings. The IVR system will require operators to submit the information necessary to accurately track landings of herring from management areas. Such information may include vessel identification and all herring landings and discards by trip and management area, and any other information deemed necessary by the Regional Administrator.

If authorized in writing by the Regional Administrator, vessel owners or operators may submit reports electronically, for example by using a vessel monitoring system (VMS) or other media.

The operator of any foreign processing vessel issued a permit to fish (as defined in 50 CFR 600.10) for herring must submit the fishing logs and reports specified in 50 CFR 600.502.

3.3.3.2 Dealer Reports

Any dealer issued a federal permit must submit weekly dealer reports as specified in 50 CFR 648.(a)(I). Atlantic herring dealers will not be required to report via an IVR system unless the Regional Administrator determines this report is required and publishes a notification in the *Federal Register*. Dealer reports must include the following information, and any other information specified by the Regional Administrator:

Name and mailing address of dealer, dealer number, name and permit number of the vessels from which fish are landed or received, dates of purchases, pounds by species, price by species, port landed. As the provisions of ACCSP are incorporated into the vessel trip report system in the Northeast Region, vessels will be required to report a trip number.

3.3.3.3 Processor Reports

On an annual basis, processors will complete all sections of the Annual Processed Products survey as directed by the Regional Administrator.

Rationale: Accurate statistics on catches are necessary to assess the status of the herring resource. The combined dealer and vessel reporting system serves as a verification of landings. In addition, some of the TAC distribution methods rely on timely reporting of this information. The requirement for weekly reporting via an interactive voice reporting system will give an easy way for fishermen or dealers to provide timely catch and landing information that will facilitate management decisions. Management of the fishery in the future may include allocation decisions that will be based, in part, on the end products produced. The processor report will provide the information necessary to evaluate the relative benefits of the various processing sectors.

3.3.4 FMP Monitoring

The NEFMC Herring Plan Development Team (PDT) will meet with the Commission's Plan Review Team (PRT)/Technical Committee (TC) to review status of the stock and the fishery. Based on this review, the PDT/TC will report to the NEFMC Herring Committee and the Commission Herring Section, no later than July, any necessary adjustments to the management measures adopted and recommendations for the specifications (OY, DAH, DAP, JVPt, JVPs, IWP, BT, USAP, and Reserve) and TACs. The PDT/TC will specifically recommend TACs for the following year and an estimated TAC for the year after. In developing these recommendations the PDT/TC will review the following data: commercial and recreational catch data; current estimates of fishing mortality; stock status; recent estimates of recruitment; virtual population analysis results and other estimates of stock size; sea sampling and trawl survey data or, if sea sampling data are unavailable, length frequency information from the trawl surveys; impact of other fisheries on the mortality of herring, and any other relevant information.

Based on these recommendations, the Herring Committee will recommend to the Council appropriate specifications and any measures necessary to assure that the specifications will not be exceeded. The Council shall review these recommendations and any public comment received and, after consulting with the Commission, will recommend appropriate specifications to the Regional Administrator. Any suggested revisions to federal management measures may be implemented through the framework process or an amendment to the FMP. The Section may recommend any changes to management measures in state waters to the Commission, which may make changes through its adaptive management process or an amendment.

Specifications (for OY, DAH, DAP, JVPt, JVPs, IWP, BT, USAP, and Reserve) and TACs will be implemented by the Regional Administrator. Proposed re-specifications and TACs will be published in the *Federal Register* on or about September 15 for the following fishing year and will provide for a 30 day public comment period. At the close of the comment period, a notice of final specifications will be published in the *Federal Register*. The previous year's specifications will remain effective unless changed by the Regional Administrator. If the specifications will not be changed, this will be announced through a notice action.

The Regional Administrator may adjust any of the specifications (OY, DAH, DAP, JVPt, JVPs, IWP, BT, U.S. at sea processing, and Reserve) and TACs during the fishing year after consulting with the Council, consistent with the plan objectives and other plan provisions. For example, adjustments may be made to correct for errors in estimating any of the specifications, to provide for increased opportunities for U.S. fishermen to use the resource, or to address conservation concerns. Proposed adjustments will be published in the *Federal Register* stating the reasons for the action and providing for a comment period.

If the Regional Administrator determines that the New Brunswick fixed gear fishery will not harvest 20,000 mt by October 1, the TAC for Management Area 1A may be adjusted by the difference for the remainder of the year. This adjustment will be made if the amount will provide increased opportunities for fishing in Area 1A for the U.S. industry. This adjustment will be accomplished through a notice action, without an opportunity for public comment.

Rationale: This measure describes a system that will provide for a regular review of the fishery and the management measures so that necessary adjustments can be made. It also provides for in-season adjustments of the specifications if necessary. While most of these adjustments provide for a comment period, the adjustment of the Area 1A TAC does not. This is so that the adjustment can be made in time for fishermen to harvest the additional herring prior to the end of the year.

The proposed specifications include a breakdown of the total amount allocated to foreign processing vessels into components for processing in the EEZ (JVPs) and in state waters (IWP). IWP activities are authorized by the governor of a state and are limited only by the necessity for the governor to consult with other states and the Council, and a determination that processing capacity in the state is not sufficient to process the fish landed in that particular state. The proposal establishes a process to make sure that the amount of herring processed by foreign processors in state and federal waters does not hinder domestic processors. The Commission has adopted the identical provision in its herring management plan as a compliance criteria, which will provide the ability to enforce this specification.

3.3.5 Framework Adjustment Measures

Many management measures in this FMP can be adjusted via framework action. The effectiveness of the management program depends on uncertain factors that may change over time. It is therefore necessary to have an administrative mechanism in place that fulfills the Council's public input and notification requirements while maximizing flexibility and responsiveness.

The framework adjustment process allows changes to be made in regulations in a timely manner without going through the plan amendment process. The purpose is to provide a formal opportunity for public comment that substitutes for the customary public comment period provided when publishing a proposed rule. If changes to the management measures were contemplated in the FMP, there was sufficient opportunity for public comment on the framework action, and the changes are not highly controversial, the Secretary of Commerce may waive the need for additional public comment through the publication of a proposed rule in the *Federal Register*.

In response to the annual review by the PDT/PRT or at any other time, the Council may recommend adjustments to any of the measures proposed by this FMP. The Council proposes to include a framework process to adjust management measures. At least two publicly announced meetings would be held to discuss and receive comment on any proposal to address an issue in the herring fishery. Following approval of the proposed management measures at the second meeting, the Council would prepare and submit the final documents to the Secretary. The pre-planned process, the public notice, and advanced availability of the proposals would give the Secretary sufficient justification to waive the customary 15 to 30 day public comment period. If the Council's submission is approved and the Council met the requirements for public comment, the management measures could be published as final rules and take immediate effect.

The initial phase of the proposed framework process will begin when the Council becomes aware of a problem in the fishery. The Council will seek industry advice through public comment, through the oversight committee, or from the herring advisory panel. After considering alternatives developed through this process, or at any other time the Council determines that adjustments are necessary, the Council will develop and analyze the recommended management actions over the span of at least two Council meetings. The meeting where the industry and oversight committee make the formal recommendations to the Council would be the first framework meeting. The Council will provide the public with advance notice of the time, date and place of the two framework meetings and will include a detailed description of the action under consideration. Notice will be announced in the *Federal Register* at least two weeks prior to the first framework meeting. The Council will also inform interested parties of the meeting by sending a notice to them.

After accepting public comment at the first framework meeting, the Council could (1) refer the issue back to the oversight committee for further consideration, (2) make adjustments to the measures that were proposed, or (3) approve of the measures and begin developing the necessary documents to support the framework adjustments. If the Council approves the proposed framework adjustments, the Council will identify, at this meeting, a preferred alternative and/or identify the possible alternatives. This decision will enable the Council to develop a framework

document that discusses and shows the impacts of the alternatives. It will be available to the public prior to the second or final framework meeting. The Council must provide NMFS with the proposed alternatives and analyses at least seven working days prior to the second or final Council meeting if more than two Council meetings have occurred on the framework, to assure that NMFS has sufficient time to review them.

Notice of the second or final meeting will be published in the *Federal Register* at least two weeks prior to the meeting. The notice will include a discussion of the proposed action, the date that the framework document having alternatives and analyses will be available to the public at the Council office, and a request for written public comments. These written public comments will be due at the Council office two days prior to the final framework meeting. If the Council cannot meet its requirements, it will schedule another meeting and follow the same procedures outlined above for the final framework meeting. The final framework meeting will be a full Council meeting, but interim meetings may be scheduled to receive public comment.

If the Council approves the framework action, it will submit documents describing the supporting rationale, and include an analysis of impacts, and a recommendation on whether the Secretary should publish the management measures as a final rule. If the Council recommends that the management measures should be published as a final rule, the Council will consider the following factors and submit the necessary support and analysis for each:

(1) Whether the availability of data on which the recommended management measures are based allows for adequate time to publish a proposed rule, and whether regulations have to be in place for an entire harvest/fishing season;
(2) Whether there has been adequate notice and opportunity for participation by the public and members of the affected industry in the development of the Council's recommendation;
(3) Whether there is an immediate need to protect the resource or to impose management measures; and
(4) Whether there will be a continuing evaluation of management measures adopted following their promulgation as a final rule.

If the Council's recommendation includes adjustments or additions to management measures, and if after reviewing the Council's recommendation and supporting information, the Regional Administrator may:

(1) Concur with the Council's recommended management measures and determine that the recommended measures may be published as a final rule based on the four factors specified above. The recommended management measures will be published in the *Federal Register* as a final rule,
(2) Concur with the Council's recommendation, but determine that the recommended measures should be published first as a proposed rule. The action will be published as a proposed rule in the *Federal Register*. After additional public comment, if the Regional Administrator concurs with the Council recommendation, the action will be published as a final rule in the *Federal Register*, or
(3) Disapprove the Council's recommendation. The Council will be notified, in writing, of

the reasons for the non-concurrence.

If the Regional Administrator approves the Council's recommendations, the Secretary is expected to waive for good cause the requirement for a proposed rule and opportunity for public comment in the *Federal Register*. The Secretary, in doing so, will publish a "final rule" to remain in effect until amended.

3.3.6 Management Measures That Can Be Adjusted Through Framework Action

These potential framework management measures and the process set up by amending the FMP constitutes the framework adjustment process. The FMP incorporates an extensive list of possible framework adjustment measures, including the possible adoption of a limited entry or controlled access system. These framework adjustments can either implement new management measures, or change existing measures in the plan.

The herring fishery is expected to expand in the future, particularly with the development of an offshore fishery targeted by U.S. vessels. The expansion of this new segment of the industry is underway and may occur rapidly. The plan provides a great deal of flexibility through this list of framework adjustment measures to quickly adapt to this developing fishery. The impacts of these framework measures have not been thoroughly analyzed but fall within the scope of possible management measures considered by this FMP.

3.3.6.1 Management Area Boundaries or Additional Management Areas

The management area boundaries adopted by the plan account for current understanding of stock structure, as well as existing fishing patterns. Additional information on herring spawning components may suggest changes in the management areas. In a similar fashion, as the fishery develops, there may be a need to adjust management areas to reflect new fishing patterns.

Rationale: This adjustment is necessary to provide the flexibility to revise management areas as additional information on stock structure is developed, or fishing patterns change.

3.3.6.2 Size, Timing, or Location of a New or Existing Spawning Area Closure

The spawning closures adopted by this plan use fixed dates and are based on existing knowledge of spawning areas. It is possible additional information will suggest dates that more accurately reflect the time of peak spawning. The areas selected for the closures may also need to be changed, particularly as spawning locations are more precisely located and defined. In addition, particularly in the offshore areas, there may be a need for additional spawning closures as the fishery develops.

Rationale: This adjustment is necessary so that the Council can insure spawning closures adequately protect the herring resource.

3.3.6.3 Closed Areas Other Than a Spawning Closure

The proposed measures do not include closed areas designed to reduce fishing mortality or to address other concerns. There is a possibility, however, that as the fishery develops a need may be identified to prevent herring fishing for a variety of reasons – to provide an adequate forage base for other spawning fish at specific times, to reduce marine mammal interactions or address

bycatch concerns, or to limit fishing mortality on a component of the stock in a particular time or area.

Rationale: This adjustment may be necessary to restrict fishing on herring in specific areas.

3.3.6.4 Restrictions in the Amount of Fishing Time

The proposed measures include effort controls that limit the days of fishing for herring as various levels of the TAC are reached. The intent of these days out of the fishery is to slow the catch rate in order to minimize market interruptions and to prevent the TAC from being exceeded. The selected days out may prove to be either excessive in number or not sufficient to accomplish these goals. Adjustments may be necessary both due to changes in resource abundance and fishermen's behavior.

3.3.6.5 Days at Sea System

The proposed management measures do not include a days at sea system as an effort control measure. Instead, the plan uses mandatory days out of the fishery ("no fishing" days) in order to lower catch rates as the TAC is approached. If this measure is unsuccessful, there may be an interest in providing additional flexibility to fishermen to fish a limited number of days of their choice. If such a system is implemented, fishermen may also want to have the ability to transfer or lease these days at sea.

3.3.6.6 Adjustments to Specifications

The proposed measures allow the Regional Administrator to adjust the specification amounts (OY, DAP, DAH, JVPt, JVPs, BT, USAP, or the Reserve) or TACs on an annual or in- season basis after consulting with the Council. The Council may, however, wish to revise the formulas used for determining the specifications or change the definitions of the different elements of the specifications.

Rationale: This adjustment is necessary to provide the Council the ability to adjust the specification process as necessary.

3.3.6.7 Adjustments to the Amount of Canadian Catch Deducted When Determining Specifications

The plan includes a limit on the amount of Canadian catch that is considered when determining specifications. This amount is based on recent Canadian landings history in the New Brunswick fixed gear and Georges Bank herring fisheries. The amount could change as the Canadian fisheries change. Additional information may also determine that the Canadian catch (particularly the New Brunswick fixed gear catch) should not be considered part of the coastal stock complex, changing the impact of this catch on the U.S. harvest. There is also interest in establishing a procedure with Canada to agree on the allocation of the coastal stock complex. Any of these factors would necessitate a change in the amount deducted when determining the specifications.

Rationale: This adjustment is necessary so the amount of Canadian catch deducted when determining specifications can be adjusted as conditions change.

3.3.6.8 Distribution of the TAC

The plan establishes a procedure for allocating the annual overall TAC to different management areas and time periods. This procedure includes an annual review, and allows for the consideration of new information on stock mixing, the relative size of stock components, and changing fishing patterns. At some point there may be a desire to revise the area/time distribution pattern to time periods or areas that area assigned part of the TAC. There may also be a desire to revise the process used to distribute the TAC.

Rationale: This adjustment is necessary to provide the Council the ability to revise the TAC distribution method to a different system or to change the time periods and areas used to allocate the TAC.

3.3.6.9 Gear Restrictions

The proposed management measures do not include any restrictions or requirements for gear types. Gear restrictions (such as mesh size, etc.) or requirements (such as bycatch reduction devices, etc.) may be a method to regulate the catch of herring in the future. This will allow the greatest flexibility to fishermen in developing the fishery. There may be a need, as the fishery expands, to regulate gear use because of concerns over discards, bycatch, interactions with marine mammals, or to target herring of a particular size.

Rationale: This adjustment is necessary to provide the ability to incorporate gear restrictions or regulations into the fishery.

3.3.6.10 Vessel Size/Horsepower Restrictions

Limiting the size and horsepower of vessels allowed into the herring fishery can be used as a measure to help control the capacity of the fishing fleet. This can be for social or economic reasons, as well as to help in conservation efforts by limiting the rapid introduction of catching capacity while there are uncertainties over the estimates of stock size and the impact of the fishery on other recovering fish stocks. It may also be determined that the limits imposed by the plan should be removed in order to allow the industry greater flexibility in using the resource.

Rationale: This adjustment provides the Council the flexibility to adjust restrictions on vessel size as conditions warrant.

3.3.6.11 Closed Seasons

The proposed measures do not include any closed seasons – periods where the landing of herring is prohibited. There could, however, be a need to establish such a season. Closed seasons could be used to reduce fishing mortality or to limit the harvest of herring during a spawning season, for example. They may also limit the impacts of herring fishing on marine mammals or other species, or reduce the number of gear conflicts. Closed seasons, while effective in limiting the catch of herring, may have severe negative impacts on herring markets due to the interruption of supply.

Rationale: This adjustment is necessary to provide the Council the flexibility to use closed seasons to reduce fishing mortality, provide spawning protection, or change the selectivity of the harvest to improve yield-per-recruit, or for other reasons.

3.3.6.12 Minimum Fish Size

The proposed measures do not establish any minimum fish sizes. Minimum fish sizes can be used to reduce fishing mortality for juvenile fish, or to increase the yield from the fishery. These limits are difficult to establish and enforce in the large volume herring fishery, which has historically included a segment that targets the harvest of juvenile fish for various markets. There could be a need in the future to limit the harvest of juveniles, or to establish minimum sizes for different uses.

Rationale: This adjustment is necessary to enable the Council to adopt minimum fish sizes should it be necessary to reduce fishing pressure on juvenile herring.

3.3.6.13 Trip Limits

The proposed measures establish a trip limit for incidental catches of herring during spawning closures or when effort controls are effective. This size of this limit may need to be adjusted. For example, it may be necessary to reduce incidental landings if additional participants enter the fishery. It may also be necessary to raise this limit to reduce discards in the incidental catch fishery.

The proposed measures do not establish a trip limit for the directed herring fishery. A trip limit could be useful in the directed fishery in order to slow catch rates of herring to extend the fishing season, minimizing market interruptions. A trip limit could also be used to reduce fishing mortality, though it will be of limited effectiveness unless the number of participants in the fishery is controlled in some manner.

Rationale: This adjustment is necessary to provide the Council the flexibility to adjust the incidental catch trip limit, or to establish a trip limit in the directed herring fishery.

3.3.6.14 Seasonal, Area, or Industry Sector Quotas

The proposed measures include the assignment of a TAC to various areas and annual time periods – in effect, a quota scheme. It may be desirable to further subdivide the TAC into quotas for specific seasons or time periods, or for some smaller area such as a state or other geographic delineation. It could also be desirable to establish a quota for a particular industry sector, such as for inshore and offshore processing sectors, or for a particular harvesting sector. These allocations will primarily address social or economic concerns. It is possible, though, that a seasonal or area quota may help protect an individual spawning component.

Rationale: This adjustment is necessary to provide the Council the flexibility to establish quotas in addition to the area and time-specific TACs.

3.3.6.15 Measures to Protect Essential Fish Habitat

The Council has identified and designated essential fish habitat for all species it manages, including Atlantic herring. The provisions of the EFH designations are incorporated by reference into this management plan. There may be additional measures identified in the future to protect EFH, such as limiting the use of particular gear types, or closing areas or seasons. In most instances, the measures chosen will be selected from the list of possible framework adjustment measures. Additional measures, however, could be identified that were not considered. They could include restrictions on discharge of harmful substances, for example, or other requirements.

Rationale: This adjustment is necessary to provide the Council the flexibility to adopt management measures necessary to protect essential fish habitat that are not included n the list of possible framework adjustment measures.

3.3.6.16 Measures to Facilitate Aquaculture

Aquaculture projects in the EEZ sometimes need accommodations from existing fishing practices in order to be established. In August, 1997 the Council voted to include in all NEFMC FMPs a framework adjustment process that would facilitate the timely approval of aquaculture projects that would otherwise require a full plan amendment. For aquaculture projects in the EEZ, the Council's recommendations on adjustments or additions to management measures must come from one or more of the following categories: minimum fish sizes, gear restrictions, minimum mesh sizes, possession limits, tagging requirements, monitoring requirements, reporting requirements, permit restrictions, area closures, establishment of special management areas or zones and any other management measures currently included in the FMP.

Rationale: The Council proposes the use of the above-described process to make necessary adjustments to Council FMPs which apply to EEZ-based aquaculture projects. The intent is to make changes to FMPs in a timely manner. During this process, the Council will address issues within its purview, including user group conflicts and fishery habitat-related issues, but will not pre-empt the role of the permitting agencies, the Army Corps of Engineers and the Environmental Protection Agency.

3.3.6.17 Changes to the Overfishing Definitions

The overfishing definitions established by the plan are based on existing scientific information. Improved data collection, changes in stock exploitation, or a better understanding of herring population dynamics may lead to new evidence that suggests more appropriate biological reference points. In particular, an improved understanding of the various components of the coastal stock complex may lead to the development of reference points that are specific to a particular spawning component or area.

3.3.6.18 Vessel Monitoring System (VMS)

The plan requires certain vessels to use VMS, and establishes specific requirements related to these systems. The VMS is intended to assist in the monitoring of area specific TACs and spawning closures, as well as to ease enforcement of closures in other management plans that do not apply to herring vessels. The criteria and operating requirements for the VMS may need to be adjusted as more vessels enter the fishery.

Rationale: This adjustment provides the Council the flexibility to change the criteria or VMS requirements.

3.3.6.19 Use Restrictions

One of the goals of the plan is to achieve optimum yield, that level of harvest with provides the greatest overall benefits to the nation. The various herring products each return different economic values. There may be a need to specify the allowable uses of herring in order to maximize the benefit from the resource. The high catch rates associated with a large-scale mealing

operation, for example, may result in rapid attainment of the TAC, reducing the availability of herring for other higher-value uses. Similarly, the harvest of herring for roe may have adverse impacts on spawning if the harvest is excessive.

The Commission has adopted restrictions on mealing and a roe fishery in state waters. Another possible reason to adopt such measures may be to complement the Commission's management actions.

3.3.6.20 Quota Monitoring Tools

A fundamental element of the plan is the overall TAC, and the distribution of that TAC to different areas and time periods. To insure the TAC is not exceeded, the plan adopts the existing reporting system (the VTR system) system and an IVR system so that timely reporting of catches can be obtained. Experience with the plan may show that additional measures, such as vessel operator or dealer reporting requirements, are necessary to effectively monitor the TAC, or that the frequency of reports can be changed (increase or reduced) for an effective system. Improved methods may be found to facilitate timely reporting.

Rationale: This adjustment will enable the Council to improve monitoring of the TACs or other quotas, for example by taking advantage of improved technology or modifying reporting frequency. reporting requirements.

3.3.6.21 Permit and Vessel Upgrading Restrictions

The proposed measures do not include restrictions on upgrading vessels or permits, or splitting permits. The Council and the MAFMC recently submitted an amendment to their plans that will make all such requirements consistent. They only apply, however, to limited entry fisheries. Since the herring fishery is an open access fishery, these regulations were not included in the plan. If, in the future, a limited entry or controlled access scheme is adopted, these permit and upgrading restrictions may be incorporated into the herring management measures.

Rationale: This adjustment is necessary so the Council can keep permit and vessel upgrading restrictions consistent across all management plans.

3.3.6.22 Implementation of Measures to Reduce Gear Conflicts

Other management plans adopted by the Council include framework adjustment measures to address gear conflicts. Gear conflict has been an historic problem for fishermen. In New England, gear conflict arose as fishermen switched from hook and line gear to trawls to catch groundfish. During the late 1970's and early 1980's, fishermen using gill nets became more adept at setting their gear on hard bottom, places historically left to fishermen using hook and line gear. This conflict erupted and the Council unsuccessfully tried to manage the problem. From the early 1990's to the present, trawl fishermen have begun to target non-traditional species (monkfish, dogfish, whiting) in areas historically fished by lobster traps and anchored gill nets.

Whenever gear conflict was infrequent, fishermen working close to one another were often able to forge informal agreements to set their gear in certain areas and follow certain guidelines. This method of resolving the problem can be effective as long as the target species do not have a high degree of overlap or when the resource is abundant enough to support the level of fishing effort.

When market demand increases, especially for an underutilized species, or when traditional species are not abundant, shifts in fishing effort occur. These shifts can cause gear conflict when vessels using incompatible methods damage other fishing gear. Adjustments made through the framework process will therefore be viewed as part of a larger program already having conservation benefits and preventing overfishing. A package of simultaneous adjustments to one or more FMPs will allow analysis and review of the beneficial and adverse impacts on all affected fisheries, rather than based on their impact on only a particular fishery or sector.

Measures used to address gear conflict may include:

(a) Mandatory monitoring of a radio channel by fishing vessels;
(b) Gear location reporting by fixed gear fishermen and mandatory plotting by mobile gear fishermen;
(c) Standards of operation when gear conflict occurs;
(d) Fixed gear marking or setting practices;
(e) Gear restrictions for certain areas;
(d) Vessel monitoring systems;
(e) Restrictions on the maximum number of fishing vessels;
(f) Special permitting conditions

Rationale: This adjustment will enable to Council to quickly adopt measures to address gear conflicts that are consistent with other management plans.

3.3.6.23 Limited Entry or Controlled Access System

The proposed action manages the herring fishery as an open access fishery. There was considerable concern during development of the plan, however, that there may be the need to control the number of participants in the fishery in the near future. This may be an issue in all management areas, but is a particular concern in the Gulf of Maine (Management Area 1). The draft management measures included a limited entry and controlled access option that was not adopted by the Council. This proposal included suggested qualification criteria and a brief analysis of the vessels that would qualify under the various criteria.

In the past, the Council has submitted limited entry or controlled access proposals as a full plan amendment. Recognizing the concern over the possible over-capitalization of the herring fishery, the Council has decided to include the adoption of such a system as a framework adjustment measure. This will facilitate the rapid implementation of such a system should it prove necessary. While this adjustment measures will allow the adoption of limited entry through a framework adjustment, the Council may choose to submit a full plan amendment.

Rationale: This adjustment will provide the utmost flexibility to the Council in implementing a limited entry or controlled access system in the herring fishery. This adjustment will allow the Council to implement such a system either through the normal amendment process, or through framework action.

3.3.6.24 Other Management Measures Currently Included in the FMP

In addition to the above list of framework adjustment measures, the current plan includes the

following management measures: permit and reporting requirements, framework adjustment procedures, observer/sea sampler requirements, joint venture restrictions, and restrictions on transfers at sea. With the exception of the last two measures, these are primarily administrative requirements that may need to be adjusted. Joint venture restrictions may need to be revised to encourage development of domestic processing. Transfer at sea provisions may need to be adjusted to facilitate enforcement of effort controls or spawning closures, or to match any changes in trip limits or other restrictions in activity.

3.4 Management Areas

Management area boundaries are key elements of the TAC distribution systems in section 3.6.3. They may also be used to apply other management measures, such as areas that require the use of VMS. The management areas and sub-areas (Figure 4) are defined as:

Management Area 1 (Gulf of Maine):
All U.S. waters of the Gulf of Maine north of a line extending from the eastern shore of Monomoy Island at 41° 35' N. lat. eastward to a point at 41° 35' N. lat., 69° 00' W. long., thence northeasterly to a point along the Hague Line at 42° 53'14" N. lat., 67° 44'35" W. long., thence northerly along the Hague Line to the U.S.-Canadian border, to include State and Federal waters adjacent to the states of Maine, New Hampshire, and Massachusetts.

Management Area 1 is divided into Area 1A (inshore) and Area 1B (offshore). This line identifies inshore fishing grounds that have supported most of the catch to date. The line dividing these areas is described by the following points:

(1)	70° 00'W	(Cape Cod shoreline at 70° 00W)
42° 38.4'N	70° 00'W	
42° 53'N	69° 40'W	
43° 12'N	69° 00'W	
43° 40'N	68° 00'W	
43° 58'N	67° 22'W;	

(the U.S.-Canada maritime Boundary).
Northward along the irregular U.S.-Canada maritime boundary to the shoreline.

Management Area 2 (South Coastal Area):
All waters west of 69° 00' W. long. and south of 41° 35' N. lat., to include state and Federal waters adjacent to the states of Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia and North Carolina.

Management Area 3 (Georges Bank):
All U.S. waters east of 69° 00' W. long. and southeast of the line that runs from a point at 69° 00' W. long. and 41° 35' N. lat., northeasterly to the Hague Line at 67° 44'35" W. long. and 42° 53'14" N. lat.

Rationale: The three management areas contained in the Preliminary Management Plan (PMP) are modified in this plan. This action is based on knowledge of the seasonal distribution and

availability of juvenile and adult fish within the management unit area, regional differences in the nature and degree of harvesting (different gear types) and processing activity (differences in sizes and ages of fish processed), differences between the inshore and offshore fishing grounds and habitat, and the location of known spawning grounds. One of the most important reasons for distinguishing management areas is to avoid over-exploitation of individual spawning components that are included within the stock complex. Despite the fact that the management unit extends throughout the range of the species in U.S. waters, there is evidence that the U.S. Atlantic herring resource is comprised of separate spawning components that occupy identifiable areas prior to and during spawning. For these reasons, it is appropriate to establish an overall management program that is consistent with unique conditions of the resource and the fishery within separate management areas and allows for the cooperative management of the resource by different regulatory jurisdictions (the states, the Commission and the New England and Mid-Atlantic Fishery Management Councils). The management areas allow the application of different TACs or management measures in different areas. This provides more flexibility to the management program, as measures do not have to be applied to the entire area when they may be more appropriate in only one area.

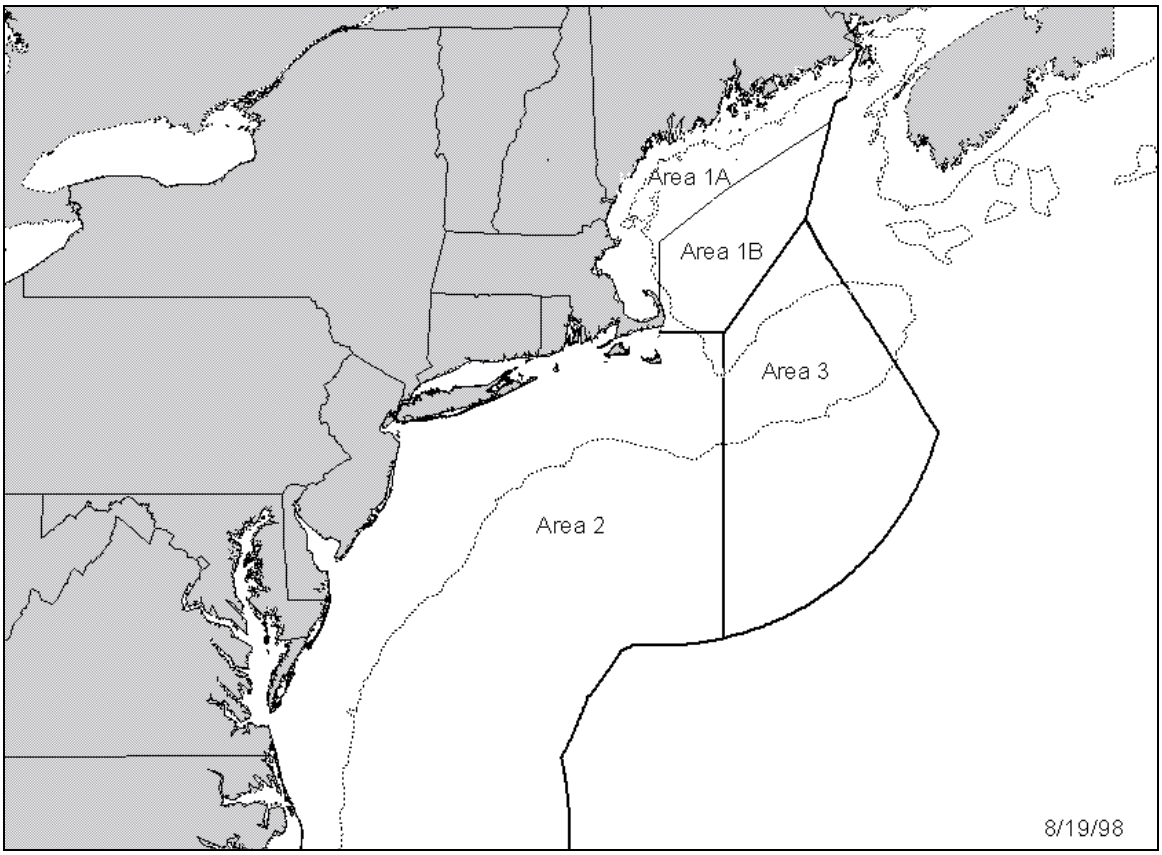

Figure 4 - Herring management areas

3.5 Spawning Area Closures

3.5.1 Management Area 1

Spawning closures are proposed for Management Area 1 (in both subareas 1A and 1B). These areas are modified from the spawning closures implemented by the Commission in its 1994 management plan. Spawning closure dates are fixed. In an area closed to protect spawning, fishing for, harvesting, or possessing herring will not be allowed except for the following exception: vessels will be allowed to catch and possess up to 2,000 pounds of herring per trip. The amount of herring landed from a closed spawning area by one vessel in a day cannot exceed 2,000 pounds (this prohibits a vessel from making multiple trips in one day to exceed the 2,000 pound trip limit). This limit will be enforced based on calendar days and not on the basis of days-at sea used in any other management plan (for example, a groundfish days at sea running clock cannot be used to land more than 2,000 pounds of herring in one calendar day). Any fishing vessel transiting a closed spawning area and possessing more than 2,000 pounds of herring must have all fishing gear stowed as specified by the Regional Administrator.

The boundaries of the spawning closures, and the dates the areas are closed, may be adjusted through framework action (see section 3.3.6). Additional area closures may also be adopted through framework action.

The spawning closure areas (Figure 5) in Management Area 1 are defined as:

Eastern Maine

All waters of the EEZ bounded by state waters and the following coordinates:

Maine state waters	68° 20'W
43° 48'N	68° 20'W
44° 04.4'N	67° 48.7'W
44° 06.9'N	67° 52.8'W
44° 31.2'N	67° 02.7'W

North along US/Canada border

Western Maine

All waters of the EEZ bounded by state waters and the following coordinates:

43° 30'N	Intersection with Maine state waters
43° 30'N	68° 54.5' W
43° 48'N	68° 20'W

North to Maine state waters at 68° 20'W

Cashes Ledge

43° 15'N	69° 30'W
43° 15'N	69° 45'W
43° 00'N	69° 45'W
43° 00'N	69° 30'W
42° 40'N	69° 30'W
42° 40'N	68° 50'W
43° 10'N	68° 50'W
43° 10'N	69° 30'W

Jeffreys Ledge

All waters in the EEZ bounded by state waters and the following coordinates:

43° 12.7'N	70° 00.0'W
43° 09.5'N	70° 08.0'W
42° 57.0'N	70° 08.0'W
42° 52.0'N	70° 21.0'W
42° 41.5'N	70° 32.5'W
42° 34.0'N	70° 26.2'W
42° 55.2'N	70° 00.0'W

Stellwagen Bank National Marine Sanctuary

All waters in the EEZ bounded by state waters and the following coordinates:

42° 34.0'N	70° 23.5'W
42° 28.8'N	70° 39.0'W
42° 18.6'N	70° 22.5'W
42° 05.5'N	70° 23.3'W
42° 11.0'N	70° 04.0'W

The closure dates will be:

Eastern Maine	August 15 – September 11
Western Maine	September 1 – September 28
JeffreysLedge/ Stellwagen Bank	September 15 – October 12
Cashes Ledge	August 1 – September 25

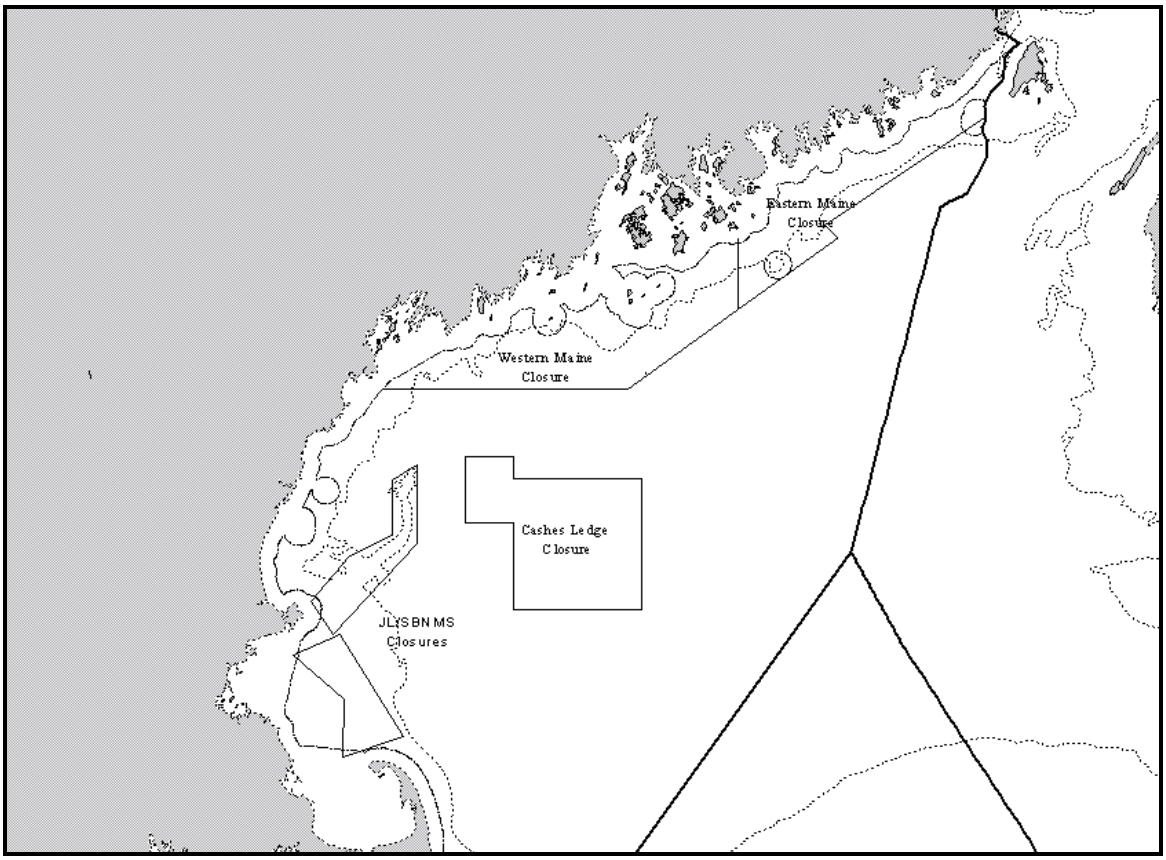

Figure 5 - Herring Management Area 1 spawning closures (with approximate territorial sea boundary shown)

Rationale: Herring schools are especially susceptible to fishing when they aggregate for spawning. This is also when herring are at their most valuable, as fat content is generally at its

peak. These economic reasons to allow fishing on spawning herring, however, are opposed by conservation concerns. Herring in the latter stages of spawning are not fit for some markets, resulting in the was. Fishing on spawning aggregations not only results in high catch rates, but it interferes with the spawning behavior of those herring not caught. There is evidence that part of the reason for the collapse of the Georges Bank fishery in the late 1970's was not only due to high overall mortality, but because sequential fishing on spawning herring reduced the resiliency of the stock to survive the increased fishing pressure (Anthony and Waring, 1980). Spawning closures provide the maximum opportunity for successful spawning.

The spawning closures adopted by this plan are also intended to complement the spawning area restrictions contained in the Commission's amended management plan for Atlantic herring. The Commission's measures apply a "tolerance" provision to fishing for Atlantic herring in states waters of the Gulf of Maine for the period August 1 through October 31. This "tolerance" allows the catching of herring as long as no more than a certain percentage consist of spawn fish. As the Commission and the Council discussed measures to protect spawning aggregations of herring, one of the options considered by the Council was to leave the protection of spawning herring to the Commission. Under this concept, the only protection for spawning fish would have been through any landing regulations implemented by the states in accordance with the Commission's plan. Some states, however, do not have the resources to implement and enforce the tolerance provision. As a result, if the Council did not adopt any spawning closures, it is possible that vessels could catch spawn herring in federal waters and land them in a state that is unable to enforce the Commission's provisions, preventing effective spawning protection. By adopting spawning closures in federal waters for the key areas and times of spawning activity, the Council's closures augment the efforts of the states to protect spawning herring.

3.5.2 Management Areas 2 and 3

Because of the robust condition of the herring resource and interest in developing the offshore fishery, spawning closures will not be established in these areas when the plan is implemented. Closures may be established in the future as information is obtained on the appropriate times and areas to be closed and the industry develops the ability to harvest herring offshore. Closures may also be adopted if it is determined a developing roe fishery needs to be limited to protect the resource.

3.6 Catch Controls

The Atlantic herring fishery will be managed as an open access fishery in the EEZ. The system adopted by the plan uses a total allowable catch to limit the harvest of herring. The TAC is distributed to different areas and time periods, both to protect various spawning components and to encourage development of the offshore resource. Effort controls are incorporated to slow the harvest of herring as the TAC is approached and to encourage fishing effort to shift into other areas as the TAC in an area is approached.

3.6.1 Total Allowable Catch (TAC)

The Total Allowable Catch (TAC) will be determined for the coastal stock complex. The TAC will serve as an analytical device for purposes of evaluating the conditions of the resource and rate of capture. TACs will also be determined for each management area. TACs will be recommended

on an annual basis by the PDT/TC. All herring catches, juvenile and adult, from both state and federal waters, will apply to the TAC. The total of any assigned TACs will not exceed OY.

Rationale: The setting of a TAC protects the resource by establishing a target harvest level that is based on the biological status of the stock. Management measures can be revised to meet this target.

3.6.2 TAC Limitation

In the event that effort controls fail to restrict the catch of herring, the catch in an area will not exceed 100% of the TAC assigned for a particular time period. Up to 5% of each area or sub-area TAC will be set aside for incidental catch in other fisheries. The directed fishery for herring will be closed in a management area or sub-area when the Regional Administrator projects the catch will exceed 95% of the TAC for that area or sub-area. The difference between 100% of the TAC and 95% of the TAC is a set-aside to allow the incidental catch of herring in other fisheries to continue after the directed fishery is closed. This set-aside can be reduced (making a larger percentage of the TAC available for the directed fishery) by the Regional Administrator if it appears to overestimate catches of herring in other fisheries. Such an adjustment will be made on an annual basis after providing an opportunity for public comment through notice in the *Federal Register*. Incidental catch in an area closed to directed herring fishing will be limited to 2,000 pounds per trip as described in section 3.6.4.

Rationale: Closing the fishery when the TAC is reached will protect the resource and ensure long term sustainable catches are achieved. This provision also sends a signal to the industry that harvests should be controlled or the fishery may close. The set-aside for incidental catches in other fisheries reduces the likelihood that the overall TAC will be exceeded. This level can be reduced by the Regional Administrator, or can be increased through a framework adjustment measure, if it appears to misstate the incidental catch. An analysis of the proposed 5% incidental catch set aside, and its impacts on the resource, is in section E.7.2.5.2.

3.6.3 TAC Distribution

The total allowable catch will be distributed to Management Areas 1A, 1B, 2, and 3 on an annual (January through December fishing year) basis. The individual area TACs are designed to allow flexibility in the harvest of herring while protecting individual spawning components. All available information, including tagging studies and the NMFS fall bottom trawl survey, is used to estimate the proportion of each spawning component (Gulf of Maine and Georges Bank/Nantucket Shoals) that occupies each management area during each season, and the size of each stock, the overall TAC is distributed so that spawning components are not overfished. The proposal includes the flexibility to revise distribution of the TAC as relative stock sizes change, additional information is learned on stock migration and mixing, or improved assessment techniques allow a more refined estimate of the size of the individual spawning components.

Using estimates of stock size developed through the assessment of the coastal stock complex of herring, allowable biological catch (ABC) can be determined. While the assessment is performed on the entire stock complex, it is widely acknowledged there are separate spawning components of herring that should not be overfished (Iles and Sinclair 1982; Boyar et al. 1973; Haegle and Schweigert 1985). Any distribution of the annual TAC that ignores the existence of these

spawning components risks damaging the resource by overfishing a specific component while remaining within the overall harvest level. For this reason, the Council proposes to distribute the overall TAC to separate areas. This will allow the setting of these area TACs to reduce the risk of overfishing a specific herring spawning component.

The determination of area TACs is complicated by incomplete information on the migration of herring and the relative sizes of the spawning components. During spawning season, however, there is believed to be little mixing of the separate spawning components. An examination of NEFSC fall trawl survey data (conducted during the spawning season for herring) by the 27th SAW resulted in estimates of minimum population size for each of three areas: the Gulf of Maine, Nantucket Shoals, and Georges Bank. An annual ratio of population size to total population was determined for each of these areas for the time periods 1988 – 1997 and 1993 – 1997. Coastal Maine accounted for 27% of the population biomass during the ten year period, declining slightly to 24% - 26% in the shorter, more recent period. Nantucket Shoals accounted for 63% of the biomass in the longer period, declining to 57% in the 1993-1997 period. Georges Bank accounted for 10% of the biomass in the longer period, but has increased to approximately 17%-18% in the recent period, reflecting the resurgence of the Georges bank component (NEFSC, 1998). These relative stock size ratios can be applied to the ABC to estimate how much herring can be taken from each spawning component. These estimates should be viewed as guidelines only rather than absolutes as the accuracy of the percentages has not been determined.

The various spawning components, however, are known to intermingle outside of spawning season. This mixing must be taken into account when distributing the annual TACs to minimize the risk of overfishing a specific spawning components. Some of the Gulf of Maine component, for example, is believed to migrate into Management Area 2 during the winter months. The following table summarizes current estimates of the distribution of the various spawning components throughout the year. This table is based on current knowledge of herring migration and mixing; as additional information is learned, the estimates of the percent of a component in a management area may be revised. For example, changes in relative size of the various spawning components may result in different percentages of the total coastal stock complex in an area during a specific season. The PDT/TC annual review of the management plan will update the estimates of stock distribution when determining TACs for the following year.

Time of Year	Component	Percent of Component in Management Area		
		1	2	3
Dec-March	GOM	100	20	0
	GB/NS	0	80	0
Apr-July	GOM	50	0	0
	GB/NS	50	100	100
Aug-Nov	GOM	100	0	0
	GB/NS	0	100	100

Table 4 - Distribution of spawning components by season

It is possible to assign seasonal and area TACs based on this estimated distribution of the various spawning components. Such a system, however, would be difficult to administer and monitor, and would risk frequent interruptions in fishing and the supply of herring as seasonal TAC s are approached and effort controls are implemented. The Council proposes a simpler approach, using annual TACs in each of four areas that consider the seasonal distribution of herring and relative size of various components.

The maximum size of an individual area TAC is based on the percentage of the ABC that can be harvested from each of the spawning components. Estimates of Canadian catches in the New Brunswick juvenile and Georges Bank fisheries are then subtracted to determine the U. S. harvest available from each spawning component (as described/limited in section 3.2). The amount that can be harvested from each area is determined after considering the migration and mixing of the various components, the pattern of the fishery, and any other relevant factors.

Most herring are currently harvested in the inshore area of Management Area 1. A TAC is established in Area 1A to limit harvest to acceptable limits. Because some Gulf of Maine herring migrate into Management Area 2 in the winter months, the TAC set for Area 1 must consider the impact of the winter fishery in the northern part of Management Area 2. Twenty percent of the fish caught in this area/time period are believed to be Gulf of Maine fish. This means the Area 1A TAC will not equal the entire amount that can be removed from the Gulf of Maine spawning component if there is a winter fishery in Management Area 2. The amount of this impact will change as the fishery develops and if relative spawning component sizes change.

The process to be followed in determining annual TACs will be as follows:

(1) Estimate the relative abundance of herring in each of three areas during spawning season
(2) Consider existing information on stock distribution and adjust the distribution of spawning components by area (Table 3) as necessary
(3) Examine seasonal patterns in the fishery to identify changes in the exploitation of various spawning components over time
(4) Based on ABC, estimate the allowable U.S. harvest from the components of herring that spawn in the Gulf of Maine, Georges Bank, and Nantucket Shoals

(5) Estimate the expected harvest of Gulf of Maine herring in the winter fishery in Management Area 2
(6) Estimate the expected harvest of Georges Bank and Nantucket Shoals herring in Management Area 1
(7) Establish the TACs for Areas 1A, 1B, 2, and 3
(8) Determine the amount , if any, of the TAC that will be assigned to a TAC reserve

The TACs for each area will be forwarded to the Regional Administrator who may implement them as described in section 3.3.4. The Regional Administrator may apportion any or all of the reserve to a management area after consulting with the Council.

The Regional Administrator will project whether the New Brunswick juvenile fishery will harvest 20,000 mt by October 1. If it is determined this fishery will harvest less than 20,000 mt, the TAC for Management Area 1A will be increased by the difference.

3.6.3.1 Initial TAC Distribution

Upon implementation of the FMP, the initial TAC distribution will be determined and distributed on the basis of an ABC of 300,000 mt and an OY of 224,000 mt. Relative abundance of herring in each area are estimated as described in Table 4. The winter removals of Gulf of Maine fish from Area 2 are estimated at 10,000 mt. The relative proportion of the biomass of herring in each area during spawning season is estimated as 25% in the Gulf of Maine, 55% on Nantucket Shoals, and 20% on Georges Bank.

For Management Area 1A, the initial area TAC is 45,000 mt as calculated below:

(coastal stock complex ABC of 300,000 mt) * 0.25 (relative proportion of Gulf of Maine spawning component) = 75,000 mt

75,000
-20,000 removed by the New Brunswick weir fishery
55,000
-10,000 removed during Area 2 winter fishery
45,000
+15,000 added for GB/NS contribution to historic Gulf of Maine summer fishery
+10,000 added for GB/NS contribution to offshore Gulf of Maine
70,000 Total Annual US TAC for Area 1 based on historic fishery

There are believed to be periods of the year when GB/NS spawning component herring are found in offshore areas of the Gulf of Maine (within Management Area 1B). The historic fishery – in particular the coastal fixed gear fishery – did not exploit these fish. An estimate of 10,000 mt of herring can be harvested from this area. The total amount of herring that can be harvested from Management Area 1 is thus 70,000 mt. This amount is divided into 1A and 1B components. The harvest of herring Management Area 1A will be limited to 45,000 mt, and the harvest in Area 1B will be limited to 25,000 mt.

Landings in Management Areas 2 and 3 will be limited to 50,000 mt each. In addition, there will

be a 54,000 mt TAC reserve. Because some Gulf of Maine herring are caught in Management Area 2 in the winter, there is a concern that an uncontrolled catch of herring in the winter fishery could damage the Gulf of Maine resource. Current estimates are that approximately 20 percent of the catch in Area 2 in the winter months may be herring from the Gulf of Maine spawning component. With an Area 2 TAC of 50,000 mt, even if this entire TAC were caught in the winter months, the amount of Gulf of Maine herring that is caught would not exceed the amount considered when setting the Management Area 1 (1A and 1B) TACs. The TAC reserve may be released to Area 2 by the Regional Administrator by a notice action, after consulting with the Council. This reserve will not be released until Gulf of Maine herring are unlikely to be in this area. As additional information is obtained on the relative sizes of spawning components, and on migration patterns, the size of the TAC reserve or the timing of its release to the industry may change.

Area	TAC
Area 1A	45,000 mt
Areas 1B	25,000 mt
Area 2	50,000 mt
Area 3	50,000 mt
Area 2 TAC Reserve	54,000 mt
Total TAC	224,000 mt

Table 5 – Initial TAC distribution

3.6.4 Effort Control – Mandatory Days Out of the Fishery

Effort controls will be used to prevent the annual TAC in each area or sub-area from being exceeded. In the event that the TAC in an area or sub-area is attained, the directed fishery will be closed. NMFS will monitor the herring catch from all areas with an assigned TAC. If catch rates indicate the TAC will be exceeded, mandatory days out of the fishery will be imposed for the directed fishery.

When catches have reached 40 percent of the TAC in an area, NMFS will project when the catch will reach 50 percent of the TAC and determine if the TAC will be exceeded during the time period. If the TAC will be exceeded, vessels will be required to take Saturday and Sunday of the fishery (in that area or sub-area) when NMFS projects the catch will reach 50 percent of the TAC.

When catches have reached 65 percent of the TAC in an area, NMFS will project when the catch will exceed 75 percent of the TAC and determine if the TAC will be exceeded during the time period. If the TAC will be exceeded, vessels will be required to take Friday, Saturday, and Sunday out of the fishery (in that area or sub-area) when NMFS projects the catch will reach 75 percent of the TAC.

When catches have reached 80 percent of the TAC in an area, NMFS will project when the catch will exceed 90 percent of the TAC and if the TAC will be exceeded. If the TAC will be exceeded, vessels will be required to take Friday, Saturday, Sunday, and Monday out of the fishery (in that area or sub-area) when NMFS projects the catch will exceed 90 percent of the TAC.

NMFS will announce the imposition of effort controls through notice action in the *Federal Register*. If catch rates are high, the imposition of effort controls may be made with little or no advance notice. Fishermen will be notified through news releases, letters to herring permit holders, and broadcast notice to mariners. NMFS will notify appropriate state marine resource officials to assist in distributing this information.

All vessels will take the same days out (that is, days out will be "no fishing" days) for a particular area. Fishing will be allowed in other areas, and catch may be landed in an area that is closed to fishing. Any vessel transiting an area closed to fishing with legally caught herring on board must have its fishing gear stowed in accordance with the requirements of the Regional Administrator.

Fishing will be allowed in other areas, and catch may be landed in an area that is closed to fishing. Any vessel transiting an area closed to fishing with more than 2,000 pounds of legally caught herring on board must have its fishing gear stowed in accordance with the requirements of the Regional Administrator.

During a closure, vessels may retain a catch of herring that does not exceed 2,000 pounds per trip. Vessels may possess no more than 2,000 pounds of herring per trip that they caught in an area closed to directed herring fishing. A vessel cannot land more than 2,000 pounds of herring per day (this prevents a vessel from exceeding the trip limit by making multiple trips).

Rationale: This measure helps control the catch of herring as the TAC is approached. The increasing number of days out of the fishery is designed to steadily reduce harvest in an area so that the TAC is harvested over a longer period, providing a supply of herring to the industry. These days out are also designed to allow a vessel to fish in an open area when one area is closed, moving effort out of the areas where catches are approaching the TAC.

The allowance of an incidental catch after 95% of the TAC is caught allows other fisheries to continue after the directed herring fishery is closed. There is a risk that the 5% allowance is not sufficient to preclude the total TAC from being exceeded. Justification for this level is contained in section E.7.2.5.2. This allowance can be increased through a framework adjustment if necessary.

3.6.5 Transfers at Sea

A vessel may not transfer (or sell) at sea to other U.S. vessels more than 2,000 pounds of herring per day in an area subject to spawning closures or effort controls. A vessel may not transfer (or sell) to other U.S. vessels more than 2,000 pounds of herring per day caught in an area subject to a spawning closure or effort controls. A vessel that catches herring in an area subject to a spawning closure or effort controls may not transfer (or sell) any herring to an IWP or JV processing vessel. Any herring that is transferred will be counted against the vessel's daily limit (see section 3.6.4).

The transfer or sale of herring at sea, except as limited by this restriction, is an authorized activity that may be subject to other regulations. For example, under the existing definition of a dealer, a lobster boat that receives bait at sea is required to file a dealer report. In other fisheries, NMFS has required vessels that conduct transfers at sea to obtain a letter of authorization from the

Regional Administrator.

Rationale: Allowing a vessel to transfer herring at sea during a closure or when subject to effort controls complicates the enforcement of the 2,000 pound trip/possession limit. A complete prohibition on all transfers, however, would unnecessarily restrict the lobster and tuna fisheries. Boats in these fisheries frequently obtain fresh bait through transfers (sales) at-sea. This measure places some controls on transfers at-sea to prevent them from leading to wide-scale violations of the trip limit. While difficult to enforce, the measures provide enforcement officials with a regulation against excessive transfers to use if they suspect a vessel of a violation. Violations of this regulation are not likely to be detected through routine enforcement actions, because it will be difficult for enforcement officials to detect repeated transfers unless specifically targeting that activity.

3.6.6 Vessel Size Limits

Domestic vessels catching, taking, or harvesting herring must be less than 165 feet in length, and can be no more than 750 GRT (a vessel that exceeds either of these limits cannot catch, take, or harvest herring). Domestic vessels catching, taking or harvesting herring must have no more than 3,000 shaft horsepower.

The amount of herring that domestic vessels over 165 feet in length, or more than 750 GRT, can receive or process at-sea is limited to the amount specified for U.S. at-sea processing (see section 3.2).

Rationale: Large vessels entering the herring fishery would rapidly increase the harvest of herring. The SARC (NEFSC 1998) recommended that the herring harvest be increased in an incremental manner until the precision of stock estimates can be improved. Restricting the size of vessels that can enter the open access fishery will slow the increase in harvest rates. Analysis (section E.1.1.1.1) of existing harvesting capacity in the Northeast Region shows it is sufficient to harvest the resource (should vessel operators find markets for their catch and choose to do so) and that an increase in harvesting capacity is unnecessary. There are also concerns over possible marine mammal interactions and bycatch.

The Council wishes to take a cautious approach on the introduction of at-sea processing capacity in the herring fishery until the risks and benefits are more clearly understood, particularly with respect to the impact on fishing communities. The provision restricting these vessels to a specific allocation allows for the careful development of the fishery. (These issues are discussed further in sections E.7.2.5.4, E.1.1.1.1, and E.7.4.2.2).

3.7 Roe Fishery

Herring may be harvested for roe as long as the carcass is not discarded. The Council will carefully monitor the development of the roe fishery. Should the amount of herring harvested for roe become a concern, the amount of herring that may be used for roe will be specified by the Regional Administrator based upon the recommendation of the Council after consulting with the Commission. Should the harvest of herring for roe become excessive, additional management measures will be implemented through framework action to limit the harvest of herring for roe.

Rationale: This measure provides the ability to establish a harvest level to control the roe fishery. A roe fishery is unlikely to develop in Management Area 1 because of spawning closures. Such a fishery may develop in the other areas, however, as there are no spawning closures being implemented. The possession of herring roe at sea will only be authorized if carcasses are also retained (this will require establishment of an expected product recovery rate to allow enforcement of this measure). This measure allows the cautious development of a fishery that takes advantage of the high value of herring roe while at the same time protecting the resource.

The genesis of the restriction on discarding carcasses is the experience with the pollock roe fishery in the North Pacific in the late 1980's. An unlimited harvest of roe rapidly led to concerns for the resource, as well as objections to the amount of waste generated in a roe fishery that allows the discard of the carcass. In this case, not only were the carcasses of female pollock discarded after stripping the roe, all male pollock were also discarded. Requiring retention and use of the carcass is consistent with the M-SFCMA purpose to develop under-utilized fisheries "…in a non-wasteful manner…" Without a requirement to retain the carcass, it is also difficult to accurately determine the amount of herring actually harvested. In particular, if male herring are discarded in a roe fishery, there isn't any way to accurately determine the number of herring caught. This would weaken, the effectiveness of the TAC as a conservation tool to protect the resource. By prohibiting the discard of male and female carcasses in a roe fishery, a more accurate estimate of actual harvest levels can be determined.

3.8 Measures to Reduce/Monitor Bycatch

National Standard 9 of the M-SFCMA requires that conservation and management measures, to the extent practicable, minimize bycatch and, to the extent it cannot be avoided, minimize the mortality of bycatch. The term `bycatch' means fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards of both target and non-target species.

There is limited information available on the extent of bycatch of regulated or protected species in the herring fishery. Recent observations on directed herring trips indicate that there are occasional large discards of herring in the fishery; in the case of some gear types, some of these discards may survive. Because these observations are all from one fishing year and are limited in the area covered, the results cannot be generalized over the entire fishery. This issue must be evaluated as the fishery expands and measures may need to be adopted in the future to minimized discard mortality.

There are discards of herring that may be reduced by some of the proposed measures in the plan. For example, some discards occur because the catch consists of spawn herring unfit for the desired market. The adoption of spawning closures may help reduce the occurrence of these discards. There have also been discards reported because vessels only needed a certain amount of herring to meet market needs. The existence of an overall TAC may tend to reduce this type of discards.

Herring vessels may also catch of some marine mammals. For marine mammals, the Northeast

Fisheries Science Center has advised on a working hypothesis—that mid-water trawling for pelagic species will result in some marine mammal bycatch. They further state that based on worldwide information, the historical distant water herring, mackerel, hake and squid fisheries that operated within the EEZ prior to 1977 had a marine mammal bycatch, although no documentation exists on the magnitude of the bycatch. There may be a need in the future for measures to protect marine mammals.

Restrictions in the FMP on the maximum size of vessels allowed to catch herring may reduce the likelihood of bycatch of marine mammals. Large pelagic trawlers in the mackerel fishery are known to have taken marine mammals (Waring et al. 1990). While the reasons are not clear for the level of takes, the prohibition on these vessels will help prevent a recurrence of this problem.

The plan does not restrict the landing of incidental catches of herring in other fisheries unless there is a spawning closure or effort controls in effect. In these instances, vessels are only allowed to possess up to 2,000 pounds of herring. This amount will prevent development of a fishery targeting small amounts of herring while reducing regulatory discards in other fisheries.

In order to monitor bycatch, the approach of the Atlantic Coastal Cooperative Statistics Program (ACCSP) will be adopted. Vessel operators will be required to record any bycatch or incidental catch; these reports will be examined by the PDT (in conjunction with the TC) on an annual basis to determine if additional management measures are required. As pointed out by the ACCSP, the most effective way to monitor bycatch is through independent fisheries observers. The Council encourages NMFS to include the herring fishery in its observer program.

3.9 Joint Venture Restrictions

3.9.1 Permits

Permits are required for foreign vessels conducting joint venture operations. Foreign vessel operators requesting a permit to conduct joint venture operations must submit an application through the Department of State. Permits may be approved and issued by NMFS through the Department of State. Detailed procedures are specified in 50 CFR 600.501. NMFS provides the Council an opportunity to comment on any application for a permit from a foreign vessel. In reviewing permit applications, the Council may consider any commitment by the vessel operator or owner to assist in the development of U.S. shoreside processing capacity for herring.

The following restrictions constitute part of the permit conditions for foreign joint venture processing vessels.

3.9.2 Management Area Restrictions

Joint venture (JV) activities are allowed in all management areas, subject to an annual review process. Joint venture allocations may be specified by management area. When allocations are specified by area, all herring supplied to that JV operation must be caught in management area with a JV allocation.

Rationale: This option provides the most flexibility for JVP operations, allowing them to locate wherever necessary. At the same time, the annual review and possible allocation by management area provides the ability to consider the impact of joint ventures on shoreside processors.

3.9.3 Observer and Data Reporting Requirements

Observers will be placed aboard each foreign processing vessel. The number of observers will be sufficient to insure all transfers of fish from domestic vessels are observed. Observers must be approved by the NMFS and will be compensated at industry expense. Each observer will be responsible for recording information that includes the quantity of herring unloaded and processed aboard the vessel on a per trip or per load basis, the name of the fishing vessel that caught and/or unloaded the fish, the location where it was caught, the gear type used, the date of capture, etc. They will also monitor the bycatch of any other species, may collect and freeze samples that will be sent to the Northeast Fisheries Science Center for processing, and record the quantity of finished product, by product type, produced each day, including any fish meal and oil or herring roe. Complete instructions and materials will be provided to each observer by NMFS prior to boarding the processing vessels. The presence of an observer does not exempt the master from any reporting requirements described in the plan.

3.9.4 Other Limitations, Conditions, or Requirements

Foreign joint venture processing vessels may neither be in, nor receive fish caught in, areas closed to U.S. vessels to protect spawning concentrations unless there is an overriding safety concern. All other restrictions on foreign vessels regarding the receiving and possession of other species of fish apply. The amount of herring that may be processed into meal or roe may also be specified.

3.10 Vessel Monitoring System (VMS)

A Vessel Monitoring System (VMS) (previously referred to as a Vessel Tracking System, or VTS) is an electronic device used to monitor the location of a fishing vessel. These devices broadcast the position of the vessel on a random, periodic basis, enabling management agencies to monitor the vessel's location.

Any vessel with a federal herring permit must have an operable VMS if it caught or possessed more than 500 mt of herring in the previous fishing year, or intends to catch or possess more than 500 mt of herring in the current fishing year. This requirement does not apply to vessels possessing herring with no ability for harvesting – herring carriers, for example. Any vessel that lands more than 500 mt of herring must declare that intention to the Regional Administrator and must have a VMS at the start of the fishing year. If a vessel does not notify the Regional Administrator and obtain a VMS before the beginning of the fishing year, it cannot catch more than 500 mt of herring in that year. Position reports will be required hourly when the vessel is underway in state or federal waters. Position reports are not required when moored, anchored, or maneuvering in a port. The system used must be approved by the Regional Administrator. Any attempt or method to determine the time or interval of location polling is prohibited.

Rationale: The VMS requirement will assist in confirming fishing locations for enforcement of the area specific TACs. Records of locations can be used to help verify reported fishing locations. While VMS only shows where the vessel was and not the activity, the track can be compared to reported catch locations to confirm the vessel was in the management area reported. Herring vessels can also be quickly located with VMS to verify current activity, which can be compared to trip reports submitted on that trip. VMS will also help enforce spawning closures and effort controls (days out of the fishery). Without VMS, the entire area of a closure requires surveillance. VMS will also support enforcement of closed areas in other management plans. Since herring vessels are allowed to fish in the multispecies closed areas, for example, VMS will help enforcement units identify vessels that are legally fishing in a groundfish closure. The 500 mt threshold insures that the majority of herring landings are monitored, while minimizing costs of the system to the industry.

3.11 Recreational Fishery

No recreational fishery management measures are proposed in this FMP.

Rationale: While there is a small recreational fishery, the catches are currently so small as to make regulation of this fishery unnecessary.

3.12 ASMFC Management Measures

The Council and the Commission worked closely to coordinate management of herring in state and federal waters while developing this plan. In addition to adopting the requirements for permits, recordkeeping and reporting, sea samplers/observers, management areas, all elements of the TAC proposals, the effort controls, use restrictions, and vessel size limits, the Commission plan is adopting management measures described below. Many of these measures were identified during plan development as more appropriate for implementation through state action only. For

example, the federal plan is silent on IWP operations because these activities are regulated by state governors in state waters.

The following measures are included in the Commission amendment to its management plan. These measures will apply in areas of state jurisdiction. They are listed below to give a better understanding of the management of herring throughout its range in state and federal waters.

3.12.1 Spawning Area Restrictions

The Commission is adopting spawning area restrictions for all state waters in the Gulf of Maine (Management Area 1A). Restrictions will start on August 1 and continue through October 31. Any vessel may fish for, take, land, or possess "spawn" herring (herring containing roe or milt) from or within a restricted spawning areas as long as such herring comprise less than 20% by number of the amount possessed on board at any time. The 20% by number will be determined under sampling procedures specified by the states and enforced dockside as a state landing restriction. Spawn herring are defined as those fish determined to be in ICNAF gonadal stages 4, 5, and 6.

3.12.2 Permits

Vessels fishing for herring in state waters only are required to obtain a permit from the appropriate state agency. Vessels fishing with fixed gear will be required to obtain a permit from the appropriate state agency.

3.12.3 Directed Mealing

The harvest of herring for reduction to meal is prohibited. The processing, transfer, or sale of cuttings, byproducts, whole herring condemned for human consumption, or waste is permitted.

3.12.4 Fixed Gear Fishery

All landings from fixed gear will be counted as part of the harvested TAC.

States will require fixed gear fishermen to obtain a permit. Fixed gear fishermen will be required to report weekly all landings of herring on a daily basis to the appropriate state agency.

3.12.5 Vessel Size Limits

Vessels catching, taking, or harvesting herring must be less than 165 feet in length, and no more than 750 gross registered tonnage (GRT). Vessels catching, taking or harvesting herring must have no more than 3,000 shaft horsepower.

3.12.6 Internal Waters Processing (IWP) Restrictions

IWP activities may take place in all management areas, subject to an annual review and the specification of IWP allocations by management area. If IWP allocations are specified by area, the IWP vessel must be in, and all herring processed must be caught from, the area. IWP allocations for the initial year of the plan area:

Area 1B	5,000 mt
Area 2	20,000 mt

3.13 Management and Research Needs

In the course of development of these proposed management measures, the Council and the Commission identified management and research needs. In the interest of consistency, the following list is taken from ASMFC Special Report No. 62, List of Prioritized Research Needs.

Develop a long-term strategy for assessing individual spawning stocks as a basis for more effective management of any heavily exploited portions of the stock complex. Evaluate the merits of acoustic surveys and other techniques to achieve sub-stock complex monitoring.

Pursue the development of a dedicated pelagic survey technique utilizing hydro-acoustic and trawling methods to provide another direct and independent means of estimating stock size.

Reinvestigate the estimation of age-3 herring, the natural mortality rate assumed for all ages, the use of catch-per-unit-effort tuning indices, and the use of NEFSC fall bottom trawl survey tuning indices in the analytical assessment of herring.

Conduct a retrospective analysis of herring larval and assessment data to determine the role larval data plays in anticipating stock collapse and as a tuning index in the age-structured assessment.

Investigate alternative methods of estimating mean weight at age used to determine the age composition of U.S. and Canadian landings from the coastal stock complex.

Evaluate the concept of a minimum biologically-acceptable level biomass (MBAL) for the herring coastal stock complex. Determine the adequacy of present methods and data to determine MBAL if appropriate.

Evaluate the concept of a fixed spawning stock size or spawning target for the herring coastal stock complex. Determine the adequacy of present methods and data to set a target if appropriate.

Investigate the effects of averaging maturity rates over blocks of years to help smooth some of the inter-annual variability in the calculation of spawning stock biomass.

Consider potential discards if fishing mortality increases in the future.

Organize annual U.S.-Canada workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.

In addition to the above needs, the Council has identified this additional need:

Determine the extent of bycatch in the fishery and its impact on the use of TACs in managing the fishery.

4.0 Description of the Fishery

4.1 Description of the Resource

A description of the resource is contained in section E.6.3.1.

4.2 Description of the Habitat

A description of the habitat is contained in section E.6.2 and in the Council's description of essential fish habitat (NEFMC 1998a).

4.3 Description of the Fishery

A description of the herring fishery is contained in section E.6.4.

4.4 Social/Cultural Framework

The social/cultural framework is described in section E.6.4.4 and Appendix 1.

4.5 Existing Management Framework

4.5.1 Applicable Federal Laws and Regulations

The Council's authority and responsibility to develop fishery management plans (FMPs) is established by the Magnuson – Stevens Fishery Conservation and Management Act (M-SFCMA). Section 303(a)(1) of the M-SFCMA requires the FMP to contain the conservation and management measures which are necessary and appropriate to prevent overfishing, and to protect, restore, and promote the long-term health and stability of the fishery, consistent with the national standards (described in section 301) other provisions of the M-SFCMA, regulations implementing recommendations by international organizations in which the United States participates, and any other applicable laws. The conservation and management measures proposed in this amendment are described in section 3.0 while the following section describes and discusses other applicable law.

4.5.2 Other Applicable Laws

A number of federal statutes and executive orders apply to the development of FMPs, including the following:

APA – Administrative Procedures Act
CSMZ – Coastal Zone Management Act
E.O. 12866 – Regulatory planning and review
ESA – Endangered Species act
MMPA – Marine Mammal Protection Act
NEPA – National Environmental Policy Act

PRA – Paperwork Reduction Act
RFA – Regulatory Flexibility Act
E.O. 12612 – Executive order on federalism
E.O. 12630 - Order on interference with constitutionally protected property rights

The requirements of these laws with respect to analysis or other options in the development or implementation of these proposed management measures will be discussed in the FMP and final EIS.

4.5.3 Other Fishery Management Plans

There are currently 22 management plans for fisheries in the northeast which may be directly or indirectly be affected by the measures proposed in this plan. The New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council (MAFMC), National Marine Fisheries Service (NMFS) and Atlantic States Marine Fisheries Commission (Commission) are the management bodies with regulatory authority of these fisheries. In addition to the managed fisheries, a number of unregulated fisheries exist in the region although management plans are in development for some of these.

The following management plans are in effect in the northeast:

NEFMC
Atlantic sea scallops
American lobster
Atlantic salmon
Northeast multispecies
Monkfish (in development) (joint with MAFMC)

MAFMC
Squid-mackerel-butterfish
Surf clam-ocean quahog
Bluefish (joint with ASMFC)
Summer flounder, Scup, Black Sea Bass (joint with ASMFC)
Dogfish (in development) (joint with NEFMC)

ASMFC
Striped bass
Northern shrimp
Winter flounder (vessels not holding federal permits)
Summer flounder (joint with MAFMC)
Bluefish (joint with MAFMC)
Weakfish
Shad-river herring
Spanish mackerel (joint with SAFMC)

NMFS
Atlantic swordfish
Atlantic billfish
Atlantic sharks
Atlantic bluefin tuna (managed under the Atlantic Tunas convention Act, P.L. 96-339)

For most of the plans listed above, the relationship to this FMP is indirect. This FMP may regulate activities by fishermen who may have been displaced from some of these fisheries. There is, however, a direct relationship to the Northeast Multispecies.

Existing Northeast Multispecies FMP regulations apply to the herring fishery. Under this FMP, mid-water trawl and purse seine vessels fishing in the Gulf of Maine/Georges bank regulated mesh area must obtain a Letter of Authorization from the Regional Administrator of the NMFS Northeast Region. Purse seine and mid-water trawl vessel are limited to catching certain species under this FMP. This FMP restricts vessels fishing for shrimp from retaining herring, contributing to herring discards. The FMP also restricts the use of small pelagic gillnets to catch herring for bait in the harbor porpoise areas. Finally, Framework Amendment 18 allowed herring mid-water trawl vessels to fish in groundfish closed areas.

4.5.4 Management Institutions

Herring is managed by the National Marine Fishery Service (NMFS), the New England Fishery Management Council (NEFMC), the Atlantic States Marine Fisheries Commission (ASMFC), and individual state governments.

NMFS: NMFS is responsible for the management, conservation, and protection of living marine resources within the United States Exclusive Economic Zone. The Magnuson-Stevens Fishery Conservation and Management Act (M-SFCMA), under which fisheries within the 200-mile Exclusive Economic Zone (EEZ) are regulated, places responsibility for fishery management jointly with the Secretary of Commerce (through NOAA Fisheries) and eight Regional Fishery Management Councils which it established in 1976. Together, NMFS, the Councils, and the Commissions are responsible for preparing Fishery Management Plans (FMP) for the nation's fishery resources.

NEMFC: The NEFMC is one of eight Regional Fishery Management Councils established by the M-SFCMA. The NEFMC is responsible for preparing and submitting fishery management plans to the Secretary of Commerce for each fishery under its authority that requires conservation and management. The NEFMC manages fisheries seaward of the states of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut.

ASMFC: The Commission coordinates management of fishery resources within state waters. The Atlantic Coastal Fisheries Cooperative Management Act and the Atlantic Coast Striped Bass Conservation Act, under which many Atlantic coastal fisheries are managed, provide a special role for the Atlantic States Marine Fisheries Commission in management of certain fisheries in federal waters.

State governments: The coastal states are responsible for managing fisheries resources within state waters. The states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey actively manage herring fishing within their waters through a variety of state regulations.

4.5.5 Treaties or International Agreements

There are no treaties or international agreements that affect the management unit. Informally, herring management is coordinated with Canada through semi-annual discussions between the U. S. and Canadian industry. Cooperative discussions between U. S. and Canadian scientists occur frequently to compare stock assessment results. The NMFS and Canadian Department of Fisheries and Oceans (DFO) are considering the adoption of a joint herring assessment, which may be in place as early as spring, 2000.

4.5.6 Federal laws, Regulations, and Policies

Herring is currently managed under a Preliminary Management Plan established under the authority of the M-SFCMA. The regulations establish OY, DAH, DAP, and JVP specifications for herring, adopt the use of the Commission management areas for distributing the JVP allocations, and prohibit JVP in Management Area 1.

P. L. 104-297 section 105(e) specifically authorizes the Secretary of Commerce to issue permits for up to 14 Canadian vessels to transship herring from U. S. catcher vessels to Canada. The herring may be used only for sardine processing and the transshipments must occur east of 69° 30' W. longitude and within the boundaries of the State of Maine.

P. L. 105-119 section 616(e) restricted the Secretary of Commerce from using appropriated funds during fiscal year 1998 to issue a permit or other authorization to any vessel larger than 165 feet or 750 gross registered tons(GRT), and 3,000 shaft horsepower, to fish for Atlantic herring or mackerel. This restriction was carried over into fiscal year 1999 by P.L. 105-277.

4.5.7 State Laws, Regulations, and Policies

Maine: The Department of Marine Resources regulates fishing for herring in Maine. In 1998, Maine state herring regulations included the following provisions:

(a) A prohibition on using otter trawls, beam trawls, pair trawls, or mid-water trawls to fish for herring within Maine territorial waters north.
(b) During the period August 1 – October 31, inclusive, it was unlawful to fish for, take, or possess spawn herring on board a Maine registered vessel within Management Area 1, or to land spawn herring caught by any vessel in this area, in any Maine port, unless spawn herring comprised no more than 20 percent of the catch. The 20 percent tolerance was determined by examination of one hundred herring from each 50 hogsheads of herring, or fraction thereof, selected at random from the catch. This restriction did not apply to stop seine and weir catches in waters north of a line drawn from Spruce Point, Cross Island, Cutler, due east magnetic to the international boundary with Canada.
(c) A spawning closure south of 43° 32'N for three or four weeks in duration, dates coordinated with the state of New Hampshire and the Commonwealth of

Massachusetts. This closure does not have a tolerance provision, but allowed an incidental catch of up to 10 percent of the total weight of the catch, or 2,000 pounds, whichever is greater. The incidental catch herring could not contain more than 20 percent spawn herring by number..

(d) A prohibition on fishing for or landing herring taken by a vessel that exceeds 165 feet in length or 3,000 shaft horsepower.
(e) A requirement for all herring harvesters to obtain a permit.
(f) A requirement for all herring bait dealers to obtain a permit.
(g) Provisions for an emergency closure if determined necessary by the Commissioner.
(h) A prohibition on using artificial lights to take herring in coastal waters, with the exception of coastal waters of York County for use as bait.
(i) A prohibition on taking, buying, selling, processing, shipping, transporting or possessing herring less than 4 and ½inches in length. This provision included a tolerance to allow up to 25 percent by volume small herring per lot.
(j) Restrictions on the use of herring for purposes other than human consumption or bait.

New Hampshire: Herring is managed within the state of New Hampshire by the New Hampshire Division of Fish and Game. In 1998, the following regulations were in effect:

(a) A prohibition on fishing for, taking, or possessing unprocessed herring within the jurisdiction of New Hampshire from September 24 through October 14. The executive director shall revise the beginning and ending dates of the closure so that the closure will be in effect when it is determined that the mean gonad somatic index for female herring is 18% or greater.

(b) During this closure, vessels fishing for species other than herring are allowed an incidental catch of herring of not more than 10% by weight, to a maximum of 2,000 pounds, of the total catch of all fish on board at any time.

(c) Permits are required to take or land herring.

(d) These provisions do not prohibit a person from possessing herring for use as bait while in the normal conduct of tending lobster or crab pots, or for angling purposes.

Massachusetts: Herring is managed within the state of Massachusetts by the Division of Marine Fisheries. In 1998, the following regulations were in effect:

(a) A prohibition on fishing for, or possessing, herring during the period September 17 through October 7. A vessel may have on board or land sea herring during this closure provided the herring are not caught in the Gulf of Maine, or herring are an incidental catch in other fisheries limited to the following percentages: no more than 20 percent by weight if a vessel is fishing for mackerel, no more than 5 percent by weight or 1,000 pounds if the vessel is not fishing for mackerel.
(b) A requirement that vessels possessing or landing herring caught outside the closure area obtain special authorization from the Director, report time of sailing and return ,and submit weekly catch reports.

(c) A permit requirement
(d) A prohibition on any vessel greater than 165 feet in overall length or 3,000 or greater horsepower to land sea herring.

Rhode Island: Herring is managed within Rhode Island by the Department of Environmental Management. 1998 regulations were:

(a) No vessel harvesting Atlantic herring shall exceed 165 feet in overall length, and 3,000 horsepower.
(b) No person shall take or possess Atlantic sea herring between October 1 and October 21 annually.
(c) No person may process Atlantic herring for other than human consumption. Direct mealing is prohibited until further notice.
(d) IWP applications must be submitted by March 1, unless accompanied by a legally binding contract for an IWP in Rhode Island waters involving Rhode Island fishing vessels. The Director may grant an allotment from Rhode Island's existing unallocated or contracted quota for a legally bound IWP application submitted after the March 1 deadline.

4.5.8 Local and Other Applicable Laws, Regulations, and Policies

There are no known local laws, regulations or policies that would impact this plan.

5.0 Compliance with National Standards

5.1 National Standard 1 – Optimum Yield

"Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry."

Optimum yield for the Atlantic herring fishery is defined so that it will not exceed the Allowable Biological Catch (ABC), and cannot exceed MSY (section 3.2). The ABC is based upon a target fishing mortality rate that is determined as prescribed in the overfishing definition (section 2.6). Optimum yield (OY) can be reduced from this maximum amount based upon relevant economic, social, or ecological factors.

The overfishing definition (section 2.6) includes the four types of reference points that are recommended by the National Standard 1 guidelines (50 CFR §600.310). These reference points area a maximum fishing mortality threshold consistent with F_{MSY}, a minimum biomass threshold, a biomass target consistent with B_{MSY}, and a fishing mortality target that is risk-averse. OY is derived from the overfishing definition. The primary management measure is the use of a TAC, based on OY. Other management measures are designed to reduce the likelihood the TAC will be exceeded and to distribute fishing effort throughout the range of the resource. These measures will prevent overfishing which will allow the development of a sustained fishery and the attainment of OY on a continuing basis.

5.2 National Standard 2 – Scientific Information

"Conservation and management measures shall be based upon the best scientific information available."

This FMP is based upon the most recent stock assessment for the coastal stock complex of Atlantic herring, conducted by the 27th Stock Assessment Workshop (SAW 27) (NEFSC 1998a) during the spring of 1998. This assessment used estimates of the number of fish caught at age for the years 1995-1997 and added them to the existing time series of data. This data provided inputs used in a virtual population analysis which was performed using the ADAPT formulation of the model. The coastal stock complex VPA was tuned using spring and winter NEFSC bottom trawl survey data. Additional analyses of fall and winter bottom trawl survey data were also summarized for characterizing the age composition of the stock complex over time and comparing the relative abundance of herring in different geographical areas during spawning season.

Estimates of discards and bycatch in the herring fishery were obtained from two sources. An analysis of the NEFSC sea sampler and observer databases was conducted by the NEFSC to characterize the incidental catch of herring in other fisheries as well as the bycatch of other species in the herring fisheries. The summary of this analysis is contained in Appendix II. This information was not examined to determine if sampling accurately characterized the fisheries. There was no

information on takes of marine mammals in the directed herring fishery in this database. There was also limited information in these databases on the directed herring fishery. In the fall of 1997 and spring of 1998, the Maine Department of Marine Resources sponsored a limited number of observer trips on herring purse seine, mid-water trawl, and paired mid-water trawl vessels. Detailed information on the fall trips is contained in section E.6.4.2.6, as well as summaries for the trips in 1998, but detailed information on the 1998 trips has not been distributed.

Information on areas and times fished and the number of vessels fishing for herring was obtained from the Maine Department of Marine Resources. Because there is no single permit or reporting requirement in place for the herring fishery, this information was obtained by combining observations in the NMFS vessel trip report database with Maine DMR information on vessels that do not submit federal logbook reports. A further discussion of the availability and limitations of catch and revenue data is contained in section E.6.1.6.

Analysis of permit data was accomplished by examining the Northeast Region permit database. This reflects permits valid as of October 2, 1998. Analysis of potential harvesting capacity in the herring fishery was performed in November, 1997 and reflects information in the permit database as of that date.

5.3 National Standard 3 – Management Units

"To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination."

This FMP proposes to manage Atlantic herring throughout the range of the species in U.S. waters, in accordance with the jurisdiction of U.S. law. While most Atlantic herring are landed in Maine, Massachusetts, and Rhode Island, Atlantic herring landings have been reported in every state from Maine through Virginia. Most Atlantic herring – between 60 and 70 percent in recent years – are caught in the EEZ. In order to address that portion of the resource that is caught in state waters, the FMP was developed in close cooperation with the Commission. As described in section 3.12, the Commission's adopted management measures are nearly identical to those recommended by the Council. The Commission's measures will be implemented through state regulations. As a result, management of herring in state and federal waters will be nearly identical. A key element of the FMP is that all herring catches, in both state and federal waters, will be limited by the TACs established by the FMP. This will require continued close coordination between the Commission and the Council. The annual plan monitoring process formally establishes that the Council consult with the Commission on an annual basis.

The coastal stock complex of Atlantic herring includes herring that are caught in the Canadian fixed gear fishery in New Brunswick and in Canadian waters on Georges Bank. While the management plan considers catches of herring that may occur in Canadian waters, it does not explicitly regulate those catches because of a lack of U. S. jurisdiction. The FMP estimates an allowable biological catch (ABC) for the entire coastal stock complex and then bases the determination of optimum yield for the U. S. fishery by accounting for the Canadian catch. Estimates of the Canadian catch that are deducted from the ABC are based on recent catches. The

FMP recognizes that these estimates may need to be revised in the future and establishes a framework adjustment mechanism so that can be accomplished expeditiously.

While the FMP manages the coastal stock complex as a single unit, it also considers impacts of fishing mortality on individual spawning components. The TAC system established to control catches assigns TACs to one of four management areas or sub-areas. This system is designed to protect the individual spawning components from excessive fishing pressure.

5.4 National Standard 4 – Allocations

"Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various U.S. fishermen, such allocations shall be:

1) fair and equitable to all such fishermen
2) reasonably calculated to promote conservation
3) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges."

The proposed management measures for Atlantic herring manage the fishery as an open access fishery. None of the measures included in the plan discriminate between the residents of any state. The FMP proposes spawning closures off the coasts of Maine, New Hampshire, and Massachusetts. These closures may disadvantage fishermen from those states, who must travel further to fish for herring during the closures, but they are necessary to provide protection to spawning aggregations of herring. This will help protect individual spawning components of herring that cannot be individually assessed because of a lack of information. The closures actually reduce the size of the areas subject to spawning restrictions from the areas incorporated in the Commission's 1994 Atlantic herring FMP.

One proposed management measure allocates fishing privileges among U.S. fishermen. The FMP restricts the catching, taking, or harvesting of herring to those vessels that meet the size limits prescribed in the plan (section 3.6.6). These size limits incorporate all current participants in the herring fishery. In effect, they allocate the herring resource to existing participants and future participants that comply with the size restrictions. By preserving the status quo, the FMP restricts future opportunity to participate in the fishery. This measure is designed to achieve a number of the FMP's goals and objectives. Preventing the introduction of large catcher vessels into the fishery will help provide for the orderly development of the herring fishery because the rapid introduction of large domestic harvesting vessels could quickly lead to harvesting overcapacity. While the same problem can develop if a large number of small vessels choose to enter the fishery, the incremental effect of each small vessel will be less and capacity is not likely to grow as quickly (see section E.6.4.2.2 for examples of current catch rates and annual catches). In addition, as discussed in section E.1.1.1.1, in an open access fishery a restriction on vessel size limits the share of the resource that can be harvested by each participant. Limiting maximum vessel size will increase the number of vessels that can participate in the fishery, helping to meet the FMP's objective to provide opportunities for fishermen in other New England and mid-Atlantic fisheries (section 2.3). This measure does not eliminate any current participants from the fishery. While any

existing vessel over the size limit will not be able to enter the fishery in the future, no vessels of this class have participated in the fishery to date. One large vessel obtained a letter of authorization to use a small mesh mid-water trawl in the Gulf of Maine/Georges Bank area, but this authorization was revoked by congressional action before the vessel actually caught herring. The proposed FMP will prevent this vessel (as well as any other vessel that exceeds the size limit) from catching, taking, or harvesting herring.

The FMP provides an opportunity for vessels over the size limits for harvesting herring to participate in the fishery by receiving or processing herring at sea, subject to the amount of herring allocated to this activity through the annual specification process. This measure directly allocates part of the resource to different processing sectors (at-sea and shoreside). The intent is to provide a mechanism for the Council to control, if necessary, the development of large vessel at-sea processing capability for the herring fishery. For the first year of the plan, the Council has recommended the specification for large vessel U.S. at-sea processing be set at zero. This recommendation allocates fishing (processing at sea is defined as fishing under the Magnuson-Stevens act) privileges for the first year of the plan to existing and new participants that use shoreside processors or small at-sea processors. This will enable the Council to evaluate the effectiveness of its management measures before introducing an unknown factor into the fishery and is consistent with the Council's goal to encourage development while taking into consideration the viability of current industry participants (section 2.3). This measure does not discriminate between the residents of any state; all are subject to the same specification limits. It also addresses the concerns of communities that are dependent on herring processing activity (section E.7.4.2.2.2), a consideration required by National Standard 8.

For both catching and processing vessels, the size restrictions are reasonably calculated to promote conservation. These restrictions help prevent the rapid introduction of excess fishing capacity into the fishery. The management measures included in the plan rely on area-specific TACs that must be monitored on a near-real time basis to be effective. By restricting vessel size, catch rates are slowed so that projections of the TAC can be more accurately determined. There are also concerns over the takes of marine mammals by large trawlers, based in part on experience with large foreign trawlers in the mid-1980's.

The Council considered a limited or controlled access scheme, in particular for the inshore Gulf of Maine area. A number of different qualification criteria (section E.5.2.2.3.1) were considered with a wide range of possible impacts on eligible participants. The most restrictive criteria would have limited the fishery to approximately 20 current participants, while the least restrictive criteria would have allowed almost any vessel with a current permit to enter the fishery. These plans were rejected because the Council did not deem it appropriate to limit participation in the fishery at the same time it was trying to encourage its development. Any limited entry program would also conflict with the Council's objective to provide opportunities for fishermen in other fisheries. The Council may, in the future, adopt a limited entry or controlled access scheme in this fishery.

5.5 National Standard 5 – Efficiency

"Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measures

shall have economic allocation as its sole purpose."

The FMP proposes to establish an open-access fishery for Atlantic herring. The open-access fishery will allow the entry of new participants, necessary to meet the goals of the FMP. These include harvesting the OY, providing for the orderly development of the inshore and offshore fishery taking into account the viability of current participants, and providing controlled opportunities for fishermen and vessels in other mid-Atlantic and New England fisheries.

The primary management measure adopted by the FMP to prevent overfishing is the establishment of an annual TAC and the distribution of that TAC to the four management areas. The establishment of a TAC will prevent overfishing of the resource. By distributing it to different management areas, the fishery is forced to spread effort over the entire range of the resource, which will reduce the risk of overfishing particular spawning components. As the TAC in an area is approached, mandatory days out of the fishery are imposed. Vessels are limited to a small incidental catch in these areas on the mandatory days out of the fishery, but can fish in other areas. This system imposes inefficiencies on the fishery as it limits the days available for vessels to fish. It also will require those vessel that want to continue fishing to travel farther in order to do so. The mandatory days out of the fishery are designed to slow fishing pressure on the resource and to encourage vessels to fish in other areas. Slowing catch rates will make it easier to accurately determine when the TAC will be reached and the fishery should be closed. Encouraging vessels to fish in different areas will provide additional protection to individual spawning components. While the mandatory days out system introduces inefficiency into the fishery, ultimately it will benefit the industry by "stretching out" the supply of herring to processors and bait dealers and by helping a sustainable fishery to develop.

Generally, there are no restrictions on gear types or product use. This will allow fishermen to use the most efficient gear available to catch herring, and to sell their catch into the most profitable markets. The plan does propose to limit the participation of large domestic fishing vessels (see the size limits in section 3.6.6). Vessels over the size limits are prohibited from catching, taking or harvesting herring. Vessels over the size limits are allowed to process Atlantic herring, subject to the USAP specification (which is recommended to be 0 mt for the first year of the plan). For the first year, this will prevent the entry into the fishery of large vessels that may be more efficient than smaller vessels. This restriction introduces inefficiencies into the fishery, as it prevents fishermen from taking advantage of economies of scale possible by using a large catcher-processor. These restrictions, however, support other biological and social objectives of the plan. As discussed in sections E.7.2.5.4 and E.7.4.2.2, the vessel size limits help to prevent overfishing and the rapid introduction of excessive fishing capacity into the fishery. These limits also take into account the uncertain impacts of large vessels on fishing communities in the region. In addition, as discussed in section E.1.1.1.1 the limitations on vessel size reduce the average share of the resource harvested by each vessel. This will help further the goal to provide additional opportunities for other fishermen and vessels in New England and mid-Atlantic fisheries by spreading the herring resource among a wider group of participants.

The Council considered using a limited entry or controlled access system. There is a desire to develop the fishery and such a system was viewed as inconsistent with this goal. While there is sufficient capacity in the region to harvest herring should vessels choose to do so, not all of these

vessels have a history of catching herring. An open access fishery provides the greatest flexibility for these fishermen to enter the herring fishery. The danger is that this will encourage the development of excess fishing capacity. From a specific fishery viewpoint this may be undesirable. When looked at in the context of other northeast region fisheries, however, this may allow the temporary shift of fishing effort from rebuilding fisheries into the under-utilized herring fishery. There are a number of factors which should serve to inhibit the rapid development of excess capacity in this fishery, including the relatively high cost for a vessel to convert to herring fishing and the high volume/low price nature of the product, and the limitations on vessel size.

5.6 National Standard 6 – Variations and Contingencies

"Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches."

There are a number of factors which could introduce variations into the Atlantic herring fishery. As noted in section E.6.3.1.9, there is some uncertainty in the estimate of current stock size. In addition, the structure and status of individual spawning components cannot be determined with precision, resulting in the assessment of a coastal stock complex rather than separate assessments for each individual spawning component. The domestic Atlantic herring fishery has not been subject to limits on catch by a federal management plan since 1982. Because of the lack of a current permitting and reporting system, there is some uncertainty in the current levels of fishing effort and the actual harvest of Atlantic herring. There is also uncertainty in the ability of U.S. fishermen to develop new markets for the increased catch levels that are possible, and for U.S. processors to process increased catches of herring that may occur under this plan.

These uncertainties make it difficult to predict exactly how the fishery will develop. The Council has adopted a precautionary approach to many elements of the management program in order to account for these uncertainties. First, even though current estimates show the stock exceeds B_{MSY} (and may be over twice as large as B_{MSY}), the Council has recommended that the initial determination of OY be based on B_{MSY} rather than on estimates of current biomass (ABC) (section 3.2.2). OY has been further reduced to less than the maximum amount possible. Because of uncertainties in harvesting and processing capacity and the impact of the management program on communities, the Council has chosen measures which will limit participation in the fishery to vessels that are similar in size and capacity to current participants. Processing activity is limited to shoreside processors or small at-sea processors.

In order to provide the greatest flexibility possible for future management decisions, the FMP includes a framework adjustment mechanism with an extensive list of possible framework adjustment measures that can be used to quickly adjust the plan as conditions in the fishery change (section 3.3.5). The FMP also establishes an annual review process, using the Council's Plan Development Team (PDT) and working closely with the Commission, to monitor the fishery and recommend changes as necessary. Finally, the Regional Administrator is provided discretion to adjust some elements of the plan as necessary after consulting with the Council.

5.7 National Standard 7 – Costs and Benefits

"Conservation and management measures shall, where practicable, minimize

costs and avoid unnecessary duplication."

Atlantic herring is a key ecosystem resource in need of management to prevent the possibility of overfishing and achieve OY. The past record of Atlantic herring management (section 2.1) shows that it is possible to quickly deplete the resource in the absence of an effective management program. As demonstrated by the overfishing of Atlantic herring on Georges Bank in the 1970's, it can take an extended period to rebuild an overfished herring resource. Because of its key role in the ecosystem, this can have adverse impacts on a wide variety of species. One of the primary reasons for adoption of the management plan is to implement a system that will prevent a repeat of this overfishing and the resulting economic losses.

Because of a lack of current information on costs in the herring fishery, the economic benefits of the management program cannot be quantified. Under the management program, landings of herring could more than double from current levels, theoretically resulting in a doubling of ex-vessel revenues. An expansion of the fishery, however, will probably result in increased costs (both fixed and operating) as fishing vessels exploit herring in offshore areas. The plan also will limit catches in inshore areas, forcing vessels into other areas. An increase in landings and the resulting increase in revenues is highly dependent on the development of additional markets for herring, rather than a direct result of the regulatory scheme. Unless these new markets develop, an increase in landings could actually depress the ex-vessel value of herring and result in few benefits accruing directly to herring fishermen while benefiting processors, bait dealers, and other users. The qualitative benefit of the management measures is that they provide an opportunity for an increase in landings and revenues in a manner that will result in a sustained fishery. Section E.7.3 provides a detailed qualitative analysis of the costs and benefits of each management measure.

5.8 National Standard 8 – Communities

"Conservation and management measures shall, consistent with the conservation requirements of the Magnuson-Stevens Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to:

1) Provide for the sustained participation of such communities; and
2) to the extent practicable, minimize adverse economic impacts on such communities."

The importance of Atlantic herring to communities and the expected impact of the management measures are described in section E.7.4. In summary, the FMP is designed to allow a significant increase in herring landings and a potential increase in revenues that should result in benefits to fishing communities. The measures are designed to encourage development of a sustainable herring fishery throughout the range of the resource while preventing overfishing. Increased landings will return significant benefits to fishing communities, but any increase in landings depends on market conditions rather than the regulations in the management plan. There are some management measures that may redistribute fishing effort away from traditional areas, and this may result in local impacts (sections E.7.3 and E.7.4). The TAC distribution system and, to a lesser extent, the spawning closures will move fishing effort away from the inshore Gulf of Maine.

This will benefit the resource and should ultimately benefit the industry and local communities. It will reduce the possibility that the spawning components in the inshore areas will be overfished and will encourage the catch of the burgeoning offshore resource. Communities that rely on landings from the inshore Gulf of Maine areas that have traditionally provided most of the herring catch may suffer adverse impacts from the FMP if fishermen are unable to catch herring in other areas. These impacts are expected to be minor because overall landings are not expected to decline and herring is readily transported to processors and dealers from all areas. In any case, they should be less than the impacts on these communities that would result if the resource is overfished due to a lack of management controls.

The FMP may also benefit some communities suffering under increasing regulation in other fisheries. Because the herring fishery will be managed as an open-access fishery, there is an opportunity for new entrants. Vessels may be able to shift effort into the herring fishery until rebuilding plans in other fisheries are successful. Because of the costs necessary to adapt vessels to a pelagic fishery and the difficulty to find herring markets, the number of vessels able to make a successful transition is likely to be small.

The FMP takes a cautious approach to the introduction of large domestic processing vessels into the fishery. These vessels are limited to a specific allocation which is set at zero for the first year of the plan. One of the reasons for this approach is because of the unknown impacts of large processing vessels on those communities that rely on or are making preparations to enter the herring fishery. Because large processing vessels have not participated in any east coast fishery, the possible social and economic impacts they may have are subject to considerable debate. What is known, however, is that in some instances the current industry structure has become important to coastal communities. The sardine canneries described in section E.1.1.1 are vital to several small communities in coastal Maine. The lobster industry, which relies on a steady supply of herring for bait, is the most valuable fishery in the northeast, with ex-vessel landings value of over $267 million in 1997. The introduction of large at-sea processors could have adverse impacts on the ability of canneries to obtain the raw material necessary for their operations. Large at-sea U.S. processors may also result in less herring being brought to shore, reducing the amount of bait available for the lobster industry. In part for these reasons, the FMP provides the ability to carefully control the introduction of offshore processing capacity in order to carefully assess the impacts on fishing communities.

One of the options considered by the Council was a complete ban on at-sea processing by large domestic fishing vessels. This would preclude any possibility of benefits accruing to communities from at-sea processors unless the plan is amended. Large at-sea processors will need to be supplied by smaller catcher vessels. If these boats come from communities in the northeast or mid-Atlantic states, this will provide an additional economic opportunity for vessels facing restrictions in other fisheries. By retaining the option to allocate herring to at-sea processors, the Council may, after consideration of the costs and benefits, choose to allocate herring to these vessels.

5.9 National Standard 9 – Bycatch

"Conservation and management measures shall, to the extent practicable:

1) Minimize bycatch; and

2) To the extent bycatch cannot be avoided, minimize the mortality of such bycatch."

The information available on the extent of bycatch in the herring fishery is summarized in section E.6.4.2.6. This information – while perhaps not representative of the entire fishery in all areas and seasons - indicates that the traditional purse seine and mid-water trawl herring fisheries are relatively "clean" fisheries, with limited bycatch of other species. The greatest "bycatch" appears to be herring that are caught and discarded for a number of different reasons. There is some concern over possible marine mammal interactions with the herring mid-water trawl fishery, based on experience with other mid-water trawl fisheries. For this reason, NOAA listed the herring mid-water trawl fishery as a Category II fishery. This will facilitate the use of marine mammal observers to determine the extent of any interactions.

There are a number of management measures in the FMP which will encourage a reduction in bycatch. Bycatch and discard information will be considered when establishing the annual TACs. Some herring discards occur because the herring is not fit for market because it is full of spawn or is "feedy". The plan's use of spawning closures in the Gulf of Maine will reduce the amount of spawn herring that are caught and will minimize those discards. The plan allows the landing of incidental catches of herring, even during spawning closures or when directed herring fishing is prohibited due to the imposition of effort controls. This will allow the landing of herring that would otherwise be discarded if a complete prohibition on landings were in place. Vessels are required to report all catches of herring – landings and discards – which will be counted towards the TAC. This provision may result in more accurate catch statistics and less discards of herring, since there will be an economic incentive to land all herring caught. Another possibility, however, is that this will encourage vessels to continue discarding herring but not to report these discards. This practice can only be monitored through the use of at-sea observers. Finally, restrictions on the size of vessels in the herring fishery may reduce the likelihood of bycatch of marine mammals. Large pelagic trawlers in the mackerel fishery are known to have taken marine mammals (Waring et al. 1990). While the reasons for the observed level of takes are not clear, the prohibition on the catching of herring by large domestic vessels will prevent a possible recurrence of this problem.

5.10 National Standard 10 – Safety of Life at Sea

"Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea."

National Standard 10 requires that conservation and management measures shall, to the extent possible, promote the safety of life at sea. Fishing is a dangerous occupation; participants must constantly balance the risks imposed by weather against the economic benefits. A management plan should be designed so that it does not encourage dangerous behavior by the participants. Two of the proposed management measures may have an impact on vessel safety. These are the imposition of a TAC and the use of mandatory days out of the fishery to slow fishing effort as the TAC is approached. The possible impacts of these measures on safety are discussed in section E.7.4.4. Another safety issue addressed in this section is vessel stability concerns that result the entry of vessels into the herring fishery from other fisheries. Vessel owners converting groundfish vessels to participate in the herring fishery must carefully consider the ability of their vessel to

safely carry the large weights associated with herring fishing, and the dangers that result if those loads are allowed to shift. This issue is a factor that must be considered before vessel operators choose to enter the open access herring fishery and is not a direct result of the adoption of the management plan.

The conclusion of the analysis is that the management measures do not pose additional safety risks. The closures that result from the TAC and mandatory days out of the fishery allow considerable flexibility to vessel operators to fish in other areas rather than choose to fish if the weather is bad on a day that is closed to fishing. The seasonal nature of the fishery also helps to minimize the potential dangers from these measures. No specific comments were received during public hearings on this issue, and no written comments were received that identified concern for the regulations impact on vessel safety. In addition, the U.S. Coast Guard evaluated the safety aspects of this management plan and concluded that the management measures did not cause any significant safety concerns (see Appendix VIII, written comments).

6.0 Fishery Impact Statement

The implementation of any new fishery management changes the environment for fishermen that target the regulated resource, but it can also result in changes for those in fisheries for other species. In many instances, the imposition of regulations to restrict effort and reduce fishing mortality forces fishing effort onto other species. In the complex fishing environment of the Northeast Region, where there are thousands of boats participating in a wide variety of fisheries, the impacts of new regulations can have unexpected consequences that complicate fisheries management. This section takes a broad overview of fisheries in the region and attempts to gauge the interactions between herring management and other fisheries.

Obviously, vessels that will be most affected by the management measures in this plan are those vessels that have been fishing for herring in recent years. The vast majority of reported landings in recent years have been by a small group of less than 20 vessels. Over 180 other vessels land herring and will also be impacted by these regulations. Because herring is not overfished and the resource is underutilized, the regulations will not reduce overall landings and revenues. Some of the measures, however, will result in a redistribution in fishing effort. The impacts of the management plan on the herring fishery are described in the Environmental Impact Statement (section 7.1). An important part of the fishery is the communities that it supports. The ports that are most dependent on herring are identified in section E.6.4.2.4. A discussion of the impacts of the management measures and the alternatives on fishing communities is included in section E.7.4 and Appendix I.

A second group of vessels that will be affected by the plan are those vessels that choose to enter the herring fishery as an alternative to fishing on stocks that are subject to increasing restrictions or regulations. Adoption of this plan will constrain their activity. Finally, the plan may have impacts on other fisheries in the northeast region that are described below.

6.1 Permit Status

Prior to plan implementation, there is no requirement for all vessels fishing for herring to possess a federal herring permit. This complicates determining the permit status of those vessels that fish for herring. While many vessels currently landing herring possess other federal permits or letters of authorization, there are some vessels that may fish only in state waters that do not. This complicates any analysis of the permits that are held by herring fishermen. Only those vessels that have another federal permit are required to submit vessel trip reports and can be readily identified in the permit, vessel trip report, and dealer weighout databases.

In an attempt to describe the options available to herring vessels to participate in other fisheries, the 20 vessels that reported landing the most herring 1996 and 1997 were identified in the vessel trip report database. (This database does not include a small number of vessels that fish only in state waters, including some vessels that land a large amount of herring, and so the results cannot be directly related to other analyses in this document that includes those vessels.) In 1996, these twenty vessels accounted for approximately 80 percent of total landings. In 1997, the top 20 vessels accounted for about 71 percent of total landings. Some of the remaining landings were by

vessels that were not required, or did not file, vessel trip reports. Because of changes from year to year, there were 28 total vessels that met this criteria. Three of those vessels surrendered their permits in the Fishing Vessel Capacity Reduction Program for the Northeast Multispecies fishery. The remaining 25 vessels possess the permits listed in Table 5. All of these vessels can be expected to request a herring permit after the plan is implemented. In addition to these vessels, there are approximately 180 – 260 other vessels that reported landing herring in 1996 or 1997 that can be expected to request a permit.

Because the fishery will be open access, a herring permit can be requested for any new or existing vessel (subject to the size and horsepower restrictions). Some vessels, however, are more likely than others to request a herring permit. As a pelagic fish, herring is most likely to be harvested by mobile gear vessels. While foreign fleets targeted herring with gillnets in the 1960's and there is a gillnet fishery for herring in Canada, mesh size restrictions in other fisheries and marine mammal concerns make it unlikely for a herring gillnet fishery to develop in U.S. waters. Because herring is a low value/high volume fishery, smaller vessel classes that do not have adequate hold capacity are also unlikely to enter the fishery. These vessels may still request a permit, however, to preserve the option of forfeiting other permits subject to size upgrading restrictions and obtaining a larger vessel to target herring. Finally, vessels that are already fishing in the mid-Atlantic or New England areas are most likely to enter this fishery. Using these rough guidelines, the number vessels that are likely to request a herring permit can be estimated. As of March 18, 1998, there were 5,358 commercial permit holders (excluding tuna permits) in the Northeast Region of NMFS. Disregarding those vessels that only possess lobster or hook gear permits, there are approximately 2,300 current permit holders that may apply for herring permits. Some of these vessels may not have landed any fish in recent years.

Table 6 – Northeast Region fishing permits held by vessels that targeted herring during 1996 – 1997, for the top 20 vessels in reported landings for each of those years. Permit status is of October 1, 1998. NMFS NER permit data.

Permit	Number of Vessels
Mackerel Open Access	20
Scallop, general category	20
Lobster, commercial	16
Fluke, limited access	15
Multispecies, fleet DAS	15
Scup	15
Ocean quahog	14
Surf clam	13
Loligo, moratorium	8
Black sea bass, limited access	13
Illex, moratorium	8
Squid, incidental catch	5
Multispecies, hand-gear	2
Scallop, limited access, full time	2
Multispecies, non-regulated open access	2
Multispecies, individual DAS	2
Multispecies, scallop	1
Multispecies, combination	1
Total vessels	25

6.2 American Lobster Fishery

American lobsters support the northeast region's most valuable fishery, worth more than a quarter of a billion dollars in 1997, accounting for 27% of the region's total fishery revenues. Eighty percent of the resource is harvested in state waters. Lobster will be managed under the provisions of the Atlantic Coastal Fisheries Cooperative Management Act, with the Commission developing regulations for state waters and complementary regulations for federal waters implemented by NMFS. Lobsters are presently overfished, and both the Commission and NMFS are in the process of implementing management plans to address concerns that the resource is dangerously close to collapse. For federal waters, NMFS will propose a series of trap limits and reductions that will take effect over the course of the years 1999 and 2000. Trawl vessels are currently limited in the amount of lobsters they can land per trip, a provision that NMFS has proposed to carry over into its new management plan (NMFS 1998b).

Lobsters are fished with both fixed gear (traps) and mobile gear (trawls). In December of 1997, there were 3,153 vessel owners with federal lobster permits, with about 900 for trawl gear. For federal permit holders, in 1996 the average length for trap vessels was 39 feet. Mobile gear vessels were larger, averaging 58 feet, with over 400 boats exceeding 60 feet in length. About two-thirds of the federal permit holders in 1997 held at least one other federal permit (NMFS 1998b). Of these vessels, the ones most able to enter the herring fishery are the trawl vessels, because of their gear and size. It is unlikely that many trap vessels would be able to enter the herring both because of their size.

The most important connection between the herring and lobster fisheries is the reliance of the lobster industry on herring for bait. As described in section E.6.4.3.1, lobster bait is currently the primary market for herring. Significant changes in the lobster fishery could result in corresponding changes in the demand for herring, which would affect development of the fishery.

6.3 Northeast Multispecies Fishery

The management unit for the Northeast Multispecies fishery includes 12 species: cod, haddock, pollock, redfish, white hake, yellowtail flounder, windowpane flounder, winter flounder, American plaice, witch flounder, Atlantic halibut, and ocean pout. An amendment is being prepared that will add whiting, red hake and offshore hake to the species complex. This fishery is managed through an extensive program of measures that include gear restrictions, closed areas, and limits on fishing effort through a days-at-sea program. Under the Northeast Multispecies Plan, purse seine and mid-water trawl herring vessels in the Gulf of Maine and Georges Bank areas are required to obtain a letter of authorization to use small mesh gear to fish for herring. In addition, some fishermen have used Multispecies Plan provisions designed to permit whiting fishing to target herring using bottom trawls.

Eight of the species in this complex are overfished and the stocks are being rebuilt through management action. Amendment 7 to the Northeast Multispecies Plan accelerated the days-at-sea effort reduction program, added new closed areas in the Gulf of Maine, and eliminated most open-access permit categories for regulated multispecies. More recently, Framework 25 was submitted in February, 1998 to reduce cod trip limits and expand the use of closed areas in the

Gulf of Maine, increase the haddock trip limit, postpone implementation of the VMS, and require a raised footrope trawl in Small Mesh Areas 1 and 2 in the Gulf of Maine.

SAW 27 reported that of the regulated species, Gulf of Maine cod is near collapse. Additional closures in the Gulf of Maine have been proposed to protect a declining Gulf of Maine cod stock. Framework 26 adopted closures for February, March, and April of 1999. Framework 27 will be submitted recommended closures and other measures for the fishing year beginning May 1, 1999.

6.4 Sea Scallop Fishery

Scallops are caught by approximately 200 full-time scallop fishing vessels with dredge and trawl gear throughout New England and the mid-Atlantic region. An additional 77 vessels have part-time or occasional category scallop permits. The fishery is managed through a combination of limited entry permit restrictions, days-at-sea controls, closed areas, gear restrictions, and limits on crew size.

The Atlantic sea scallop current stock biomass is at a low level, has high fishing mortality rates, and is showing signs of a lack of significant recruitment. Amendment 7 to the Atlantic Sea Scallop Fishery Management Plan proposes a schedule to rebuild the resource over a ten year period. The proposed action will reduce days-at-sea for full-time scallop vessels from 120 days in 1999 to only 34 days in 2004. The estimated economic impacts of these reductions is that full-time scallop vessels will not be able to maintain their economic viability during the first six- to nine years of the program. While the difference between the number of days necessary to meet costs is small in 1999, beginning in 2000 the average break-even days-at-sea requirement far exceeds the full-time allocation. Full-time vessels earn over 90% of their revenues from scallop fishing. These boats have limited opportunities to participate in other fisheries. 194 vessels have multispecies permits, 127 have mackerel permits, and only 33 have multispecies permits, limiting possible alternative fisheries. Under the proposed Monkfish Fishery Management Plan, they will only be able to land monkfish when using a scallop day-at-sea, losing a traditional supplement to scallop revenues (NEMFC 1998c).

Two possible fisheries that scallop vessel may choose to enter include the mackerel fishery and the herring fishery. Scallop dredge vessels would have to rig to use either purse seine or mid-water trawl gear to enter these fisheries. The higher ex-vessel revenue received for mackerel may make that fishery more attractive to scallop owners. There has, however, been some interest in the New Bedford fishing industry to develop the ability to process and distribute herring.

6.5 Squid, Mackerel, Butterfish Fishery

Fisheries for two species of squid (*illex* and *loligo*) and mackerel provided total revenues of approximately $30.1 million in 1997 (*loligo* $26.5 million, *illex* $6.1 million, mackerel $9.5 million) (MAFMC 1998a). All three of these fisheries are managed using an annual quota system. There are also minimum mesh sizes for vessels fishing for loligo. While the mackerel fishery remains an open access fishery, the two squid fisheries both have a limited access system in place. In September, 1997, a control date was published for the mackerel fishery, but the qualification criteria to receive a permit has not yet been established.

There are some similarities between the herring fishery and these fisheries. The fisheries for *illex* and mackerel also are dominated by a small group of vessels. In 1993, one-third (18) of the vessels that reported landing illex accounted for 99% of the total catch. Just over one-fifth (58) of the vessels that reported landing mackerel accounted for 95% of the catch. While there is a larger group of participants in the *loligo* fishery, 90% of the catch was still landed by one-third of the vessels. The primary gear for squid vessels is the bottom otter trawl. Vessels fishing for mackerel – primarily with mid-water trawls - also catch a considerable amount of herring. Table E.24 and Table E.25 summarize individual trips that landed both herring and mackerel in 1996 and 1997. Another indication of this close link between the two fisheries is that an examination of weighout data from 1992 showed that herring is the second most common species (by weight) for those trips that landed more than 10,000 pounds of mackerel, accounting for 13% of the total pounds landed, but only 2.2% of the total value (MAFMC 1994). Herring was not among the top five species, either by weight or by value, in either of the squid fisheries. Finally, much like the herring resource, the mackerel resource is under-utilized. U.S. and Canadian landings totaled about 34,800 mt in 1996 with an estimated ABC of 1,175,00 mt. Total U.S. landings in 1997 were essentially unchanged from 1996 at 17,142 mt (MAFMC 1998a).

The average ex-vessel price per pound for Atlantic mackerel increased from 13 cents in 1996 to 28 cents in 1997. NMFS attributes the increase value of the frozen at-sea product delivered by the New Jersey and Rhode Island freezer trawler fleet (NMFS 1998a). Much like herring, mackerel landings are dependent on market conditions. According to the MAFMC, the major supplier of mackerel to world markets has traditionally been Norway. "A lack of mackerel in the North Sea area and the potential for future mackerel TAC reductions are providing opportunities for U.S. producers to place additional exports of mackerel in the international market" (MAFMC 1998a). Recent financial instability in eastern European and Asian countries, however, may force a revision to this assessment.

6.6 Whiting

Vessels fishing for whiting with small mesh bottom trawls catch also catch herring. Some vessels use the whiting small mesh bottom trawl exemption to target herring during specific times of the year. The Council is preparing an amendment to the Northeast Multispecies plan that will establish regulations for fishing for whiting, red hake, and offshore hake. The plan proposes an additional moratorium permit on commercial vessels fishing for whiting, with several different permit categories and qualification criteria. Proposed measures will include a minimum mesh size of 3-inches to retain up to 30,000 pounds of whiting/offshore hake. Vessels using a 2.5 inch mesh will be allowed a whiting/offshore hake limit of 7,500 pounds, and vessels choosing to use less than a 2.5 inch mesh will be allowed a whiting/offshore hake possession limit of 3,500 pounds. In the Gulf of Maine/Georges Bank area, whiting fishing will be allowed on Cultivator Shoals during the period June 15 through September 30. Fishing will be allowed in two defined small mesh areas; Small Mesh Area 1 will be open to fishing from July 15 to November 15, and Small Mesh Area 2 will be open from January 1 through June 30. (Additional closed areas adopted under the Northeast Multispecies Plan may restrict some of these possible fishing times.)

The proposed measures include three permit categories. Vessels with a limited access small mesh

multispecies permit will be allowed to possess from 3,500 pounds to 30,000 pounds of whiting/offshore hake, depending on the mesh size in use. Vessels with a limited access small mesh multispecies possession limit permit will be restricted to 2,500 pounds of small mesh multispecies. Vessels with an open access multispecies incidental catch permit will be restricted to 100 pounds of small mesh multispecies. Preliminary analysis shows that an estimated 414 vessels will qualify for the limited access small mesh multispecies permit, and 992 will qualify for the limited access small mesh multispecies possession limit permit. Another 1,500 vessels could still qualify for a small mesh multispecies permit either by obtaining a current multispecies permit or through the appeal process.

Some vessels that fish under existing whiting programs target herring on a small number of trips. These vessels supply bait herring to local lobster or tuna boats. The exact number of these vessels is unknown. In 1997, there were 100 vessels that caught 823 mt of herring, while also landing 4,000 mt of whiting. The most herring reported by an individual vessel was just over 30 mt, but the average was only 3.5 mt (see section E.7.3.4.3).

6.7 Monkfish

The Monkfish FMP was submitted for approval in September, 1998. This FMP establishes a limited access program for monkfish, trip limits for monkfish days-at-sea, minimum size limits, mandatory time out of the fishery, and limits on gillnets. It also establishes management areas for setting biological reference points and implementing differing management measure. The plan is designed to rebuild monkfish to more than the 1965-1981 stock biomass average within ten years. This will be accomplished by reducing fishing mortality, which will result in a change in a negative median net present value of gross revenues until 2017 (NEFMC 1998).

Most monkfish landings are as bycatch in the groundfish and scallop fisheries. Landings from all gear types increased to record high levels, due to increasing directed fishing effort through the mid- to late 1980's. In addition, some gillnet fishermen that used to target groundfish have begun to target monkfish. Monkfish was a significant part of scallop vessel revenues, exceeding 30 percent of total trip revenue on ten percent of scallop dredge trips. Approximately 600 vessels are expected to qualify for monkfish limited access permits. About 1,215 vessels that landed at least one pound of monkfish during the qualification period will not automatically qualify for a limited access permit. There is a possibility that if some of the trawl or scallop vessels do not qualify for monkfish permits, they may change gears and target herring.

6.8 Spiny Dogfish

The fishery for dogfish began to expand dramatically in 1990, with landings increasing to 27,000 mt in 1996 before declining to 20,500 mt in 1997. The primary gear types in this fishery are trawls and gillnets. Landings occur in every state from Maine to North Carolina, with Massachusetts and North Carolina recording the highest landings for the period 1988-1997 (MAFMC 1998b). In 1996, gillnets accounted for more than 80% of the dogfish landings.

The Mid-Atlantic Fishery Management Council and the Council are developing a joint fishery management plan for dogfish. Because dogfish are overfished, the proposed plan recommends a

one year "exit" fishery with landings of 10,000 mt, followed by a nine year rebuilding schedule that estimates allowable landings of approximately 3,000 mt per year, increasing gradually towards the end of the time series to about 3,700 mt. The allowable landings may be divided into different time periods. Because of the requirement to have a low level of landings to meet the mortality goals of the plan, a major consideration is the impact of discards. The proposed FMP estimates discards from bottom trawl and gillnet gear for the 1989-1997 time period, using the domestic sea sampling program database. The FMP includes estimates of discards in these gears based on target species. For Atlantic herring bottom trawls, the FMP estimates annual discards occurred at a rate of 0.0235, resulting in discards ranging from a low of 25,200 pounds in 1989 to a high of 211,000 pounds in 1992 (MAFMCb, 1998).

As described in section E.6.4.2.6, observer trips in the fall of 1997 noted discards of dogfish in both the mid-water trawl and purse seine herring fisheries. The highest proportion was in the purse seine fishery, with catches of 75,050 pounds of dogfish in a small number of sets in one particular area. The observed discards from limited observer data are higher than the estimated discards for directed herring bottom trawls for three of the nine years summarized in the spiny dogfish FMP. The limited number of observed trips, as well as the highly localized nature of the large dogfish catches, makes it impossible to draw conclusions on the overall discards of dogfish in the herring fishery. In addition, as noted in section E.6.4.2.6, there is no estimate on dogfish discard mortality in the herring purse seine fishery.

6.9 Conclusions

The herring fishery is one of the few remaining open access fisheries in the New England and mid-Atlantic areas. The resource is also in an underutilized condition, though there is concern the Gulf of Maine spawning component may be fully utilized. This fishery has the ability to absorb some additional fishing effort and provide additional revenues to the region. This capacity is not unlimited and will need to be closely monitored. If a significant number of vessels enter the fishery, it may lead to development of a “part-time” fishery as the increased fishing effort results in the TAC being reached early in the season. While new entrants using herring as a supplement to other fisheries may benefit from this arrangement, some of the traditional herring boats do not have permits that would allow them to enter another limited entry fishery. Any shifts of fishing effort onto herring will depend, in large measure, on the ability to enter into existing markets and develop additional demand.

Vessels that rely on the fishery for most of their revenue are likely to continue to do so. In particular, the 20 vessels(as identified in the VTR database), that currently land most of the herring are not likely to shift into other fisheries. The area TAC system will shift some of the effort of these vessels out of the inshore Gulf of Maine area into other areas, particularly Management Area 1B and, in the summer, Area 3. This change will benefit the resource as it will reduce pressure on the inshore Gulf of Maine spawning component. This shift will not be without cost. These areas have only been fished in limited manner by current participants and will require lengthier trips to locate and catch herring. New vessels may also choose to enter the fishery – in fact, two new participants entered the fishery in the fall of 1998. One vessel was converted from another fishery, while the second was new construction.

There may also be some shifts in effort from other fisheries into the herring fishery in response to increasing regulation in those fisheries. The primary methods for herring fishing are purse seines and mid-water trawling. Those vessels in other fisheries that use dredge or trawl gear can enter the fishery in one of two ways. Scallop vessels, in particular, may seek ways to enter the herring fishery in order to supplement revenues reduced by a stringent days-at-sea reduction program. One way to enter the herring fishery is to convert a vessel to one of the two primary herring gears. The most likely conversion is for a bottom trawl or scallop vessel is to convert to a mid-water trawl net. This conversion can cost in the range of $100,000 - $150,000.

An additional difficulty faced by those choosing to convert to this fishery is the rapid decomposition of herring after it is caught. This requires either short trips or a system to chill or preserve the herring at-sea. Two typical processes are a refrigerated sea water (RSW) system or freezing. The addition of RSW systems, considered necessary to bring in a food quality product from offshore, can raise the total costs to over $200,000. This high cost will serve to limit the number of vessels that choose to enter the herring fishery through conversion. Another possible impact is that those vessels that choose to convert and enter the fishery may forego expensive cooling systems and fish close to shore. This could result in rapid landing of the TAC in Management Area 1A, for example, and the slow development of a fishery that targets the offshore resource.

One possible way to avoid the RSW conversion costs and develop the offshore resource is for vessels to use processing capacity on another vessel. In the past, this was accomplished in other fisheries through joint venture activities with foreign processing vessels. This option is available in the herring fishery if foreign partners can be found, subject to the JVP specification, but there has been limited participation in the herring fishery by JVs in recent years (section E.6.4.2.2). In addition, the FMP may provide an opportunity for a similar activity with U.S. processors, limited to the USAP specification. While the recommended specification for USAP for the first year of the plan is 0 mt, there may be an opportunity for this activity in the future.

A lower cost option for some vessels will be to use a small mesh net authorized under the proposed whiting regulations to target herring. This would avoid the costs of conversion to a mid-water trawl configuration. In the Gulf of Maine and Georges Bank area, these vessels would be limited to fishing in certain specific areas and time periods. These vessels are not restricted in the amount of herring that they can land, as long as whiting possession limits appropriate for their permit category are not exceeded. In 1998 there was also an experimental small mesh fishery, using a grate, that targets whiting. These vessels were limited to fishing within the Gulf of Maine/Georges Bank Small Mesh Northern Shrimp Fishery Exemption Area during the period June 15 – November 30. Thirty-two vessels participated in this fishery in 1997, but this experimental fishery has not yet been approved for 1999. Approximately 31 vessels have participated in a whiting experimental raised footrope trawl fishery during the autumn throughout portions of the Gulf of Maine. Although this experimental fishery has not yet been approved for 1999, raised footrope trawls are currently required in both Small Mesh Area 1 and Small Mesh Area 2 to fish for any species. Small mesh bottom trawls in use throughout these areas are therefore raised footrope trawls and are already capable of catching not only whiting, but also herring and several other small mesh species. The use of small-mesh bottom trawls allowed in the whiting fishery provides a relatively low cost way to enter the herring fishery. The permit

moratorium proposed for the whiting fishery, however, will limit the number of vessels that can use this option to enter the herring fishery on a seasonal basis.

Another category of vessels that are more likely to enter the herring fishery are the freezer trawlers that participate in the squid, mackerel, and butterfish fishery. In 1998, the *illex* squid quota was caught by September. As a result, some of these vessels began fishing for herring to extend their seasons. This option will still be available under the proposed herring management plan, and these vessels can be expected to take advantage of this fishery if the *illex* fishery closes early in the future. A late-summer or early-fall herring fishery could serve as a "bridge" between an *illex* season that closes early and the winter mackerel fishery. Mackerel vessel fishing in the winter will continue to occasionally catch herring. There may be increased reporting of these landings as these vessels establish a history of fishing for herring in anticipation of any future limited entry or controlled access programs that may be considered.

All of these other fisheries are for species higher in value than herring. It is unlikely that vessels will exit these fisheries unless there is a complete closure. Rather, they will use the herring fishery as a supplement to primary fishery caused by increasing regulations and poor resource conditions. Some current participants in the whiting and monkfish fisheries that do not qualify for a limited access permit may shift to herring, but most of these vessels possess permits for more valuable fisheries, so this is not likely to be a widespread practice. In the squid and mackerel fisheries, the timing of the normal fishing seasons may make the herring fishery an attractive way to extend their seasons. Mackerel is primarily caught in the January through March time frame. Most *loligo* landings occur in the winter or autumn (January through April and October through December), while most *illex* landings are taken during the June through October time frame (MAFMC 1998a). This pattern may fit in well with a shift into the herring fishery in the late summer/early autumn, particularly in those years when the *illex* quota is taken in the late summer. As noted above, many of the boats in this fishery are able to freeze their catches at sea. This ability will make them well-suited to target the herring resource on Georges Bank and Nantucket Shoals if the Area 1A herring TAC is reached.

The strict landings quotas proposed for the dogfish fishery will reduce that fishery to incidental catches only. Because most dogfish are landed by gillnet vessels, there is unlikely to be a major shift in effort by these vessels into the herring fishery, as they probably lack the size, power, and equipment necessary to target herring. It is possible, however, that trawl vessels that target dogfish may continue their search for an alternative to groundfish and may enter the herring fishery. A more likely interaction between the dogfish and herring fisheries may be the result of dogfish bycatch in the herring fishery. If the dogfish plan does not meet its mortality targets because of discards in other fisheries, there may be a necessity to implement measures to reduce the bycatch of dogfish in the herring fishery. Whether such action is necessary will be difficult to determine without additional information on dogfish discards and, in particular, dogfish mortality in the seine and mid-water trawl herring fisheries. If the limited observer information from 1997 accurately depicts the localized nature of dogfish bycatch, the proposed first-year TAC for Management Area 1A may reduce dogfish bycatch by reducing the fishing effort in this area in the fall.

One impact difficult to predict is how fishing effort will shift in response to development of a roe

fishery. The plan does not initially impose any limitations on the harvest of herring for roe, other than the overall TACs and the restrictions on dumping of the carcasses, though a harvest limit may be imposed in the future. If a market can be identified, the higher value of roe may encourage investment in costly mid-water gear. This could also provide an opportunity for smaller vessels to enter the fishery, since the higher price received for roe means large volumes will not be as critical to success.

One factor that will be critical to the developing herring fishery will be the impact of management measures in the lobster fishery on the demand for bait. These two industries are closely linked because each depends on the other. If the proposed trap reductions and other measures significantly reduce bait demand, it will be critical for herring fishermen to develop alternative markets in order to fully utilize the resource. A reduction in demand from the lobster industry, coupled with a failure to develop new markets, could slow development of the fishery, make it more difficult for vessels to enter the herring fishery, and actually reduce herring landings. In a similar fashion, however, the collapse of the lobster fishery due to overfishing would have more immediate impacts. The TAC distribution scheme adopted by the herring plan may result in local shortages of herring until the industry exploits the offshore resource and redistributes its effort.

An expanding herring fishery could also lead to increased conflicts with fixed gear fishermen. In particular, if the number of mid-water trawl vessels increases, there may be additional conflicts with lobster fishermen. Contributing to the possibility of additional conflicts are the increased restrictions on small groundfish vessels in the Gulf of Maine. Many of these small vessels will be unable to fish for groundfish due to additional seasonal closures. While a considerable investment in gear is required, some of these boats may fish for lobster as an alternative. Many lobster fishermen locate their gear in groundfish closed areas, taking advantage of the lack of mobile gear fishing to minimize gear losses. Herring vessels, however, are allowed into groundfish closed areas. The most likely areas for conflicts will be the Gulf of Maine and Georges Bank, where the summer/fall herring season coincides with heavy lobster fishing activity. While there is a possibility that an increase in effort during the winter fishery may result in increased conflicts in southern New England, this is less likely since the lobster fishery moves offshore and in recent years most winter herring fishery has been inshore. An increase in the number of herring vessels could result in additional gear conflicts, particularly in these areas. The large volumes of herring landed by full-time herring fishermen, however, means that the total number of boats in the fishery will likely be relatively small compared to the number of vessels in other fisheries. In addition, the requirement that vessels that catch most of the herring be equipped with VMS will make it easier, if necessary, to adopt and enforce areas to reduce gear conflicts.

7.0 Relationship with Other Applicable Laws

7.1 National Environmental Policy Act (NEPA)

The Environmental Impact Statement (EIS) is incorporated into this document. For ease in recognition, all sections of the EIS are numbered beginning with the letter "E". The EIS begins with the following cover sheet.

COVER SHEET

RESPONSIBLE AGENCIES:

Assistant Administrator for Fisheries
National Oceanic and Atmospheric Administration
U. S. Department of Commerce
Washington, D. C. 20235

New England Fishery Management Council
Suntaug Office Park
5 Broadway (Route 1)
Saugus, MA 01906

PROPOSED ACTIONS:

Adoption, approval, and implementation of the fishery management Plan for Atlantic Herring (Clupea Harengus).

FOR FURTHER INFORMATION CONTACT:

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TYPE OF STATEMENT

( ) DRAFT (X) FINAL

ABSTRACT:

The New England Fishery Management Council and the NOAA Assistant Administrator for Fisheries propose to adopt, approve and implement pursuant to the Magnuson-Stevens Fishery Conservation and Management Act a fishery management plan (FMP) for Atlantic Herring. The FEIS present the details of a long-term herring management program which is designed to address identified management problems. Elements of the program include the adoption of management objectives and supporting management strategy which incorporates measures for immediate implementation. The management measures selected by the Council are intended to achieve the management objective through their positive effects on the long-term abundance and productivity of the herring resource. Specifically, measures being recommended for the management program include: (1) establishment of an overfishing definition, (2) the adoption of a Total Allowable Catch (TAC) for the herring fishery and distribution of the TAC across time and area (3) closure of the fishery in an area when the TAC is reached (4) the permitting of all participating vessels, operators, and dealers (5) the requirement that licensed vessels and dealers be subject to mandatory data reporting (6) implementation of effort controls (7) restrictions on size and type of vessels allowed in the fishery (8) a series of spawning area closures.

DATE BY WHICH COMMENTS MUST BE RECEIVED: _____ _

E.1.0 Environmental Impact Statement Cover Sheet

Preceding page.

E.2.0 Table of Contents

The Table of Contents for the EIS is integrated into the table of contents on page iv of this document.

E.3.0 Summary

E.3.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (M-SFCMA) established a national program of fisheries management designed to achieve the optimum yield from the fishery resources of the U.S. The M-SFCMA authorizes eight regional fishery management councils to prepare comprehensive fishery management plan (FMP) for the resources within their geographical areas of authority. These FMPs are in turn submitted to the Secretary of Commerce for approval and implementation through the promulgation of federal regulations.

The National Environmental Policy Act (NEPA) requires all agencies of the federal government to include in every proposal for "major federal actions significantly affecting the quality of the human environment" a detailed statement on the environmental impacts of and alternatives to the proposed action. NOAA has determined that actions initially adopting and implementing natural resource management plans, programs or policies, including fishery management plans, are action which normally require an environmental impact statement (NAO 216-6).

The "major federal action" described in this statement is a process, prescribed by the M-SFCMA, with three identifiable phases, i.e. adoption, approval, and implementation of an Atlantic Herring FMP. The first step in the process is taken by the New England Fishery Management Council (Council). The second and third steps are taken by the Assistant Administrator for Fisheries of NOAA, under authority delegated by the Secretary of Commerce.

The Fishery Management Plan for Atlantic Herring has been under development by the Council since 1996. The proposed management measures were developed in consultation with the Atlantic States Marine Fisheries Commission (ASMFC) and the Mid-Atlantic Fishery Management Council (MAFMC). This draft environmental impact statement (DEIS or statement) is intended to accompany the proposed measures through the
M-SFCMA process and serve as a vehicle for further public and agency review. Comment received on the DEIS were thoroughly considered by the Council in its preparation of the final Atlantic Herring FMP and the final EIS.

This EIS draws directly from the proposed management measures for Atlantic herring for the background of herring management, the problems to be addressed, and the description of the

proposed management measures. In some parts, these sections have been restructured and edited liberally to fully comply with the NEPA standard format for environmental impact statements. (Where appropriate, extensive references are given to more complete technical and descriptive discussions within the proposed management measures.)

A detailed background of herring management is contained in section 2.1 of this document. The New England Fishery Management Council has reviewed the status of the sea herring resource and the condition of the industry which utilizes this resource. The Council has determined that sufficient management problems exist to warrant the development and implementation of a federal program for conservation and management. The Council consulted with the Atlantic States Marine Fisheries Commission when making this determination.

The U.S. Atlantic herring fishery is currently managed as one stock complex along the East Coast from Maine to Cape Hatteras although there is evidence to suggest there are at least two separate biological stocks. Generally, the resource has been divided into an inshore Gulf of Maine (GOM) and an offshore Georges Bank (GB)/Nantucket Shoals component. The most recent fully reviewed assessment (NEFSC 1998a) concluded that the abundance of the coastal stock complex is currently at a record high level of 2.9 million metric tons (mt) while the most recent estimate of spawning stock biomass (SSB) is 1.8 million mt.

The herring resource is in an under-exploited state. There is increasing commercial interest in developing this fishery. There are, however, concerns that specific spawning components (notably the Gulf of Maine (GOM) stock) may be unable to sustain current or increased fishing pressure over the long term. There is also concern that uncontrolled exploitation of this component may lead to a stock collapse in the future. Other issues that are to be addressed by this FMP are listed in the goals and objectives section of the proposed management measures (section 2.3).

To address these concerns, the proposed management measures for Atlantic herring establish a continuing management program for the herring resources within the Exclusive Economic Zone (EEZ) of the U.S. This FMP has been coordinated with the Atlantic States Marine Fisheries Commission (ASMFC) to insure its consistency with measures taken within state waters.

E.3.2 Major Conclusions

The EIS concludes that the proposed measures will have positive impacts on the physical, biological, and human environment.

E.3.3 Areas of Controversy

NOAA Administrative Order 216-6 defines "controversial" as referring to a substantial dispute which may concern the nature, size, or environmental effects, but not the propriety, of a proposed action. The need for management is widely recognized through the herring industry. There is near universal agreement with the proposed requirements for permits, spawning closures, reporting systems, and a method to limit catch if it appears sustainable harvests are being exceeded. There are, however, several proposed measures that spark considerable controversy.

The Council considered a controlled access proposal to limit participation in the fishery, depending on qualification criteria selected to issue permits. There is disagreement in the industry on the need for a controlled access system and on the possible qualification criteria. Some view the proposed criteria as overly restrictive for a fishery that is not presently over-exploited. Others believe that a controlled access system should be implemented immediately to protect the resource, particularly the Gulf of Maine spawning component. The Council recommends managing the herring fishery as an open access fishery.

The action recommended for limiting vessel size in the fishery is the subject of considerable debate. The proposed limitation to prevent vessels over the size limits to catch, take or harvest herring was opposed by some segments of the industry. At least one company was preparing to enter the fishery with a vessel that exceeded the size limits, but was prevented from doing so through legislation adopted by Congress. This vessel has not caught or processed any herring in the Northeast Atlantic. This plan would prevent that vessel from entering the fishery. Since this vessel was modified with the intent of entering the east coast herring and mackerel fisheries before any restrictions were in place, there are some in the industry who view the Council's continued ban as an unfair action. At the same time, there was considerable support for limiting the overall size of vessels. An indicator of this support was the passage of the American Fisheries Act in October, 1998, which constrains the future ability of any vessel over 165 feet in length, 750 GRT, or 3,000 horsepower to receive a fisheries endorsement on its documentation.

Similarly, the Council's decision to constrain the ability of boats over the size limit to process herring at-sea polarized participants in the decision process. Many supported an outright ban on this activity, rather than the Council's recommendation to provide an allocation to this sector. At the same time, the Council's decision to recommend this allocation be set at zero for the initial year of the plan drew criticism from those who view at-sea processors as an effective way to make use of the offshore herring resource and develop products for foreign markets.

E.3.4 Issues to be Resolved

The primary scientific issue to be resolved is the identification of specific herring spawning stocks. Because this information is not adequately described, the management plan makes assumptions on the distribution of herring. These assumptions directly impact many of the selected management measures. For example, because of lack of information on spawning locations, the spawning area closures may not be of the correct size, at the right time, or in the correct location, to protect spawning stocks while minimizing impact of the closure on the fishery. A better understanding of the stock structure of herring would lead to better management of the resource.

Another issue concerns the trans-boundary nature of the resource. The management unit is only part of the coastal stock complex, which includes herring in Canadian waters, beyond the jurisdiction of this plan. The size of the Canadian fishery will impact the status of the stocks and the size of the total allowable catch (TAC) available for U. S. fishermen. This fact has been recognized throughout the plan's development. Close cooperation between U.S. and Canadian scientists and fishery managers will be necessary to successfully manage the herring resource.

E.4.0 Purpose and Need for Action

The purpose and need for action is discussed in detail in section 2.2 of this document. Briefly, the primary issue to be resolved is to establish a management regime that will allow the orderly development of a fishery for the herring resource in the EEZ while preventing damage to specific spawning stocks. The Council is concerned that absent a management program, the herring resource—including specific spawning components—could be overfished as a result of increasing commercial interest in the resource. The proposed management measures also provide a framework for the management of joint venture operations in the EEZ. The goals and objectives of the FMP are listed in section 2.3.

E.5.0 Alternatives Including the Proposed Action

E.5.1 Description of the Proposed Action

The proposed action is described in section 3.0 of the document.

E.5.2 Alternatives to the Proposed Action

In the development of the proposed action, the Council considered a number of variations of the measures that were finally adopted. For example, the Council considered different methods to determine the starting or ending dates for spawning area closures. These variations do no constitute a true alternative to the proposed action. Impacts of these variations are discussed in the same sections that summarize the impacts of the adopted measures. The two alternatives considered were no action and the adoption of a limited entry or controlled access system. Impacts of these measures are described individually.

E.5.2.1 No Action Alternative (status quo)

Under the no action alternative, Atlantic herring would continue to be managed under a combination of the Commission's Fishery Management Plan, a Preliminary Management Plan in federal waters, and state regulations. Since Section 314(c) of the M-SFCMA directs the Council to prepare a fishery management plan for any under-utilized species of the northwest Atlantic Ocean to prevent overfishing, and herring are identified as underutilized, the Council is constrained from choosing this alternative.

The Commission is adopting Amendment One to its management plan for Atlantic herring. This amendment was coordinated with the Council so that management in federal and state waters would be complementary. The following list summarizes management provisions that would exist if the Council did not adopt its plan, but the Commission did adopt its amendment for state waters.

ASFMC

- Overfishing reference points and target fishing mortalities
- Adoption of four management areas
- Spawning area restrictions for state waters in the Gulf of Maine
- Vessel, dealer and operator permits
- Vessel and dealer reporting requirements
- Area specific TACs
- Imposition of effort controls as the TAC is approached
- Limitations on directed mealing and the roe fishery
- Prohibition on vessels larger than 165 feet and 3,000 horsepower from harvesting herring

PMP

- Identification of specifications for the herring fishery
- Regulations for the conduct of joint ventures for herring in the EEZ

State

- Existing state regulations are listed in section 4.6. State regulations will change to implement the Commission's amendment to its management plan.

E.5.2.2 Limited Entry/Controlled Access

The primary alternative to the open access system recommended by the Council is a limited entry or controlled access system. The Council considered a comprehensive system that could be adopted for either the entire management unit or for specific management areas. Elements of the open access system (in particular, the use of a TAC) were considered as part of these controlled access proposals.

E.5.2.2.1 Discussion

The controlled access approach was designed to:

1. Conserve the Gulf of Maine stock component which is fully exploited;
2. Provide for continuous fishing throughout the year;
3. Provide opportunities for profitable exploitation of all herring and associated resources;
4. Prevent the development of overcapacity in harvesting or processing by providing appropriate investment signals for the utilization of each stock component, and
5. Permit the safe exploitation of unusually large stocks when they occur.

Under this alternative catches are limited by controlling the amount of fishing effort exerted on a stock. This is done by controlling the number and kinds of permits that apply and on the effort associated with each permit. Two kinds of permits are discussed below: Conservation Permits which guide the harvest of the sustainable portion of the stock , and temporary Development Permits which deal with amounts available above what the Conservation permit holders will take.

The alternative suggested controlling access to the sustainable portions of two components using

two controlled access programs: one for the Gulf of Maine component (referred to below as the Gulf of Maine Controlled Access Fishery) and another for the resources outside the first including the Georges Bank and Nantucket Shoals stock components (for convenience referred to as the GB/NS Controlled Access Fishery).

The control on access could have been effective in the Gulf of Maine as soon as the FMP is adopted because sufficient effort may already exist on the sustainable portion of that stock to issue a complete set of Conservation Permits for that area. Different options for this are discussed below. For the other areas, entry into the fishery would be encouraged until 50% of the TAC defined for those areas is taken in a given year. At that time, qualifying factors similar to those proposed to apply for the Gulf of Maine fishery (see below) could be evaluated and a set of Conservation Permits defined for those stock areas will be issued.

E.5.2.2.2 Gulf of Maine Controlled Access Area Options

Two options for defining the area for the Gulf of Maine controlled access fishery are described below based on alternative ways to protect that coastal stock.

Area option 1 Controlled Access Fishery for Gulf of Maine Area 1A.
The controlled access fishery for Gulf of Maine Area 1A (see section 3.4) would draw on the near coastal Gulf of Maine stock. Beside the vessels which will be brought into that program, others fishing on this portion of the Gulf of Maine stock will include:

1. the Maine, Massachusetts and New Hampshire territorial sea open access herring fisheries,
2. those taking a 2000 lb per trip incidental catch of herring in the EEZ in this area and
3. vessels harvesting for any IWP fishery.

The initial allowable harvest from area 1A for controlled access qualifiers would be based on the proportion of a conservative lower bound of the estimate of MSY for the Gulf of Maine component which is considered to be in area 1A, less estimates of what these other fisheries are expected to take. For all areas outside 1A taken together (i.e. Georges Bank and Nantucket Shoals), the available harvest far exceeds the actual harvest.

If this option to defining the Gulf of Maine stock area were chosen, some consideration might be given to restrictions on fishing in area 1B and others may be put on the winter fishery in area 2 to conserve the Gulf of Maine spawning component. These additional measures wouldn't be based on access control, but on some other measures to limit the harvest of the Gulf of Maine spawning component outside of 1A. They would be designed to minimize the impact on the larger herring fishery in those areas.

Area Option 2 Controlled access fishery for Gulf of Maine management area 1 (1A+1B).
Area 1 encompasses almost all of the Gulf of Maine (see section 3.4 and Figure 4). As in option 1, the stock defined for this area would be harvested by those in the controlled access fishery, those in the open access territorial sea fisheries of New Hampshire, Maine and Massachusetts, those taking a 2,000 lb. incidental catch per trip and by those participating in any IWP. The initial

allowable harvest from stock area 1 for controlled access qualifiers would be based on a conservative lower bound estimate of the Gulf of Maine stock's MSY, less what these other fisheries are expected to take. For all areas outside area 1 taken together, e.g. Management Areas 2 and 3, the available harvest is significantly above what is currently caught.

If this option to defining the Gulf of Maine stock area were chosen, some consideration might be given to restrictions on fishing on the Gulf of Maine stock in the winter fishery in area 2. These additional regulations wouldn't be based on controlled access, but would be designed to minimize the impact on the fishery in that area.

E.5.2.2.3 Limits on Catches and Effort

In the simplest TAC arrangement, a "hard" TAC would apply to each of the two controlled access fisheries. More complex arrangements could be based on management areas or different time periods. Each controlled access fishery would have a cap on effort based on individual Days at Sea (DAS). This system would be designed to allow harvesting to occur over the entire fishing year without interruption. A participant in a controlled access fishery would have a Conservation Permit for that fishery which would have a number of DAS associated with it which would be set annually. In general, the initial number of DAS any individual receives would be determined by the number of people who "qualify" into the fishery and how much effort these qualifiers represent. How many people qualify into the fishery is determined by the criteria used. Some options are suggested below. The DAS qualification program for the fishery outside of area 1 (or 1A) would be determined when 50% of the TAC is harvested. Some options for guiding that qualification are suggested in a later section.

In both fisheries, once the qualifiers are identified, the DAS they used would be summed and scaled up or down so that the total effort allowed would be compatible with the allowable harvest. A statistical relationship between DAS and landings would be used to relate catch and the effort that produced it. This relationship would include vessel characteristics (including net size), days at sea, fishing time, landings and possibly other variables. A similar process was developed for the scallop fleet.

The available harvest each year will be expressed at the individual vessel level as days at sea for that particular vessel. Adjustments would be made in individual DAS allocations for individual vessel upgrades so that the total harvesting potential for the fleet is capped. The choice of more complicated TAC options than the two discussed here may make the arrangements described more complicated.

E.5.2.2.3.1 Options for Qualifying for Participation in Area 1 or 1A

The criteria most often used to "qualify" vessels into a controlled access system are the existence of permits and participation in the particular fishery as reflected by landings. Given the lack of herring permits, four options are examined below. Each uses different criteria to qualify participants into the Gulf of Maine controlled access fishery for area 1 or 1A. Some idea of the outcomes from applying these criteria are shown.

Qualifying Option 1 Those who fished in Area 1 and landed herring under a letter of

authorization from the Regional Administrator in 1996 or 1997.

Under this option, 15 vessels would be brought into the controlled access program. If this group were to fish as much as the most active vessel in this group (133 DAS), their total catches would be twice the available resource for area 1A or 133,000 mt -- exceeding the MSY estimate for the entire Gulf of Maine stock. If they were to fish the same number of days as their maximum number of days in either year, the projected harvest (35,000 mt) would fall short of the resource available for the controlled access fishery (60,000 mt for 1A and 65,000 mt for area 1). This group contains half the number who would qualify under the next option. Some statistics on the vessels which would qualify under this criterion are listed in section E.7.3.11.2.1 on page 283.

Qualifying Option 2 Those who fished in Area 1 in 1996 or 1997 and who landed 2000 or more pounds on average per trip on which herring was landed.

Under this option, 54 vessels would qualify into the controlled access program by having, on average, larger landings than that provided by the proposed incidental catch regulation (2,000 lb/trip). If this group were permitted to fish as much as the most active vessel (165 trips) in the group, their landings would be more than four times (262,000 mt) the allowable catch for the controlled access program in area 1 If allocated days at sea equivalent to each individual vessel's maximum number of days fished in 1996 or 1997, the total harvest is projected to be 75,000 mt. If each vessels days at sea were reduced proportionately to meet the available harvest, they would have approximately 85% of the maximum number of DAS they used in 1996 or 1997. Some statistical information on those who would qualify under this scheme are included in section E.7.3.11.2.1.

Qualifying Option 3 Those reported fishing in Area 1 in from 1988 through 1997 and who landed 2000 or more pounds on average per trip on which herring was landed.

Under this option, 48 more vessels would be added to the 54 included above under option 2. If they were allocated the maximum number of days they fished in any one year in those ten, their additional contribution to landings would be 18,000 metric tons. By including these vessels, the number of days at sea any one vessel would have available would be their maximum in any one year reduced by thirty percent. Some statistical information on those who would qualify under this scheme are included in section E.7.3.11.2.1.

Qualifying Option 4 Those who possess a multispecies, scallop or squid, mackerel, butterfish permit.

Under this option. 2,848 permits would be issued to the qualifying fleet to fish in area 1 or 1A. The per-vessel allocation of DAS would be quite small on average and close to zero for most participants if the DAS were prorated by landings in recent years. Some vessel characteristics of four tonnage classes of this fleet are included in section E.7.3.11.2.1.

Qualifying Option 5 Reserve 10,000 metric tons of whatever formula is adopted for Area 1 or 1A for performance based qualifying into the Gulf of Maine limited access fishery by vessels with a Northeast multispecies permit.

This option reserves roughly one sixth of the available Gulf of Maine resource in area 1 or 1A for those with groundfish permits who wish to convert to herring fishing. If the vessels involved choose to upgrade in the conversion, they might be required to forego their groundfish permits or, be required to acquire another, probably latent groundfish permit to forego in the upgrading. In this case, the DAS available for those others qualifying would be reduced proportionately. As in the process described below in qualifying for a Conservation Permit for Areas 2 and 3, information on the amount of capacity participating through this route would be monitored closely to prevent the development of overcapacity.

Qualifying Option 6: Option 6 solicits public comment on additional qualifying criteria.

E.5.2.2.4 Options for Qualifying Outside Area 1 or 1A

The GB/NS fishery (defined as all areas outside the Gulf of Maine Controlled Access fishery) would operate as an open access fishery until approximately 50% of the conservative estimate of MSY for those stock areas is taken in a given year. Qualifying criteria for participation in this fishery beside actual fishing and/or evidence of investment for participation could include one or more of the following:

Qualifying Criteria Option 1 Ownership of a vessel having any Northeast Region Permit

Qualifying Criteria Option 2 Meeting a Reserved Vessel Categories Requirement. Categories might be reserved for vessels with a particular mix of qualifications such as those capable of offshore fishing or those possessing mackerel permits (assuming reciprocal arrangements exist).

Qualifying Criteria Option 3 Other

If criteria additional to fishing for and landing herring in anticipation of qualifying for a Conservation Permit for the GB/NS are to be applied, they need to be suggested, adopted and specified before that activity begins. At the point where 50% of the available resource in the GB/NS controlled access fishery is reached several processes for completing the qualification of vessels into the fishery can be pursued. For example:

Option 1 Prorate the activity of participants (DAS) up to a full year's fishing counting only participants and their landings.

Option 2 Prorate the activity of participants (DAS) up to a full year's fishing and an estimate of the potential activity of others having undertaken investments (contracted vessel starts and conversions).

Option 3 Allocate the equivalent of existing DAS utilized by each participant and apply the average to other vessels having undertaken investments to enter the herring fishery.

Option 4 Take into consideration the allocations a vessel has in other fisheries.

Regardless of the nature of process above, estimates of actual and potential capacity in the second controlled access stock areas will be maintained as it develops and the information will be made available to the public.

E.5.2.2.5 Transferability: Conservation Permits and Associated DAS

Once a controlled access fishery is fully subscribed, i.e. the available effort is spoken for, questions about the transferability of either or both the permit itself and the associated DAS arise from a desire for flexibility in taking advantage of market and resource conditions. These needs must be weighed against the administrative burdens and costs of keeping track of such transfers (e.g. leases, grants, consolidation, etc.) and their conditions, and against the desire to maintain local control. From a national perspective, benefits from resources available for harvest should be realized to the extent that they can safely be realized. Initially these are issues for the Gulf of Maine controlled access fishery only. Some options on the transferability of Conservation Permits are:

Conservation Permit Option 1 Conservation Permits may be transferred freely.

Conservation Permit Option 2 Conservation Permits may not be transferred.

Conservation Permit Option 3 Other

Subject to, in all cases, an adjustment (rescaling) of DAS to the particular vessel using them, several options on the transferability of DAS associated with a permit are possible.

CP DAS Option 1 Subject to approval of the Regional Administrator, the annual days at sea (DAS) associated with a Conservation Permit may be transferred (leased or granted or consolidated over vessels) in whole or part but must be utilized in the fishery for which they were designed.

CP DAS Option 2 Days at sea associated with a Conservation Permit may not be transferred (leased, granted or consolidated).

CP DAS Option Subject to approval of the Regional Administrator, other conditions on DAS apply.

Suggestions are solicited which would facilitate the flow of appropriate scale fishing effort to profitable opportunities.

E.5.2.2.6 Fishery Development Permits

The remaining 75% of the herring stock which is found in Areas 2 and 3 is underexploited in a biological sense. Goals 3, 4 and 5 of this alternative are aimed at establishing a system which will allow this currently underutilized resource to provide benefits without the region incurring the long term cost of overcapitalizing harvesting or processing capacity. Guidance can be adopted

now which would help minimize the risk of building and investing in excess capacity while not hampering opportunities which exist now or which may soon be available.

Under the controlled access alternative, all fishing in the EEZ for herring outside of that permitted for as incidental catch would be governed by either Conservation Permits or Development Permits. Unlike Conservation Permits, Development Permits exist for a limited time only. In general, development permits are temporary permits which may allow for:

1. the harvest of quantities of resource above the conservative estimates of MSY which govern Conservation Permits (but less than F_{MSY} applied to the current biomass);
2. the harvest of whatever portion of the sustainable resource available for permanent Conservation Permits is not likely to be harvested in a given year as the GB/NS Controlled Access fishery develops in areas 2 and 3; and
3. the harvest of a portion of the sustainable resources in areas 2 and 3 set aside for distressed fisheries.

Other features of Development Permits are designed to discourage permanent over-investment. In the long run, when all of the Conservation permits for the sustainable fishery for herring in areas 2 and 3 have been assigned, the only uses for development permits will be to fish resources above the sustainable yield which are temporarily available if all indications are that this can be done safely and possibly to fish some set aside portion of the sustainable harvest intended for distressed fisheries as determined by the Council and the Regional Administrator. Under these circumstances the following rules would apply to Development Permits:

1. that fishing conducted under these permits provides no “history” for future consideration in the allocation of Conservation Permits; and
2. that in the face of resource contractions, fishing under these permits ceases before downward adjustments are made to the allocation of DAS of Conservation permit holders.

However, prior to the time when all Conservation Permits for fishing herring in areas 2 and 3 are assigned, it may be profitable to conduct fisheries on the unassigned proportion of the sustainable resource as well as any temporarily available resource above MSY. For example it might be possible to have a temporarily expanded set aside for distressed fisheries or one or more of the following activities:

1. IWP arrangements
2. Joint Venture (US harvester-Foreign Processor) arrangements
3. Mealing arrangements
4. Community allocated DAS leased to out of region vessels and even
5. Community allocated DAS leased to foreign fishing enterprises

The Council may deem that some of the above activities and others may be appropriate for conduct under a Development Permit and not in the run-up to establishing history for a Conservation Permit. It is appropriate that some guidance be established which will provide the appropriate signals to fishermen and investors distinguishing what activity will need to be conducted under a Development Permit in this period and which can be conducted and counted as

performance for qualifying for a Conservation Permit for this area. The follow options are given as examples of that guidance:

Development Permit Guidance Option 1 Not less than fifty percent of any resource amount harvestable under development permits will be made available to holders of any valid Northeast region permit. Within a reasonable planning period, the remaining resource available for harvest under development permits may be made available to any person or company which meets performance standards, including evidence of a sound business plan, adequate financial safeguards and technical skills, to the satisfaction of the Regional Administrator may apply for access to those resources under a development permit.

E.5.2.2.7 Other Guidance in Permit Structure

The Council could consider the path of development of conservation permits in the two controlled access areas once and act to realign that development by providing further guidance and/or provide incentives for the realignment so that profitable opportunities for herring harvest and processing are not forgone. Some consideration might include:

1. Vessel size
2. Vessel harvesting capacity
3. Vessel range
4. Vessel processing capacity
5. Regional, national and international markets

E.5.2.3 Alternatives Outside the Council's Authority

An alternative management approach that was not considered by the Council is the use of individual fishing quotas. Under this concept, the right to catch a specific amount of fish is distributed to vessel owners. Generally, these rights can be traded, rented, used, or harvested at the discretion of the owner of the quota. Councils are prohibited from implementing such systems by section 303(d) of the M-SFCMA until after October 1, 2000.

E.6.0 Affected Environment

E.6.1 Data Considerations

A description of the system for collecting and using fisheries data is given in the SEIS for Amendment 5 to the Northeast Multispecies Plan and is also provided in each issue of the NEFSC publication *Status of the Fisheries Resources of the Northeastern United States*, "Status of the Stocks". The management information system has undergone a number of changes in recent years, most notably a shift from voluntary to mandatory vessel reporting in 1994 pursuant to Amendment 5, and continues to evolve to address changing needs and improvements. The following paragraphs describe some of the components of the data and information systems used by the Council, including changes and improvements currently underway.

E.6.1.1 Stock Assessment Workshops

The Northeast Regional Stock Assessment Workshop (SAW) process is a partnership of the NMFS Northeast Fisheries Science Center (NEFSC), NMFS Northeast Region (NER), New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council (MAFMC), and Atlantic States Marine Fisheries Commission (Commission). The SAW objective is to produce stock assessments, perform peer reviews of those assessments, and prepare scientific advice based on the peer-reviewed assessment results for fisheries management. This is the process that provides the primary biological information used in the management and conservation of the fishery resources in the region.

The SAW process began in 1985 and has gradually evolved in structure and procedure to its present format of two SAW cycles per year. There are three stages to the process which are overseen by a Steering Committee.

Working Groups

There are currently five standing Working Groups (Northern Demersal, Southern Demersal, Coastal/Pelagic, Invertebrate, and Assessment Methods), with each Group responsible for assessing assigned stocks. The Working Groups have no formal membership other than a Chair (generally from the NEFSC) appointed by the Steering Committee (see below). Meetings are attended mainly by NEFSC personnel whose assessment responsibilities or expertise coincide with the stocks being considered at a given meeting, but scientists from states, the two Council staffs, the Commission staff, universities, and Canada are welcome to attend. Fishing industry representatives are also welcome. Each Working Group has the following broad mandate:

- assembly of relevant input data;
- analysis of input data, performance of assessment, and investigation of analytical options;
- formulation of research recommendations;
- production of Working Paper (and ultimately the NEFSC Reference Document) and draft Advisory Report on Stock Status document for submission to SARC (see below);
- drafting of the appropriate section of the SARC Consensus Summary of Assessments document.

Depending on the stocks on the agenda for a particular SAW cycle, some or all of the Working Groups meet 1-2 months in advance of the SARC meeting to perform the assessments and prepare the necessary documentation. Either the Working Group Chair or the lead person for the specific assessment gives an oral presentation of the assessment at the SARC meeting.

Stock Assessment Review Committee

The Stock Assessment Review Committee (SARC) meets once during each SAW cycle (generally two each year, although three in 1997) usually in late June and late November or early December, with each meeting lasting five days. The SARC is chaired by the SAW Chair, and membership (at least 12 scientists which varies from meeting to meeting) includes four assessment experts chosen by the Chair from the NEFSC, two state people, one person each from the two Council staffs, one person from the NER, and generally at least one person each from Canada (DFO), academia, and

another NMFS Fisheries Science Center. SARC meetings are open to the public and are frequently attended by members of the fishing industry, academia, state agencies, Councils, and environmental groups. However, only the SARC members are responsible for developing the Consensus Summary of Assessments and Advisory Report on Stock Status. The SARC has the following mandate:

- peer review Working Papers (containing assessments) submitted by Working Groups, undertake dialogue on analytical options and, if necessary, conduct re-analyses to clarify issues, and refer assessment back to Working Group if problems persist;
- determine management advice;
- formulate research recommendations;
- produce Consensus Summary of Assessments and Advisory Report on Stock Status.

The SAW Chair is responsible for editing and assembling the draft Consensus Summary of Assessments and the draft Advisory Report on Stock Status and forwarding these documents to the Steering Committee (see below) for their approval prior to their distribution to the Councils.

Public Review Workshop
The Public Review Workshop consists of two half-day sessions, one each held in conjunction with a NEFMC and MAFMC meeting, at which time the assessment results and management advice from the SARC are presented and explained by the SAW Chair (with assistance from the Working Group Chairs). These sessions are open to the public and offer an opportunity for dialogue among Council members, scientists, and members of the fishing industry on the assessment results and management advice.

SAW Steering Committee
The Steering Committee is an executive group comprised of the NMFS Regional Administrator, NEFSC Science and Research Director, and the Executive Directors of the NEFMC, MAFMC, and ASMFC and chaired by the SAW Chair. The Steering Committee determines the stocks to be reviewed at each SAW and approves terms of reference, allocates personnel and funding resources to facilitate the assessment and peer review process, oversees the assessment and advisory process, sets dates and venues for SARC and Public Review Workshop sessions, evaluates the sufficiency and style of the SAW Reports and any additional communication required, and guides the SAW policy.

SAW Schedule
Normally, there are two SAW cycles annually. For the first one, the SARC meeting is generally held in late June and the Public Review Workshop sessions completed by August, while for the second, the SARC meeting is held in late November or early December and the Public Review Workshop sessions completed in January or February.

The SAW generally considers stocks considered by the SAW are generally on a multi-year schedule. Whether or not a stock is addressed at the spring or autumn SAW is based on survey timing, data availability, and management schedules. Working Group meetings for spring SAWs are generally held in April or early May. The NEFSC conducts its annual autumn trawl survey in September and October, and its annual spring survey in March and April, but the spring data are

not available for use in any assessments for the spring SAW.

E.6.1.2 NRC Review of Northeast Fishery Stock Assessments

In response to public questions, particularly among the harvester sector, about the scientific basis for management restrictions, Congress mandated in the SFA that the National Research Council (NRC) of the National Academy of Sciences conduct a review of stock assessments, information collection methodologies, biological assumptions and projections and other relevant scientific information used as the basis for conservation and management in the Northeast multispecies fishery. The NRC report concluded that "the current assessment process, despite the need for improvements, appears to provide a valid scientific context for evaluating the status of fish populations and the effects of fishery management."

The report also contained eight recommendations to NMFS to improve the assessments. These are:

1. Improve the collection, analysis, and modeling of stock assessment data as detailed in Chapter 3. Such improvements could include evaluations of sample size, design, and data collection in the fishery and the surveys; the use of alternative methods for data analysis; consideration of a wider variety of assessment models; and better treatment of uncertainty in forecasting;

2. Improve relationships and collaborations between NMFS and harvesters by providing, for example, an opportunity to involve harvesters in the stock assessment process and using harvesters to collect and assess disaggregated catch per unit effort data;

3. Continue to educate stock assessment scientists through short-term exchanges among NMFS centers so that each center can keep abreast of the latest improvements in stock assessment technologies being used at other NMFS fishery science centers and other organizations in the United States or elsewhere;

4. Ensure that a greater number of independent scientists from academia and elsewhere participate in the Stock Assessment Review Committee (SARC) process; where necessary, pay competitive rates for such outside participation to ensure that a sufficient number of the best people are involved in the review;

5. Increase the frequency of stock assessments. As the New England Fishery Management Council intensifies its management of the Northeast fishery, stock assessments may have to be performed more frequently than every three years (the current timing);

6. Consider a wider range of scenarios (e.g., recruitment, individual growth, survival, sub-stock structure, ecosystem, data quality, compliance with regulations, long-term industry response) in evaluating management strategies;

7. Investigate the effects of specific management actions, such as closed areas and days at sea limitations, on fishing mortality and related parameters;

8. Work toward a comprehensive management model that links stock assessments with ecological, social and economic responses, and adaptation for given long-term management strategies. This involves input from the social sciences (economics, social and political science, operations research) and from a wider range of natural sciences (ecology, genetics, oceanography) than traditionally is the case in fisheries management.

The NRC Review of Northeast Fishery Stock Assessments is available from:

National Academy Press
2101 Constitution Avenue, N.W.
Box 285
Washington, D.C. 20055
http://www.nap.edu

E.6.1.3 NMFS Strategic Plan for Research

Also in response to an SFA mandate, NMFS has recently published a national "Strategic Plan for Fisheries Research" which outlines the agency's goals and objectives for research in all areas, including biology and population dynamics, ecology, conservation engineering, information management, and socioeconomic aspects of the fishery. The report also contains specific regional research priorities for the NEFSC which will result in programs to improve collection, management and analysis of data specific to fisheries in this region.

E.6.1.4 Atlantic Coastal Cooperative Statistics Program

NMFS and the Council are participating in the Atlantic Coastal Cooperative Statistics Program (ACCSP) along with the Atlantic States Marine Fisheries Commission, coastal state fishery agencies and the U.S. Fish and Wildlife Service. The ACCSP is a cooperative state-federal marine and coastal fisheries data collection program. It is intended to coordinate present and future marine and coastal data collection and data management activities through cooperative planning, innovative uses of statistical theory and design, and consolidation of appropriate data into a useful database system.

The mission of the ACCSP is to cooperatively collect, manage, and disseminate fishery statistical data and information for the conservation and management of fishery resources for the Atlantic coast and to support the development and operation of a national program.

The four goals of the ACCSP are:

(1) plan, manage, and evaluate a cooperative, coordinated, cost-effective, dependable, non-duplicative and accurate state-federal marine and coastal fisheries data collection program for the Atlantic coast in which the general public, fishermen, and fisheries managers have confidence;

(2) undertake a unified state-federal marine and coastal fisheries data collection system for

the Atlantic coast, including both commercial and recreational sectors, to provide to the general public, fishermen, fisheries managers and stock assessment biologists, the best scientific and technical data needed for effective management on a timely basis;

(3) establish and maintain an integrated cooperative coastwide fisheries data management system among all Atlantic Coastal states from Maine to Florida, the regional fishery management councils, the National Marine Fisheries Service, the US Fish and Wildlife Service and other state or federal agencies involved in the collection, compilation, and management of marine, estuarine, anadromous and catadromous fisheries statistics; and

(4) support the continued development and operation of a national system to collect, manage, and disseminate marine fisheries information for use by states, councils, interstate commissions, and federal marine fishery management agencies using the existing regional programs as building blocks.

Development of the ACCSP began in 1996 and implementation is scheduled for 1999.

E.6.1.5 Transboundary Resources Assessment Committee

Since 1977, Canada and the USA have independently developed peer review processes for their stock assessments. In Canada, in late 1992, the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC) was disbanded and the Regional Advisory Process (RAP) put in its place. RAP in the DFO Maritimes Region currently provides advice on about 120 marine and freshwater finfish, shellfish and marine plant resources. In the Northeast Region of the National Marine Fisheries Service (NMFS), the SAW process currently provides advice on about 44 marine finfish and shellfish resources.

Collaboration between Canada and the USA on stock assessments and related research has been strong. Regular scientific meetings are held to co-ordinate joint research programs and facilitate inter-lab communication. Protocols for routine data exchange, particularly commercial and survey, have been established and joint work on assessment related issues is common. Finally, participation in each other's peer review process is routine.

The 1996 Canada/USA Scientific Discussions noted that it would be desirable to conduct joint assessments of the Georges Bank groundfish stocks during the 1997 assessment cycle. Thus in April 1997, scientists from Canada and the USA combined efforts to prepare assessments of Georges Bank cod, haddock, and yellowtail flounder. The peer review of these assessments was subsequently conducted first by RAP in Canada and then by the SAW Stock Assessment Review Committee (SARC) in the USA. Upon completion of the 1997 process, it was evident that there would be efficiencies realized by eliminating the duplication in the peer review process. This would also ensure that RAP and SARC would not produce divergent and inconsistent status reports on these stocks.

An outline of a joint Canada/USA peer review process has been agreed to by both Canada and the USA and the first joint assessment is currently in process. The following is a summary of this process.

Stocks to Consider
There are a number of stocks that could be considered in a combined process, however, for the initial joint assessment only three principal stocks are being addressed to allow the incremental development of the new joint process. Since the U.S. and Canada have had close interaction (data sharing and participation in each other's assessments) on 5Z cod, haddock, and yellowtail flounder, these stocks are the focus of the initial joint process. Other groundfish stocks in the Georges Bank - Gulf of Maine region that may also be considered include Southern New England yellowtail flounder, Gulf of Maine cod, Gulf of Maine - Georges Bank plaice, and Georges Bank winter flounder. Atlantic sea herring may be incorporated into the process in 1999.

Structure of the Peer Review
Transboundary Assessment Working Group
A multidisciplinary Transboundary Assessment Working Group (TAWG) has been established with membership composed of Canadian and USA scientists with a range of backgrounds. Industry participation from both countries is also encouraged. Its mandate is to:

- analyze pertinent assessment information and produce stock assessments on identified stocks;
- formulate research recommendations which will lead to long-term improvements in the assessments.

Meetings of the TAWG are arranged on a mutually agreed basis by both countries. The Chair of the TAWG will be determined by the RAP and SAW Chairs (see below).

Transboundary Resources Assessment Committee
A new Transboundary Resources Assessment Committee (TRAC) has been established to peer review the stock assessments produced by the TAWG. The TRAC will be distinct from RAP and SARC. The TRAC will be co-chaired by the Chairs of RAP and SAW who are also responsible for all logistical arrangements associated with TRAC meetings (e.g., dates, venue, participation). The TRAC is charged with producing final, approved assessments and resulting documentation on the status of the transboundary resources.

Participation at the first TRAC meeting was by invitation and will consist of a limited number of representatives. The policy on participation at future meetings will be developed based on experience with the new process. The TRAC will alternate its venue between Canada and the USA, with the host country serving as chair. The first meeting was held in St. Andrew's, N.B., Canada 20-24 April , 1998.

TRAC Coordination
The RAP and SARC Chairs, with the guidance of their respective steering committees, will oversee the activities of the TRAC and TAWG.

Management Advice and Public Meetings
Once the TRAC review process has completed its deliberations, the results may be used by either country for fisheries management purposes as appropriate e.g., preparation of management advice

in Canada by the Fisheries Resource Conservation Council (FRCC) and in the USA by the SARC. Each country may conduct independent consultations with clients or disseminate the information to the public, informing the other side as required.

Documentation

Technical Documents

The current plan is not to establish a new technical document series for resources reviewed by the TRAC. For 1998, when the TAWG and TRAC meetings will be held in Canada, the Canadian Stock Assessment Secretariat (CSAS) Research Document series will be used to catalogue the technical reports produced by the TRAC and the TAWG. For 1999, when the meetings will be held in the USA, the Northeast Fisheries Science Center (NEFSC) Reference Document series might be used. A definitive policy for the cataloguing of future documents in either of the existing Canadian or USA series remains to be developed.

Stock Status/Advisory Documents

The purpose of the joint Canada/USA stock assessment process for transboundary resources will be only to produce and peer review assessments of stocks of mutual interest and not to prepare management advice. Each country will use the assessment results from this joint process for their respective fisheries management purposes. The document series currently employed by each country at RAP and SARC meetings to convey a brief summary of stock status and management advice for individual stocks (i.e., the DFO Science Stock Status Report series in Canada and the SAW Advisory Report on Stock Status in the USA) will continue to be used for those purposes in each country because they serve different purposes and clients in each country. For stocks reviewed at a given TRAC meeting, the TRAC will produce final, approved documents for the Canadian SSR series. These documents, as well as the technical documents noted above, will provide the basis for management advice to be prepared by the SARC, following the TRAC meeting, and reported in the SAW Advisory Report on Stock Status.

E.6.1.6 Herring Fishery Data Limitations

Atlantic herring is currently regulated by a management plan adopted by the Commission and implemented by individual states. The federal preliminary management plan does not address domestic vessels. While the states have permitting and recordkeeping requirements, an overall system does not exist that tracks all participants in the fishery and centralizes collection of all catch data in one location. This lack of a central reporting system complicates analysis of the fishery and the impacts of the proposed management program.

Some herring vessels possess federal permits for other fisheries that require the vessel operators to report all landings and discards through the vessel trip report system described above. In addition, many purchasers of herring also purchase other federally regulated species and are required to have federal dealer permits and comply with federal dealer reporting requirements. Landings from these vessels and dealers can be identified in the vessel logbook and dealer databases. In addition to these sources of information, the Maine Department of Marine Resources tracks landings information from several vessels that do not have federal permits and do not report through the federal reporting system. Maine combines this information with dealer and vessel logbook data to construct a more complete file of the major participants in the

industry, but excludes trips of less than one metric ton in order to facilitate data handling. The Maine database also does not include revenue information. While this has little impact on the assessment of the resource, it complicates analysis of the economic impacts of the management measures.

There are discrepancies between these three databases. For example, in attempting to identify 1997 landings from small otter trawl vessels that use the various whiting fishery exemption programs to target herring at certain times of the year, analysts noted the landings attributed to bottom trawl gear in the dealer database are almost double the amount in the vessel logbook database. A cursory investigation suggested some landings in the dealer database may have the gear type mis-coded. In another example, some vessels in the Maine database are not included in either the dealer or vessel logbook databases. In describing the fishery and analyzing the impacts of the proposed management program, all three databases were used. There are some differences between each of the databases The discussion that follows identifies the data sources that support the analyses. In the following discussions, there are minor differences between the data sources that will be noticed. These are not considered significant and do not affect the analysis of impacts.

Another difficulty with analyzing impacts is the lack of information on the operating costs of herring vessels. While Capital Construction Fund and survey information is available for many of the gear types used in the Northeast Region, there is almost no information available for mid-water trawl and purse seine vessels. The NMFS is funding a project to collect this information for mid-water trawl and purse seine vessels, but it is not finished. The Council's proposal to incorporate the herring fishery into the Northeast Region reporting system, coupled with improvements in state and federal reporting that will be adopted through ACCSP, should improve the quality and reliability of herring landings in the future, identify participants in the fishery, and help develop information on operating costs.

E.6.2 Physical Environment

This section contains a general description of the physical environment in the region. Pursuant to the mandates of the Sustainable Fisheries Act (SFA), the Council, after receiving recommendations from NMFS, has:

- identified and described the essential habitat for the fish species managed by the Council;
- described adverse impacts to that habitat from fishing activities;
- described adverse impacts to that habitat from non-fishing activities;
- recommended conservation and enhancement measures necessary to help minimize impacts and protect and restore habitat.

The essential fish habitat for the species managed by the Council (including herring) is described in a comprehensive document submitted to NMFS for approval in October, 1998. In addition to the description of the physical habitat, this document includes a summary of the life cycle stages of herring and the observed range and preferred habitat for each stage. The applicable sections of this document are incorporated by reference into this FMP. The Essential Fish Habitat Source Document is attached as Appendix IV.

E.6.2.1 Gulf of Maine

The Gulf of Maine is a semi-enclosed sea of 90,700 km2 (35,000 square miles) bordered on the east, north and west by the coasts of Nova Scotia, New Brunswick and the New England states. To the south, the gulf is open to the North Atlantic Ocean. Below about 50 m depth, however, Georges Bank forms a southern boundary for the gulf. The gulf is connected to the deep North Atlantic Ocean by three channels, the major passage being the Northeast Channel between Georges Bank and the Scotian Shelf. The interior of the gulf is characterized by five major deep basins (>200 m) which are separated by irregular topography that includes shallow ridges, banks and ledges. Water flows in and out of the Bay of Fundy around Grand Manaan Island. Major rivers include the St. John, St. Croix, Penobscot, Kennebec, Androscoggin, Saco and Merrimack.

The bottom type within the gulf is quite variable and generally related to the topography. The deep basins are characterized by very fine sediments, while the irregular topography between the basins has a higher fraction of sand. The various banks and ledges are either rocky or composed of sand and gravel. The near coastal region south of Casco Bay is largely sand, while to the north and east, silt and clay predominate. The bottom type in near coastal areas is, however, extremely variable.

The predominantly rocky coast north of Portland, Maine is characterized by steep terrain and bathymetry with numerous islands, embayments, pocket beaches and relatively small estuaries. Tidal marshes and mud flats occur along the margins of these estuaries. Further south, the coastline is more uniform with few sizable bays, inlets or islands, but with many small coves. Tidal marshes, mud flats and sandy beaches along this portion of the coast are gently sloped and very extensive. Marshes exist along the open coast and within the coves and estuaries, but the amount of coastal wetlands (1,200 square miles) is small compared to other regions in the country. Tidal flats are, however, a predominant coastal feature north of Cape Cod: Maine alone has over 100,000 acres of tidal flats. Estuaries within the Gulf of Maine were formed by glaciers that carved steep-sided channels through the rocky shoreline through which rivers now run to the ocean.

The surface circulation of the Gulf of Maine is generally counterclockwise, with an offshore flow at Cape Cod which joins a clockwise gyre on the northern edge of Georges Bank. Surface water flows eastward to the northeast part of Georges Bank and then southwestward along the bank's broad southern flank. From there most o the water flows westward south of New England and through the Mid-Atlantic Bight. Some portion of the flow from the southern side of Georges Bank turns northward through the Great South Channel to recirculate around the bank. The counterclockwise gyre in the Gulf of Maine is more pronounced in the spring when river runoff adds to the southwesterly flowing coastal current. Surface currents reach velocities of 80 cm per second (1.5 knots) in eastern Maine and the Bay of Fundy region under the influence of very strong tides and gradually diminish to 10-20 cm per second in Massachusetts Bay, where tidal amplitude is only 3 m or so. The shoal region of Georges Bank also experiences large tidal currents of 70-100 cm per second.

The seasonal variation in sea surface temperature in the Gulf of Maine is extreme, ranging from 4 C in March throughout the gulf, to 18 C in the western gulf and 14 C in the eastern gulf in August. The salinity of the surface layer also varies seasonally with minimum values in the west

occurring during summer, from the accumulated spring river runoff, and during winter in the east under the influence of runoff from the St. Lawrence River (from the previous spring). With the seasonal temperature and salinity changes, the density stratification in the upper water column also exhibits a seasonal cycle. From well-mixed, vertically uniform conditions in winter, stratification develops through the spring and reaches a maximum in the summer. Stratification is more pronounced in the southwestern portion o the gulf where tidal mixing is diminished.

E.6.2.2 Georges Bank

Georges Bank is a large (roughly 45,000 km2 or 17,500 square miles) shallow bank that appears as an eastward extension of the continental shelf. It was formed during the last ice age as the glaciers melted and retreated northward. The bank has a steep slope on its northern edge and a broad, flat, gently sloping southern flank intersected by several submarine canyons. It is separated from the rest of the continental shelf to the west by the Great South Channel. The central region of the bank is quite shallow, with areas less than 10 m (30 feet) deep, and the bottom is sandy and flat, with some regions of gravel on the northern and eastern parts of the bank.

E.6.2.3 Middle Atlantic Region (Cape Cod to Cape Hatteras)

The coastal zone of the middle Atlantic states varies from a glaciated and rugged coastline from Cape Cod south to the New York Bight; further south the coast is bordered by a 160 km wide plain. Along the coastal plain, the beaches of the outer banks and barrier islands are wide, gently sloped and sandy, with gradually deepening offshore waters. The area is characterized by a series of sounds, broad estuaries, large river basins (e.g. Connecticut, Hudson, Delaware and Susquehanna), and barrier islands. Conspicuous estuarine features are Narragansett Bay, Long Island Sound, the Hudson River, Delaware Bay, Chesapeake Bay, and the nearly continuous band of estuaries behind outer banks and barrier islands along southern Long Island, New Jersey, Delaware, Maryland, Virginia and North Carolina. The complex estuary of Currituck, Albemarle, and Pamlico Sounds behind the Outer Banks o Cape Hatteras (covering an area of 6,500 km2 or 2,500 square miles, with 150,000 acres of salt marsh) is an important feature of the region. Chesapeake Bay is the largest estuary in the U.S., draining 64,000 square miles of land in five states, and includes almost 300,000 acres of salt marsh and 100,000 acres of tidal flats. Coastal marshes border small estuaries in Narragansett Bay and all along the glaciated coast from Cape Cod around Long Island Sound. Nearly continuous marshes occur along the shores of the estuaries behind the outer banks and around Delaware Bay. As a whole, this region contains more than 3,500 square miles of wetlands, one-third of which are in Chesapeake Bay. Middle Atlantic coastal plain estuaries are characteristically shallow and subject to strong tidal circulation, thus creating ideal conditions for biological productivity.

At Cape Hatteras, the shelf extends seaward approximately 33 km, then widens gradually to 113 km off New Jersey and Rhode Island. It is intersected by numerous underwater canyons. Surface circulation north of Cape Hatteras is generally southwesterly during all seasons, although this may be interrupted by coastal indrafting and some reversal of flow at the northern and southern extremities of the area. Speeds of the drift are on the order of 9 km per day. There may be a shoreward component to this drift during the warm half of the year and an offshore component during the cold half. The Gulf Stream is located about 160 km offshore of Cape Hatteras, but

becomes less discrete and veers to the northeast north of the cape. Surface currents as high as 200 cm per second (4 knots) have been measured in the Gulf Stream off Cape Hatteras.

Hydrographic conditions in the mid-Atlantic region vary seasonally due to river runoff and warming in spring and cooling in winter; the water column becomes increasingly stratified in the summer and homogenous in the winter due to fall-winter cooling of surface waters. In winter, mean minimum and maximum sea surface temperatures are 0 and 7 C off Cape Cod and 1 and 14 C off Cape Charles (at the end of the Delmarva Peninsula); in summer, the mean minimums and maximums are 15 and 21 C off Cape Cod, and 20 and 27 C off Cape Charles. The tidal range averages slightly over one meter on Cape Cod, decreasing to a meter at the tip of Long Island and on the Connecticut shore. Westward within Long Island tide ranges gradually increase, reaching two meters at the head of the Sound and in the New York Bight. South of the bight, tide ranges decrease gradually to slightly over a meter at Cape Hatteras.

The waters of the coastal middle Atlantic region have a complex and seasonally dependent circulation pattern. Seasonally varying winds and irregularities in the coastline result in the formation of a complex system of local eddies and gyres. Surface currents tend to be strongest during the peak river discharge period in late spring and during periods of highest winds in the winter. In late summer, when winds are light and estuarine discharge is minimal, currents tend to be sluggish, and the water column is generally stratified

E.6.3 Biological Environment

E.6.3.1 Species Life History

E.6.3.1.1 General

Atlantic herring (*Clupea harengus harengus*) are distributed along the Atlantic coast from North Carolina to the Canadian Maritime provinces. Schools of adult herring undertake extensive migrations to areas where they feed, spawn and overwinter. Herring are found all along the coast in inshore and offshore waters to the edge of the continental shelf during late winter and early spring. Adult herring move north into the Gulf of Maine in the spring, and in the summer and fall they segregate into more or less discrete spawning aggregations. After spawning, the adults migrate south again. This changing seasonal distribution has given rise to both mobile and fixed gear fisheries which harvest herring of all age groups. The catch supplies domestic and foreign markets for juvenile and adult herring which are used for human consumption, bait and food for zoo animals.

Adult herring undertake extensive seasonal movements, which have been best defined for the Georges Bank stock. Three phases are apparent: (1) a late summer-early autumn spawning migration of ripening fish; (2) a rapid post-spawning migration to warmer waters to the south for overwintering; and (3) a spring-early summer feeding migration. The Soviets followed adult herring from Georges Bank after spawning. They found that post-spawners moved southwest to off Chesapeake Bay in November and overwintered there. The larger and older fish seemed to

move furthest south. Feeding migrations back to Georges Bank began in May or early June, and to shallower spawning sites on the northern edge in September. The waters off Cape Cod seemed to constitute a mixing area, with different groups passing at different times of the year (Sindermann 1979).

The essential fish habitat for the life stages of herring are identified in the Council's Essential Fish Habitat amendment (NEFMC 1998). The sections of this document that are applicable to Atlantic herring are incorporated by reference into this FMP.

E.6.3.1.2 Age and Growth

Atlantic herring grow to a maximum length of about 43 centimeters (17 inches) and a weight of 680 grams (1.5 pounds). The maximum age of Atlantic herring is reported to be 18 years and they reach maturity at three or four years of age. A three year-old herring weighs approximately 90 g (0.2 pounds), while a four year-old weighs about 129 g (0.3 pounds).

Growth rates can vary greatly from stock to stock and from year to year. Some herring will mature by age-3, most will mature by age-5. Growth is highly variable and appears to be influenced by many factors, including temperature, food availability, and population size. During periods of low population levels herring may mature at a smaller size while growth may be accelerated in a large year class. In general, there appears to be evidence of overall environmental control of growth (Moores and Winters 1982, Sinclair et al. 1982, Tibbo 1957).

Larval herring from coastal Maine grow about 2.0 mm per week from October to early January and from late February to early March; little growth, if any, occurs during midwinter (Townsend and Graham 1981). Other growth rates reported from the Gulf of Maine-Georges Bank area were 1.75 mm per week after hatching, 2.1 mm per week for larvae 20 days old in September and October, and <1.0 mm per week for fish 75 days old in winter (Lough et al. 1982). The average daily growth increment for larvae from Georges Bank-Nantucket Shoals was 0.2 mm (Lough 1976).

Most of the growth of juvenile herring occurs during summer. In New Brunswick, the average growth of two year-old herring during May to September ranged from 30 mm in 1965 to 55 mm in 1978 (Sinclair et al. 1981). Both sexes are about 90 to 125 mm TL at the end of their first year, and 190 to 200 mm TL after the second (Bigelow and Schroeder 1953).

Anthony (1971), in comparing juvenile growth from different areas in Maine, reported modal lengths of fish in the 1960 yearclass (age group II) in October from eastern, central, and western Maine of 142, 155, and 175 mm, respectively. The lengths of the 1959 yearclass for the same age groups and areas were 190, 216, and 214 mm. In fish up to three years old, growth was inversely related to population density, and was faster in western than in eastern Maine.

Von Bertalanffy growth curve parameters, k (growth rate) and L (maximum length), were 0.251 and 37.4 cm in eastern Maine (Anthony 1971). The same parameters for southern and central Maine combined were 0.267 and 36.0 cm. A Newfoundland study provided little evidence to support density-dependent growth in the first year, but suggested density-independent growth

regulated by temperature (Moores and Winters 1982).

Anthony and Waring (1980) reported that adult herring reach their peak weight each year in August or September, and are at their lightest in February-March. They also reported that herring of both sexes from Nova Scotia, eastern and western Maine, and Jeffreys Ledge all had “oceanic” (offshore) growth characteristics common to fish of the northeast Atlantic. These characteristics included large maximum size, slow growth rate, and maximum ages of 15-18 years.

Georges Bank herring are more similar in growth characteristics to northwest Atlantic “shelf” (inshore) populations, which have a smaller maximum size, higher growth rate, and lower maximum age (Anthony and Waring 1980). The von Bertalanffy growth rate (k) of Georges Bank herring increased from 0.350 (1960-63 year classes) to 0.357 (1964-67 year classes) to 0.510 (1968-71 year classes). The increased growth rate of all year classes after 1968 may have been related to the decline in abundance (Anthony and Waring 1980).

E.6.3.1.3 Spawning/Reproduction/Early Life History

Atlantic herring are believed to return to natal spawning grounds throughout their lifetime (Ridgeway 1975, Sindermann 1979). This behavior is fundamental to the species’ ability to maintain discrete spawning aggregations and is the basis for hypotheses concerning stock structure in the northwest Atlantic and elsewhere. Since fall spawning aggregations of herring in the northwest Atlantic can not be distinguished genetically (Kornfield et al. 1982), the only direct evidence for this homing behavior is provided by a tagging study in Newfoundland which showed that adult Atlantic herring returned to the same spawning grounds year after year (Wheeler and Winters 1984). It could not be demonstrated, however, that these were the same spawning grounds where the fish were spawned.

Spawning occurs from year to year in specific locations in the Gulf of Maine in depths of 10-100 meters (30-300 feet) on coastal banks such as Jeffreys Ledge, along the eastern Maine Coast (and at various other scattered locations along the Maine coast), south of Grand Manan Island (New Brunswick), and off southwest Nova Scotia (Figure E.9). Jeffreys Ledge appears to be the most important spawning ground in the Gulf of Maine based on the number of spawning and near-spawning adults (Boyar et al. 1973). Spawning also occurs on Nantucket Shoals and Georges Bank (Boyar et al. 1973). Spawning concentrations of herring on Georges Bank in 1962 were reported to be as long as 64 to 80 km and as wide as 6 to 13 km. A spawning bed in Miramichi Bay, New Brunswick was examined by divers (Pottle et al. 1981) where most eggs were found attached to bottom vegetation at depths of 0.9-4.3 m, with the greatest concentration of eggs at 1.4-4.0 m. Spawning occurs earlier along the eastern Maine coast and southwest Nova Scotia (August – September) than in the southern Gulf of Maine (early to mid-October in the Jeffreys Ledge area and as late as November – December on Georges Bank).

Atlantic herring spawn on the bottom by depositing adhesive eggs of 1.0-1.4 mm in diameter (Messieh 1976), which stick to gravel, sand, or algae, and to each other to form mats or beds. Gravel is the preferred substrate (Drapeau 1973). A single egg bed surveyed on the eastern Maine coast in 1986 was determined to be 0.8 square kilometers (km2) or 0.3 square miles in area, a continuous carpet up to one inch thick and containing an estimated 2-3 x 1012 eggs (Stevenson

and Knowles 1988). Egg beds have also been surveyed on Jeffreys Ledge (Cooper et al. 1975) and Georges Bank (Anthony and Waring 1980, Valentine and Lough 1991). One egg bed surveyed on Georges Bank in 1964 covered an area of about 25 square miles (Noskov and Zinkevich 1967). Depending on their size and age, female herring can produce from 55,000 to 210,000 eggs (Kelly and Stevenson 1983). Once they are laid on the bottom, herring eggs are preyed upon by a number of species, including cod, haddock, red hake, spiny dogfish, sculpins, skates and moonsnails. Egg predation and adverse environmental conditions often result in high egg mortalities.

Larvae are about 4-10 mm (0.25 in) in length at hatching which occurs 10-15 days after the eggs are deposited on the bottom (Fahay 1983). The larvae remain pelagic through the winter in nearshore and estuarine waters in the Gulf of Maine (Chenoweth 1980; Chenoweth et al., 1989), and have been reported as far south as New Jersey (Ken Able, Rutgers University, pers. comm.). Metamorphosis occurs in the spring at a length of about 40 mm (1.5 in). Schooling behavior begins in the late larval and early juvenile, or “brit” stages. Young-of-the-year herring undergo a general offshore movement in the summer and fall, and they are believed to spend the winter in deep coastal waters.

The persistence of discrete aggregations of larvae for several months after hatching over tidally mixed continental shelf spawning grounds in the Gulf of Maine and elsewhere, despite the presence of fairly strong longshore currents, has provided the basis for a larval "retention hypothesis" (Iles and Sinclair 1982). This hypothesis states that Atlantic herring stock structure in an area like the Gulf of Maine is determined by the number, location, and extent of geographically stable retention areas. Such retention areas have been described off southwest Nova Scotia, around Grand Manan Island, and on Georges Bank (Iles and Sinclair 1982), and more recently, in eastern Maine waters adjacent to Grand Manan (Chenoweth et al. 1989).

The eastern Maine-Grand Manan spawning ground is an important source of larvae which are transported to the southwest along the Maine coast (Graham and Townsend 1985, Townsend et al. 1986). The larvae overwinter in bays, estuaries and nearshore waters, and become juveniles in the spring. Those juveniles which survive until the following spring and summer (age – 2) are harvested as sardines in the coastal fishery. Larvae which hatch on Jeffreys Ledge, another important coastal spawning ground in the Gulf of Maine, are mostly transported shoreward (Cooper at al. 1975), although some overwinter in nearshore waters on the Maine coast (Lazzari and Stevenson 1991).

Mortality of Atlantic herring in the larval stage is very high since the larvae remain vulnerable to very low temperatures and a limited food supply for a prolonged period during the winter, especially in the shallow nearshore and estuarine waters (Townsend and Graham 1981, Graham et al. 1991). Campbell and Graham (1991) developed an ecological model in order to examine which factors affected larval survival to the early juvenile stage. Some of the conclusions of that study were:

- Larval herring recruitment in Maine coastal waters is the result of a complex interaction among many processes, no one of which is truly dominant;

- Two year-old recruitment to the Maine herring fishery is established in the larval stage in some years and not until the brit stage in others;

- Larval food supply in autumn and winter, along with the quantity and distribution of spawning , are primary factors controlling herring recruitment to the brit stage for those years in which the larval stage is critical;

- When larval survival is above a threshold, density-dependent predation on brit can reduce year-class size (the assumption being that the brit become the food of choice for opportunistic pelagic and demersal predators when brit exceed an abundance threshold);

- Temperature and longshore transport are secondary factors determining survival that may be most important through their interaction with primary factors;

- In most years, more larvae survive the winter in the coastal areas than in the estuaries and embayments;

- The distribution of larvae along the Maine coast in springtime is largely a function of the variable movement of larvae.

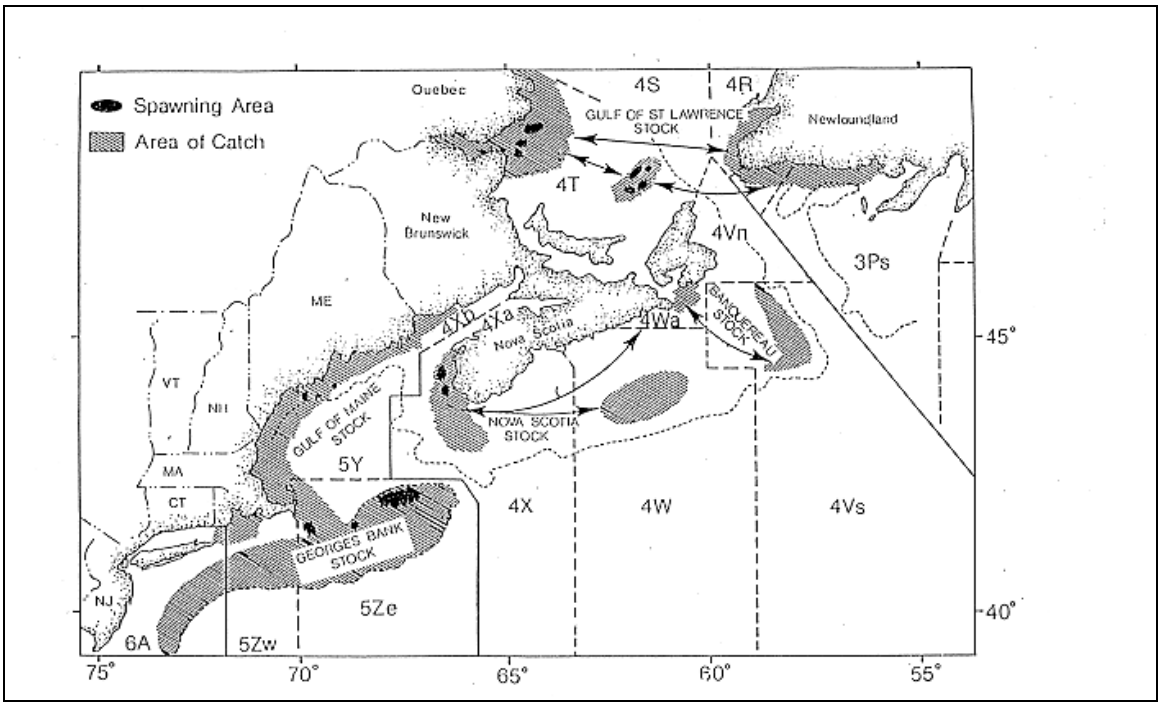


Figure E.6 - Map of the northeastern U.S. and eastern Canada showing distribution and spawning locations of major Atlantic herring stocks (Iles, 1972)

E.6.3.1.4 Distribution

Juvenile and adult herring range from south of Cape Hatteras to the Bay of Fundy and Browns Bank (Reid et al. 1998). The Essential Fish Habitat Source Document for Atlantic herring (Reid et al. 1998, Appendix IV) contains chartlets that reflect the observed distribution of herring at various life stages.

The location and movement of juvenile Atlantic herring which originate from spawning on Georges Bank is not known with any certainty, although surface circulation patterns and the abundance of juveniles in southern New England and Long Island Sound in recent years suggests that juveniles move inshore south of Cape Cod or are transported there as larvae. There has always been some speculation that a portion of the juvenile (age-2) herring found along the western Gulf of Maine coast (Massachusetts to New Brunswick) are derived from spawning on Georges Bank, but there is no real evidence so far. Recent evidence relating to the distribution of Atlantic herring south of Cape Cod and in the Gulf of Maine is summarized here.

Delaware's trawl survey takes adult herring (>20 cm) in the lower portion of Delaware bay during March and April. Adults have also been observed in the adjacent ocean waters, often mixed with mackerel. Juvenile herring do not typically appear in survey catches (Rick Cole, Delaware Div. Fish. & Wild., pers. comm.).

New Jersey conducts a trawl survey during the months of January, April, June, August, and

October. Adult Atlantic herring averaging 26-27 cm, are abundant in survey catches in January, typically ranking with small-sized elasmobranches, as the most abundant species by weight. Herring are found in all depth strata sampled (0-30 meters) along the New Jersey coast in January. Smaller herring, averaging 21-22 cm, are present during April but at a lower abundance than observed in January. No herring are taken during the summer sampling period, and very few juvenile fish are taken at any time during the survey. Larval and early juvenile herring (2-5 cm) are abundant in plankton samples from Little Egg Inlet, NJ during February to April (Ken Able, pers. comm.) and in Delaware Bay and its tributaries (Bruce Freeman, pers. comm.).

In New York, juvenile Atlantic herring (<18 cm) appear in trawl survey samples in the Peconic Bays area during the summer (Sherri Aicher, NY DEC, pers. comm.).

A trawl survey of Long Island Sound has been conducted by the Connecticut DEP from April to November. Adult herring (20-34 cm) are most common in April, with limited numbers of adult fish taken in May and November. It appears that the adult herring are present in Long Island Sound before the survey begins in April. Juvenile herring are abundant in Long Island Sound during the summer. Two length modes are apparent in the survey data, the largest at 7-9 cm and a smaller mode at 15-18 cm. The largest concentrations of juvenile herring tend to occur in the western Sound with good catches occurring even in areas where bottom dissolved oxygen (DO) concentrations are below 3 mg/l. There is some speculation that juvenile herring may be feeding above hypoxic bottom waters in algal blooms near the surface which are often associated with hypoxic areas. Herring are found in all depths sampled from 5-40 m, although concentrations tend to be higher in 10-30 m depths (David Simpson, CT DEP, pers. comm.).

Rhode Island fishery independent surveys take Atlantic herring year round in Narragansett Bay. Fish range in size from 5-36 cm, with fish greater than 15 cm occurring from November to April, and smaller fish (<20 cm) present from June to October (Tim Lynch, RI DEM, pers. comm.). Coastal ponds sampled with numerous gear types primarily support large (25-38 cm) fish. Herring are most abundant in coastal ponds between October and early June (Dick Satchwell, RI pers. comm.). Larval herring have been found from February to June in Mount Hope Bay, as well as the Seekonk and Providence Rivers (Grace Kline-McPhee, RI, pers. comm.).

Massachusetts conducts trawl surveys during the spring (May), and fall (September). Brit, or juvenile herring 4-7 cm are commonly taken in the spring trawl and June seine surveys south of Cape Cod. Few adults are observed south of the Cape in state waters covered by the survey. Brit are taken in about 1 m of water in the June seine survey, typically in areas that are close to the open Sound. Late in June these fish appear to move east and north into Cape Cod Bay and the Gulf of Maine. North of Cape Cod, fish tend to be larger (>12 cm) than observed south of Cape Cod in the spring. Adult herring are taken in the fall survey, both north and south of the Cape.

Atlantic herring are present in New Hampshire gillnet samples throughout the year, with seasonal peaks in the spring and late fall. Larval herring are present from October to April. While there is no extensive sampling throughout New Hampshire waters, it is expected that larvae are present in the coastal waters and estuaries including Great Bay.

The distribution of Georges bank fish during the 1960's at the time when abundance was peaking

and the catch was primarily by foreign nations, was described by Zinkevich (1967), using data collected from 1963-65 by Soviet fishing and scouting vessels. He concluded:

> "Herring were distributed over the greatest area in winter months. From November to March, herring were fished from 36° N along the continental shelf to the northern extremity of Georges Bank. During that period the herring were active and did not form stable concentrations. In February and March, the bulk of the fish was observed in the areas of Long Island, Hudson Canyon, and farther south. For instance, in March 1964, the bulk (of the fish) was found in the area from 36° to 38° N.
>
> In the spring months, the herring moved from the area of Wilmington and Hudson Canyons to the southern parts of Georges Bank, where they gradually increased in numbers, whereas they decreased in numbers south of 40° N.
>
> From May to October, the bulk of the fish was feeding or spawning on Georges Bank."

E.6.3.1.5 Foods/Feeding

Atlantic herring are visual feeders, consuming plankton during daylight hours (Blaxter 1966), filtering out small organisms with long, well-developed gill rakers. Young herring begin to feed on small phytoplankton, eating larger organisms as they grow. Fingerlings or larger-size herring (brit) consume large quantities of copepods. Adult herring feed heavily on the euphausiid crustacean *Meganyctiphanes norvegica*, but may also eat copepods, fish eggs, pteropods, mollusk larvae and the larvae of small fish such as sand lance, silversides, herring and capelin (Scott and Scott 1988). Legare and Maclellan (1960) found copepod genera *Calanus*, *Pseudocalanus*, *Eurytemora*, *Acartia* and *Tortanus*, to be important prey items of herring in the Quoddy region of New Brunswick. They found the most active feeding period to be September to November. Sherman and Perkins (1971) concluded the diet of juvenile herring in Maine coastal waters was varied with copepods the most important prey, especially in summer. Other zooplankton preyed upon included cladocerans, larval cirripeds (barnacles), decapods and pelecypods. Herring in Newfoundland waters were found to eat very little in winter (December to April), apparently living on their accumulated fat (Hodder 1972).

Atlantic herring compete with other species such as Atlantic mackerel and sand lance (*Ammodytes* spp.) for some of the same food sources, e.g., euphausids. In the mid to late 1970's, when mackerel and herring abundance declined, the abundance of sand lance increased explosively, giving rise to speculation that some sort of competitive relationship existed between these three species, especially between sand lance and the mackerel/herring dyad.

E.6.3.1.6 Predator/Prey Relationships

Herring is an important species in the food web of the northwest Atlantic. Herring eggs or spawn are subject to predation by a variety of bottom creatures, including winter flounder (Pottle et al. 1981, Tibbo et al. 1963), cod, haddock and red hake (Caddy and Iles 1973), and sculpins, skates

and smelt. Juvenile herring, especially brit (age-1 juveniles) are preyed upon heavily due to their abundance and small size. Mortality due to predation during the first year of life is believed to be a major factor affecting recruitment to the fishery at age-2 the following spring and summer. Herring finfish predators include: cod, pollock, haddock, red hake, white hake, silver hake, squid, spiny dogfish, porbeagle, blue shark, thresher shark, shortfin mako, clearnose skate, little skate, goosefish, hickory shad, Atlantic salmon, bluefin tuna and swordfish. However, according to Grosslein et al. (1980), for many of these predators the information is qualitative only, and the actual quantity of herring consumed as prey is unknown.

Analysis of stomach contents data collected during NMFS bottom trawl surveys in late 1969-72 showed herring to be an important prey item for cod, pollock, haddock, silver hake and white hake (12.5-27.4% by weight) and not for a number of other gadiform fishes or for any species of flounder (Langton and Bowman 1980, 1981). Of these five species, cod ranked the highest. In another study conducted in 1973-76, silver hake diets were composed 80% of fish but only 2.7% of herring (Bowman 1980). More recent information, based on 1978-1990 NMFS food habits data, indicates that large amounts of herring were consumed by silver hake and dogfish on Georges Bank. Other predators that also fed on herring, but did not have a very large impact on the herring population because of their low abundance, were cod and winter skate (Tsou and Collie 1997).

Some quantitative information is available which indicates the importance of herring as a food source for other species. Overholtz et al. (1991) estimated that silver hake, cod, and dogfish annually consumed an average of about 1500, 200 and 4300 metric tons (respectively) of herring from 1988-92 on the northeast U.S. continental shelf. Overholtz et al. (1991) also calculated that five species of whales, three species of dolphins, harbor porpoises and harbor seals consumed, on average, 19,300 mt (42.5 million lbs) of herring a year from 1988-92. Herring was the third most common prey species behind sandeels (55,760 mt) and mackerel (36,260 mt). Finback whales accounted for about 50% of the total quantity of herring consumed by the ten species of marine mammals (10,000 mt). Humpback whales (2,600 mt) and pilot whales (2,800 mt) were also significant consumers. Research on harbor seals off Monomoy Island, Cape Cod during 1984-87 indicated that herring increased in their diet from 5% in January and February, to 16% in March and April, although the importance of herring in the diet may have been much higher (Payne and Selzer 1989). A review of the stomach contents of 95 harbor porpoise caught in gillnets in the Gulf of Maine during the fall from 1989-1994 showed that herring occurred in 78% of non-calf stomachs and contributed 44% of ingested mass, the largest proportion of any species (Gannon et al. 1998). Seabirds also take a share of the herring resource. Estimates were that the northern gannet consumed about 3,000 mt and the shearwater about 250 mt a year during 1988-92 on the U.S. northeast shelf (Overholtz et al. 1991).

These calculations indicate that between piscivorous fish, marine mammals and marine birds, approximately 30,000 mt of herring is consumed each year. This is probably an underestimate since it was based among other things, on a presumed low abundance of herring on Georges Bank and herring, at least during the spawning season, are known to be much more abundant in recent years as the offshore portion of the stock has recovered. However, even using an estimate of 50,000 mt, this only represents 2.5% of the estimated total stock size of Atlantic herring in 1990, and 50% of the current commercial harvest. The annual natural mortality rate used to estimate

stock size, in contrast, is 18%.

Natural mortality rate estimates for Gulf of Maine herring at different ages (Anthony 1972) indicated that M increases from values of 0.2-0.3 at ages 1-3, then increases exponentially at older ages, reaching 0.8 at age 8. These estimates were based on the relative abundance of adult herring caught incidentally in other fisheries (e.g., bottom trawls) along the coast of Maine in the 1960s, at a time when the only demand was for juvenile herring. Total mortality rates estimated by this technique at that time were thus attributed entirely to natural mortality. This assumption is probably correct, but the rapid increase in M at older ages is illogical and contrary to results based on feeding rates (see above). It is likely that the decline in the catch rates of older herring was biased by an increasing ability of larger fish to avoid capture or to leave coastal areas where the catches were made in favor of deeper, offshore waters.

On Georges Bank, Tsou and Collie (1997) estimated predation mortality rates on herring that varied from 1.2 (70%) at age 0 to 0.01 at age 5. The biomass of herring consumed by silver hake, dogfish, cod, haddock and winter skate varied roughly between 5,000 mt and 35,000 mt between 1978 and 1990. Predation mortality on the two principal prey species, herring and silver hake, was estimated to be much higher than fishing mortality and higher than the constant M=0.2 rate that is generally assumed.

The ICES Multi-Species Working Group compiles annual stomach contents data for the important predatory species in the North Sea and estimates composite predation mortalities on each key prey species, taking into account the stock sizes of each predator and prey population. The mean multi-species predation mortality rates for herring for the period 1974-1994 declined from a high value of 0.72 at age 0 to 0.07 at age 5, with an additional residual M value of 0.1 at all ages (ICES 1997). At ages 0 and 1, these long-term mean M values were lower than the estimates currently used by the ICES Herring Assessment Working Group for the North Sea, but at the older ages they were higher. The MS Working Group calculated that a million metric tons of herring were consumed by the other species included in their analysis in 1987 and that residual natural mortality removed an additional 200,000 mt a year. The fishery at that time harvested 700,000 mt. In more recent years (1991-1995), natural mortality was estimated to be about 400,000 mt of herring a year (300,000 mt from predation) and yield was between 500,000 and 600,000 mt a year. Stock biomass in the North Sea has dropped from a high of 1.9 million mt in 1987 to about 700,000 mt in 1995.

In a recent study, estimates of prey consumption by four species of seals in the maritime provinces of Canada during 1990-1996 showed that capelin, sand lance, and arctic cod accounted for most of the estimated consumption. The estimated consumption of herring in 1996 was 131,000 mt and was mostly small fish. Another study in the northeast Atlantic concluded that a population of 85,000 minke whales consumed 633,000 mt of herring a year between 1992 and 1995.

Juvenile herring collected in inshore waters of the Gulf of Maine in 1968 were feeding primarily on copepods (Sherman and Perkins 1971). Adult herring collected during NMFS bottom trawl surveys were feeding primarily on euphausiids and chaetognaths in the early 1970s (Maurer 1976) and on euphausiids, copepods, and other crustaceans during 1973-1980 (Reid et al. 1998). Information collected during 1981-1990 (Reid at al. 1998) indicates that herring in other locations

had more varied diets than herring in the Gulf of Maine: primary prey taxa were amphipods and mysids on Georges Bank; amphipods, chaetognaths, fish, crustaceans, mysids, copepods, and euphausiids in southern New England; and amphipods, crustaceans, mysids, sand lance, euphausiids, and shrimp in the Mid Atlantic Bight.

Herring are also known to feed on pelagic fish eggs and may in some cases have an effect on the recruitment of these species. A study in the North Sea estimated that herring only consumed 0.7 to 1.9% of all the plaice eggs and 0.04 to 0.19% of all the cod eggs produced in 1980, 1982 and 1983 (Daan et al. 1985). Fluctuations in Pacific cod and herring stocks in British Columbia between 1950 and the early 1980s suggest that herring recruitment rates were strongly influenced by cod predation. Also, cod recruitment rates were positively correlated with herring abundance, but it is impossible to tell whether this correlation reflects predator-prey interdependence or the effects of cannibalism by older cod on their own offspring (Walters et al. 1986).

Fogarty et al. (1998), in an analysis of the large-scale disturbances caused by fishery impacts on Georges Bank, note the current large biomass of pelagic species and the potential impact this may have on other species. The reduction in predation pressure on herring and mackerel stocks caused by the decline in groundfish populations may have contributed to the explosive growth in these species. This, in turn, may impact other species. For example, Sherman et al. (1994) linked declines in zooplankton levels to the abundance of pelagic fish.

E.6.3.1.7 Parasites/Disease

Atlantic herring are infected by a number of parasites, some of which can cause mass mortalities. Margolis and Arthur (1979) listed the following as known parasites: protozoans (3), myxosporidians (3), trematodes (6), cestode (1), nematodes (4), and copepod (1). Arthur and Arai (1984) reviewed the known parasites of herring throughout its holarctic range, listing over 80 species. The presence of some parasites, such as *Anisakis* and the coccidians *Goussia clupearum* and *Eimeria sardiniae*, may be useful in distinguishing certain herring stocks (Hodder and Parsons 1971, Morrison and Hawkins 1984). Some parasites may be more obvious than others, such as pigment-spot disease, caused by the larval trematode *Cryptocotyle lingua*, whose intermediate host is the common periwinkle and definitive host the herring gull.

The systemic fungus pathogen *Ichthyosporidium hoferi* has been known to cause large-scale mortalities of herring (Sindermann 1963, 1965). Herring may also be infected by the piscine erythrocytic necrosis (PEN) virus (Reno et al. 1978). A mass mortality of herring in the Bay of Fundy caused by a toxic dinoflagellate, *Gonyaulax excavata*, contained in pteropods and zooplankton, which had been consumed by the herring (White 1977, 1980).

During the winter of 1969, a series of extensive herring mortalities occurred in the Placentia Bay, Newfoundland region. The dead herring were red in color (fins and body) and attracted much publicity. Mortality was first thought to be caused by a disease but was later shown to be the result of industrial pollution, mainly phosphorus, from a nearby industrial plant (Jangaard 1970).

E.6.3.1.8 Stock Structure and Migration

There are three major stocks of Atlantic herring in the Gulf of Maine region that spawn in

geographically discrete areas on Georges Bank and Nantucket Shoals, in coastal waters of the Gulf of Maine, and off southwest Nova Scotia (Figure E.6). Each of these major spawning areas is composed of a number of smaller spawning grounds. Observations of year to year changes in the abundance of adults on individual spawning grounds, in response to fishing pressure, tend to confirm the view that each of these areas supports a discrete spawning aggregation (or sub-stock) of herring (Stephenson 1998). Some of these discrete spawning grounds are located within 10-15 miles of each other (e.g., Trinity Ledge and Lurcher Shoals, off the southwest coast of Nova Scotia). Adults from the two U.S. stocks mix during their winter migration to southern New England and mid-Atlantic waters and separate out onto their respective spawning grounds following a return northward migration in the spring. Adults that spawn off southwest Nova Scotia (the 4WX stock) for the most part migrate north after spawning and are not believed to mix to any significant degree with herring that spawn on Georges Bank or in the Gulf of Maine (Stephenson et al. 1998). Spawning takes place in the late summer and fall in fairly shallow tidally-mixed shelf waters where larvae are retained for varying periods of time before being dispersed to overwintering areas (Iles and Sinclair 1982).

The evidence for separate stocks in the Gulf of Maine region is derived from discrete larval distribution patterns (Iles and Sinclair 1982), differences in spawning times and locations (Boyar et al. 1973, Haegele and Schweigert (1985), and distinct biological characteristics, such as growth rates (Anthony and Waring 1980), meristic and morphometric counts and measurements (Anthony 1981, Safford 1985), and the incidence of parasites (McGladdery and Burt 1985). Some degree of stock differentiation was achieved with early enzyme electrophoresis research (Ridgway et al. 1970, 1971), but more recent attempts to differentiate geographically isolated fall spawning stocks in eastern Canada and the northeast U.S. on the basis of genetic characteristics have been unsuccessful (Kornfield et al. 1982, Kornfield & Bogdanowicz 1987). Evidence for homing is provided by tagging studies (Wheeler and Winters 1984) which showed that the same fish return to the same spawning grounds year after year. Tagging studies conducted on spawning herring in Nova Scotia, on Cultivator Shoals and Jeffreys Ledge, and along the Maine coast during the late 1970’s and 1980’s demonstrated considerable affinity for home spawning grounds, with some intermixing in the winter, spring and early summer (Stobo 1983, Creaser and Libby (1988).

The most compelling evidence supporting the existence of separate Gulf of Maine and Georges Bank/Nantucket Shoals stocks was the collapse of the large Georges Bank/Nantucket Shoals stock in the early 1970s after several years of heavy exploitation by foreign fishing fleets. This stock remained in a depressed state for about ten years, during which time the smaller Gulf of Maine stock continued to support a strong coastal fishery. Both of these stocks are transboundary stocks since adult herring occupy both sides of the U.S.-Canada boundary on Georges Bank and because juvenile and adult herring on the New Brunswick shore of the Bay of Fundy are believed to originate from spawning grounds in U.S. and Canadian waters (Stephenson et al. 1998).

E.6.3.1.9 Abundance and Present Condition

For the purpose of this FMP, the U.S. Atlantic herring coastal stock complex is defined to include all herring occupying continental shelf waters over the entire range of the species between the Gulf of Maine and North Carolina, including Canadian waters on Georges Bank and in New Brunswick (Bay of Fundy). The stock complex comprises separate spawning components on

Georges Bank, Nantucket Shoals, and in coastal waters and on nearshore banks in the Gulf of Maine. The aggregation of biologically discrete spawning stocks into a single stock complex was first adopted in the fall of 1991 (NEFSC 1992) and has been the convention for U.S. herring assessments ever since then. The decision was based on the fact that there was insufficient data to support independent assessments for individual spawning components and the view that juvenile herring harvested in the New Brunswick fixed gear fishery originated from spawning grounds located in U.S. waters, not from spawning grounds located off southwest Nova Scotia (Stephenson et al. 1995).

All available resource survey and assessment information indicates that the coastal stock complex has grown rapidly in size since the early 1980's. Results from the most recent assessment (Figure E.7) indicate that stock biomass started to increase in the early 1990's, climbing rapidly from 500,000 mt in 1992 to 2.9 million mt at the beginning of 1997 (NEFSC 1998a and b). Spawning stock biomass in 1997 was 1.8 million mt, with an 80% probability that it was between 1.4 and 2.2 million mt. This dramatic increase in abundance in recent years is due largely to the recovery of the Georges Bank/Nantucket Shoals components of the stock complex which supported a large foreign fishery during the 1960's and early 1970's, but collapsed in the mid-70's as a result of over-exploitation. Current stock size estimates are more than double what they were in the late 1960's. Annual fishing mortality rates exceeded 50% for a number of years following the collapse of the Georges Bank stock and have declined rapidly during the last 15 years. The fishing mortality rate in 1996 was only 5%. Currently, the stock complex is large and underutilized. It may increase in size even further in the near future under current exploitation and recruitment patterns.

Population size and fishing mortality rate estimates for the Atlantic coastal stock complex are based on a virtual population analysis that relies on historical estimates of the number of fish harvested at each age and spring and winter trawl survey abundance indices by age for the time period 1967 to the present. (Trawl survey data are used to select the terminal fishing mortality rates for the VPA in a process that is called "tuning"). Fall trawl survey data can not be used because they are too variable from tow to tow, the result of the aggregation of adults in certain locations during the spawning season. Trawl surveys conducted in the winter and spring, after spawning is over, are not prone to this problem, but at this time of year adult herring belonging to different spawning stocks are mixed (primarily in southern New England and the mid-Atlantic region) and can not be distinguished from each other. For this reason, separate "tuned" VPA's for the two principal spawning stocks cannot be performed. Larval survey data collected every year between 1971 and 1994 were used in the past as a second tuning index for the VPA, but are no longer available since NMFS larval herring surveys were discontinued in 1994.

The growth of the stock is also evident in the increased abundance of herring caught during fall and spring bottom trawl surveys conducted by the National Marine Fisheries Service along the Atlantic coast over the past 30-35 years (Figure E.8). Catch rates during the fall spawning season averaged 0.5-1 kg/tow during the 1960's, were negligible throughout the 1970's and early 1980's and then, starting in 1987, increased to values as high as 10 kg/tow. Catch rates in 1996 and 1997 were about 3.5 kg/tow and the five year moving average was easily five times higher than it was during the 1960's at the height of the offshore fishery on Georges Bank. There has been a very similar increase in catch rates in the spring survey from extremely low abundance in the mid

1980's to about 3.5 kg/tow during the last four years, with a high value of 7.5 kg/tow in 1993. Unlike the fall survey data, the catch rates at the beginning of the spring time series (1968-1969) are very similar to catch rates in recent years, suggesting that the stock has recovered, but not beyond the point where it was in the late 1960's.

VPA-derived population size estimates for the stock complex are substantially over-estimated for the most recent years in the time series. To illustrate the nature of the problem, the last time an assessment of this resource was done (in 1995), the 1994 stock size estimate was 3.6 million mt. In 1998, with the addition of three more years (1995-1997) of catch at age and survey data to the analysis, the 1994 biomass estimate dropped by 2/3, to 1.1 million mt. Comparison of stock size estimates from the 1998 VPA with the results of previous assessments (NEFSC 1996) and an examination of catch rates in the spring trawl survey (Figure E.8) and winter larval survey (Figure E.10) also indicate that the increase in stock size started in the mid to late 1980's.

Results of an assessment of the U.S. Atlantic coastal stock complex of herring using a surplus production model (Prager 1994,1995) were presented to the Overfishing Definition Review Panel (Applegate et al. 1998) in the winter of 1997-1998. New overfishing definitions for this stock that were recommended by the Panel and subsequently adopted by the New England Fishery Management Council were based on this model and the 1995 VPA results (Applegate et al. 1998). (See Table 2 and section 2.6 of this FMP). Results of the more recent 1998 VPA were not available when the ODRP met to review overfishing definitions for Atlantic herring. The ODRP established a maximum sustainable yield (MSY) of 317,000 mt for the stock complex, biomass (B) at MSY of 1,066,000 mt, a biomass based fishing mortality rate (F) at MSY of 0.30, a target F of 0.28, and a minimum biomass level of ¼ B_{MSY} (which was subsequently increased by the New England Fishery Management Council to ½BMSY, or 500,000 mt). It also defined a stock rebuilding strategy that would be required if the stock were to drop below the threshold or minimum biomass levels. (See section 2.6 for a more complete explanation of overfishing definitions and MSY control rules for this stock).

The 1998 stock status report (NEFSC 1998b) included projected estimates of stock biomass and fishing mortality under three different scenarios. These scenarios included catch constant at the 1997 level (119,000 mt), catch constant at 200,000 mt (the MSY level estimated by the SARC), and a catch level of 317,000 mt (equal to MSY). Under all three scenarios, spawning stock biomass would increase from 1998 through 2000. The results of these projections are summarized in the following table. It should be noted, however, that these projections are median values based on the over-estimated 1997 VPA stock size estimate. A total stock size estimate of 1.92 million mt, derived from the surplus production model (Applegate et al. 1998) is probably more accurate.

There is some information on the relative sizes of the two principal spawning stocks that make up the stock complex. Historical assessment information indicates that the western Gulf of Maine stock (herring spawning on Jeffreys Ledge and other locations in Massachusetts Bay) was only 10-15% as large as the Georges Bank/Nantucket Shoals stock during the 1960's and 1970's, prior to stock collapses produced by excessive foreign fishing (Anthony and Waring 1980, ICNAF 1976). The NMFS fall trawl survey provides more up-to-date information on the relative size of each spawning component since it is conducted when adult herring occupy their traditional spawning grounds. An examination of the fall trawl survey data by the 27th SAW (NEFSC 1998)

resulted in estimates of minimum population size (biomass) for each of the three areas for the time periods 1988-97 and 1993-97. Coastal Maine (Management Area 1) accounted for 27% of the population during 1988-97 and 26% in the more recent time period. Nantucket Shoals (Area 2) accounted for 63% of the population from 1988- 97 and declined to 57% during 1993-97. Georges Bank (Area 3) accounted for 10% of the biomass in 1988-97 and has increased to 17% in the recent period, a reflection of the increased amount of spawning on Georges Bank during the last five years. These data indicate that the Gulf of Maine spawning stock accounts for about 25% of the total spawning stock biomass and the Georges Bank-Nantucket Shoals stock for the remaining 75%. These estimates are consistent with the historical assessment results when one considers that herring which spawn in the western Gulf of Maine probably represent about half of the total coastal spawning population.

Larval surveys conducted by the National Marine Fisheries Service between 1971 and 1994 clearly document the collapse of the offshore portion of the stock complex in the early 1970's and its recovery over the past ten years. Catch rates of small, recently-hatched herring larvae on Georges Bank and Nantucket Shoals were moderately high in 1973 and 1974, then declined to very low levels until the late 1980's and early 1990's (Figure E.9). Larval catch rates on Nantucket Shoals increased from <100 larvae per 10 m^2 in 1987 to 800-1700 per 10 m^2 between 1990 and 1994, indicating that considerably more herring were spawning there than on Georges Bank or in Massachusetts Bay. There was no evidence that spawning had resumed on northeast peak of Georges Bank until 1992, when small larvae first appeared in Canadian waters (Melvin et al. 1996). Moderately high larval catch rates in Massachusetts Bay in 1981-1982 (but not in 1973 and 1974) and from 1985 through 1994 indicate that spawning in the western Gulf of Maine proceeded independently of spawning on Nantucket Shoals and Georges Bank.

Catch rates of herring in the spring bottom trawl survey started to increase in the mid-1980's and reached record high levels in 1996 and 1997 (Figure E.9). High catch rates of two year olds in 1996 and three year olds in 1997 in both the winter and spring surveys indicate that the 1994 year class is large and that the stock will continue to increase in size as fish from this year class recruit to the spawning stock. The 1989 and 1990 year classes also show up as strong ones through ages 5-7 in both surveys.

Despite the continued growth and large size of the stock complex, the fishery is still primarily conducted as a near shore fishery in the Gulf of Maine, on the smaller Gulf of Maine spawning stock and migrants from the Georges Bank stock which occupy this area to some extent in the spring. Concerns have repeatedly been expressed by the scientific community that current levels of exploitation could threaten smaller localized spawning populations in the Gulf of Maine. The 1998 assessment included an un-tuned exploratory VPA of the coastal Gulf of Maine stock. The results of this VPA indicate that biomass was relatively stable (130-200,000 mt) between 1976 and 1984, tripled between 1984 and 1986, remained relatively stable (300-350,000 mt) through 1995 and then increased again (to 400-450,000 mt). The rapid increase in biomass between 1984 and 1986 corresponded with the decline of the fixed gear juvenile fishery along the Maine coast after 1982 and the sharp reduction in juvenile fishing mortality rates. Population growth was stimulated by the influx of these juveniles into the adult population and by the recruitment of the large 1983 year class. Juvenile and adult fishing mortality rates were high through 1982, then dropped and remained between 0.20 and 0.60 for the next 15 years, indicating that this stock was fully utilized

throughout this time period, despite the increase in stock size.

Fishing mortality rates between 0.30 and 0.50 (equivalent to 25-40% annual removal rates) in the Gulf of Maine in recent years indicate that this component of the stock complex may, in fact, be overfished. Without an overfishing reference point or MSY estimate for this stock, it is impossible to be sure. Also, as pointed out by the SAW 27 Stock Assessment Review Committee, it is possible that there is some emigration of adults from the large and growing offshore portion of the stock complex into coastal Gulf of Maine waters. Such an emigration could in part account for the relatively high stock size during a time period when fishing mortality rates are also high, and support the single stock and management approach.

1998			**1999**			**2000**			**Implications**
F	Landings	SSB	F	Landings	SSB	F	Landings	SSB	
0.031	119	2,444	0.029	119	3,170	0.028	119	3,715	SSB increases about 52%
			0.049	200	3,121	0.048	200	3,589	SSB increases about 47%
			0.078	317	3,051	0.080	317	3,405	SSB increases about 39%

Table E.7 – Projections for the coastal stock complex of Atlantic herring (landings and SSB estimates in thousands of metric tons) (NEFSC 1998a)

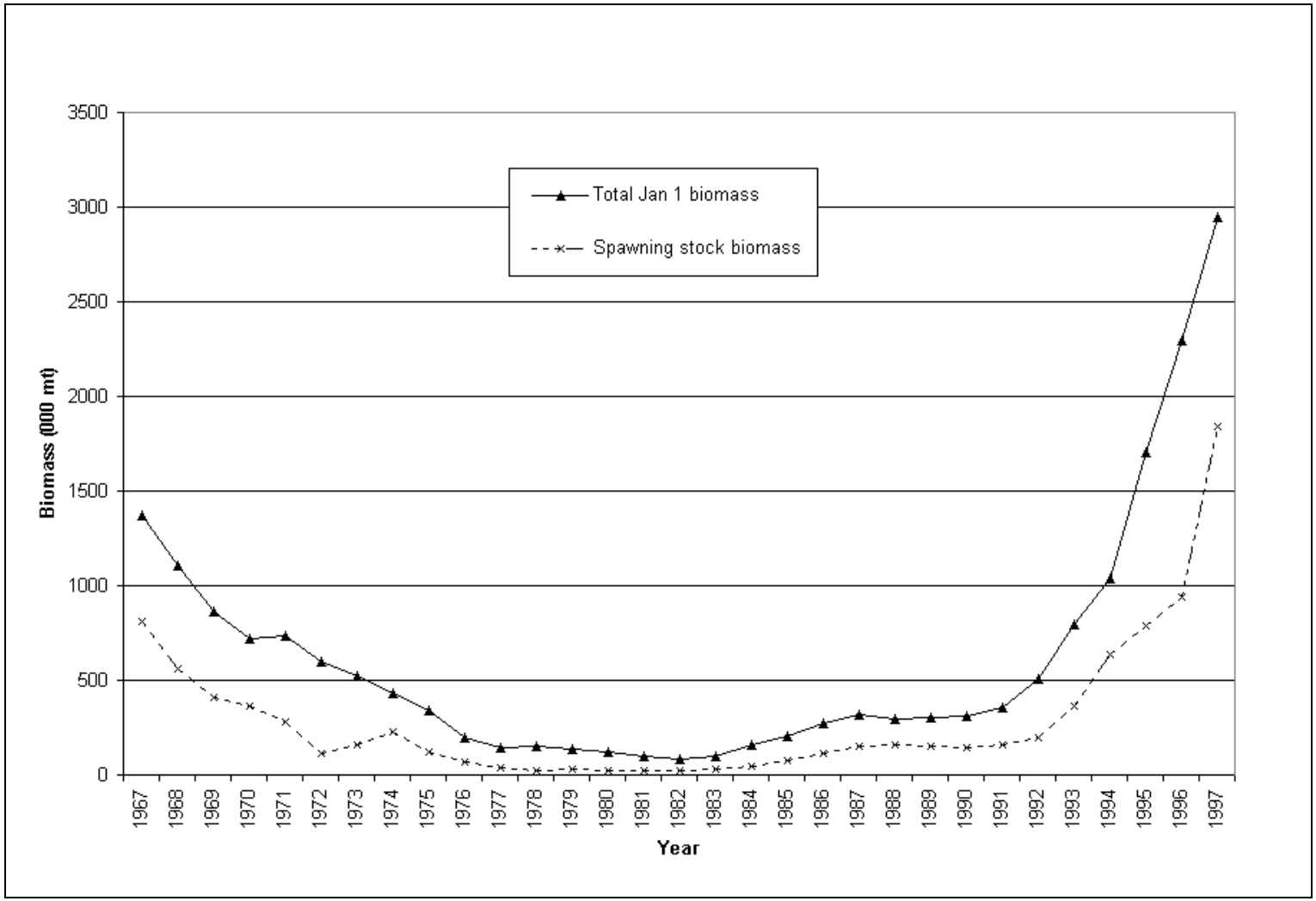
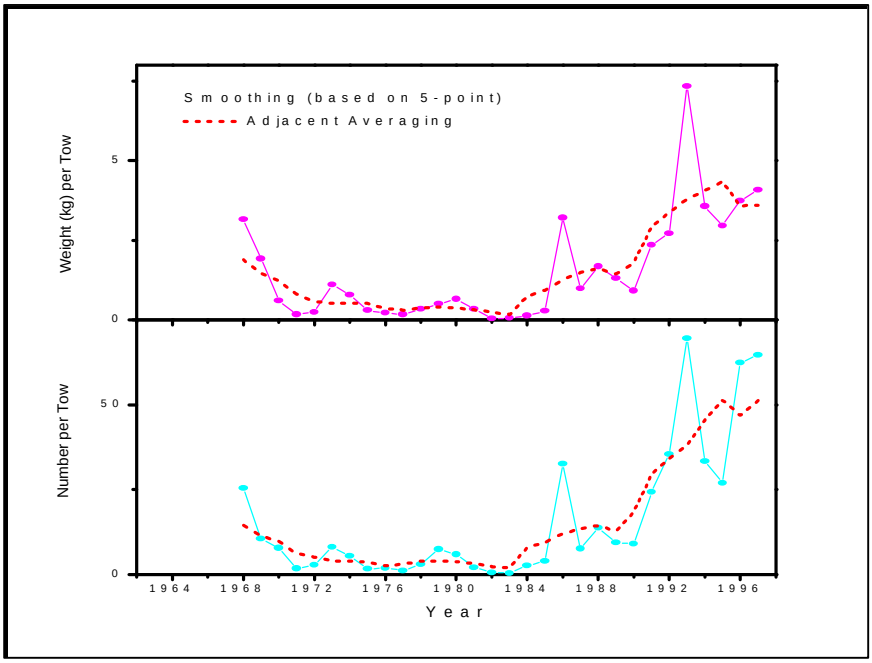


Figure E.7 - U. S. Atlantic herring coastal stock complex biomass (NEFSC 1998a)



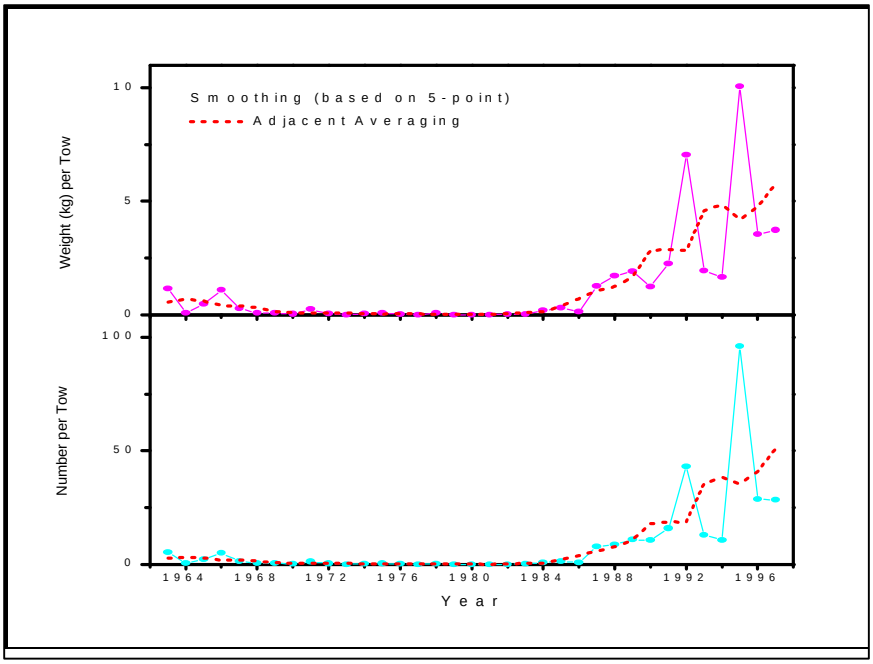


Figure E.8 – NMFS spring (above) and fall (below) bottom trawl surveys (Source: NEFSC 1998a)

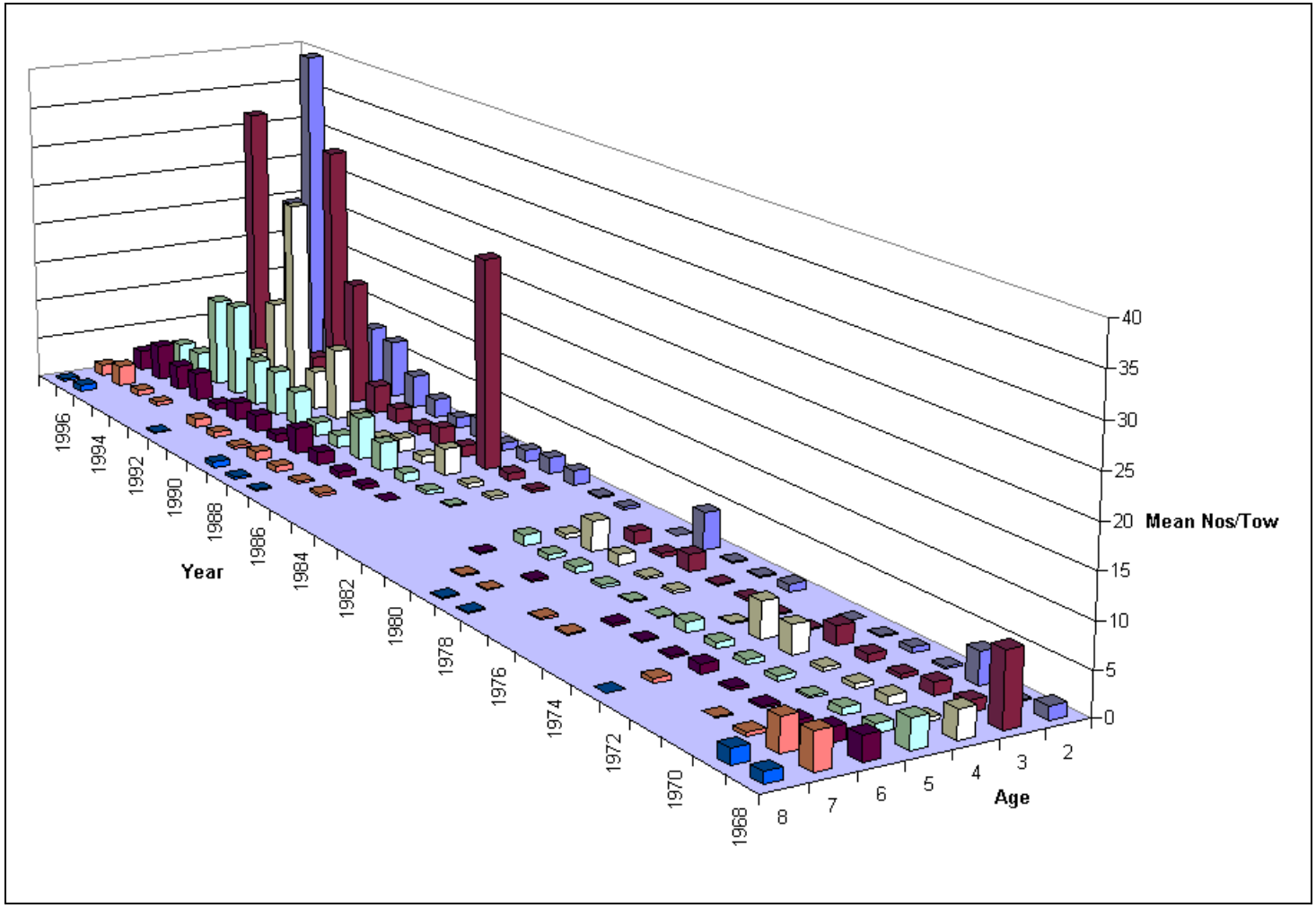


Figure E.9 - NMFS spring bottom trawl survey (from Stevenson et al. 1997)

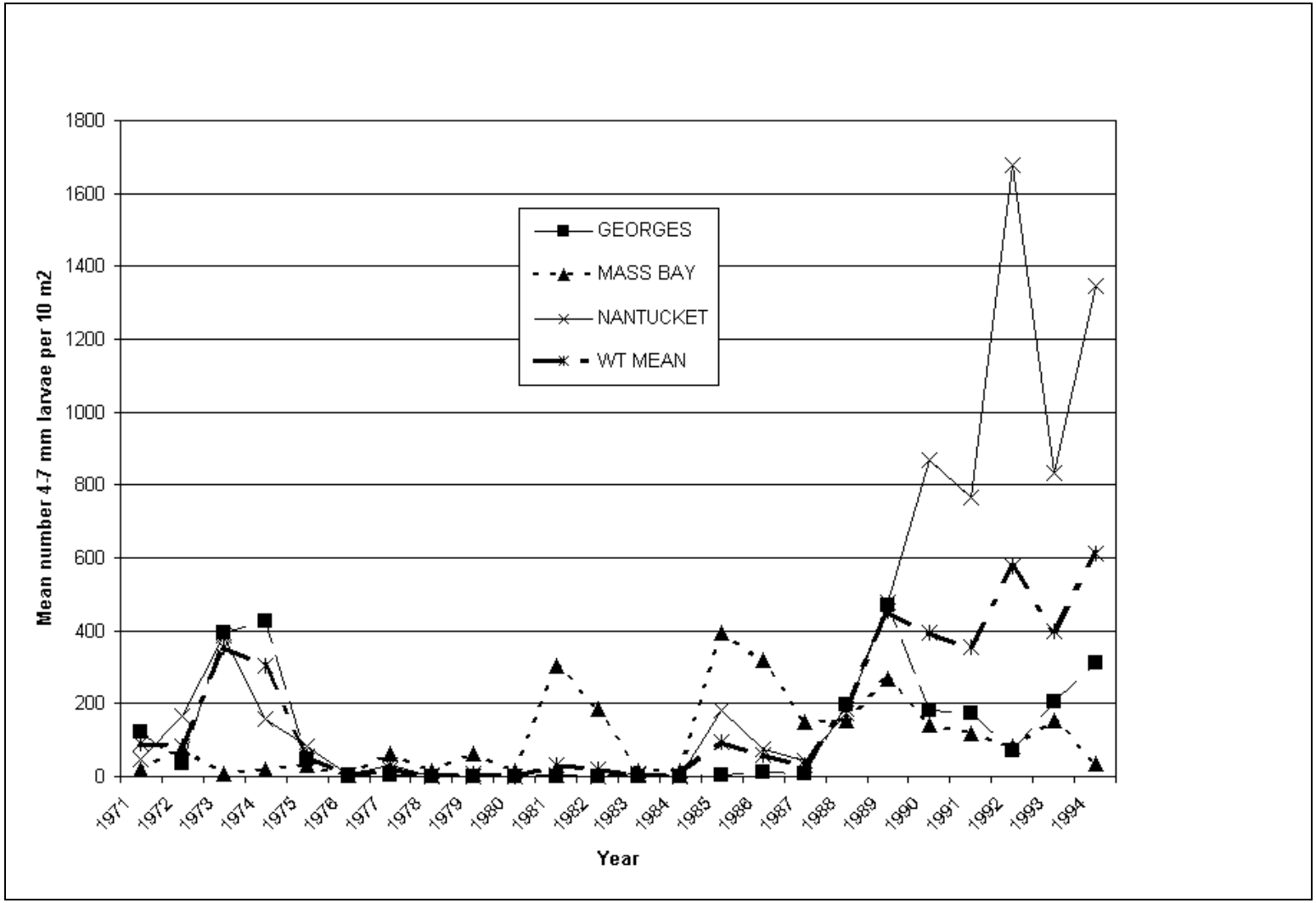


Figure E.10 - NMFS larval herring abundance indices (from Stevenson et al. 1997)

E.6.3.2 Other Stocks

In addition to herring, there are a number of other commercially valuable species in the region, many of which are managed by plans developed by the NEFMC, the MAFMC, the Commission, and NMFS, or are regulated by individual states. Some are not regulated, though they may be fished commercially. Vessels fishing with herring gear do take limited quantities of many of the groundfish species. In some cases, vessels fishing for herring will catch considerable amounts of mackerel. The geographical distribution, life histories, and habitat requirements of these stocks cover the range of possibilities as can be seen by the diversity of species listed. The Council's amendment addressing Essential Fish Habitat summarizes the life history and distribution of those species under Council management. The relative value of fisheries for these species also covers a wide range. Table E.8, reprinted from NMFS Status of Fisheries of the U. S., 1998, summarizes the species most important to fisheries in the northeast. Data for landings (L, thousands of metric tons), value (V, millions of dollars), and prices (P, dollars per pound) are shown.

Herring fishery interactions with these fisheries may be direct (through the gear of as an incidental catch, for example) or indirect (through some ecosystem interaction). Because herring is a key forage species., indirect effects, if not carefully monitored, may be more important than direct effects. The relationship between the herring fishery and other fisheries is not static but changes based on fluctuations in abundance geographical distribution, and market. A detailed description of these stocks is beyond the scope of this document.

Year	L	V	P	L	V	P	L	V	P	L	V	P	L	V	P
	American Lobster			Sea Scallops			Blue Crab			Atlantic Salmon			Oysters		
1993	26.3	160.4	2.77	7.4	97.9	6.03	57.1	69.5	0.55	6.7	42.6	2.86	4.2	35.9	3.9
1994	31.7	207.3	2.96	7.6	84	5	43.1	73.8	0.78	6.1	35.6	2.64	2.8	36.1	5.94
1995	31.8	214.6	3.06	8	91.1	5.16	56.7	101.2	0.81	10	56.7	2.56	3.1	38	5.48
1996	32.5	242.8	3.39	7.9	98.2	5.64	37.7	64.3	0.77	10	46.2	2.1	2.8	36.9	6.02
1997	32.3	223.6	3.14	6	87.4	6.6	43	79.4	0.84	12.2	49.5	1.84	3.2	39.4	5.61

	Goosefish			Hard Clams			Surfclams			Menhaden			Squid(Loligo)		
1993	18.5	21.7	0.53	4.3	43.6	4.58	33.5	38.2	0.52	317	41.9	0.06	22.3	29.6	0.6
1994	21.1	26.2	0.56	3.5	35.3	4.61	32.4	45.7	0.64	252.3	34	0.06	22.6	31.9	0.64
1995	25.1	36.1	0.65	4.2	42.1	4.5	30.1	45.1	0.68	344.9	45.7	0.06	18.5	23.8	0.58
1996	25.3	32.3	0.58	3.2	35.1	4.94	28.8	41.3	0.65	283.1	37.9	0.06	12.5	18.6	0.68
1997	28.8	35	0.55	3	34.2	5.09	25.6	36.1	0.64	245.4	33.6	0.06	16.2	26.5	0.74

	Atlantic Cod			Sea Urchins			Ocean Quahogs			Bluefin Tuna			Winter Flounder		
1993	23	45	0.89	19.2	27.2	0.64	26.2	29.3	0.51	1	19.3	8.92	5.3	15.3	1.31
1994	17.8	36.6	0.93	17.6	33.4	0.86	21.1	18.7	0.4	1	19.6	8.72	3.6	11.2	1.41
1995	13.7	28.6	0.95	15.6	35.7	1.04	23.2	21.7	0.42	0.9	20.4	10.66	4	12.7	1.43
1996	14.3	26.7	0.85	10.1	24	1.08	21.1	20.4	0.44	0.9	16.5	8.42	4.8	14.5	1.38
1997	13	24.5	0.86	8.5	20.5	1.09	19.8	19.8	0.45	1	16.4	7.4	5.3	15.7	1.34

	Summer Flounder			Silver Hake			Atlantic Herring			Northern Shrimp			American Plaice		
1993	4.4	15.3	1.57	17.3	14	0.37	49.5	6.5	0.06	2.3	5.2	1.03	5.8	15	1.17
1994	5	18.3	1.67	16	13.7	0.39	45.2	5.7	0.06	3.7	6.5	0.79	5.1	13.5	1.21
1995	5	20.4	1.86	14.7	14	0.43	68.8	8.8	0.06	6.8	13.2	0.88	4.6	13.2	1.29
1996	4	14.3	1.64	16.2	13.6	0.38	87.7	10.9	0.06	9.5	15.1	0.72	4.4	12.3	1.27
1997	4.1	15.5	1.73	15.6	15.1	0.44	96.9	11.6	0.05	6.4	11.5	0.82	3.9	11.4	1.31

Table E.8 – Important species landed or raised in the northeast. Landings (L, thousands of metric tons), value (V, millions of dollars), and prices (P, dollars per pound) (from Status of Fisheries of the U.S., 1998, NMFS)

Year	L	V	P	L	V	P	L	V	P	L	V	P	L	V	P
	Soft Clams			Atlantic Mackerel			Yellowtail Flounder			Striped Bass			Penaeid Shrimp		
1993	2.1	20.5	4.47	4.7	1.3	0.13	3.6	10.4	1.3	0.6	2.7	2.05	0	0	3
1994	1.2	12.5	4.8	8.9	2.6	0.13	3.1	8.1	1.19	0.8	3.1	1.81	0	0	4.93
1995	1.1	10.7	4.48	8.4	2.7	0.15	1.9	6	1.42	1.8	6.2	1.54	0	0	2.27
1996	1	8.3	3.75	15.8	4.6	0.13	2.4	7.6	1.43	2.1	8	1.72	0	0	2.31
1997	1	9.9	4.31	15.4	9.5	0.28	2.9	9.5	1.5	2.3	7.5	1.46	1	7.4	3.23

	Witch Flounder			Scup			Squid (Illex)			Spiny Dogfish			Swordfish		
1993	2.6	9	1.57	4.4	5.7	0.58	18	8.5	0.21	15.8	4.6	0.13	1.5	9.9	2.92
1994	2.7	9.3	1.58	4	5.8	0.66	18.4	10.4	0.26	13.4	4.3	0.15	1.2	8.5	3.09
1995	2.2	8.4	1.73	2.9	5.8	0.91	14.1	8.1	0.26	16.3	7.1	0.2	1.2	7.7	2.89
1996	2.1	7.7	1.67	2.7	6.3	1.07	17	9.7	0.26	18.2	7.5	0.19	0.8	5.6	3.06
1997	1.8	6.6	1.69	2.2	6.4	1.32	13.6	6.1	0.2	17.6	5.8	0.15	1	5.5	2.6

	Pollock			Tilefish			Butter-fish			Black Sea Bass			Yellowfin Tuna		
1993	5.7	8.4	0.67	1.8	5	1.23	4.5	6.8	0.69	1.3	2.9	0.99	0.6	2.6	2.06
1994	3.7	6.8	0.82	0.8	3.4	1.96	3.6	4.1	0.51	0.8	2.2	1.18	0.6	2	1.52
1995	3.4	6.8	0.92	0.7	2.9	1.98	2.2	2.6	0.55	0.9	2.9	1.5	1.1	3.8	1.64
1996	3	4.5	0.69	1.1	4.2	1.68	3.6	5.2	0.66	1.5	3.6	1.13	0.4	1.9	2.14
1997	4.3	5.3	0.57	1.8	4.9	1.24	2.8	4.7	0.76	1.2	3.9	1.48	0.9	3.7	1.96

	Haddock			Skates			White Hake			Bigeye Tuna			Weakfish		
1993	0.9	2.7	1.38	12.9	3	0.11	7.5	7.2	0.44	0.8	5.9	3.55	1.1	1.9	0.78
1994	0.3	1	1.38	8.8	5	0.26	4.7	5.7	0.55	0.8	7.7	4.36	1.1	2	0.77
1995	0.4	1.2	1.33	7.1	3.4	0.22	4.3	6.2	0.65	0.9	8	4.19	1.8	2.5	0.62
1996	0.6	1.5	1.18	14.2	6.3	0.2	3.3	4.6	0.63	0.4	2.8	3.62	1.5	2.6	0.8
1997	1.5	3.6	1.09	10.5	3.3	0.14	2.2	3.2	0.65	0.5	2.9	2.85	2.4	2.8	0.53

Table E.8 (cont.)

Year	L	V	P	L	V	P	L	V	P	L	V	P	L	V	P
	Bluefish			Mussels			Red Hake			Windowpane Flounder			Redfish		
1993	2.8	1.9	0.31	3	2.7	0.4	1.7	0.9	0.25	1.7	2.3	0.63	0.8	0.8	0.46
1994	3.1	1.9	0.28	2.5	1.9	0.35	1.7	0.9	0.25	0.5	0.6	0.52	0.4	0.6	0.62
1995	2.3	1.8	0.36	3	2.5	0.37	1.6	1	0.28	0.8	1	0.58	0.4	0.6	0.62
1996	2.7	1.9	0.32	2.6	2.3	0.39	1.1	0.7	0.29	1	0.9	0.42	0.3	0.5	0.66
1997	3.3	2.2	0.3	2	1.7	0.38	1.3	0.8	0.28	0.5	0.6	0.51	0.3	0.3	0.54

	Total Shellfish 3	
	L	V
1993	210.7	542.6
1994	216.7	604.7
1995	223.2	653.2
1996	194.5	623.9
1997	189.8	612.8

Total Finfish	
L	V
537.2	344.5
461.4	319.3
587.3	373.2
555.3	335.8
531.3	348.5

Total	
L	V
747.9	887.1
678.1	923.9
810.6	1026.4
749.8	959.7
721.1	961.3

1 North Carolina landings and price data not included for 1993-1996.

2 Amounts raised and value at first sale

3 Price not meaningful for total figures

Table E.8 (cont.)

E.6.3.3 Endangered Species and Marine Mammals

E.6.3.3.1 Endangered and Protected Species

A number of endangered and other protected species inhabit the management unit addressed in Atlantic Herring Fishery Management Plan. Eleven are classified as endangered or threatened under the Endangered Species Act (ESA) of 1973; the remainder are protected by the provisions of the Marine Mammal Protection Act (MMPA) of 1972. In the Northeast, protected species utilize marine habitats for purposes of feeding, reproduction, as nursery areas and as migratory corridors. Some species occupy the area year round while others use the region only seasonally or move intermittently inshore and offshore.

Entanglements of several species of marine mammals have been documented in fishing gear employed in the Atlantic herring fishery. They include the northern right whale, humpback whale, minke whale, harbor porpoise, harbor seal and gray seal. The status of these and other marine mammal populations inhabiting the Northwest Atlantic has been discussed in great detail in the U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. Initial assessments were presented in Blaylock, et al. (1995) and are updated in Waring, et al. (1997). The report presents information on stock definition and geographic range, population size and productivity rates and unknown impacts. The species found in New England and Mid-Atlantic waters are listed below. Species of particular concern include harbor porpoise as well as right and humpback whales.

Endangered

Right whale (*Eubalaena glacialis*)
Humpback whale (*Megaptera novaeangliae*)
Fin whale (*Balaenoptera physalus*)
Sperm whale (*Physeter macrocephalus*)
Blue whale (*Balaenoptera musculus*)
Sei whale (*Balaenoptera borealis*)
Kemp's ridley (*Lepidochelys kempi*)
Leatherback turtle (*Dermochelys coriacea*)
Green sea turtle (*Chelonia mydas*)
Shortnose sturgeon (*Acipenser brevirostrum*)

Threatened

Loggerhead turtle (*Caretta caretta*)

More detailed descriptions of the species in the above list, including endangered sea turtles and fish, was provided the Final Environmental Impacts Statements for Amendments 5 and 7 to the Northeast Multispecies FMP, Amendment 5 to the American Lobster FMP and Amendment 4 to the Atlantic Sea Scallop FMP. The most recent information on sea turtle status is contained in the 1995 and 1997 status reviews of listed turtles prepared jointly by NMFS and the U.S. Fish and Wildlife Service (NMFS and USFWS 1995 and 1997).

Other Protected Species/Marine Mammals
Other species of marine mammals likely to occur in the management unit include the minke whale (*Balaenoptera acutorostrata*), white-sided dolphin (*Lagenorhynchus acutus*), white-beaked dolphin (*Lagenorhynchus albirostris*), bottlenose dolphin (*Tursiops truncatus*), [coastal stock listed as depleted under the MMPA], pilot whale (*Globicephala melaena*), Risso's dolphin (*Grampus griseus*), common dolphin (*Dephinis delphis*), spotted dolphin (*Stenella* spp.), striped dolphin (*Stenella coeruleoalba*). Pinnipeds species include harbor (*Phoca vitulina*) and gray seals (*Halichoerus grypus*) and less commonly, hooded (*Cystophora cristata*) harp (*Pagophilus groenlandicus*) and ringed seals (*Phoca hispida*).

E.6.3.3.2 Other Biota

Zoogeographically, the Gulf of Maine region is boreal, and the fauna is typically Acadian. South of Cape Cod to Cape Hatteras is warm temperate, and the fauna is Virginian. Although Cape Cod is the general dividing line, many species are found throughout the region from the Gulf of Maine to Cape Hatteras. Gulf of Maine fauna may include subtropical, tropical, temperate, and arctic immigrants at various times of the year.

~~The Plankton~~ The plankton are microscopic plants (phytoplankton) and animals (zooplankton) that drift in the water column. The annual cycle of the plankton community is typical of the temperate zone. In winter, nutrients are abundant in the water by phytoplankton abundance is low because productivity is suppressed by low levels of solar radiation and temperature. The level of solar radiation increases as spring approaches, and causes an intense phytoplankton bloom which is comprised primarily of diatoms. This level of productivity results in a decrease of inorganic nutrients, and as summer approaches, phytoplankton abundance begins declining.

Zooplankton feed predominantly on phytoplankton, but fish larvae commonly feed on zooplankton (often copepods). During summer, zooplankton reach maximum abundance, while the phytoplankton decline to near winter levels. Dinoflagellates and other phytoplankters, apparently more suited to warm, nutrient-poor waters, become abundant during summer. Although bacteria in sediments actively remineralizes nutrients from organic debris, summer stratification of the water column may prevent nutrients from being returned to the near surface where they may contribute to primary productivity through photosynthesis. On Georges Bank and the eastern and northeastern edge of the Gulf of Maine, vertical mixing of the water column occurs during the summer, thereby recirculating nutrients and maintaining high plankton productivity. Water column stability may be affected by sever storms, and anomalies in temperature may disturb the timing between annual cycles of interacting species. In the autumn, decreasing water temperatures result in a breakdown of the vertical temperature gradient, and nutrients are again circulated up into the euphotic zone. Another phytoplankton bloom results, and lasts until slow solar radiation levels inhibit photosynthesis. Phytoplankton and zooplankton levels then decline to the winter minimum, and nutrient levels increase to their winter maximum.

The Nekton The nekton are animals that swim in the water column. They are predominantly fish, but also include other animals such as squid, whales and porpoises. The ability to swim allows nektonic organisms to migrate between locations or to maintain a specific breeding location with some consistency year after year.

The feeding habits of nekton vary by species, by the size of the individual, and probably by season and food availability. Adults of many commercially important species of the region feed on either fish or invertebrates, but small fish, including the young of some large species, often feed on plankton. Adults of some large species, such as various whales, basking sharks and ocean sunfish, are plankton eaters throughout life.

The Benthos The benthos are animals that live on or within the bottom sediments. They are predominantly invertebrates (e.g. tube worms, starfish), although strongly bottom-oriented fishes are considered benthic. Benthic organisms are extremely diversified, and include species from several phyla. They can be classified by size, by their location on or in the sediments, by the type of bottom in which they live (sand, mud, gravel, rock, etc), by feeding type, and by the type of community with which they are associated.

E.6.3.4 Stellwagen Bank Marine Sanctuary

On October 7, 1992, Congress reauthorized Title III of the Marine Protection, Research and Sanctuaries Act and passed an amendment which designated Stellwagen Bank as a National Marine Sanctuary. The area, located between Cape Cod and Cape Ann, Massachusetts, is known to support a rich and diverse population of marine life at different times of the year, including several species of endangered whales, groundfish stocks and bluefin tuna. Commercial fishing is not a regulated sanctuary activity, and will continue to be the responsibility of the NEFMC.

The Sanctuary designation places a prohibition on the "exploration for, and mining of, sand and gravel and other minerals" and requires a consultation process of agencies proposing actions which are likely to destroy, cause the loss of, or injure any Sanctuary resource. To the extent that certain activities with deleterious effects on fish stocks may be affected, the designation may have positive impacts on commercial stocks.

E.6.4 Human environment

E.6.4.1 History of exploitation

Herring fisheries have existed in Europe for over 1,000 years and in the Northwest Atlantic for about 450 years. Along the coast, aboriginal fisheries were practiced prior to the arrival of 16th century fishermen. During the colonial period, a sizeable herring fishery developed which supplied bait for the cod fisheries that were expanding off the coasts of the U.S. and Canada. By the end of the 18th century, as the U.S. cod fishery extended its range as far as the Labrador coast, the demand for herring as bait increased and by the

early 19th century the U.S. was importing salt and pickled herring for use both as bait and food. During the early years of the twentieth century, the market for bait herring declined as the cod fishery changed form hook and line methods to the otter trawl.

The herring fishery in Maine developed during the late 19th century along the eastern Maine coast. Two events during the latter part of the 19th century led to a resurgence of the herring fisheries. One was the development of the sardine canning industry in eastern Maine in the 1870's, which later spread throughout the Maine coast and into New Brunswick. The other was the expansion and intensification of the lobster fishery after the 1860's. Exploitation of herring fishery from this time until the early 1970's was primarily of young herring of a size suitable for canning as sardines.

The growth of the fishery was stimulated by the development of the canning industry in eastern Maine and New Brunswick during this period and through the first half of the 20th century. There were nearly 50 canneries in operation along the Maine coast during the late 1940's and early 1950's, packing over 3 million cases (100 cans per case) of sardines a year. The establishment of the lobster fishery in the late 19th century also created an additional market for herring as bait. Landings as high as 80,000-90,000 mt were recorded as early as 1898, 1905, 1911, and 1916. Landings of the same magnitude were recorded in the late 1940's and 1950's. Historically, landings have been highly variable due largely to changes in the availability of juveniles along the coast. From 1896 to 1916 the catch averaged around 60,000 tons, then declined to around 25,000 tons from 1917 to 1940, and then in the late 1940's through the 1950's increased again to around 60,000 tons. From 1964 to 1969 the catch was consistently low at about 28,000 tons and from 1970 to 1975 it averaged only 17,400 tons. Landings have been consistently lower during the last 30 years or so, except for a brief period during 1979-1981 (Table E.12). Herring landed in Maine in the past have also been used for fertilizer, for smoking and pickling, as fresh herring (whole or fillets), and for reduction purposes (fish meal and oil). Currently, most of the herring landed in Maine are canned or used for lobster bait

Most herring caught along the Maine coast since sardine canning began in 1875 were juveniles of age 2 (about 17cm, or 6.7 inches, total length) and have ranged from age groups 1 to 3. Until the early 1960's, the capture of adult fish was of minor importance. As the availability of small fish decreased , large herring were used increasingly in canned sardine products; most recently a domestic market for canned specialties, such as steaks and tidbits, has developed. The increased utilization of larger herring by the canning sector was accompanied by an increased use of purse seines in the near shore areas.

An adult herring fishery developed in the western Gulf of Maine (Jeffreys Ledge area) in 1967-1968, with U.S., Canadian and German vessels taking 30-40,000 mt a year between 1968 and 1972. U.S. landings from this fishery reached 20,000 mt during 1970-72 (Anthony and Waring 1980). The fishery in this and other inshore areas was supported by a limited number of U.S. filleting/freezing plans that shipped herring to West German markets. There was also a reduction plant in Gloucester, MA during the 1970's that provided an additional market for herring. Landings in southern New England (mostly in Rhode Island) and the mid-Atlantic states did not exceed 5,000 mt a year until 1995

(Table E.12). In more recent years, herring landed in Massachusetts, southern New England, and the Mid-Atlantic states have either been trucked to canneries in Maine and New Brunswick, or sold as bait, primarily for the lobster fishery. An undetermined amount of herring landed in U.S. ports is also converted into fish meal in Canada and utilized for salmon feed.

A foreign fishery for herring began in the early 1960s on Georges Bank and intensified during the latter part of the decade as the foreign fishing effort increasingly turned to resources other than the traditional groundfish species. During 1961, the Soviet herring fleet on Georges Bank totaled 100 vessels, catching over 67,000 mt (Table E.9). By 1965, 200-250 Soviet vessels were fishing for herring, red and silver hake, haddock, and cod on Georges Bank and off southern New England, and over the period 1961-1965, reporting herring catches of 43,000 to 152,000 mt a year. By 1967, the Soviets were joined by vessels from the Federal Republic of Germany (FRG), the German Democratic Republic (GDR), Poland, Japan, Romania, and Canada. The total catch from Georges Bank, Nantucket Shoals and southern New England reached a maximum of 374,000 mt in 1968. From 1965 to 1972, the total number of foreign fishing vessels sighted in waters off the U.S. coast from Georges Bank to Cape Hatteras increased from about 450 to over 1,000, thereafter declining in response to reduced fish stocks and increasing catch restrictions. Much of this distant water fleet activity was directed towards herring. As many as 200 large Soviet stern trawlers were active in the New York Bight winter herring fishery, while more than 100 Soviet side trawlers rigged for purse seining conducted a summer fishery on Georges Bank. Polish stern trawlers fished for herring in conjunction with a winter mackerel fishery and exploited herring on Georges Bank during the summer and fall. GDR vessels followed a similar pattern. It should be noted that historic catch statistics for the foreign fishery on Georges Bank include catches from Nantucket Shoals and the areas south of New England.

The intense fishing pressure during the 1970s is believed to have led to the collapse of the George bank stock. Estimated age 3+ stock size dropped from 1.2-1.35 million mt in the late 1960s to about 400,000 mt in the mid 1970s (Anthony and Waring 1980). In 1977, with the U.S. withdrawal from the International Commission for the Northwest Atlantic Fisheries (ICNFA) and the implementation of the Magnuson Fishery Conservation and Management Act, foreign fishing for herring became completely controlled by the U.S. and regulated through the provisions of the Preliminary Fishery Management Plan prepared by the Department of Commerce, and then, in 1978, under the provisions of the Council's FMP for herring. Directed foreign fishing ceased when approval of this FMP was withdrawn in 1982.

Since 1982, there have been several significant shifts in the coastal fishery. The Maine fixed gear fishery (stop seines and weirs), which harvested over 44,000 mt in 1981, has averaged only 1,600 mt annually since 1984 and has produced less than 1,000 mt since 1994. An increasing portion of the catch has been harvested by purse seines, and, especially in the last five years, by mid-water trawl vessels. Another change has been the increase in herring used for bait. As the lobster fishery has expanded, at least half the herring catch is now sold for lobster bait. Some bait herring is also used in the tuna

fishery. These shifts in fishing patterns have been reflected in the catch at age. Estimates of juvenile harvest show a steady decline in numbers during the last ten years (NEFSC 1996). In recent years, a few mid-water trawl vessels have returned to George Bank, though catches from this area remained below 3,000 mt in 1996 and 1997 (Table E.9). Catches from this area, however, are increasing. Overall, domestic landings of Atlantic herring have increased in recent years, with the largest catch from the Gulf of Maine. In 1996, 81,000 mt of herring were taken from the Gulf of Maine, an increase of almost 20,000 mt over the previous year. Landings in southern New England, particularly Rhode Island, also increased substantially in 1995, 1996, and 1997 (Table E.12).

The other significant change in the U.S. herring fishery during the last 10-15 years was the development of Internal Waters Processing (IWP) operations in the Gulf of Maine and southern New England (see section E.6.4.3.2). Operating under provisions in the Magnuson-Stevens Act, foreign-owned processing ships anchored in U.S. internal waters receive herring caught by U.S. fishermen, subject to annual allocations made by the Commission and the states (ASMFC 1994). Total IWP "landings" reached 11,000-12,000 mt in 1989, 1990 and 1996 and averaged 7,850 mt a year between 1989 and 1996. This relatively small harvest has represented and important supplementary market for new vessels trying to break into the fishery, enabling them to also supply shoreside markets. Herring processed aboard IPW vessels is sold overeas.

In addition, a small amount of herring caught in the Gulf of Maine (average 1,858 mt between 1992 and 1997) is transferred at sea to Canadian carriers and landed in New Brunswick. These transfers (see section E.6.4.3.3) are part of a larger reciprocal U.S.-Canada trade in which herring move freely by truck across the border between Maine and New Brunswick, supplying canneries and lobster bait in both countries.

E.6.4.2 The Commercial and Recreational Herring Fishery

E.6.4.2.1 The Recreational Herring Fishery

A very small recreational fishery for Atlantic herring exists, providing late fall to early spring fishing opportunities for both shore and boat anglers. Landings, however, are negligible (NMFS 1998c).Most Atlantic herring catches are reported during March-April and November-December, with some catches reported from September-October. The Marine Recreational Fishery Statistics Survey (MRFSS) does not sample during January-February in the north or mid-Atlantic sub-regions and since herring may be taken during this period, total catch may be underestimated. The herring caught by hook and line anglers are taken as a secondary species in a mixed fishery in conjunction with Atlantic mackerel (*Scomber scombrus*).

A recreational fishery for herring in the northern one third of New Jersey is associated with the Atlantic mackerel and silver hake fisheries. The catch of herring is an incidental catch in these two directed recreational fisheries. The herring are taken on small "teasers" (plastic tubes covering a long shanked hook) used for mackerel, as well as small bucktails

and metal jigs. Most of the fish are kept for home consumption, being pickled or smoked, or used as bait, either cut or whole. The great majority of the recreational fishery is conducted from party boats, and to a lesser extent, from charter boats that operate between November and April.

Herring is also used as bait in the recreational tuna fisheries. While bait herring can be purchased from dealers or other boats, some tuna vessels are known to catch herring for use as live bait in this fishery. The use of small pelagic gillnets to catch herring for this purpose is authorized under the Northeast Multispecies Plan. There are no statistics on the extent of this practice or the amount of herring that is taken for this purpose. Some industry participants have estimated that 50 to 90 percent of the vessels fishing for tuna in New England waters may catch herring for bait.

E.6.4.2.2 The Commercial Herring Fisheries

E.6.4.2.2.1 Directed Fishery

The commercial herring fishery has changed significantly over the past twenty years. When the Council drafted its original fishery management plan in 1978, there were two distinct commercial fisheries: a harvest for juveniles, primarily using fixed gear but supplemented by purse seine vessels, and a fishery for adult herring that supplied the European market with herring for fillets and freezing. In 1976, there were 27 weirs, 65 stop seines, and only 15 purse seine vessels active in the Maine juvenile herring fishery. Thirty three vessels (mid-water and pair trawlers) targeted herring for the adult fishery (NEFMC 1978). There is no charter fishery that specifically targets herring, though herring may be caught coincidental to other operations.

Domestic landings of Atlantic herring increased since 1986. In 1997, domestic landings (excluding IWPs and Canadian transshipments) totaled over 95,700 mt worth $11.5 million (Table E.10). Average ex-vessel prices have remained nearly constant (declining in real terms), as the 1986 ex-vessel value was about 5.4 cents per pound and the 1997 value was 5 cents per pound (Table E.8). Estimated potential ex-vessel revenues from this fishery, should the entire U.S. harvest of 270,000 mt be caught (based on B_{MSY} and F_{Target}, with a 30,000 mt allowance for expected Canadian catches), is over $35 million. This estimate is based on an ex-vessel price of 6 cents per pound; development of higher value products may increase this revenue.

The current domestic herring fishery is not clearly defined by a fishery for juveniles and a fishery for adults. As mentioned earlier, the proportion of juveniles harvested has declined. The fishery is primarily a mobile gear fishery, as landings from the fixed gear sector have declined significantly. Since the demise of the Maine fixed gear fishery in the early 1980's, purse seine vessels have accounted for most of the catch, but in recent years mid-water trawlers have increased their proportion of the landings, reaching 41% between 1995 and 1997 (Table E.13). This table also shows renewed interest in mid-water pair trawling in recent years. Some herring is also taken by small bottom trawl vessels that use various small mesh whiting fishery exemptions to target herring at certain times of the year. While

only a small part of the annual herring catch, this is an important seasonal fishery to these fishermen.

Another shift that has taken place is the location of the catch. In the 1970's, the majority of the catch was taken in state waters , reflecting the predominance of the fixed gear fishery. In recent years the majority of the catch has been taken outside of state waters, a result of the increased importance of the mobile gear fisheries (Table E.11). Because the majority of the under-exploited resource is in federal waters, the importance of this fishery is likely to increase.

While herring is caught over a wide range (a description of the range is provided in the Council's Essential Fish Habitat amendment), there is a definite seasonal pattern to the fishery. During the winter months (December-March) the fishery is usually active in the coastal waters south of New England, as adults migrate to this area. In some years, there has been an active winter fishery north of Cape Cod, but this has not occurred since 1993. As spring approaches, the fishery moves north into the offshore waters in the Gulf of Maine (e.g., Jeffreys Ledge). In late summer/early fall, the focus of the fishery is on the coastal waters of Maine, New Hampshire, and Massachusetts as herring move into these areas prior to spawning. Landings from these areas usually begin to decline in November and the fishery moves south of New England again. Catches on Georges Bank in recent years have been made in the summer and early fall. There have also been some recent landings from the area just east of Nantucket Shoals in the late summer. These patterns vary over time. A review of landings from Management Areas 1 and 2 over the past twenty years shows that the percent of annual landings from these areas taken in any given month has shown varied considerably from year to year (Table E.15 and Table E.16).

A detailed review of 1997 herring catches by NMFS statistical area and month (Figure E.12 through Figure E.14) shows the temporal and spatial distribution of fishing effort during the year. Fishing activity was concentrated in nearshore Rhode Island waters in January, with some fishing west of Block Island and off Montauk Point and offshore of the Rhode Island and Massachusetts coast. In February, more herring were caught off Long Island and off the Rhode Island/Massachusetts coast than inshore, with some additional catches off New Jersey. March catches were spread over several statistical areas, but area 537 remained the most important area. In April, the fleet moved north into the Gulf of Maine where it remained through November. The majority of the catch at this time of year came from areas 512 and 513. By December, winter conditions again prevailed: there was still some fishing in the Gulf of Maine, but most of the catch came from Rhode Island.

The fishery is dominated by a relatively small group of vessels, though a broader group of vessels lands some herring in small amounts (Table E.14). In 1997, nearly 98 percent of the landings were made by 21 vessels, and 10 boats accounted for 92% of the catch. This same year, only 61 vessels averaged more than 2,000 pounds of herring on trips that reported landing herring. Nine boats were active in the Gulf of Maine summer-fall fishery in 1997 and ten fished in the Gulf of Maine and in southern New England and the mid-Atlantic region in the winter. Three of the boats that fished all year also harvested small

amounts of herring on Georges Bank in 1997. Six of these 19 boats were purse seiners, ten were mid-water trawlers (operating as either single boats or paired with a second boat), and two used both types of gear, switching from a seine in the summer-fall fishery to a trawl in the winter. Vessels that fish during the winter and offshore are larger. A total of four vessels were equipped with either refrigerated sea water systems or were freezer trawlers; these systems allow them to stay at sea longer and still bring in a high quality product. Several of the larger mid-water trawlers also harvested mackerel in the winter or squid during the spring and summer. Average landings per trip for the group of eleven primary vessels in 1997 (Table E.14) was about 77 mt (170,000 lbs); the highest average landings per trip for any vessel in this group was 157 mt. One small group of fishermen target herring using small mesh bottom trawls under several different groundfish exemptions. Typically, these boats make less than 10 –15 herring trips each year, with total landings of less than 250 mt in 1997. A further description of these boats is contained in section E.7.3.4.3.

Most herring fishing trips in all areas were about one day in length, with the exception of a small number of trips by freezer trawlers that were 5 to 7 days long. This is probably due to two factors: the fishery is primarily prosecuted near shore, and there is a need to get the herring to market rapidly before it decomposes. In some instances, vessels fished close enough to shore that they were able to make more than one trip in a day. An examination of the number of days that each boat lands herring (using the Maine DMR database) helps to give an understanding of the intensity of fishing effort in the different management areas during different seasons, and the impact of mandatory days out of the fishery. The only segment of the industry this does not accurately capture is the effort by freezer trawlers, who fish for several days before offloading. In 1997, this represented a small portion of the total landings and trips.

In Management Area 1, the weeks with the most landings of herring occurred from July through October, reflected in the high landings rate during this time of year (Figure E.23). This coincides with the aggregation of spawning herring in the Gulf of Maine, but also with a rise in demand to support the peak season for the lobster fishery. A total of 38 boats reported landing more than one metric ton of herring from Management Area 1 a total of 1,145 days in 1997. 12 of these boats landed less than ten mt during the year. In 1997, only 13 boats ever landed herring on more than 4 days a week. Of the 38 boats, only three ever landed herring every day of the week (Sunday through Saturday) at any time during the year. These three boats fished every day of the week during a total of six occasions, accounting for 42 of days with landings of one metric ton or more. Nine boats landed herring on six days of the week, doing so during a total of 20 weeks (120 of the days with landings of one mt or more). 13 boats landed herring on five days of the week on 58 occasions (290 of the instances), and 14 landed herring on four days of the week (98 instances). In other words, in 1997 48% of the days that individual vessels landed one mt or more of herring came during weeks the vessel fished for 1 to three days. The next most common fishing practice in Management Area 1 was for boats to land herring on five days of the week, accounting for 35% of the days with herring landings of more than 1 mt by an individual vessel.

In Management Area 2, the weeks with the most landings of herring were January, February, and December, reflecting the winter nature of this fishery and the movement of herring into the mid-Atlantic area. 36 boats reported landing at least one trip of one metric ton in 1997; 6 of these boats landing less than 10 mt for the year. The intensity of fishing effort is far less than in Management Area 1, as would be expected by the lower landings reported from this area. There were landings of more than one mt by a vessel on 529 occasions in Management Area 2. Only one boat ever landed herring on all seven days of a week, doing so during two separate weeks (14 days with landings of more than 1 mt by a vessel). On 12 occasions, 3 boats landed herring on each of six days of the week (84 days total). 3 boats landed herring on five days of the week on 5 occasions (25 total), and 8 boats landed herring on four days of the week on a total of 22 occasions (88 total). In this area, the most common fishing practice was to land herring on less than four days of a week, accounting for nearly 60% of the days with landings of one mt or more from an individual vessel.

Most landings of herring are made in Maine, harvested by four different gear types: weirs and stop seines (fixed gear), purse seines and mid-water trawls (mobile gear). During the first half of this century the fishery harvested mostly juvenile two year-old herring (“sardines”) using fixed gear. Weirs were by far the most common gear used until the 1940's, mostly in eastern Maine, where strong tides and the presence of long, shallow bays make this method of fishing most suitable. By the 1950's, the fish had become more common in the central section of the coast and stop seines had become the dominant gear type. Purse seines accounted for a growing percentage of the catch after 1960 and are the most important gear used in this fishery since they can be used more or less selectively to catch a variety of ages and sizes of herring. The increased use of purse seines and mid-water trawls, a growing demand for adults as canned “steaks”, for bait, and for sale to foreign processing ships, and the scarcity of juveniles in nearshore waters in recent years have caused a shift from a fishery dominated by juveniles to one that is more evenly divided between ages 2, 3, and 4+. The catch has been composed primarily of adults in recent years (75% age 3+ since 1986). Primary landings ports are Rockland and Portland (see section E.6.4.2.4).

Fixed gear have accounted for only a small percentage of the total Maine herring landings since 1983. In 1992, there were 16 fishermen in Maine using purse seines, 24 using stop seines, and only 5 using weirs. The reduced use of stop seines and weirs since the late 1970's and early 1980's has been dramatic (78 fishermen were reported using stop seines in 1981 and 88 using weirs in 1984), owing to the absence of herring in nearshore waters. Fixed gear landings in Maine dropped from 45,000 mt in 1981 to 11,000 mt in 1982 and then to 2,500 mt in 1983, and have remained below 5,000 mt since then. Fixed gear landings during 1994-1997 were less than 500 mt a year (Scully et al. 1998).

Most purse seiners supply more than one market depending on price, the availability of different sizes or qualities of herring, and demand. Sales to the canneries are preferred because the price is higher (they also demand a better quality product). While most of the purse seine vessels are independently owned, two are owned by one of the packing companies.

Herring are caught in Maine coastal waters between June and November. In recent years, catches from the western and central areas of the coast have predominated with very little coming from eastern Maine. Some herring landed in Maine are caught in Massachusetts and New Hampshire coastal waters, primarily on Jeffreys Ledge. Total domestic landings in 1997 were 52,040 mt (114,750 lbs) with a landed value of $6.3 million and an average value of $121 per metric ton (or 0.055cents a pound). The sardine industry in Maine currently generates over $40 million a year in sales of canned products (see section E.1.1.1).

The Atlantic herring fishery in New Hampshire has been minimal according to records kept since 1879. Early fishery statistics show annual landings around the turn of the century that range from 10to 160 metric tons. The years from 1908 to 1976 are not well documented, but it is supposed that the actual landings during these years were similarly low. Commencing in 1977, annual landings of Atlantic herring were recorded except for 1978-79. One year, 1980, shows an unusually high landing of 3,000 mt. This unusual record was the result of a regulatory inconsistency between New Hampshire and the other Atlantic coast states. Following that event, New Hampshire adopted regulations to prevent this from continuing. In recent years, the otter trawl herring fishery in New Hampshire has been limited to a few vessels that supply bait for local lobstermen and the bluefin tuna fishery. Occasionally, landings of herring are trucked to Maine for processing. No processing of herring other than bait preparation is currently conducted in New Hampshire. Landings in New Hampshire have averaged less than 400 mt annually since 1990 (Table E.12).

Purse seines, pair trawls, otter trawls and fish traps are used to harvest sea herring in Massachusetts waters. Purse seines are responsible for the majority of herring landings with most of the seiners being from other states, especially Maine. Most of the seiners fish on grounds outside of Massachusetts waters except in those years when for whatever reason (e.g. favorable water temperatures) fish are abundant and available fairly close to shore such as during the winter and early spring of 1989-90, in Cape Cod Bay. Herring are landed primarily in Gloucester (see E.6.4.2.4)

During some years, seiners have taken advantage of overwintering, smaller fish in Massachusetts Bay by offloading and trucking fish from Gloucester, which supplies cannery and bait markets on the U.S. Atlantic coast and eastern Canada. Massachusetts shoreside plants also are supplied with herring, although shoreside demand is minimal except for use as bait and food for zoos. The greatest demand for herring shoreside was in the late 1970's and early 1980's, when the overseas market for filleted fish was strong, and Gloucester had a fish meal plant. With the loss of the plant and the absence of an overseas market during the latter part of the 1980's and early 1990's, internal waters processing operations took on great importance for the state.

Massachusetts herring landings peaked in 1971 from previous low landings of many years, decreased in the mid-1970's, and then steadily increased with a peak of 30,330 mt in 1980 with a value of $3,787,000 (average $155.60/metric ton). Landings decreased dramatically

from 1980 to 1983 (Table E.10). Only 4,075 mt were landed in 1983. It was caused by a markedly reduced demand for U.S. herring owing to (a) a resurgence of North Sea herring stocks to meet the needs of the European economic community markets, especially in Germany; (2) other species (e.g. mackerel) became a preferred alternative to herring since herring were scarce and consumers switched to more available species; and (3) a strong U.S. dollar created a lower demand for U.S. herring (e.g. in 1982 the U.S. dollar was stronger than the Canadian dollar by 20%, therefore, U.S. herring cost more than Canadian herring). By 1988, shoreside landings had returned to more than 20,000 mt and remained between 20,000 and 28,000 mt until 1992. Landings dropped in the next three years, then returned to 22-24,000 mt in 1996 and 1997 (Table E.12).

The Atlantic herring fishery of Rhode Island developed during the late 19th century. Landings were negligible (under 2,000 pounds/year) during the early years of the fishery, but catches increased dramatically in the early 1900's, with 100 mt landed in 1908. Rhode Island's herring landings have been extremely variable since then, ranging from 15 mt in 1944, to a high of 330 mt in 1973. At times, the landings from one year to the next have changed by as much as 1,500 mt (Table E.12).

Early in this century, floating traps dominated the state's fishing industry. Otter trawls were introduced to the state in the early 1930's; however, herring sometimes swim too high off of the ocean floor to be caught with traditional otter trawls. In 1968, the URI Marine Advisory Service introduced wing trawls (which have higher openings) to Point Judith's fishermen, and catches increased. In 1971, The MAS introduced the pelagic pair trawl, which remained in use for about ten years. Currently, most of the herring landed in Rhode Island is caught with mid-water trawls, although purse seines are also used in the winter fishery. Most of the vessels participating in the winter fishery in southern New England and the mid-Atlantic region spend the summer and fall fishing in the Gulf of Maine.

Shoreside landings have increased dramatically in Rhode Island during the last three years, reaching 20,000 mt in 1997. Principal ports are Point Judith, Portsmouth, and Davisville. Herring landed in RI during the winter are trucked as far as the mid-Atlantic states and Canada to supply cannery and bait markets. A fish dehydrating plant once operated in Galilee, R.I. The Rhode Island Atlantic herring season extends from November through March. Internal Waters Processing operations based in RI in 1990-91 and 1996-97 provided an additional market for U.S. fishermen. The IWP catch was 4,163 mt in 1996 and less than 1,000 mt in 1997 (E.6.4.3.2).

In Connecticut, Atlantic herring are taken principally by trawl, and to a lesser extent, in pound nets and gill nets. Catches within state waters are limited by seasonal (Nov-May) mesh size restrictions in the trawl fishery (4.5 in mesh codend) and a year-round 3 inch minimum mesh size for gillnets fished in marine waters. The trawl fishery takes herring mixed with mackerel outside of Long Island Sound between November and April. The pound net fishery typically took Atlantic herring from mid-March through April. However, catches have declined in recent years presumably due to fluctuations in local abundance. The gill net fishery takes herring as an incidental bycatch.

Atlantic herring fisheries in New York have not been of major importance over the years, but they have been fairly constant. Landings in the domestic fishery have ranged from as low as 3 mt to as high as 2,907 mt. The domestic fishery in New York is predominantly a bait fishery because there is no local market for any other product. The market is extremely limited and there is little demand.

The primary gears used in the domestic herring fishery are the trawl and seine. There have also been landings from the pound net and gill net fisheries but these are limited. In 1991, however, New York fishermen participated in an Internal Waters Processing operation for herring. The gear used was a pair trawl and the landings from this operation were significant for the New York fishery. Over 1,000 mt were taken. New York does not currently have any management restrictions directed at herring.

In New Jersey, from the late 1800's to the mid-1900's, Atlantic herring were taken mostly in state waters from pound nets during late fall to early winter, and again in early spring. While these stationary nets were set from spring to late fall, they were taken up during winter because of severe weather. Catches varied from year to year but were usually less than 250 mt and most of this was sold for bait, though some was salted or pickled for food. During those years, otter trawl vessels accounted for less than ten percent of the total herring catch.

Since the late 1950's, the commercial fishery in New Jersey was almost exclusively conducted by otter trawl vessels which operated from two miles off the coast (New Jersey's law did not allow otter trawl vessels to operate closer to shore than this distance) and offshore over the entire breadth of the continental shelf. Catches in New Jersey during the 1970s and 1980s were very sparse. Landings increased to 3,750 mt in 1992 and 1,390 mt in 1993, but since then have declined again. The principal herring port is Cape May. There is also a considerable but unknown by-catch of herring taken in other fisheries, especially the mackerel fishery. At times, the discard of herring equals or exceeds the directed catch of other species. The commercial season normally extends from late November through mid-March, the period when Atlantic herring frequent middle Atlantic waters. There was a small IWP operation in Cape May in 1992, and a second operation targeting mackerel took a small amount of herring in 1997.

As was indicated above, the herring were often taken incidental to the mackerel fishery. But with increased abundance of herring and growing market for its sale, there has developed a directed fishery for this species. It should be noted that the catch of Atlantic herring and the river herrings, including alewives and blueback herring, *Alosa* spp., were often grouped into the same category for reporting purposes. Any herrings caught at sea were often recorded as "sea herring" and were listed as Atlantic herring. Recent information indicates that much of New Jersey's catches made during April and May and reported as Atlantic herring were probably blueback herring or alewives. The existing market structure for herrings now dictates that the various species be distinguished so that Atlantic herring are reported as *Clupea harengus*, whereas the species category "alewives", includes both *Alosa* species.

Domestic landings of herring in Virginia and North Carolina reached 400-700 mt in 1995-1997 (Table E.12).

Table E.9 - Total Gulf of Maine (GOM), Southern New England (SNE), Middle Atlantic (MAT) and New Brunswick, Canada (NB) herring catch, 1960-1996 (metric tons). (Includes IWP operations and at-sea transfers to Canadian carriers in the Gulf of Maine) (Source: SAW-27, NEFSC 1998a)

YEAR	GB[1]	GOM[2]	SNE[3]	MAT[4]	NB[5]	TOTAL
1960	0	60237	261	152	34304	94954
1961	67655	25548	197	101	8054	101555
1962	152242	69980	131	98	20698	243149
1963	97968	67736	195	78	29366	195343
1964	131438	27226	200	148	29432	188444
1965	42882	34104	303	208	3346	80843
1966	142704	29167	3185	176	35805	211037
1967	218743	35417	247	524	30032	284963
1968	373598	62425	245	122	33145	469535
1969	310758	53420	2104	193	26539	393014
1970	247294	41786	1037	189	15840	306146
1971	267347	52129	1318	1151	12660	334605
1972	174190	61664	2310	409	32699	271272
1973	202335	32492	4249	233	19935	259244
1974	149525	37356	2918	200	20602	210601
1975	146096	37187	4119	117	30819	218338
1976	43502	50808	191	57	29206	123764
1977	2157	50730	301	33	23487	76708
1978	2059	49316	1730	46	38842	91993
1979	1270	63492	1341	31	37828	103962
1980	1700	82244	1200	21	13525	98690
1981	672	64324	749	16	19080	84841
1982	1378	32157	1394	20	25963	60912
1983	53	24824	72	21	11383	36353
1984	58	33958	79	10	8698	42803
1985	316	27157	196	13	27863	55545
1986	586	27942	632	20	27883	57063
1987	11	39970	376	87	27320	67764
1988		39568	1307	365	33421	74661
1989		52774	269	39	44112	97194
1990		54192	2761	48	38778	95779
1991		50984	3947	402	24576	79909
1992		55948	716	4564	31968	93196
1993		53929	1829	1347	31572	88677
1994	474	51413	1935	502	22241	76565
1995	64	64593	10866	612	18248	94383
1996	1758	80925	20177	803	15913	119576
1997	6262	70171	21382	456	20552	118823

[1] 1961-1987: foreign catches from 5Z and 6, including some US landings; 1994-1997: catch from NMFS statistical areas 521, 522,526,561,562;. [2] ME, MA & NH landings + foreign catches from Jeffreys Ledge (1967-1978) – GB catch; [3] RI, CT, NY landings; [4] NJ, DE, MD, VA landings; [5] Fixed gear catch only

Year	Landings ('000 pounds)	Value ('000 dollars)
1986	79,381	4,314
1987	84,536	4,368
1988	90,397	5,229
1989	89,657	5,041
1990	113,095	5,746
1991	107,067	6,339
1992	122,993	6,821
1993	109,645	6,511
1994	100,997	5,816
1995	147,181	8,654
1996	197,124	11,194
1997	211,010	11,543

Table E.10 - U. S. commercial herring landings and value (excluding IWP, JV, and Canadian transshipments) (Source: Fisheries of the United States (series))

Herring Landings by Distance Offshore (mt / %)							
Year	0-3 Miles		3-200 Miles		>200 miles		Total
1981	49,168	78%	13,922	22%		0	63,090
1982	26,229	79%	6,859	21%		0	33,088
1983	16,195	70%	7,053	30%		0	23,248
1984	20,697	62%	12,765	38%		0	33,462
1985	18,420	71%	7,490	29%		0	25,911
1986	24,589	68%	11,418	32%		0	36,007
1987	19,406	51%	18,939	49%	0	0	38,345
1988	16,694	41%	24,306	59%	3	0	41,003
1989	13,887	26%	39,255	74%		0	53,142
1990	14,403	28%	36,896	72%	0	0	51,300
1991	29,169	48%	31,714	52%	0	0	60,884
1992	20,138	34%	39,783	66%	3	0	59,924
1993	32,512	58%	23,587	42%	293	0	56,392
1994	N/A		N/A		N/A		N/A
1995	31,201	41%	45,314	59%	0	0	76,516
1996	39,766	38%	64,224	62%	0	0	103,990
1997	30,023	31%	67,693	69%	0	0	97,716

Table E.11- Herring landings by distance offshore (Source: Fisheries of the U. S. (series))

	State										
Year	**CT**	**DE**	**ME**	**MD**	**MA**	**NH**	**NJ**	**NY**	**RI**	**VA**	**Total**
1976	1		31858	3	18025		54	12	178	0	50130
1977	0		33135		17113	25	33	8	293	0	50607
1978	29		30343	3	18393		43	13	1688	0	50513
1979	2		40540	1	23038		30	58	1281	0	64951
1980	0		48908	1	30322	3010	14	104	1096	6	83462
1981	12		51979	0	12300	48	16	49	688		65092
1982	13	7	23207	2	7123	581	11	18	1363	1	32323
1983	6		18161	1	4057	943	20	20	46		23254
1984			21263		12146	82	10	30	48		33580
1985	1		14570		11128	2	11	46	154	2	25914
1986	3		19797		11543	1	20	49	583		31997
1987	9		20484		18498	0	23	52	311	64	39441
1988	0		16531		22800		23	216	1091	342	41004
1989			15625		24497	284	31	55	214	8	40715
1990	0		22582	1	28085	167	48	3	757	0	51644
1991	4		24327	27	21706	173	367	124	2042	14	48783
1992	0		28049	48	22975	255	3749	9	707	0	55791
1993	2		34750	10	11213	351	1391	8	1821	204	49750
1994	1		35326	4	7306	197	470	27	1910	569	45811
1995	2		43025		14238	148	199	27	10865		68505
1996	55		50357		21882	15	286	47	15999	137	88778
1997	63		55990		24224	69	134	37	14921		96923

Table E.12 - Domestic herring landings by state (does not include IWP, JVP, or transfers to Canadian herring carriers) Personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, http://remora.ssp.nmfs.gov/commercial/landings)

Gear	Year													
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997*
Floating Traps (Shallow)	16	8	23	13	21	5	15	0	0	8	3	0	2	.085
Gill Nets, Drift, Other		1	0	0	1		5	1	1	0	3	8	11	9
Gill Nets, Other	5	1	0	3	20	2.629	5	12	3	12	19			
Gill Nets, Sink/Anchor, Other											12	30	3	39
Lines Long Set With Hooks							0		45		0			
Not Coded											1	55		
Otter Trawl Bottom, Fish	491	249	870	1.345	1.389	692	944	1.955	4.836	2.513	2.894	2.003	1.886	1.203
Otter Trawl Bottom, Other										4				
Otter Trawl Bottom, Shrimp	4	3	17	16	19	14	0	5	2	0	0	318		
Otter Trawl Midwater					774				1.939	6.114	7.164	30.644	31.585	41.311
Pots And Traps, Lobster Inshore						0			0		51		0	
Pound Nets, Fish	8		4		16	0	2	18	7	2	1	0	3	1
Pound Nets, Other					201				0	1				
Purse Seines, Herring	29.428	21.004	29.012	36.515	36.266	35.846	50.032	44.708	45.118	38.432	34.546	34.608	54.695	51.240
Purse Seines, Mackerel	12										82			
Purse Seines, Other											8			
Stop Seines	70	3.739	1.645	1.225	732	763	216	918	3.443	2.290	293		438	
Trawl Bottom, Paired	8		0					2						
Trawl Midwater, Paired	1.349	2			282		2	1.108		59		839		1.373
Weirs	228	860	382	311	1.202	765	422	50	393	56	168		18	170
Grand Total	31.619	25.867	31.954	39.428	40.925	40.714	51.644	48.778	55.787	49.492	45.247	68.504	88.641	95.348

Table E.13 - Landings by major gear type (metric tons), 1986-1997 (Personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, http://remora.ssp.nmfs.gov/commercial/landings; 1997 data is preliminary)

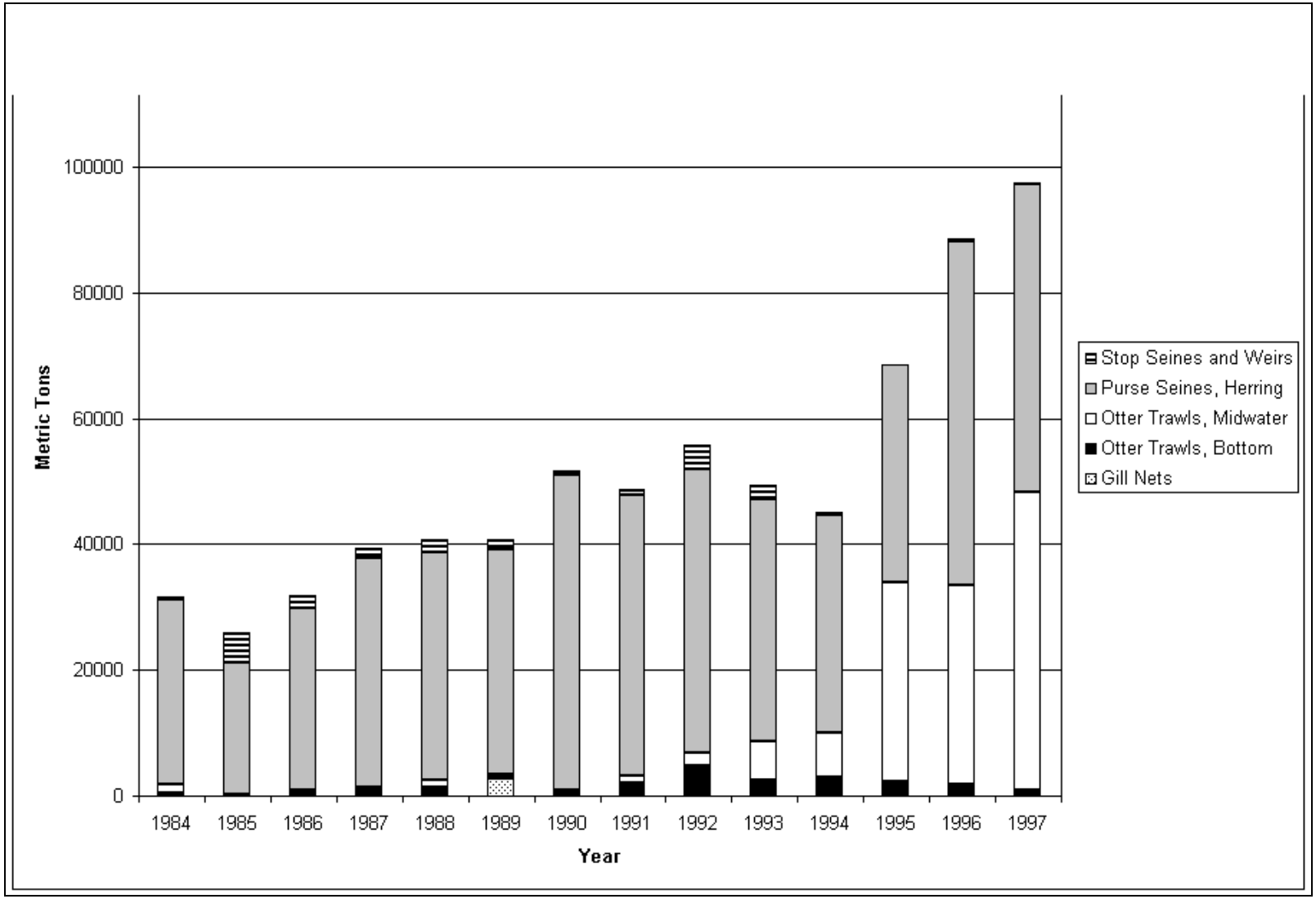


Figure E.11 - Herring landings by major gear type, 1984 – 1997 (does not include IWP/JVP catches, or transshipments to Canada)

Summary of 1997 Landings								
Vessels (ranked by annual herring landings)	**Total Landings**		**Number of Trips**			**Average Pounds/Trip**		**Average Annual Revenues/ Vessel ($.05/lb)**
	MT	%	Mean	Lo	Hi	Mean	Hi	
1 – 10	25	<0.1%	1	1	1	5,424	7,938	$271
11 - 20	66	<0.1%	2	1	6	9,150	14,994	$721
21 – 30	206	0.2%	4	1	10	14,716	29,988	$2,270
31 – 40	549	0.6%	3.6	1	12	59,525	114,660	$6,053
41 – 50	5,873	5.9%	20.8	2	44	108,179	404,066	$64,753
51 – 61	90,295	92%	115.5	8	191	170,054	347,011	$905,005
Total Identified Landings	97,013	98.7%						

Table E.14 – Summary of 1997 landings. Total 1997 landings: 98,271 mt. Only vessels that averaged more than 2,000/lbs trip are included. (Maine DMR summary of NMFS statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	2	4	10	17	18	33	49	64	79	92	100	100
1977	5	13	20	26	30	37	55	73	84	96	99	100
1978	6	16	24	24	25	30	47	69	83	90	98	100
1979	5	13	20	26	30	37	55	73	84	96	99	100
1980	1	6	13	13	13	18	39	61	84	98	100	100
1981	2	5	6	7	7	14	31	57	78	98	100	100
1982	2	5	5	5	6	9	22	53	72	89	96	100
1983	2	5	5	6	7	12	29	64	78	89	99	100
1984	3	12	19	23	24	25	38	62	80	92	97	100
1985	4	14	22	27	27	36	51	66	77	89	94	100
1986	5	14	25	28	30	31	42	54	79	87	94	100
1987	5	14	25	29	33	38	51	64	76	86	91	100
1988	7	18	33	39	40	45	55	66	78	84	95	100
1989	7	17	30	44	44	49	57	68	78	85	95	100
1990(3)	8	17	32	37	43	49	60	70	77	84	93	100
1991(3)	6	11	15	21	21	30	44	52	63	72	88	100
1992	8	12	18	28	29	36	46	55	67	81	94	100
1993	3	3	3	5	11	21	31	45	63	80	92	100
1994(4)	0	0	0	4	9	20	38	52	66	85	96	100
1995(5)	1	1	1	9	17	27	45	63	75	88	98	100
1996(6)	0	0	0	3	14	29	40	57	72	88	99	100
Average 76-96	3.9	9.5	15.5	20.0	22.8	29.9	44.1	61.4	75.8	88.0	96.1	100.0

Table E.15- Annual landings distribution (percent each month), Management Area 1 (NMFS VTR database)

Notes: (1) Management area 1 includes statistical areas 511, 512, 513, 514, 515.
(2) Domestic landings only (does not include IWP, JVP, or foreign catches) as cumulative per cent of annual landings.
(3) 1990 and 1991 include some landings not reported by month.
(4) 13.9% of annual landings not reported by area; these landings are not included in this table.
(5) 0.3% of annual landings not reported by area; these landings are not included in this table.
(6) 2.1% of annual landings not reported by area; these landings are not included in this table.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	5	19	22	31	91	91	91	91	100	100	100	100
1977	19	73	97	99	99	99	99	99	100	100	100	100
1978	1	66	95	99	100	100	100	100	100	100	100	100
1979	1	11	90	96	96	96	97	97	97	97	97	100
1980	1	53	84	100	100	100	100	100	100	100	100	100
1981	71	90	92	95	96	96	96	99	99	99	99	100
1982	13	48	96	98	100	100	100	100	100	100	100	100
1983	23	29	52	69	70	71	71	71	81	84	88	100
1984	7	20	47	71	72	72	72	75	77	79	98	100
1985	3	15	39	56	58	59	59	59	59	99	99	100
1986	13	35	87	90	96	99	99	99	99	99	99	100
1987	3	23	66	90	91	91	92	92	94	94	98	100
1988	6	33	69	70	70	70	71	71	72	73	99	100
1989	16	22	38	42	44	45	46	46	46	46	46	85
1990	58	63	69	70	70	70	70	70	70	70	76	100
1991	13	51	57	60	61	61	61	61	61	61	93	97
1992	34	77	94	98	98	98	98	98	98	98	98	100
1993	26	38	54	58	58	58	58	58	58	58	58	59
1994	30	60	87	99	99	99	99	100	100	100	100	100
1995	37	66	87	89	89	89	89	89	89	89	89	100
1996	32	49	65	71	72	72	72	72	72	72	78	100
Average	19.6	44.9	70.8	78.6	82.4	82.7	82.8	83.1	84.3	86.5	91.1	97.2

Table E.16 - Annual landings distribution (percent each month), Management Area 2 (Note: In 1989 and 1993, significant landings from Area 2 were not reported by month)

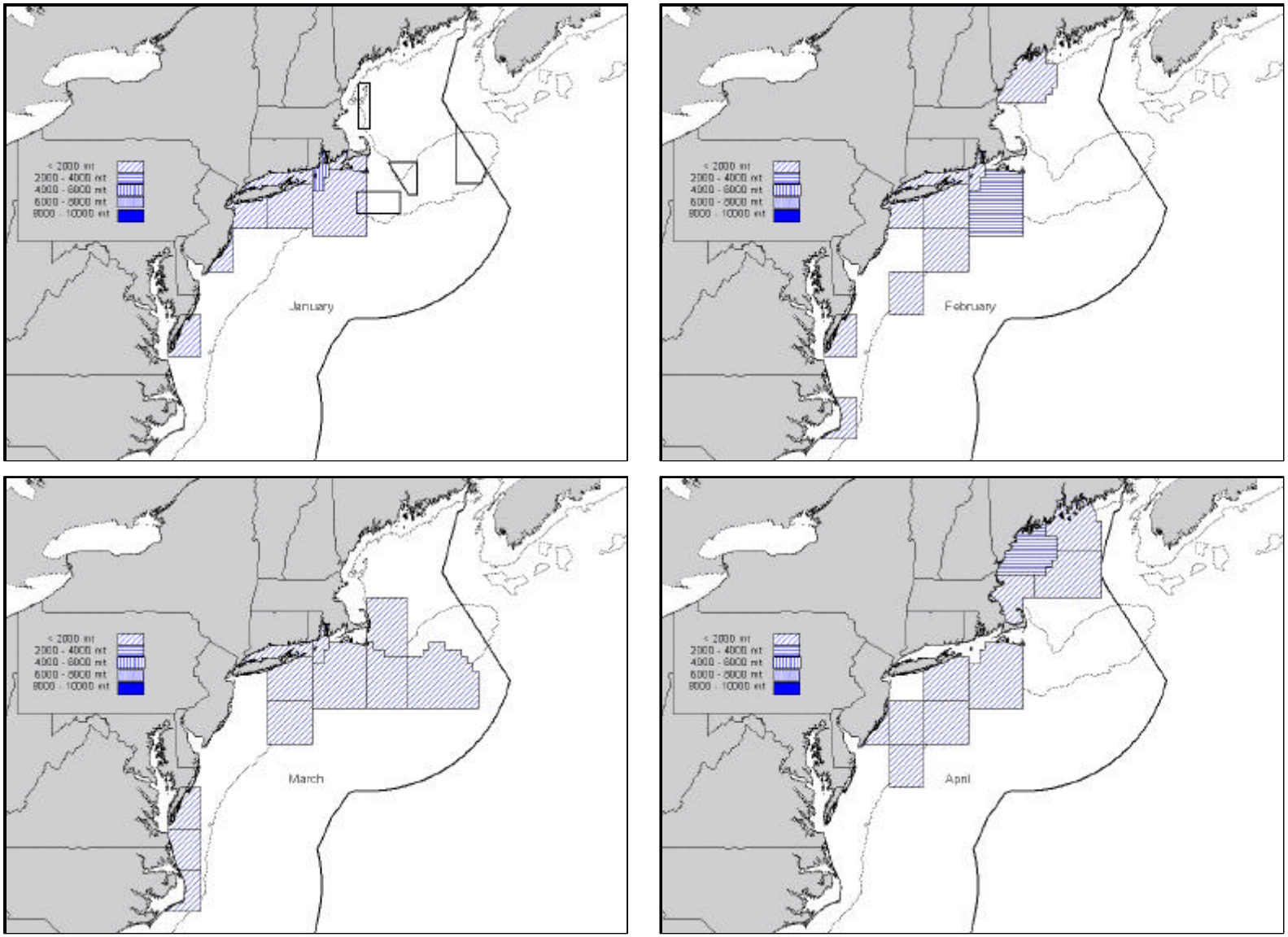


Figure E.12 – 1997 (Jan-Apr) Atlantic herring catch by statistical area (Unpublished data, NMFS VTR database)

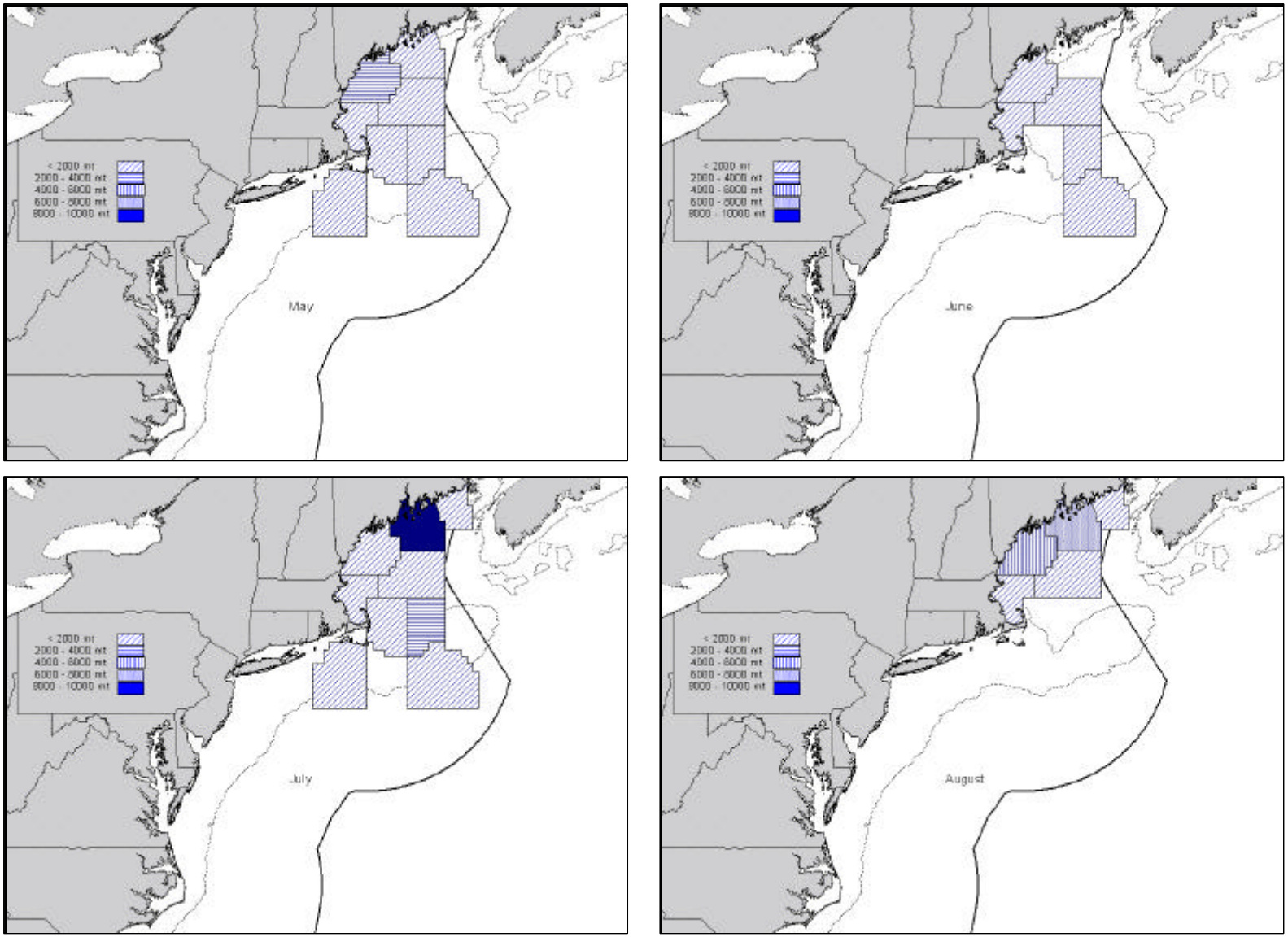


Figure E.13 – 1997 (May-Aug) Atlantic herring catch by statistical area (Unpublished data, NMFS VTR database)

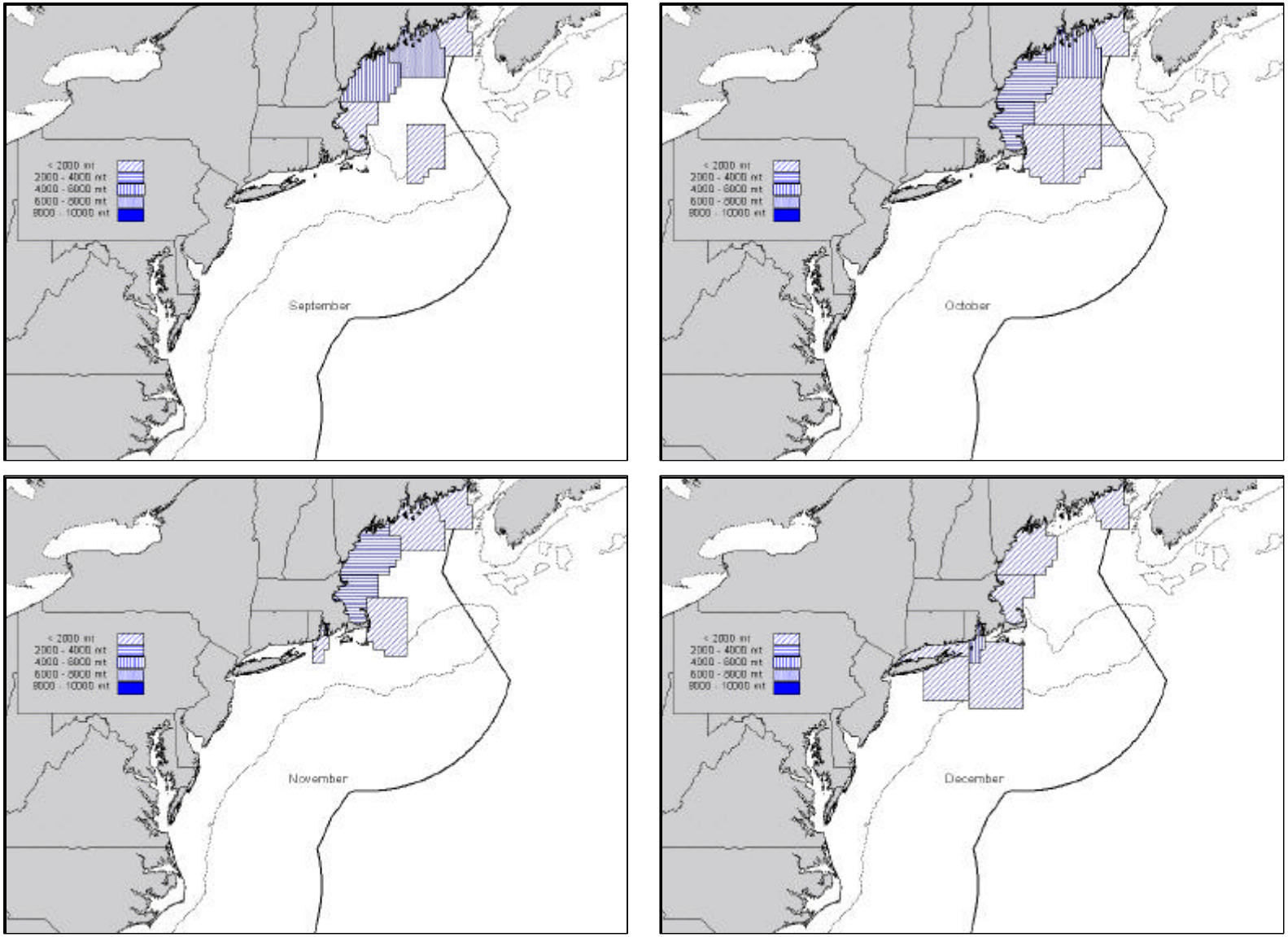


Figure E.14 – 1997 (Sep-Dec) Atlantic herring catch by statistical area (Unpublished data, NMFS VTR database)

E.6.4.2.3 Vessels and Domestic Harvesting Capacity

Logbook and weigh-out data were used to uniquely identify 279 vessels catching and selling herring in the Northeast Region in 1996. Because the weigh-out system lumps some vessel landings (mostly small vessels) into categories of landings by unknown and/or under-tonnage vessels, not all of the 104,000 metric tons landed in 1996 can be traced directly to a vessel. Information from the vessels that can be identified can be used to determine herring catch rates.

Table E.17 shows the identified herring vessels by principal herring gear type and tonnage class (tonnage class 1 (TC1) is gross tons less than 5, tonnage class 2 (TC2) is from 5 gross tons to less than 50, tonnage class 3 (TC3) is from 50 gross tons to less than 150, tonnage class 4 (TC4) is gross tons greater than or equal to 150.) Because some vessels caught herring with more than one gear type, a vessel is assigned a gear type based on the gear used to catch the majority of herring in 1996.

A geographic breakdown of these vessels would violate confidentiality rules for many groupings. For the groups with larger numbers of vessels, the number of vessels by principal state of landing, as declared on federal permit applications, is as follows. For mid-water trawl TC4 there are 5 from RI, 3 each from ME and MA, 1 each from DE and an unknown principal state. For bottom trawl TC2 there are 29 from NY, 24 from ME, 18 from MA, 15 from NH, 7 from NJ, and the rest from RI, CT, and MD. For bottom trawl TC3 there are 18 from NY, 12 from NJ, 9 from RI, 6 from MA, and the rest from CT, MD, ME, and NC. For bottom trawl TC4 there are 7 from RI, 5 from NY, 4 from NJ, and the rest from MA, ME, PA, and VA.

	Purse Seine		**Mid-Water Trawl**		**Bottom Otter Trawl**			**Other**				
Tonnage Class	TC2	TC4	TC3	TC4	TC1	TC2	TC3	TC4	TC1	TC2	TC3	TC4
Number of unique vessels	<3	3	5	13	<3	101	54	20	6	60	10	<3
Avg. GRT	<15	169	106	178	<5	25	93	194	3	19	73	<180
Avg. length	<45	75	68	91	42	44	68	89	27	39	65	<90
Avg. horse	<400	516	550	917	302	302	512	956	220	337	599	<800
Avg. year built	-	1975	1982	1981	1985	1975	1976	1983	1977	1977	1975	------
Vessels catching herring only	2	3	3	5	3	30	3	1	1	8		1

Table E.17 - Overview of vessels that landed herring, 1996 (NMFS/NEFSC, Harvest Capacity of Northeast Herring Vessels)

In order to describe the current degree of dependence by vessels on herring, the landings of 201 vessels that reported herring landings to the dealer weighout database in 1997 were examined. The data illustrates the degree of dependence on herring, and the different gear types that vessels use to fish for herring and for other species. The results differ slightly from those presented in the regulatory flexibility analysis (section 7.3) because different data sources are used. For that

reason, these tables should be viewed as indicators of activity rather than a precise description of all vessels in the fishery. Dependence is measured by the size of herring revenue relative to revenue from all species. Dependence classes are established where:

- dependence class 1 = 75% to 100% herring revenue
- dependence class 2 = 50% to 75% herring revenue
- dependence class 3 = 25% to 50% herring revenue
- dependence class 4 = greater than 0% to 25% herring revenue

In order to illustrate how dependence is distributed geographically and by vessel size, Table E.18 through Table E. 21 report dependence by home state and length class, where length class is:

- length class 1 = vessel length less than or equal to 50 feet (22 feet was the minimum)
- length class 2 = vessel length greater than 50 to 90 feet
- length class 3 = vessel length greater than 90 feet (126 feet was the maximum)

Also illustrated in Table E.18 through Table E. 21 are the principal gears (gear associated with the most revenue) used to catch herring and the principal gears used to catch other species. Herring gear is listed in the columns and non-herring gear is listed in the rows. Vessels are summarized by state of homeport and by the three length categories. When a vessel registered a different primary state of landing on its permit application than its homestate, that is noted in the columns.

Displaying numbers of vessels in this manner indicates the degree to which gear is switched between herring and non-herring fishing. For vessels highly dependent on herring, one would expect that the gear used for herring is the same gear used for other species (i.e., a herring purse seiner tends to always purse seine). For vessels less dependent on herring one might expect gear changes are made while targeting herring. This does not hold true, however, for bottom trawl vessels in dependency class 4 (0 percent to 25 percent herring revenue). Because such a low percentage of the total revenue for these vessels came from herring, it is unlikely they are using bottom trawls to target herring on a regular basis. This suggests that many of these vessels catch herring while targeting other species or are occasionally targeting herring without changing gears.

There were 21 vessels with herring landings reported either to Maine or in the logbook in 1997 but that had no landings recorded in the 1997 dealer data. Degree of dependence could not be calculated for these vessels. Six of these vessels were from Maine with 5 reporting using weirs and 1 using purse seine. Five of the vessels that could not be assigned to a dependence class were from MA, 5 from NY, and one vessel each from CT, NH, NJ, and VA. One vessel could not be associated with a home port. Most in this group of vessels that could not be assigned to a dependence class had less than 1 metric ton of herring landings in 1997. Besides the weir gear and a couple purse seiners, the gear used was mostly bottom otter trawl and sink gillnet.

Examination of the tables shows that only a few of the vessels (15) that reported landings in 1997 relied on herring revenue for more than 50 percent of landings revenue. Of the 14 vessels in

dependency class 1, seven listed Maine as homeport or principal state. Seven (some that listed Maine as principal state) list Massachusetts as the homeport. The limited number of vessels that rely on herring for most of their revenue matches well with 1997 landing statistics illustrated in Table E.14. The rapid rise in catch per number of vessels indicates that a small group of vessels lands most herring. Most likely, these are the same vessels that rely on herring for the majority of their income.

Dependence Class 1		**Principal Herring Gear**																	
		Purse Seine			**Mid-Water Trawl**			**Paired Mid-water Trawl**			**Bottom OtterTrawl**			**Sink gillnet**			**Other**		
Principal Non-Herring Gear	Home State	Length Categories																	
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Purse Seine	MA		3/ ME																
	ME	1	1																
Mid-Water Trawl	MA					1/RI	2/1 RI												
Paired Mid-Water Trawl	MA									1									
Bottom Otter Trawl	ME	1																	
	NY											1CT							
Longline	ME	1				1													
	MA					1RI													

Table E.18 - Dependency on herring revenue by gear type, dependence class 1 (75 to 100 percent of revenue), 1997

Dependence Class 2		Principal Herring Gear																	
		Purse Seine			Mid-Water Trawl			Paired Mid-water Trawl			Bottom Otter Trawl			Sink gillnet			Other		
Principal Non-Herring Gear	Home State	Length Categories																	
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Fish pot	ME		1																

Table E.19 - Dependency on herring revenue by gear type, dependence class 2 (50 to 75 percent of revenue), 1997

Dependence Class 3		Principal Herring Gear																	
		Purse Seine			Mid-Water Trawl			Paired Mid-water Trawl			Bottom Otter Trawl			Sink gillnet			Other		
Principal Non-Herring Gear	Home State	Length Categories																	
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Bottom Otter Trawl	MA				2ME								1RI						

Table E.20 - Dependency on herring revenue by gear type, dependence class 3 (25 to 50 percent of revenue), 1997

Dependence Class 4		**Principal Herring Gear**												
		Purse Seine	**Mid-Water Trawl**		**Paired Mid-water**		**Bottom Otter Trawl**			**Sink gillnet**			**Other**	
Principal Non-Herring Gear	Home State	Length Categories												
		2	2	3	2	3	1	2	3	1	2	3	1	2
Purse Seine	NJ							2NY						
Bottom Otter Trawl	DE							1ME						
	MA		1	2RI	1		14 4ME/3RI/2NH	17 3RI/3ME/1NH					1	
	ME	1					9 1NH	3					2	
	NC							2						
	NH						7	1						
	NJ						4	8/1MD						
	NY						16/1NJ	20/3NJ/1RI						
	PA							2NJ	1NJ					
	RI		1				1	4						
	VA							2NC						
	WV						1ME	1NY						
Sink Gillnet	MA						1			2	1			1
	NJ									1				
	NY									7				
	RI									1				
Longline	MA						6/4ME						2	
	ME						1			1			2	
	NH						1							
	NY									1			2	
Lobster/Fish pot	NJ						1			1			2	
	WV		1ME											
Drift Gillnet	NJ									3				
Scallop	PA							1NJ						

Table E. 21 - Dependency on herring revenue by gear type, dependency class 4 (0-25 percent of revenue), 1997

The landings in 1996 were examined to establish an estimate of the domestic harvesting capacity available for the herring fishery. Vessels that caught herring in 1996 were listed according to their catch. Actual catch levels out at around 20 vessels and 80,000 metric tons (total catch in 1996 was about 100,000 metric tons but not all landings could be traced to individual vessels). Then their catch was "annualized" by multiplying their average catch rate times the number of trips recorded by the most active vessel. The annualized catch levels out at around 50 vessels and 260,000 mt. In other words, if the 214 vessels that caught herring made the same number of trips as the most active vessel, and caught herring at the same rate as in 1996, the potential harvest is about 260,000 mt. Most of the harvest still would be taken by about fifty vessels. Figure E.15 illustrates this data.

Since the handling of herring requires certain specialized vessel characteristics, such as RSW systems, additional vessels were identified as likely to have these features but have not reported any herring landings. Vessels that caught mackerel or menhaden but no herring are shown in Table E.22 with their expected annualized herring catch should they enter this fishery.

	Number of Vessels	**Catch per Trip (mt)**	**Number of Trips**	**Annualized Catch (mt)**
Menhaden Purse Seine - Tonnage Class 3*	7	50	182	63,700
Menhaden Purse Seine - Tonnage Class 4	<3	83.5	182	15,197
Mackerel Mid-water Trawl - Tonnage Class 3	8	19	182	27,664
Mackerel Mid-water Trawl - Tonnage Class 4	7	56	182	71,344
Totals	<26			177,905

* Tonnage Class 3 = 50 to 150 GRT

Tonnage Class 4 = 150 GRT and greater

Table E.22 - Annualized catch of additional northeast vessels

Combining the results of these two analyses, the potential existing domestic capacity for Atlantic herring is approximately 438,000 mt. This exceeds current estimates of the MSY for the herring resource by 121,000 mt. This figure does not necessarily equate to the domestic annual harvest of herring (DAH), as this figure is developed by considering not only the capacity, but by estimating the extent to which domestic vessels will harvest the resource.

There are a number of assumptions that make this a rough estimate of potential capacity. The first group of vessels examined actually landed herring in 1996, demonstrating the capability to do so. Few of these vessels, however, possess the

refrigerated sea water (RSW) systems necessary to harvest herring offshore. They may have already maximized their ability to take herring from coastal areas, with the result they may be incapable of increasing the number of trips and landings. On the other hand, there are a number of vessels included in the first group that are not currently targeting herring who may be able to significantly increase their catch rates should they choose to do so. The high costs ($150,000 or more) necessary to convert to the herring fishery may limit the number of these vessels that enter the directed herring fishery. Any large scale shift of effort from other fisheries into the herring fishery will be dependent on the development of additional markets.

The second group of vessels—particularly the mackerel mid-water trawl vessels—are equipped for a relatively smooth transition into the herring fishery. They are, however, currently pursuing other fisheries—in the case of mackerel, for a higher priced product. The main deterrent to the entry of these vessels in the herring fishery is the low price of herring and limited markets available.

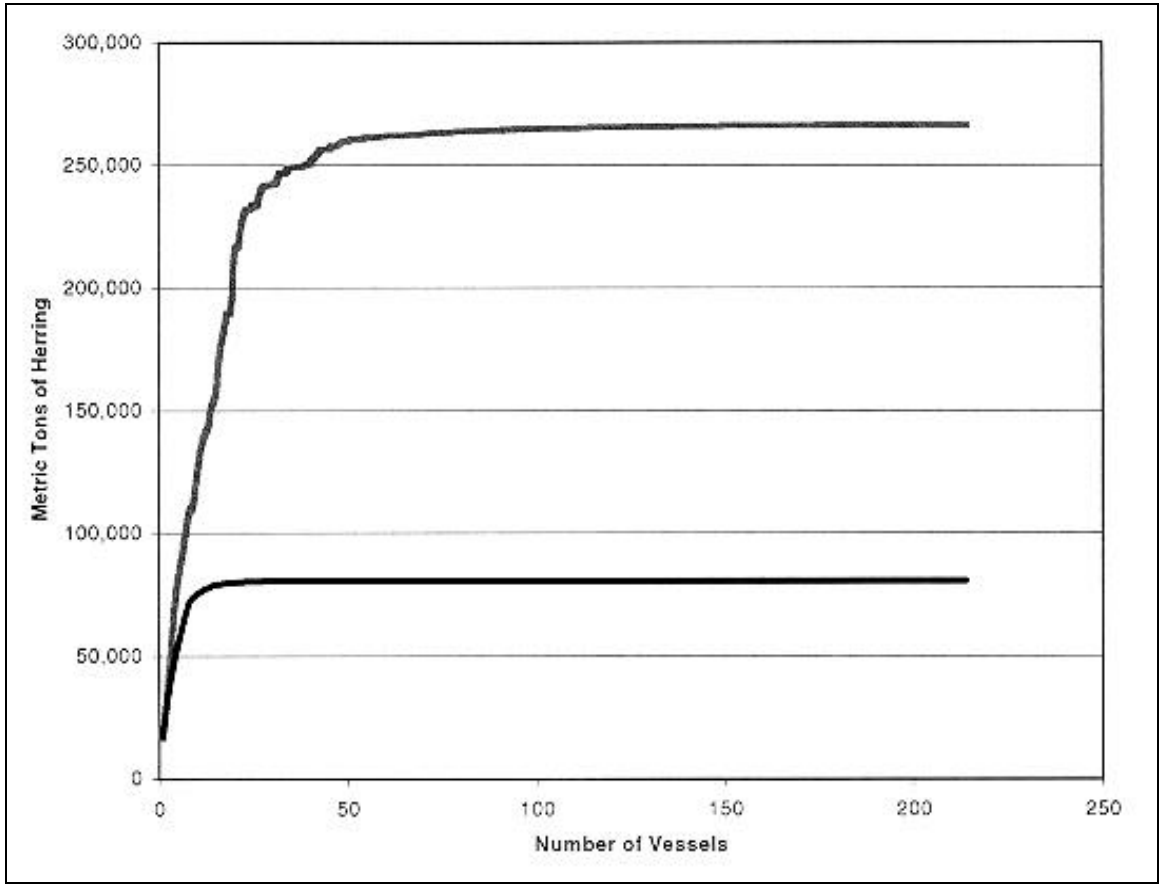


Figure E.15- Potential harvest of vessels that landed herring in 1996. Bottom line represents actual 1996 catch. Top line represents possible catch if all vessels fished the same number of trips as the vessel that made the most trips. (Source NMFS landings data)

E.6.4.2.4 Ports

In order to examine the importance of herring landings to different ports, data from the vessel logbook database and the Maine DMR database were examined. These data provide different (generally, higher) estimates of landings in various ports than the dealer weighout database. In some instances, state totals generated from these databases differ from the state totals in Table E.12.

The major states for herring landings are Maine, Massachusetts, and Rhode Island. Landings in other states were less than 1 percent of the total herring landings in 1996 and 1997, and less than 6 percent of total landings in 1995. Almost 30 percent of total herring landings in 1997 were made in Rockland, ME. The second highest landing port was Gloucester, MA, which accounted for almost all the landings in Massachusetts. The third ranking port was Portland, ME. No other port received more than 15 percent of the total landings. Landings in the state of Maine accounted for nearly 55 percent of the total landings in 1997. Rhode Island landings in 1997 were almost equally distributed among three different ports (Table E.23).

Because herring is a large volume fishery, the weight of herring landings tends to dominate the total weight of all fisheries landings in each of the ports. Rockland, ME and Portsmouth, RI are the two ports most dependent on herring landings and revenues. In both these ports, the landings of herring were more than 90 percent, by weight, of all landings, and the value of these landings was more than 50 percent of the value of all landings. Rockland in particular shows a growing dependence on herring revenues; in 1995, herring accounted for only 32% of landings revenues while in 1997 it had increased to 52.7% of revenues. Herring revenues accounted for about one-fifth of the landings revenues in Gloucester, MA in 1995 and 1996, but declined to about 10 percent in 1997 at the same time that the landed weight remained nearly constant. While herring revenues are important in individual ports, the value of these landings is a small part of the overall fisheries revenues for the three states (Table E.24).

Herring landings can be expected to increase in importance for most of these ports. Increased fishing restrictions in the Gulf of Maine for both groundfish and shrimp can be expected to result in reduced landings of these higher value species. In the near future, herring revenues may assume increased importance for all of these ports.

State	Port	Herring landings (mt)			Percent of total landings		
		1995	**1996**	**1997**	**1995**	**1996**	**1997**
Maine	Portland	16,072	17,682	13,988	22.6%	16.4%	14.4%
	Rockland	13,789	22,817	29,054	19.4%	21.2%	29.8%
	Belfast	3,212			4.5%		
	Cundys Harbor			1,645			1.7%
	Prospect Harbor			3,508			3.6%
	New Harbor			1,070			1.1%
	All Maine ports	35,500	58,249	53,321	49.9%	54.1%	54.7%
Massachusetts	Gloucester	14,449	22,382	21,437	20.3%	20.8%	22.0%
	New Bedford		2,081	1,634		1.9%	1.7%
	All Massachusetts Ports	18,979	26,979	23,072	26.7%	25.1%	23.7%
Rhode Island	Point Judith	9,922	5,568	8,181	13.9%	5.2%	8.4%
	Portsmouth	856	2,607	2,709	1.2%	2.4%	2.8%
	North Kingstown		12,748	8,306		11.8%	8.5%
	All Rhode Island Ports	13,054	22,094	20,481	18.4%	20.5%	21.0%
Total (mt)		71,139	107,574	97,422			

Table E.23 - Herring landings by major port, 1995 - 1997 (The other states that had herring landings (CT, NH, NJ, NY, NC, and VA) had less than 1% of total landings)

State	Port	Percent of weight of all species landed in port			Percent of value of all species landed in port		
		1995	1996	1997	1995	1996	1997
Maine	Portland	60.7%	55.2%	45.4%	5.3%	6.0%	4.3%
	Rockland	68.5%	95.7%	94.0%	32.0%	50.3%	52.7%
	All Maine ports	32.1%	51.2%	44.7%	1.7%	3.1%	2.6%
Massachusetts	Gloucester	52.2%	66.8%	60.1%	20.3%	20.8%	10.1%
	New Bedford		6.7%	5.5%		1.9%	0.2%
	All Massachusetts Ports	22.3%	25.1%	27.1%	26.7%	25.1%	1.5%
Rhode Island	Point Judith	13.9%	5.2%	26.1%	13.9%	5.2%	2.3%
	Portsmouth	1.2%	2.4%	96.4%	1.2%	2.4%	61.2%
	North Kingstown		11.8%	43.9%		11.8%	7.7%
	All Rhode Island Ports	18.4%	20.4%	34.3%	18.4%	20.5%	3.0%

Table E.24 - Herring landings as a percent of total landings and as a percent of total value of all landings in a port, 1995-1997

E.6.4.2.5 Other fisheries

Atlantic herring are also caught as an incidental catch in the coastal bottom trawl fishery and either landed as bait or discarded at sea. The incidental catch ratios reported by observers on bottom trawl trips are relatively low. Some whiting fishermen target herring for a limited number of trips each year. A review of data from the observer/sea sampler database provides estimates of the amount of bycatch in the shrimp fishery (Table E.25). Ratios vary depending on the area fished and time of year. An estimation of the total incidental catch based on these catch ratios is contained in section E.7.2.5.2.

Herring is also caught in the mackerel mid-water trawl fishery. A review of 1996 and 1997 vessel trip report data from vessels that reported both herring and mackerel catches shows that there are occasionally trips landing large amounts of both species. There is limited observer data on this mid-water trawl fishery to document the extent of discards of herring in this fishery. Vessels targeting herring also land some mackerel. Because mackerel is a higher value fish, it is unlikely there are significant discards of mackerel in the herring fishery.

Statistical Areas	January	February	March	April	May	December
0		.0037				
511		.0000				
512	.0000	.0012	.0052			
513	.0427	.0085	.0244	.0662	.0059	
514	.1436	.0204	.0243	.0502	.0020	.2482
521	3.2970	.0263	.1717			
538			.0661			
(blank)	.0412		.0029	.0639	.0050	.0705
Total	.0680	.0092	.0269	81	31	117
Observed Hauls	285	215	261			

Table E.25 - Herring bycatch ratios in the shrimp fishery (NMFS sea sampler/observer database)

Trips That Reported 10,000 lbs or more of Mackerel			Trips That Reported 10,000 lbs or more of Herring		
Herring	*Frequency*	*Cumulative %*	*Mackerel*	*Frequency*	*Cumulative %*
0	0	0%	0	0	0%
1000	2	5%	1000	3	6%
5000	1	8%	5000	10	26%
10000	3	15%	10000	4	34%
20000	1	18%	20000	7	48%
40000	7	36%	40000	5	58%
60000	6	51%	60000	6	70%
80000	7	69%	80000	4	78%
100000	5	82%	100000	4	86%
120000	5	95%	120000	0	86%
140000	0	95%	140000	0	86%
160000	0	95%	160000	2	90%
More	2	100%	More	5	100%

Table E.26. - Summary of trips landing herring and mackerel, 1996 (NMFS VTR)

Trips That Reported 10,000 lbs or more of Mackerel			Trips That Reported 10,000 lbs or more of Herring		
Herring	*Frequency*	*Cumulative %*	*Mackerel*	*Frequency*	*Cumulative %*
0	0	0%	0	0	0%
1000	2	6%	1000	4	12%
5000	0	6%	5000	1	15%
10000	5	22%	10000	4	26%
20000	2	28%	20000	4	38%
40000	9	56%	40000	5	53%
60000	4	69%	60000	7	74%
80000	3	78%	80000	1	76%
100000	4	91%	100000	2	82%
120000	0	91%	120000	2	88%
140000	0	91%	140000	0	88%
160000	1	94%	160000	1	91%
More	2	100%	More	3	100%

Table E.27 - Summary of trips landing herring and mackerel, 1997 (NMFS VTR)

E.6.4.2.6 Bycatch

The Sustainable Fisheries Act established National Standard 9, which requires that "conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch." "Bycatch" means fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic and regulatory discards. This definition differs from the traditional use of the term "bycatch", which many used to mean fish which are caught incidental to fishing for another species, whether or not those fish were retained for use. For commercial vessels, the current definition does not exclude fish that survive after being discarded. This section will summarize the limited information available on fish bycatch in the herring fisheries. Information on marine mammal and endangered species bycatch is discussed in section E.6.3.3.

At the request of the Council, the NEFSC analyzed data contained in the sea sampler/observer database to address four issues questions:

- Herring bycatch in all other fisheries
- Multispecies bycatch in the herring fisheries
- Marine mammal bycatch in the herring fishery
- Marine mammal bycatch in other midwater trawl fisheries.

The full NEFSC reply is contained in Appendix II. The NEFSC noted that the observer trips had not been examined to determine if they accurately characterized each fishery. The NEFSC identified only seven hauls using mid-water gear that targeted herring in 1995. The largest bycatch—none of which was retained—was spiny dogfish and silver hake. There was also a considerable discard of herring. Table E.28 summarizes this information.

In 1997, the Maine Department of Marine resources contracted for observer coverage of the herring fishery (Stevenson and Scully 1999). The complete report is in Appendix III. A total of 50 trips were made aboard eight different vessels. Trips were divided between purse seiners (23) and mid-water trawlers (27) either working singly (16) or in pairs (11), and were made to 21 different fishing locations, primarily in coastal Gulf of Maine waters. Table E.29 lists the bycatch species and quantities observed, by gear type. With the exception of spiny dogfish and mackerel, most bycatch was of small quantities on a number of different trips.

Most of the discards of spiny dogfish were observed in eleven haulbacks on six fishing trips. Five haulbacks using mid-water gear (including paired mid-water gear) averaged less than 80 pounds of dogfish per haulback, out of a total of 32 observed mid-water gear haulbacks. These catches were taken from a wide area, ranging from Seguin Island to Ipswich Bay. Six observed instances of observed dogfish incidental catch were using purse seine gear. One of these haulbacks contained 50,000 pounds of dogfish, a second contained 20,000 pounds, three other haulbacks averaged averaged about 1,500 pounds, and the final haulback consisted of only 50 pounds of dogfish. The large catches were made in August in the vicinity of Mt. Desert Rock. A total of 36 purse seine haulbacks were observed.

The review of the sea-sampling and observer database conducted by the NEFSC (see Appendix II) identified only one instance of dogfish discards. This is likely due to the limited observer coverage in the herring fishery. A review of dogfish discard mortality conducted during SAW 26 (NEFSC 1998c) focused on discards using bottom otter trawl and gillnet gear. While there was limited information available to base estimates of discard mortality, SAW 26 advised that estimates of 50% for discard mortality in bottom trawls, and 75% for discard mortality in gillnets, were reasonable. In the instances of purse seine incidental catches, the presence of large amounts of dogfish in the seine prevented the vessels from pumping herring. When the vessel operator recognizes this problem, the seine can be "slipped" and the catch released. Under these circumstances, the mortality of dogfish would be expected to be lower than the estimates for trawl or gillnet gear.

The majority of the mackerel bycatch was observed in the mid-water trawl fishery on Georges Bank or Cultivator Shoals. About 70,000 pounds of mackerel incidental catches were taken in June and July 1998. An additional 18,000 pounds was taken by mid-water trawlers in the winter fishery off Rhode Island. Most of the observed bycatch of bluefin tuna and all of the striped striped bass occurred in a series of mid-water trawl haulbacks made on the same day in the vicinity of the Great South Channel in October 1997. Two purse seine haulbacks also caught smaller amounts of bluefin tuna. In one instance, 11 bluefin tuna were released alive after being caught in a mid-water trawl net, apparently as it was being hauled back.

The Maine observer trips also recorded information on the quantity of herring discards, including the reasons for those discards, by gear type. These discards meet the current M-SFCMA definition of bycatch whether the herring survives or not. Based on these observed trips, the total amount of herring discarded for all gear types was nine percent of the herring caught. There was some variability across gear types, however, as discards in the trawl fisheries were less than one percent of the catch, while in the purse seine fishery it was 15.4 percent of the catch. The most common reason for discarding herring, and the greatest quantity discarded, was that the vessel was filled. Table E.30 summarizes these observations.

Within the purse seine fishery, herring released from the seine before pumping may survive. "Herring were caught, but not brought aboard, during 14 purse seine trips (16 sets) and 7 mid-water trawl trips (8 tows), or during 32% of all seine sets and 15% of all trawl tows" (Stevenson and Scully 1999). Herring discards by seiners reached 13% of the total catch. In some instances, herring also escaped because of problems with the gear. The most common reason why herring was discarded was because the vessel was too full to take any more on board. In one instance, 50,000 lbs of juvenile fish were released because they had no market value. Estimates of survival made at the time of release are not considered reliable because if herring suffer significant scale loss, long-term survival is unlikely (Stevenson and Scully 1999). Survival would seem to depend on the extent to which the seine is "dried up" before the herring are released. There are no studies available that document the survival rates of herring caught in purse seines, but Lockwood et al. (1983) estimated mortality of 50-90% for mackerel in a simulated purse seine experiment. To the extent herring released from a seine survive, this fishing method may reduce the mortality of bycatch as mandated by the Sustainable Fisheries Act. Discards only accounted for 1% of the trawl catch.

These limited observations do not cover all fishing seasons or all fishing areas and may not be truly representative of bycatch in the herring fishery. They are, however, comparable to a study of discard practices in the Irish Celtic Sea herring fishery during the 1994/1995 fishing season. The vessels in the study were paired mid-water trawlers of 21 to 25 meters in length. This study observed a discard rate for herring of 4.7%. As with observations in the Maine study, one of the major reasons for the discard of herring was due to market considerations. In the case of the Irish fishery, the primary reason for discards was due to a low roe content (Berrow et al. 1998). Bycatch of other species in this fishery was also small – 99.5% of the catch (by weight) was herring.

The NEFSC also examined its databases for information on herring bycatch in other fisheries. Because of more thorough observer coverage, the NEFSC was able to provide tables showing bycatch ratios for other gear types by month and statistical area. For bottom trawl gear, observed herring catches in other fisheries was less than ten percent of the amount of fish landed (on an annual basis) in all statistical areas except 539, 611, 612, 613, 615, and 625. In these areas, catch to landings ratios exceeded 15 percent on an annual basis, usually due to high ratios in several winter months. Observed catch to landings ratios also exceeded 10 percent in statistical areas 513 and 514 during the months of August and September. Bycatch ratios in the shrimp fishery are shown in Table E.25. The information provided by the NEFSC was used to estimate incidental catches of herring in other fisheries in order to evaluate the 5% TAC set-aside. This analysis is in section E.7.2.5.2.

Species	Discarded	Retained	Total
Bluefish	1	73	74
Atl. Herring	120,150	281,000	401,150
Lumpfish	5		5
Mackerel	10		10
Spiny Dogfish	253		253
Silver Hake	450		450
Illex Squid	17		17
Total	120,886	281,073	401,959

Table E.28 - Catch of other species for mid-water trawl gear targeting herring in 1995 (pounds) (NMFS Sea sampler/observer database)

Species	Seine	Trawl	Total
Atlantic Cod		19	19
Atlantic Mackerel	1,052	98,171	99,223
Atlantic Menhaden		50	50
Blue Shark, Round		310	310
Bluefin Tuna, Round	700	2,770	3,470
Blueback Herring		7,319	7,319
Bluefish	250	312	562
Butterfish		427	427
Harbor Seal		300	300
Longhorn Sculpin	2	8	10
Lumpfish	10	17	27
Mako Shark, round	25	199	224
Monkfish		37	37
Ocean Pout		16	16
Pollock		168	168
Porbeagle Shark		70	70
Scup		1	1
Sea Raven		4	4
Sea Robin		3	3
Illex squid	289	497	786
Silver Hake		2,224	2,224
Skate	2	1	3
Spiny Dogfish	75,050	3,837	78,887
Striped Bass		850	850
Thresher Shark		250	250
Torpedo ray		40	40
White Hake		11	11
Winter Flounder		1	1
Total	77,380	117,910	195,290

Table E.29 - Bycatch species (pounds) observed during observer trips funded by Maine DMR, 1997 (Maine DMR)

Gear Type		No market value	Gear damage prevented capture	Vessel filled	Pump clogged or other malfunc-tion	Not enough to pump	Gear Malfunction, fish escaped	Retained (trips without discards)	Total Catches (pounds)
Mid-water	Discards			19,360	4,000	22,520			45,880
	Retained			433,770	100,000	325,000		1,596,148	2,454,918
Pair trawl	Discards		100			4000			4,100
	Retained		140,000					1,845,000	1,985,000
Purse Seine	Discards	50,000	105,000	456,000	20,000	1,000	102,000		734,000
	Retained	40,000	235,000	1,425,000	200,000	400	230,000	1,139,000	3,269,400
Total	Discards	50,000	105,100	475,360	24,000	27,520	102,000		783,980
	Retained	40,000	375,000	1,858,770	300,000	325,400	230,000	4,580,148	7,709,318

Table E.30 - Observed herring catches (pounds), retained and discarded, on trips with herring discards, 1997 – 1998 (Stevenson and Scully 1999)

E.6.4.3 Herring Processing Sector

Herring fishermen sell their fish into both domestic and international markets. The vast majority of the catch, however, supports the domestic bait market and the sardine canneries. In recent years there has been little success in selling herring fillets into the international market for frozen fillets, though this has been an important product in the past.

Because of the large volume of herring that are landed, catches are offloaded via pumps that are either mounted shoreside or on the vessel. The herring is typically pumped into trucks that carry a combined mixture of herring and water, but are not cooled in any manner. For this reason, it is important the fish be landed soon after they are caught and transported as rapidly as possible. The typical truck is estimated to hold about 40,000 pounds (or just under 20 mt) of herring. Each boat may unload to a number of trucks that are owned by different herring dealers. Some small bait dealers may use smaller trucks or plastic containers to receive the herring. The herring are then shipped to the bait dealer, cannery, or processor that will use and sell the product. Some boats may unload herring at several different locations to a number of lobster cooperatives or other dealers. Small bottom trawl vessels that target herring at certain times of the year may sell herring directly to lobster or tuna boats, either at the dock or at-sea. When herring are plentiful, one of the key problems facing fishermen is to obtain, and retain, a ready market for their fish. The introduction of IWP's, discussed below, was in part a response to find an additional market for herring fishermen. Many fishermen do not leave the pier without knowing who will buy their fish and how much they should deliver.

E.6.4.3.1 Domestic Processors

The two major domestic processing markets for Atlantic herring are the sardine canneries and the bait market. At times, U. S. herring have also successfully competed in the foreign frozen fillet market to the European and foreign markets, but the last time this market was significant was in 1982. Herring are processed as canned products in five packing plants, sold as bait (either as whole fish or cuttings left over after canning), or sold whole to foreign processing ships (IWP operations), where they are frozen or brined for transport. There is currently no domestic market for whole fresh fish or fillets, and only limited international trade in these products (see section E.6.4.3.3). A few adult herring are smoked or pickled as specialty products and some are sold as food or pet food. No herring have been reduced to fish meal or oil in the U.S. since the closing of a reduction plant in Rockland, Maine in 1989, but some herring is shipped to Canada to be processed into these products.

The current primary use of herring is as bait for the lobster, tuna, and various long-line fisheries. The size of the bait market for herring is uncertain. Some herring landed in Maine is used for bait in Massachusetts and New Hampshire, and in the southern New England and mid-Atlantic region lobster and blue crab fisheries. The lack of a comprehensive dealer reporting system, as well as the transfer of bait directly over the side from harvesters to users, makes estimates of market size difficult. Reported bait landings varied between 10,000 and 15,000 mt during 1989-92. Reported bait landings of menhaden, which is substituted for herring when herring is not available, were roughly 7,000 mt in 1991. Maine

DMR (1997) estimated that 31,755 mt of the herring landed in Maine in 1996 was used for bait, an increase of more than 8,000 mt from the previous year. This only available estimate links the bait market to landings in a particular state. Most observers believe that at least 50,000 – 70,000 mt was used in the bait market in 1996 and 1997, with an estimated value of $15.6 million. Some observers believe that unreported landings and sales to this market may in fact be much higher. Especially in Maine, herring bait is critical to full and part time lobster fishermen (Dyer and Poggie, 1998). The increase in the number of lobster traps in the last four years, coupled with the lack of availability of an alternative bait, may help explain the rise in domestic herring landings. The demand for lobster bait in the summer and early fall mirrors the increased landings of herring during this same period. Comparisons of New England lobster landings with New England Atlantic herring landings for the period 1993 through 1997 reflect the link between these two fisheries (Figure E.16).

The Maine sardine industry dates back to the late nineteenth century. The first canneries were built when American importers, familiar with imported French sardines made from pilchards, began searching for a fish caught in the U. S. that could be similarly canned. Experiments with menhaden proved less than satisfactory. After much experimentation with herring, the industry developed a successful product marketed as sardines. In 1875, about two or three hundred cases were processed (Earll, p. 163). Prior to 1880, the industry was limited to Eastport, Maine, but it then began to expand to other cities in the vicinity. In 1950, 46 plants packed over 3.8 million cases worth $21.2 million. After 1950, the number of canneries declined until only five remained in 1997. The amount packed declined to under one million cases during the 1980's, but recently climbed over this mark for the first time since 1982. The amount of herring used by the canneries has remained stable at 30-35,000 mt for the past five years (Maine DMR, 1997).

An economic of the Maine sardine industry was conducted in 1982 (Hu et al. 1983). At the time of this review, 14 plants were operating in Maine, providing employment for 1,176 processing workers in 1980. The industry contributed $66 million to the Maine economy in 1980, about one third of the total estimated income contributed by the seafood processing industry to the state. Hu et al. found that the 14 existing plants were operating under extremely low profit margins—particularly the smaller plants (less than 50 employees and 50,000 to 100,000 cases packed annually). Small plants were pressured by increased costs for materials (particularly cans) and increased maintenance costs from operating older plants.

An updated economic study of the sardine industry was conducted in late 1997 (Reiling and Bennett 1998). Reiling and Bennett focused on the five remaining sardine-packing plants, owned by three separate companies. In 1996, more herring was packed by these three companies, and one company that closed, than in any year since 1981. 74% of the pack was sardines, the remainder herring steaks. As much as 40% of the herring purchased by sardine packers in 1996 was sold a lobster bait. The domestic market for sardines has remained unchanged for the past ten years. The report estimated that the packers could double their existing production given a steady supply of herring and increased market demand. Reiling and Bennett also estimated the economic impact of the canneries; this information is discussed in later sections.

The total production of six packing plants operating in Maine in 1996 was 1,022,621 standard cases (35,380 mt) with a wholesale value of $51.1 million (Table E.31). Of the total production of sardines, steaks, and kippers in 1996, 47% was supplied by domestic Maine landings. The remainder was trucked to Maine plants from other states (42%), mostly from Massachusetts, or from Canada (11%). In addition to canned product, the canneries are also participants in the bait market. Herring "cuttings", produced when large herring are canned as steaks, are sold to the bait market. In addition, some of the herring that arrives at the canneries is not suitable for canning and is diverted to the bait or other markets.

Maine canneries use both domestic and Canadian harvested herring. The movement of herring in both directions across the border has been an important factor in the Maine sardine industry since the industry began. In early years, the movement was primarily of fish caught in Canadian waters taken to canneries in downeast Maine. The application of customs duties was an issue, as the levying of tariffs made it uneconomical to use the Canadian fish in U. S. canneries. In the 1880's, a favorable decision by the U. S. Customs treated any fish carried across the border in vessels of less than five net tons as being “trucked” across the border and not subject to duties. In addition, the building of Canadian canneries resulted in herring moving across the border in both directions (Earll 1887). By the 1970’s, there were periods when most of the product used in U. S. canneries came from Canadian waters—in 1970, 70 percent of the sardines canned in Maine were caught in Canada (Hu et al. 1983). In years when the supply of juveniles is higher in New Brunswick, imports from Canada have accounted for 50% of the production by Maine plants (e.g. 1988 and 1990); at other times, Maine has exported a surplus to Canadian plants (most recently in 1980 and 1981) (NEFMC 1978; Maine DMR 1997). Herring is also trucked into Canada from other New England ports.

A limited amount of herring is processed as meal (usually waste cuttings from some other primary use), or sold to zoos and aquariums as animal feed. Preferred herring for zoo feed are fillet sized herring that are firm and high in fat content. The price for zoo feed can be as high as $0.17/lb. There have also been attempts to break into the food market with other value added products. The Gloucester Fishermen's Wives Association, for example, has developed several value added products (Dyer and Poggie 1998).

While the demand for herring has increased considerably in recent years as indicated by the rise in landings, this has not affected the ex-vessel price received by fisherman. The price has hovered in the range of $0.05 - $0.06 per pound. Of the two primary markets, the sardine canneries require a higher quality herring. Herring cannot be "feedy" or full of spawn for this fishery, and must be delivered to the canneries as fresh as possible. The canneries use herring caught by both mid-water trawlers and seiners. Part of the challenge facing herring fishermen is finding a market to sell their catch. Particularly in the bait market, it can be difficult to find a buyer when herring are abundant. Many boats do not leave the pier unless they know who they will sell their catch to, and how much is needed. Some in the industry report that in order to guarantee a place to sell their catch, vessels must agree to provide dealers with an occasional "truckload" of herring at no charge.

There is considerable interest in development of additional processing capacity in the herring fishery. One existing processor currently handles about 10,000- 15,000 mt annually and would like to increase to 40,000 – 50,000 mt. Other interests are considering developments that would add 150,000 –200,000 mt capacity to the industry. These developments hinge on finding additional markets for herring products. There may be an opportunity to enter the international food fish market, which will provide another outlet for herring fishermen. To be successful, a reliable source for high quality herring must be found and plants must have the flexibility to process the herring into different products (Dyer and Poggie, 1998).

Table E.31 – Maine canned herring products and packing plants

Year	Standard Cases	Wholesale Value($)	No. of Plants
1950	3,844,164	21,209,033,	46
1951	1,676,764	14,635,352	44
1952	3,530,876	21,507,970	48
1953	2,782,495	16,954,119	44
1954	2,934,933	18,152,815	43
1955	1,268,843	9,333,350	35
1956	2,231,441	16,692,008	39
1957	2,217,688	14,733,259	37
1958	2,099,959	15,873,963	33
1959	1,753,145	14,902,142	31
1960	1,997,618	16,699,987	31
1961	753,647	7,559,619	31
1962	2,144,372	19,931,333	31
1963	1,637,348	13,547,306	27
1964	865,751	7,583,821	23
1965	1,226,903	10,868,060	23
1966	1,332,544	12,261,590	23
1967	1,250,411	13,862,330	23
1968	1,730,306	19,296,978	22
1969	1,042,806	11,531,342	21
1970	806,501	11,226,817	21
1971	950,821	11,796,509	20
1972	1,561,535	23,877,119	18
1973	995,056	15,688,156	17
1974	1,434,801	23,954,640	16
1975	1,248,929	27,998,614	15
1976	1,209,074	29,591,481	15
1977	1,269,955	34,407,778	15
1978	1,301,965	41,167,963	15
1979	1,429,646	49,370,005	14
1980	1,109,883	41,370,210	14
1981	1,468,809	49,433,137	14
1982	1,014,336	40,573,440	13
1983	724,103	26,450,000	12

Table E. 29 (cont.)

Year	Standard Cases	Wholesale Value ($)	No. of Plants
1984	870,179	34,213,000	12
1985	983,651	37,800,000	11
1986	953,194	43,680,696	10
1987	882,178	40,414,536	10
1988	980,826[3]	44,137,170	9
1989	770,224	34,660,080	8
1990	815,758	37,340,886	8
1991	847,319	42,317,602	7
1992	948,792	47,439,600	6
1993	924,298	46,214,900	6
1994	934,686	46,734,300	6
1995	872,924	43,646,200	6
1996	1,022,621	51,131,050	6
1997	891,000	44,550,000	5

1. Data reported as standard cases of 100 cans beginning in 1990 when cans larger than 3¼ oz. were eliminated and value of $50 per case beginning in 1991.
2. Data prior to 1950 available from the Maine Department of Marine Resources.
3. Maine and Massachusetts – Massachusetts with one plant.

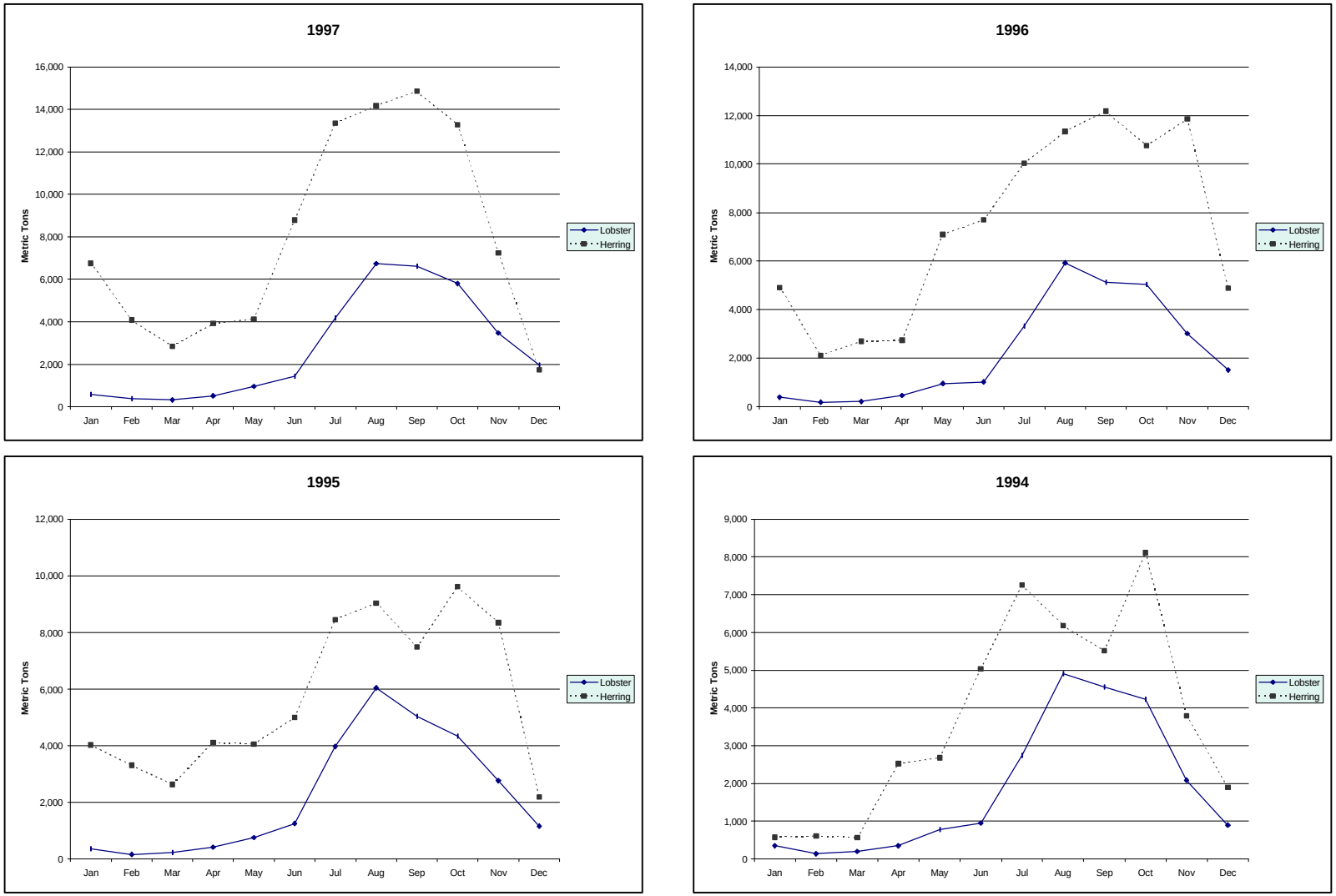


Figure E.16 – Comparison of New England lobster and herring landings, 1994-1997 (Source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division.)

U. S. GOM Catches Processed in Canada (mt)			Reported Herring Catches in SNE
Year	Truck	Boat	Truck
1987	4438	791	
1988	5933	186	
1989	4549	118	
1990	5180	42	
1991	5413	723	
1992	5042	1537	167
1993	1534	976	0
1994	2273	1547	183
1995	3280	2117	3316
1996	4489	3690	6359
1997	102	1280	5546

Table E.32 – Atlantic herring exports to Canada (Source: Maine DMR)

Year	From Canada (mt)	Total (mt)
1991	9,247	33,281
1992	11,742	35,335
1993	8,200	31,799
1994	7,054	32,874
1995	2,804	29,788
1996	3,777	35,380
1997	4,687	27,161

Table E.33 – Herring used by Maine sardine canneries (Source: Maine DMR)

E.6.4.3.1.1 Estimate of DAP

DAP is defined as the amount of the U.S. harvest that domestic processors will use, combined with the amount of the resource that will be sold as fresh fish. The ability to estimate DAP is complicated by poor information on the amount of herring being sold as bait (caught in both the US and Canada) and a lack of detailed information on plans of domestic processors. Improved reporting of vessel landings and dealer purchases after adoption of the plan should facilitate better estimates in the future. Information from various sources was used to estimate actual harvest and use of herring in 1994 through 1997.

	1994	**1995**	**1996**	**1997**
U.S. Landings	54,324 mt	76,135 mt	103,663 mt	98,083 mt
IWP	2,849	8,776	10,903	1,000 mt
Total amount processed (DAP)	51,475	67,359	92,760	97,083mt
Sardine canneries	32,874	29,788	35,380	27,162 mt (prelim. est.)
Other uses	18,601	37,571	57,380	69,921 mt
Trucked to Canada	2,456	6,596	10,848	5,546 mt
Boated to Canada	1,547	2,117	3,690	1,280 mt
Canadian herring processed in US canneries	7,054	2,804	3,777	4,687 mt
Canadian herring used as bait in U.S.	Unk	Unk	Unk	Unk

Table E.34 – Summary of recent herring processing estimates

This summary of historic processing performance can be used as a baseline for estimating DAP, but it does not indicate future developments. At various public hearings, sardine industry representatives have stated their canneries are operating at 66 to 80 percent of capacity. In 1996, roughly 35,000 mt of herring were processed by the canneries. For purposes of estimating DAP, the Council assumed 50,000 mt of herring (a 42 per cent increase over 1996) would meet the canneries needs for the foreseeable future. The bait industry is expected to stay at current levels. Reported use of bait is estimated at approximately 70,000 mt, but there are concerns that this number may actually under estimate the actual bait market. For this reason, the herring bait market is estimated at 100,000 mt. During development of the DEIS, various processors indicated an interest in increasing their processing by approximately 30,000 mt. Combining this information results in a DAP of 180,000 mt.

Even though it increases known processing performance by 80%, the Council's estimate of DAP

was questioned as being too low. Supporting this argument was the introduction of a new, moored processing vessel capable of harvesting 20,000 mt in Maine in October, 1998. The freezer/trawlers in the mackerel fishery are also capable of processing herring , should they choose to do so, which would increase processing capacity. While these developments were not explicitly considered when the Council developed its recommendation, all of this capacity fits into the Council's estimated increase of nearly 80,000 mt in DAP from 1997 performance.

E.6.4.3.2 Internal Waters Processing (IWP)

Internal waters processing operations for Atlantic herring began in Massachusetts in1985 (internal waters of a state are shoreward of the baseline used to delineate the territorial sea; they are not the waters between the baseline and the territorial sea limit). The first operation was conducted during the summer by Mayflower International of Gloucester in 1985 and 1986 using an East German processor. In 1985, 1,360 mt of the allocated 3,000 mt were taken, and the operation was considered a success. Unfortunately, 1986 was a disappointment. Only 127 mt of an allocated 2,500 mt (7,500 mt requested) were taken. Poor results were blamed on purse seine breakdowns and fish being unavailable in Massachusetts and adjacent waters.

During 1987 and 1988 there was a lull in IWP activity, with a small IWP harvest in Maine, but nothing in Massachusetts (Table E.36). This lull quickly changed to a frenzy as the demand for IWP permits and allocations grew dramatically from 1989 through 1991, with the emphasis (in Massachusetts) shifting from the summer/fall fishery to the winter/spring.

Three companies used 8,721 mt of 11,500 mt allocated by Massachusetts in 1988-89. An additional 3,500 mt was harvested in Maine during the summer of 1989. A total of 45,000 mt was requested by four applicants. The Commission's Atlantic Herring Section became involved in 1989 and allocated 10,000 mt for the Massachusetts winter fishery and 12,000 mt for Rhode Island (Table E.35). The Massachusetts allocation was taken during January-March 1990 by three companies using four Soviet processors, while only 2,000 mt was processed in Rhode Island.

In 1990-91 and 1991-92, Massachusetts IWP’s were unsuccessful since fish were unavailable. In 1991, there were IWP operations in four states. Reduced allocations in 1990-91 and 1991-92 (including a zero allocation in Maine in 1990) reflected concern for the Gulf of Maine herring resource. With the adoption of a single stock assessment in 1991 indicating that the stock complex was underutilized, IWP allocations increased substantially in subsequent years. IWP operations from 1992 to 1995 were confined to the Maine summer-fall fishery, except for a small operation in New Jersey in 1992 (Table E.35). In 1996, there were IWP operations in three states and in 1997 a single one in Rhode Island that processed 843 mt.

IWPs continue to be an important part of the processing sector. States coordinate the amount of herring allocated to IWPs through the Commission. Generally, the amount of herring allocated to IWPs has been greater than the actual amount taken (Table E.35 and Table E.36). Maine, Massachusetts, Rhode Island, New York, and New Jersey have allowed IWPs in recent years.

IWP landings in Maine peaked at 8,776 mt in 1995. In Massachusetts, IWP landings peaked at 9,673 mt in 1990. Quantities in other states have not exceeded 2,000 mt.

STATE	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
ME	Unk	0	3,500?	25,000	30,000	35,000	16,000	13,000[2]
MA	10,000	5,000	6,000	35,000	42,000	35,000	16,000[1]	8,000[3]
RI	12,000	2,400	3,000	15,000	18,000	15,000	21,600	42,000
NY			2,000	15,000	10,000	15,000	14,400	5,000
NJ			500	10,000		15,000		5,000
TOTAL IWP	22,000?	7,400	15,000?	100,000	100,000	115,000	68,000	73,000
AREA 2 (JVP)							20,000	20,000
AREA 3 (JVP)							20,000	20,000
TOTAL	22,000?	7,400	15,000?	100,000	100,000	115,000	108,000	73,000[4]

Table E.35 - Internal waters and joint venture processing allocations (mt) by state and fishing year, 1989 - 1996 (Source: Maine DMR)

1 = An initial allocation of 10,000 mt was made by MA with 6,000 mt held in reserve
2 = Maine allocated 6,750 mt for calendar year 1996
3 = MA allocated 4,000 mt to each of two companies, providing they diverted a portion of their production to shoreside processors
4 = Allocations for 1996-97 in areas 2 and 3 did not distinguish between IWP and JVP use

State	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
ME			300		3491		2918	3339	6647	2849	8776	3803
MA	1360	127			8748	9673	897					2937
RI						2000	740					4163
NY							1034					
NJ								772				
Total	1360	127	300		12239	11673	5589	4111	6647	2849	8776	10903

Table E.36 - Internal Waters Processing (IWP) landings (mt) by state, 1985-1996. (Source: Maine DMR)

E.6.4.3.3 International Trade

Through imports and exports of food herring products at various market levels, the U. S. herring market and the New England herring industry are linked to the international herring market. This market has historically been characterized by a major concentration of both supply and demand in the European countries and the former U. S. S. R. In 1974, 80 percent of the world catch of herring was taken by fleets from these countries (NEFMC 1978).

World resources of herring are supplied by stocks in the North Pacific and North Atlantic. The share of world supply from the North Atlantic has increased from about 82 percent in 1986 to over 90 percent in 1995. Most Atlantic herring entering the market are caught by European countries in the northeast Atlantic. Major countries landing herring include Norway, Denmark, Sweden, the United Kingdom, Ireland, and the Russian Federation. The percentage of Atlantic herring caught from this area has ranged from 80 to 88 percent of the total Atlantic herring landings between 1986 and 1995 (Table E.37). Canada is the largest producer of herring from the northwest Atlantic, providing about 70 percent of the world catch of Atlantic herring from this area in 1995. This is only about 8 percent of the world's catch of Atlantic herring, however. In 1995, herring from the northwest Atlantic was less than 6 percent of the total world production of all herring.

Catches of herring from the northeast Atlantic are limited by TACs established by the European Community (EC). The EC also negotiates a TAC for North Sea herring with Norway. For 1998, the overall TAC for the EC was set at 2.445 million mt. This is an increase of about 400,000 mt over catches from this area in 1995. The accessibility of the European market to herring from the northwest Atlantic is determined in large measure by the status of European catches. Herring from the eastern Atlantic is generally preferred, as it has a higher fat content. During periods of low harvests in the past, herring from the U.S. and Canada has been able to penetrate this higher value market successfully.

World demand for imported herring in 1996 is illustrated by Table E.38. The five major importers of herring are Germany, the Russian Federation, Japan, Denmark, and the USA (although USA is not listed in Table E.38.). Japanese frozen herring imports are of a higher value than those to other countries because of imports of frozen roe herring from the Pacific. Not all of these markets are available to U.S. suppliers. As can be seen by comparison with Table E.44, several of the major world importers (Denmark, the Netherlands, Poland, Lithuania, Nigeria and Austria) of herring are not among the top ten that import U.S. herring. Particular countries demand that certain product qualities, such as fat content and meat consistency, meet their standards. U.S. caught herring (Atlantic and Pacific) may not be suitable for all markets. The product form groupings in Table E.38 are broad and do not identify particular market niches. Note in Table E.38 inclusion of “Prepared/Preserved Sardines”. Since “sardine” is defined as any small ocean fishes in cans, the “harmonized” codes used to classify imports do not distinguish among species used in making sardines. The herring caught off the Northeast U.S. coast is *Clupea harengus*

(Atlantic Herring) which a major portion is sold as canned sardines. There are currently 22 other species sold as canned sardines including *Sardinus pilchardus* (European Pilchard), and *Sprattus sprattus* (Brisling, Sprat).

U. S. imports of all herring products (including inedible pilchard meal) reached a high of over $40 million in 1993, declining to just over $34 million in 1997. By far the largest value of herring imports since 1980 have come from Canada, which averaged $26 million since 1990 (Table E.41). The major products imported from Canada in 1997 included fresh herring (6,519 mt worth $2.8 million) and salted herring (3,137 mt worth $2.6 million). Other major sources for imports since 1980 include Iceland, Germany, Norway, Sweden and Finland for edible products, and Chile and Peru for inedible pilchard meal.

U. S. exports of all herring products (both Pacific and Atlantic herring) peaked at $116.8 million in 1985, and were just over $68 million in 1997 (Table E.42 through Table E.44). By far the greatest value per metric ton in exported herring is for roe from the various West Coast roe fisheries. The largest volume of exported herring is frozen. Major markets for U. S. herring products include Japan, South Korea and Canada. Herring fillets and steaks were a substantial part of exports in the early 1980's, but declined over the next ten years with the exception of 1988. The international market for New England herring products are limited by the low fat content, averaging 5-6 percent over the course of the year (Dyer and Poggie, 1998).

Census data combines both Atlantic and Pacific herring, making it difficult to identify exports of Atlantic herring from the east coast fishery. Table E.45 lists exports of herring from all customs districts in the U.S. since herring caught in the Northeast can be exported from any district. Table E.45 is based on data supplied by U.S. Bureau of the Census. However, there appear to be some inaccuracies. It is unlikely that the large amounts of fresh herring reportedly going to Egypt, Japan, Nigeria, Russia, and the United Kingdom was fresh and not frozen. The reported amount of fresh herring exported to Canada may also be inaccurate. As in Table E.38 the category “Prepared/Preserved Sardines” is included in Table E.45. Since Maine is the major producer of canned sardines in the U.S., the export quantities and value represent what occurred in the Northeast for this product form. There may be small amounts of canned sardines produced in California included in these export numbers.

The Department of Resource Economics and Policy at the University of Maine in Orono did an economic evaluation of the Maine Sardine Industry (Reiling and Bennett, 1998). In their paper they discuss the issue of two-way trade in round herring with Canada. This issue is discussed below and the two-way trade with Canada section from the University of Maine report is included.

E.6.4.3.3.1 Two-Way Trade in Round Herring with Canada

The official Census data on imports of fresh and frozen herring from Canada to Northeast U.S. Customs districts is shown in Table E.46. Imports in 1996 and 1997 (combined) of fresh herring totaled over 8,600 mt worth approximately $1.5 million. By contrast, imports of all other herring

products except for frozen herring totaled nearly 18,000 mt worth over $30 million in these two years.

While this data was obtained from the international trade database maintained by NMFS, the estimates in these tables for shipments of herring to Canada may be in error. Historically, there has been an extensive trade in herring between the northeastern U. S. and Canada which has benefited both countries. This trade has been used by the industry on both sides of the border to smooth out fluctuations in the supply of herring for both the sardine canneries and the bait market. From 1972 through 1976, for example, imports of Canadian herring provided over 50 percent of the raw material for Maine sardine canneries (NEFMC 1978). The trade occurs both via truck and vessel. In 1996, the M-SFMCA was amended to allow NMFS to issue permits to up to fourteen Canadian vessels to load herring from U. S. vessels and transport it to Canada. U. S. caught herring is also transported to Canada by truck. The Maine Department of Marine Resources monitors the levels of this trade. Quantities exported by both methods in recent years are provided below. There are significant discrepancies between these statistics and those contained in the international trade database maintained by NMFS, which relies on Canadian import data to estimate U.S. exports. As can be seen by comparing Table E.46 and Table E.47, there is a significant trade in fresh herring by both truck and Canadian herring carrier that is not documented in the international trade database. The following discussion of two-way trade with Canada is from the University of Maine report (used with the permission of the authors). Note that the figures for Table 4 (in the University of Maine report) differ from those provided in Table E.47 for 1995 and 1996.

Begin section of University of Maine report

> "The appearance of juvenile herring in Maine coastal waters is highly variable and unpredictable. This unpredictability has caused shortages of herring for some Maine processing plants while providing an overabundant supply to processing plants in Canada and visa-versa. The two-way trade of whole herring between Maine and Canada has helped to maximize the utilization of the herring resource by allowing herring to be transported from regions where processing capacity is insufficient to regions where processing capacity is underutilized.
>
> The Maine and Canadian herring processing industries depend heavily on the trade of whole herring between their borders. To help ensure that fresh herring is available to sardine processors in both countries, tariffs on unprocessed herring were dropped in both countries many years ago. Maine canneries received approximately 48% of their herring supply from Canadian fishermen in 1988 and 1990 while Canadian canneries imported approximately 8% in those years and 25% in 1996. These fluctuations in the percentage of Canadian herring processed in Maine are caused by the changing availability of herring on both the Maine and Canadian fishing grounds.
>
> The following two tables are derived from 1996 Maine Herring Fishery Statistics supplied by the Maine DMR and data supplied by Connors Bros. Ltd. Of New

Brunswick Canada (Connors, 1998). The first table depicts the metric tons of herring imported to Maine for processing while the second table depicts the metric tons of herring exported from Maine and Southern New England to Connors Bros. for processing.

Table 3, shows the amounts of herring landed in Maine, imported to Maine from other states and Canada, and the percentage of Canadian herring used to make sardines, steaks and kippers in Maine from 1987 to 1996. The table is derived from 1996 Maine DMR Herring Fishery Statistics and shows how the percentage of Canadian herring transported to Maine has varied over the period from 1987 to 1996. The percentage of Canadian herring used for processing in Maine was close to 50% in 1988, and 1990. The average percentage of Canadian herring used for processing in Maine was 28.9% over the ten-year period and nearly 11% in 1996. Our study indicated that in 1996, Maine packers imported more than 95% of the small herring used to pack sardines in 7-12 pack cans.

Table 3. Sources of Herring Processed in Maine to make sardines, steaks and kippers. (thousand metric tons)

Year	Imported From other States	Landed in Maine	Imported from Canada	Percent Imported from Canada
1987	10.6	12.2	11.3	33.2
1988	9.0	8.5	16.0	47.8
1989	5.5	5.1	4.8	31.2
1990	7.7	6.8	13.5	48.3
1991	10.2	13.9	9.2	27.8
1992	9.1	14.5	11.7	33.2
1993	5.7	17.9	8.2	25.8
1994	8.2	17.6	7.1	21.5
1995	11.2	15.8	2.8	9.4
1996	14.8	16.7	3.8	10.7
10 year average				28.9

Canadian processors also depend on the two-way herring trade. Table 4 shows the metric tons of herring imported by Connors of New Brunswick from Maine and Southern New England and the percentage of production those imports represented for Connors from 1987 to 1996. Connors imported the highest percentages of herring; 18.6% in 1995 and 25.1% in 1996. The average percentage of imported herring used over the ten year period was 11.4%.

Table 4. Sources of Herring Imported by Connors Bros. Ltd. Of Canada (thousand metric tons)

Year	Imported from Gulf of Maine	Imported from Southern New England	Percent imported from Gulf of Maine and Southern New England
1987	5.2	0	8.4
1988	6.1	0	8.5
1989	4.7	0	8.9
1990	5.2	0	7.6
1991	5.8	0.3	12.9
1992	6.6	0	10.7
1993	2.5	0	4.8
1994	3.8	0.2	8.2
1995	2.6	6.1	18.6
1996	4.6	7.2	25.1
10 Year Average			11.4

We have also quantified the importance of the Maine Canadian trade in herring with data purchased from the U.S. Department of Commerce, Bureau of the Census. The Bureau of the Census provided statistics on fresh or chilled herring imported from and exported to Canada through the customs district of Portland, Maine in the years 1989 through 1996. The census data varied widely from data supplied by the Maine DMR and Connors Bros. of New Brunswick.

The census data on imports (Table 5) from Canada appear to be similar to the import data supplied by the Maine DMR but the census data on exports to Canada appears to be consistently less than that supplied by the Maine DMR.

It is beyond the scope of this study to reconcile or explain the difference in export data to Canada provided by the two sources."

Table 5. Comparison of Herring Import and Export Data (thousand metric tons)

Year	Imported from Canada		Exported to Canada	
	Maine (DMR) Data	U.S. Census Data	Connors of New Brunswick Data	U.S. Census Data
1989	4.8	10.7	4.7	0.24
1990	13.5	11.9	5.2	0.01
1991	9.2	8.2	5.8	0.03
1992	11.7	7.2	6.6	0.01
1993	8.2	7.1	2.5	0.01
1994	7.1	6.2	3.8	0.02
1995	2.8	2.9	2.6	0.03
1996	3.8	3.7	4.6	0.20

End section of University of Maine report

In addition to the trade in fresh/frozen/preserved herring products, exports and value of canned sardine exports are listed in Table E.48. Exports have remained relatively constant since 1991, in the range of 10-12 million pounds worth approximately $10 million. This is a significant increase from the 1.8 million pounds in exports in 1980 (Hu et al. 1983). The major markets for these sardines are in Canada and the Caribbean (Reiling and Bennett, 1998). Sardine imports (Table E.49) have declined in recent years from a high of over 65 million pounds in 1987 to 41 million pounds in 1996.

E.6.4.3.3.2 International Markets for Various Product Types

Canned Sardines
Prior to 1988 exports of canned sardine products from the US were relatively small compared to the levels of activity from 1988 to 1997 (Table E.48). Table E.44 shows the variety of countries that were importing canned sardines from the U.S. in 1996 and 1997. The largest importer is Canada because favorable tariffs/duties induce processors to export product to consuming countries through Canada. There were 40 countries importing U.S. canned sardines in 1996 and 1997 largely in countries of the Caribbean, Central America, and Pacific Rim. Much of the demand is for an inexpensive source of protein in protein poor equatorial countries.

The European market for canned sardines is essentially closed to northeast U.S. canned product because of restrictions placed on the species that can be imported as sardines. Many European countries only allow *Sardinus Pilchardus* (European Pilchard) to be imported as sardines. The U.S. is lobbying European governments to remove this restriction.

Approximately 40% of what enters the canning plants is eventually sold to the bait market. Product sold in the bait market is generally cuttings or sizes of fish not suitable for canning. The

other 60% is canned as either sardines (two-thirds) or steaks (one-third). The canned steaks are mostly for the U.S. market but some goes to Australia.

Whole Frozen

The frozen herring figures in Table E.45 are exports from both East Coast and West Coast fisheries. The large quantities going to Japan are mostly frozen Pacific roe herring. It is difficult to distinguish exactly which of the other countries are importing Northeast U.S. herring. China, Egypt, Russia, South Korea, and Malaysia were probably importing mostly northeast U.S. herring. As mentioned above, the fresh product listed as exports to Egypt, Japan, Nigeria, Russia, and the United Kingdom was most likely frozen.

The market for whole frozen herring is serviced by both domestic freezers (onshore and offshore) and JVP/IWP operations. Prior to the 1990's onboard canning and packing of herring into barrels was done by Soviet processor vessels through JVP/IWP agreements. After the fall of communism, these operations ceased in U.S. waters. Since that time the focus has been on freezing whole herring at sea. Currently there are International Fisheries Agreements, which is a prerequisite for establishing a JVP or IWP, with Russia, Estonia, Lithuania, Latvia, and Poland. Prior to 1998 the only recent JVP activity in which herring was transferred was in 1990. In1998 three vessels from Estonia (1) and Lithuania (2) came to U.S waters primarily for mackerel but also processed a small amount of herring over a three month period (quantities cannot be reported due to confidentiality concerns). Table E.35 shows what has been allocated to JVP's and IWP's since 1989 and Table E.36 shows the amount of herring taken by just the IWP operations since 1985. There are also domestic shore based and at-sea processors competing for the whole frozen market.

The market for whole frozen herring is determined by size, grade, and fat content. The major countries consuming this product are in the Middle East, West Africa, Asia (primarily China), and to a lesser extent the Baltic States. Nearly all the product, which is usually frozen in 20 kilogram blocks, is for human consumption where the blocks are thawed and sold in shops. It is felt that there are potentially large markets in these areas. Both domestic freezers and companies that arrange for JVP's and IWP's feel there is significant demand for whole frozen herring and plan to further pursue these markets given adequate supply.

Atlantic herring					Pacific herring				Grand Total
Year	**NE Atlantic**	**NW Atlantic**	**Canada**	**Total**	**NE Pacific**	**E. Pacific**	**NW Pacific**	**Total**	
1986	1,308,912	223,305	186,730	1,532,217	68,255	7,551	248,928	324,734	1,856,951
1987	1,306,700	287,195	248,744	1,593,895	85,064	8,355	255,098	348,517	1,942,412
1988	1,403,165	321,002	278,896	1,724,167	84,291	6,927	213,433	304,651	2,028,818
1989	1,365,764	283,865	229,239	1,649,629	85,944	9,199	118,009	213,152	1,862,781
1990	1,226,670	314,920	260,449	1,541,590	82,978	7,345	109,165	199,488	1,741,078
1991	1,124,925	279,292	216,743	1,404,217	88,636	7,250	119,636	215,522	1,619,739
1992	1,270,332	267,134	215,750	1,546,466	101,787	5,226	120,421	227,434	1,773,900
1993	1,378,642	254,330	197,597	1,632,972	85,813	3,849	121,607	211,269	1,844,241
1994	1,641,351	255,445	206,777	1,896,796	89,120	2,972	92,559	184,650	2,081,446
1995	2,083,731	270,246	193,260	2,325,977	75,702	4,623	131,607	211,873	2,537,654
1996	2,039,305	291,223	187,022	2,330,528	71,447	5,328	181,021	257,796	2,588,324

Table E.37 - World nominal catches of herring, 1986-1996 (FAO Yearbook , Fishery Statistics, Catches and Landings, Volume 82, 1996 and Volume 80, 1995)

		PRODUCTS						
		Fresh/ Chilled Herring	**Frozen Herring**	**Prepared/ Preserved Herring**	**Salted/ Brine Herring**	**Smoked Herring**	**Prepared/ Preserved "Sardines"**	**Total**
Germany	mt	12,311	15,484	45,793	8,758	234	10,034	92,614
	$ ('000's)	11,606	12,021	83,320	17,192	743	35,131	160,013
Russian Federation	mt		146,261	15,519	7,102		44,986	213,868
	$ ('000's)		79,640	10,777	5,468		39,580	135,465
Japan	mt	4,771	64,162	1,139			359	70,431
	$ ('000's)	4,172	117,278	3,226			2,781	127,457
Denmark	mt	90,012	4,787	6,906		222	1,178	103,105
	$ ('000's)	41,961	4,257	19,697		481	2,066	68,462
Netherland	mt	3,328	31,561	3,195	4,083	136	3,628	45,931
	$ ('000's)	2,768	22,490	5,592	6,488	396	8,945	46,679
France	mt	889	1,970	1,501		261	10,154	14,775
	$ ('000's)	1,002	1,495	4,449		988	29,567	37,501
UK	Mt	518	4,326	1,646			12,618	19,108
	$ ('000's)	216	3,169	6,202			27,705	37,292
Colombia	Mt			34		1	27,250	27,285
	$ ('000's)			126		8	35,085	35,219
Poland	Mt	2,145	33,015	8,649	3,346		173	47,328
	$ ('000's)	1,150	19,804	11,066	2,509		404	34,933
Lithuania	Mt	375	46,720	1,876	897	37		49,905
	$ ('000's)	215	29,243	2,923	656	46		33,083

Table E.38 - Top 10 non-USA herring importing countries (from all sources), 1996, based on value (Source: FAO, Time Series of Production and Trade of Fisheries Commodities)

Product	1980	1981	1982	1983	1984	1985	1986	1987	1988
Fresh	6,370 $1,104,293	3,411 $628,252	8,576 $1,911,309	9,685 $1,728,901	7,659 $1,194,865	14,676 $2,335,063	9,590 $1,706,656	10,483 $1,911,102	15,282 $3,173,761
Pilchard Meal, Inedible									
Salted	7,587 $10,388,250	9,108 $11,522,563	9,603 $10,641,556	9,207 $9,830,600	9,165 $9,898,511	8,948 $8,641,489	9,884 $9,269,353	10,075 $9,592,212	9,223 $8,617,516
Oil/Fractions	3,686 $1,365,720	4,542 $1,661,758	2,581 $824,626	4,352 $1,416,070	3,577 $1,374,689	4,230 $1,647,702	5,581 $1,457,855	6,661 $1,682,177	4,792 $1,535,379
Frozen	1,998 $1,394,497	2,582 $1,665,382	2,044 $1,453,918	1,683 $1,659,804	3,402 $1,735,736	1,604 $1,257,277	3,135 $1,869,314	5,211 $3,216,878	3,723 $2,196,051
Fillet/Dried/ Salted/Brine									
Canned, Not In Oil	2,517 $8,574,895	2,790 $9,760,774	2,436 $8,251,706	2,495 $8,991,403	1,913 $6,358,974	2,506 $8,217,538	2,566 $9,327,545	2,487 $8,611,566	2,949 $10,229,089
Kippered									
Smoked/Fillet									
Prepared/ Preserved									
Smoked, Whole or Beheaded	249 $523,897	302 $522,862	349 $652,391	269 $456,657	343 $600,163	394 $689,093	260 $466,813	339 $592,190	398 $710,545
Smoked, Otherwise	324 $902,079	377 $1,042,650	543 $1,123,651	457 $962,070	487 $912,229	617 $1,132,705	500 $1,157,531	393 $992,794	576 $1,286,454
Pickled									
Smoked/Fillet/ Boneless									
Canned, In Oil	57 $173,609	70 $216,783	42 $113,674	114 $307,967	116 $295,365	133 $291,190	86 $224,540	109 $253,485	144 $349,593
Pickled/Fillet									
Smoked	209 $399,154	168 $302,646	107 $202,235	122 $243,085	119 $203,706	145 $236,658	46 $85,325	206 $286,598	152 $242,796
Tomato Sauce/ Smoked/									
Roe/Dried/ Salted/									

Table E.39 – U.S. herring imports, by product 1980-1988 (NMFS, Fisheries Statistics and Economics Division, pers. comm.)

Product	1989	1990	1991	1992	1993	1994	1995	1996	1997
Fresh	11.005 $2,065,255	12.890 $3,151,446	8.607 $2,062,637	8.166 $2,486,796	8.674 $3,126,841	8.703 $2,734,155	3.854 $1,583,977	4.138 $1,357,935	6.519 $2,839,227
Pilchard Meal. Inedible		23.974 $9,490,734	15.370 $6,963,587	18.594 $9,572,059	34.892 $11,675,85	21.851 $7,276,998	6.586 $3,869,867	7.800 $5,594,817	6.757 $4,831,220
Salted	2.838 $2,804,198	2.263 $2,255,311	2.135 $2,079,324	2.169 $2,101,203	3.003 $2,799,727	3.121 $2,676,725	3.771 $3,174,825	2.397 $2,229,426	3.180 $2,756,259
Oil/Fractions	5.338 $1,866,193	4.470 $1,535,833	4.195 $1,445,427	4.424 $1,771,783	7.588 $3,038,287	4.804 $2,401,174	4.528 $2,330,772	7.847 $3,869,769	6.273 $3,331,653
Frozen	2.388 $2,028,032	3.247 $1,986,081	7.430 $4,029,958	5.797 $3,074,124	5.476 $3,266,683	5.194 $2,938,277	3.775 $2,513,857	3.122 $2,102,557	3.778 $2,525,881
Fillet/Dried/Salted/ Brine	69 $78,447	5.717 $5,161,875	6.299 $5,812,715	6.172 $6,227,834	5.226 $4,940,664	5.205 $4,845,235	4.175 $3,667,764	4.403 $3,901,731	4.338 $4,172,016
Canned. Not in Oil									
Kippered		2.043 $7,821,970	1.664 $7,222,288	1.757 $7,215,598	1.769 $7,402,726	1.685 $7,229,355	1.652 $6,623,191	1.475 $6,241,743	2.004 $7,353,940
Smoked/Fillet	3.116 $9,204,126	528 $1,050,367	339 $857,038	594 $1,371,765	384 $933,206	604 $1,410,363	718 $1,529,887	519 $1,222,120	516 $1,232,117
Prepared/ Preserved		1.371 $2,403,713	1.352 $2,425,893	731 $1,746,593	580 $1,505,127	424 $1,334,366	476 $1,639,100	533 $1,939,167	501 $1,565,935
Smoked. Whole or Beheaded	312 $468,169	124 $234,093	243 $415,970	162 $225,164	129 $199,309	191 $346,802	177 $257,333	40 $68,545	204 $278,917
Smoked.Otherwise Processed									
Pickled	2.128 $2,181,294	44 $145,367	39 $124,575	58 $129,307	99 $190,761	113 $273,139	74 $275,698	59 $269,361	153 $519,973
Smoked/Fillet/ Boneless		245 $695,864	258 $737,452	295 $823,189	284 $706,562	245 $566,557	278 $599,611	298 $719,624	501 $1,159,529
Canned. In Oil	184 $285,792	144 $379,487	124 $289,953	113 $347,919	129 $399,729	189 $499,044	175 $496,966	171 $505,636	190 $571,163
Pickled/Fillet		386 $398,254	46 $91,552	85 $179,193	117 $260,344	144 $392,026	117 $293,166	204 $576,149	304 $623,941
Smoked									
Tomato Sauce/Smoked/ Kippered	63 $106,741	15 $46,146	33 $92,667	18 $59,565	34 $80,757	25 $80,138	101 $170,047	4 $13,036	3 $6,050
Roe/Dried/Smoked /Salted/Brine	15 $332,010	17 $371,676	62 $613,758	66 $977,590	20 $313,658	29 $383,871	14 $353,436	38 $471,636	22 $290,850

Table E.40 U.S. herring imports, by product, 1989 – 1997 (Source: NMFS Fisheries Statistics and Economics Division, pers. com.)

Year	Data	Canada	Iceland	Germany	Chile	Peru	Norway	Sweden	Denmark	Nether.	Finland
1980	mt	21.962	340	176		27	131	90	37	64	63
	Dollars	$21,013,905	$1,410,252	$559,721		$15,600	$544,348	$450,924	$132,163	$181,566	$313,293
1981	mt	22.231	241	187		165	123	117	21	74	37
	Dollars	$23,875,201	$970,593	$513,217		$278,150	$447,274	$520,217	$68,962	$200,231	$216,093
1982	mt	25.179	364	175		48	62	92	10	73	39
	Dollars	$21,513,723	$1,536,523	$443,573		$18,721	$194,234	$523,427	$30,948	$188,543	$216,134
1983	mt	26.781	471	186			170	167	112	63	47
	Dollars	$21,002,593	$1,871,091	$481,870			$285,654	$774,772	$344,917	$164,169	$219,505
1984	mt	22.953	399	236			456	126	135	66	36
	Dollars	$17,447,764	$1,534,237	$517,735			$885,879	$513,670	$430,595	$141,301	$189,000
1985	mt	29.759	455	564			693	88	450	339	61
	Dollars	$18,029,190	$1,867,334	$1,117,943			$1,252,898	$307,189	$598,858	$305,769	$281,000
1986	mt	24.807	619	379	3	1	883	131	147	143	51
	Dollars	$17,892,158	$2,105,463	$951,049	$6,623	$1,100	$1,586,784	$456,755	$384,229	$193,299	$253,063
1987	mt	30.433	540	377	3	122	561	108	71	58	41
	Dollars	$19,966,898	$1,891,778	$1,070,236	$3,795	$159,552	$1,467,202	$391,559	$266,184	$136,880	$217,943
1988	mt	33.432	336	878	0	353	979	142	38	68	59
	Dollars	$21,778,086	$1,330,489	$1,201,107	$3,087	$475,592	$1,529,194	$520,073	$162,578	$185,965	$293,000
1989	mt	25.714	442	350		4	261	118	3	53	35
	Dollars	$16,670,834	$1,584,937	$798,705		$4,123	$666,801	$385,804	$10,764	$175,327	$174,000
1990	mt	37.605	548	324	12.272	5.500	123	94	22	353	59
	Dollars	$25,865,871	$2,669,044	$950,412	$4,197,374	$1,553,500	$379,457	$436,687	$43,365	$240,905	$234,000
1991	mt	35.864	421	364	10.774		51	110	8	55	83
	Dollars	$26,304,568	$1,792,508	$1,112,352	$4,145,251		$139,041	$338,937	$28,360	$140,546	$313,200
1992	mt	35.168	3.008	340	10.196		32	167	128	36	31
	Dollars	$28,833,177	$2,358,771	$1,097,821	$4,676,222		$101,180	$423,892	$117,135	$109,142	$179,000
1993	mt	32.388	1.593	254	8.010	22.745	140	108	1.844	1.086	29
	Dollars	$27,367,672	$788,407	$834,467	$3,052,796	$6,309,571	$211,887	$489,293	$704,546	$505,539	$158,200
1994	mt	28.013	3.805	335		16.099	367	215	1.449	927	61
	Dollars	$24,856,384	$1,754,080	$1,115,229		$4,440,819	$375,915	$367,065	$685,076	$789,351	$307,008
1995	mt	25.631	213	372		41	283	78	1.989	1.320	55
	Dollars	$24,523,808	$318,559	$1,364,603		$52,920	$297,133	$537,979	$1,129,287	$542,929	$256,250
1996	mt	24.537	2.139	367	35		6	71	3.152	1.626	60
	Dollars	$23,979,984	$1,262,650	$1,412,749	$27,358		$47,936	$441,134	$2,271,687	$808,172	$334,978
1997	mt	29.276	2.449	323			1.733	5	4	51	69
	Dollars	$28,624,839	$1,691,039	$1,067,876			$1,112,841	$25,836	$18,684	$150,030	$394,804
Total MT Tons		511.733	18.383	6.188	41.293	45.104	7.053	2.027	9.621	6.454	914
Total Dollars		$409.5M	$28.7M	$16,.6M	$16.1M	$13.3M	$11.5M	$7.9M	$7.4M	$5.2M	$4.6M

Table E.41 - U. S. herring imports, top 10 countries by value (NMFS, Fisheries Statistics and Economics Division, pers. comm.)

Product	Data	1981	1982	1983	1984	1985	1986	1987	1988
Fillet/Steak/Portion Fresh/Frozen	mt	9,011	5,162	2,133	278	853	2,474	1,248	8,795
	Dollar	$11,544,142	$6,668,318	$3,666,305	$536,991	$1,722,393	$4,044,590	$2,511,715	$18,392,966
Fresh	mt								
	Dollar								
Fresh/Frozen	mt	36,446	38,581	45,157	35,236	43,392	38,545	41,851	33,836
	Dollar	$39,766,121	$46,518,488	$65,508,349	$49,804,255	$70,560,512	$66,177,329	$81,516,803	$76,551,462
Frozen	mt								
	Dollar								
Prepared/Preserved	mt								
	Dollar								
Roe	mt	3,919	3,803	4,222	5,615	6,912	4,800	3,089	8,389
	Dollar	$20,011,566	$24,798,207	$16,507,993	$16,662,717	$44,559,082	$19,148,078	$23,125,001	$34,478,682
Roe/Dried/Smoked/ Salted/Brine	mt								
	Dollar								
Roe/Frozen	mt								
	Dollar								
Salted	mt								
	Dollar								
Smoked	mt								
	Dollar								
Total Metric Tons		49,376	47,546	51,512	41,129	51,157	45,820	46,188	51,020
Total Dollars		$71,321,829	$77,985,013	$85,682,647	$67,003,963	$116,841,987	$89,369,997	$107,153,519	$129,423,110

Table E.42 - U. S. herring exports, by product, 1981-1988 (NMFS, Fisheries Statistics and Economics Division, pers. comm.)

Product	Year	1989	1990	1991	1992	1993	1994	1995	1996	1997
Fillet/Steak/Portion	mt									
Fresh/Frozen	$									
Fresh	mt	7,426	7,003	6,021	9,637	12,363	7,356	11,012	13,192	4,152
	$	$8,511,677	$1,660,390	$2,149,111	$6,546,972	$3,129,280	$2,514,485	$3,235,869	$11,959,359	$4,845,084
Fresh/Frozen	mt									
	$									
Frozen	mt	29,328	35,927	36,118	47,032	32,820	33,670	32,061	23,034	35,199
	$	$34,455,229	$57,529,838	$60,474,977	$65,038,943	$45,014,622	$51,155,161	$66,414,847	$41,171,155	$43,001,886
Prepared/	mt	567	546	598	510	932	1,119	911	1,043	350
Preserved	$	$1,030,462	$1,002,749	$1,101,070	$949,073	$1,692,435	$1,981,502	$1,671,465	$2,001,122	$594,093
Roe	mt									
	$									
Roe/Dried/Smoke	mt	4,096	1,674	500	1,131	1,061	1,334	2,299	5,668	982
Salted/Brine	$	$7,614,813	$5,747,993	$4,451,988	$9,183,424	$12,569,343	$14,933,111	$13,441,114	$17,582,439	$6,743,749
Roe/Frozen	mt	8,251	4,055	8,048	1,880	4,419	4,708	10,591	10,118	7,401
	$	$22,941,372	$16,031,148	$18,069,781	$14,713,118	$17,188,789	$9,109,002	$24,931,500	$34,034,405	$13,011,696
Salted	mt	1,256	72	22	29	16	17	24	276	7
	$	$1,715,680	$251,759	$102,977	$178,642	$39,576	$50,202	$135,474	$687,840	$12,777
Smoked	mt	502	6	7	5	6	4	4	95	5
	$	$951,168	$24,186	$63,494	$55,017	$26,201	$17,014	$34,988	$242,480	$10,871
Total Metric Tons		51,426	49,283	51,315	60,225	51,617	48,209	56,902	53,427	48,096
Total Dollars		$77,220,401	$82,248,063	$86,413,398	$96,665,189	$79,660,246	$79,760,477	$109,865,257	$107,678,800	$68,220,156

Table E.43 - U. S. herring export products, 1989-1997 (NMFS, Fisheries Statistics and Economics Division, pers. comm.

Year	Data	Japan	South Korea	Canada	China	Sweden	USSR	Russia	Germany	Taiwan	Finland	Grand Total
1981	mt	28,534	8,700	8,618		33			3,298	25		49,208
	$	$50,094,205	$14,261,359	$3,465,971		$536,140			$2,383,735	$123,910		$70,865,320
1982	mt	35,832	7,690	3,142	226	41			397			47,327
	$	$60,759,648	$14,380,183	$1,460,576	$436,265	$433,642			$210,791			$77,681,105
1983	mt	41,296	6,067	1,112	2,691	25			185			51,376
	$	$66,490,354	$13,265,022	$1,396,918	$4,011,335	$243,250			$101,920			$85,508,799
1984	mt	34,939	5,178	437	456	25			1	16		41,052
	$	$58,127,789	$7,173,502	$609,558	$684,207	$279,583			$4,193	$14,490		$66,893,322
1985	mt	37,890	8,605	2,578	1,127	26			82	392		50,701
	$	$89,376,010	$20,457,351	$3,788,206	$1,839,867	$261,722			$134,000	$647,955		$116,505,111
1986	mt	33,730	5,866	3,717	1,980	48			13			45,353
	$	$64,008,244	$12,908,618	$6,918,221	$3,598,961	$818,592			$10,750			$88,263,386
1987	mt	33,855	6,627	5,135	408	24	37					46,086
	$	$81,121,998	$15,411,615	$8,988,162	$973,260	$499,571	$3,681					$106,998,287
1988	mt	44,049	3,609	3,259		25						50,942
	$	$116,213,834	$8,181,788	$4,610,957		$307,352						$129,313,931
1989	mt	31,181	7,076	2,530		35	10,487					51,310
	$	$57,830,489	$10,987,525	$3,993,820		$712,238	$3,365,269					$76,889,341
1990	mt	35,192	3,997	3,361	211	34	6,275			42		49,113
	$	$70,989,294	$4,478,535	$4,668,334	$483,577	$668,726	$685,351			$24,000		$81,997,817
1991	mt	40,153	2,689	3,607	291	18	4,247		2			51,007
	$	$76,768,224	$3,483,139	$4,188,648	$506,672	$358,644	$465,140		$12,714			$85,783,181
1992	mt	47,790	633	5,040	1,309	32		5,263		15		60,082
	$	$85,411,158	$1,040,762	$6,890,372	$1,347,124	$621,311		$516,389		$253,720		$96,080,836
1993	mt	35,183	1,153	3,217	1,565	40		10,431				51,590
	$	$69,810,038	$2,276,019	$4,053,058	$1,712,792	$676,726		$1,018,602				$79,547,235
1994	mt	37,422	1	4,396	395			5,789	2	20		48,027
	$	$72,764,141	$3,400	$4,900,319	$922,800			$733,119	$4,329	$28,099		$79,356,207
1995	mt	37,583	137	5,055	10,763	38		782				54,358
	$	$90,397,022	$229,201	$7,153,589	$11,003,063	$160,325		$442,726				$109,385,926
1996	mt	27,414	400	12,047	3,390	264		4,095		64	163	47,836
	$	$75,791,585	$623,325	$19,174,509	$7,459,198	$502,717		$774,890		$352,800	$780,840	$105,459,864
1997	mt	33,362	78	9,681	3,902			278		175	175	47,651
	$	$49,862,387	$248,567	$11,615,009	$4,749,998			$144,760		$509,350	$605,831	$67,735,902
Total mt		615,406	68,508	76,932	28,714	708	21,046	26,639	3,980	748	338	843,018
Total $s		$1,235,816,420	$129,409,911	$97,876,227	$39,729,119	$7,080,539	$4,519,441	$3,630,486	$2,862,432	$1,954,324	$1,386,671	$1,524,265,570

Table E.44 - U. S. herring exports, top 10 countries, by value (NMFS, Fisheries Statistics and Economics Division, pers. comm.)

Product	Destination	1996		1997	
		Metric Tons	Dollars ('000)	Metric Tons	Dollars ('000)
Fresh Herring	Canada	5,098	7,322	3,017	3,051
	Costa Rica[1]	-	-	66	44
	Egypt[1]	282	267	-	-
	Japan[1]	1,323	3,293	988	1,718
	Nigeria[1]	1,811	478	-	-
	Russia[1]	3,664	487	81	32
	Mexico	3	16	-	-
	United Kingdom[1]	1,011	96	-	-
Frozen Herring	Canada	4,318	6,308	5,028	6,154
	China	2,751	5,642	3,782	4,455
	Egypt	2,393	910	-	-
	Japan	12,519	27,072	25,902	32,065
	Other	1,053	1,239	487	328
Prepared/ Preserved Herring	Canada	997	1,763	350	594
	Netherlands	26	194	-	-
	Russia	20	45	-	-
Salted	Canada	-	-	7	13
	Japan	258	602	-	-
	Israel	11	38	-	-
	Mexico	8	48	-	-
Smoked	Canada	84	207	2	7
	China	11	32	-	-
	St. Lucia	1	3	-	-
	Guyana	-	-	3	4

Table E.45 - U.S. Exports of herring by product form and country for 1996 and 1997 (Source: NMFS International Trade Database) (Note 1: probably frozen, not fresh)

Prepared/ Preserved "Sardines"	Australia	39	105	50	142
	Bahamas	34	146	56	240
	Canada	3,859	6,848	2,479	4,578
	Dominican	393	746	508	1,065
	French Polynesia	-		20	16
	Guyana	19	39	47	75
	Israel	7	14	36	65
	Japan	143	104	37	58
	Malaysia	372	225	73	49
	Mexico	4	10	76	107
	New Zealand	58	70	20	19
	Panama	67	136	199	368
	Papua New Guinea	93	102	19	19
	Philippines	91	137	41	78
	Trinidad &	36	75	31	67
	Western Samoa	57	57	75	78
	Other	195	838	311	761

Table E.45 – (cont.) U.S. Exports of herring by product form and country for 1996 and 1997 (Source: NMFS International Trade Database)

Product	Destination	1996		1997	
		Metric Tons	Dollars (in thousands)	Metric Tons	Dollars (in thousands)
Fresh	Northeast	3,714	616	4,940	914
	Entire U.S.	4,135	1,333	6,519	2,839
Frozen	Northeast	2,011	933	2,551	1,115
	Entire U.S.	3,101	2,038	3,218	1,946
Other (prepared, preserved, salted, smoked, kippered, pickled, roe, and meal)	Northeast	9,065	14,893	8,964	16,262
	Entire U.S.	12,731	20,610	13,378	22,207

Table E.46 - Imports of Herring to Northeast U.S. Customs Districts and the Entire U.S. from Canada

Year	U. S. GOM Catches Processed in Canada		Reported Herring Catches in SNE Processed in Canada (mt)
Year	Truck	Boat	Truck
1987	4438	791	
1988	5933	186	
1989	4549	118	
1990	5180	42	
1991	5413	723	
1992	5042	1537	167
1993	1534	976	0
1994	2273	1547	183
1995	3280	2117	3316
1996	4489	3690	6359
1997	102	1280	5546

Table E.47 – Northeast U.S. Atlantic herring exports to Canada (Source: Maine DMR)

Year	Amount ('000 lbs)	Value ('000 dollars)
1986	271	321
1987	999	688
1988	8,555	7,902
1989	8,951	7,823
1990	8,977	9,155
1991	10,434	9,394
1992	12,690	10,786
1993	12,275	10,457
1994	11,010	9,413
1995	11,775	8,915
1996	12,209	9,623
1997	9,321	8,115

Table E.48 - Canned sardine exports, 1986-1997 (Source: Fisheries of the United States (series))

Year	Imports ('000 pounds)
1986	53,264
1987	65,022
1988	53,359
1989	56,379
1990	56,963
1991	48,515
1992	36,511
1993	39,111
1994	43,942
1995	42,280
1996	40,926
1997	42,771

Table E.49 - U. S. Imports of canned sardines, 1986-1997 (Source: Fisheries of the United States (series))

E.6.4.4 Social and Cultural Aspects

Aguirre (1996) analyzed the fishing communities of the northeast and described the characteristics of the communities that depend on this industry. While focused on the impacts of increasing regulation and declining catches in the northeast multispecies fishery, this analysis includes brief discussions on the herring fishery in Gloucester and Pt. Judith/Galilee, RI. For the most part, the same communities described in this report are important to the herring fishery. Through impacts on the community, support business, and infrastructure, reductions in the multispecies fishery will impact herring fishermen. Many of the concerns held by groundfish participants are the same as ones held by herring fishermen. At present, however, the herring resource is in a healthy condition—in fact, the resource is estimated to be at its largest size in the past twenty years. Those who have participated in the fishery during periods of reduced abundance are interested in maintaining it in a healthy state so they can benefit from the increased abundance. Some fishermen in fisheries that are rebuilding view the herring fishery as an alternative that can supplement their income until they can rely on these fisheries in the future. If herring landings and ex-vessel revenues were to double, the value of landings would rival those for Atlantic cod and would exceed the value of many other groundfish species.

Dyer and Poggie (1998) (Appendix I) build upon the concept of natural resource communities in their analysis of the social and cultural aspects of the herring industry. They provide information specific to herring harvesters and processors, as well discuss the impacts of the management measures under consideration. The directed herring fishery for Atlantic herring is a relatively small subset of the east coast fishing industry. Currently, less than 20 boats land the majority of the herring caught, as compared to well over 2,800 vessels in the northeast multispecies fishery, or over 3,000 federal lobster permit holders. Communities dependent on fishing are experiencing severe social and economic uncertainty caused by declines in fish stocks, and increasing regulation (Dyer and Poggie 1998). Appendix I contains a description of the major participants in the herring industry and a discussion of the potential impacts of various management alternatives. This appendix provides the basis for the discussion in this section and an analysis of the social impacts of the various management measures in section 3.0.

With the collapse of the Georges Bank herring fishery in the late 1970's, the U. S. herring industry was concentrated in the Gulf of Maine. With the exception of a brief period in the early 1980's, the major market for herring was the Maine sardine canneries until the development of an expanded bait market in the early 1990's. This continued the historic importance of the herring resource to the small communities of eastern Maine that began in the 1800's.

In spite of its relatively small size compared to other northeast fisheries, the herring fishery is critical to some small communities that have developed a dependence on a steady supply of herring for economic survival. The sardine canning industry, located entirely in Maine, is a key employer in several small towns that have limited alternatives for manufacturing employment. According to the Bureau of the Census economic profile of Maine, in 1995

there were twelve canned and cured fish and seafood processors (six were sardine canneries) employing 910 workers with a payroll of $9,578,000. In 1996, the five remaining sardine canneries employed nearly 850 people full and part-time and have a payroll of $8.5 million. Three of the remaining Maine packing plants are owned by one company. Four plants account for 90% of the total payroll. The plants that are still open are located in Prospect Harbor (Hancock County), Milbridge and Lubec (Washington County), Belfast (Waldo County), and Bath (Sagadahoc County). Table E.50 provides a summary of employment statistics for these areas (including one cannery that was open in 1990 and has since closed).

Location	Persons	Employed	Agriculture /Forestry/ Fishing	Non-durable Goods Manufacturing	Durable Goods Manufacturing	Median Household Income, 1989
Hancock County	46,948	21,000	1,108	1,406	1,254	$25,247
Sagadahoc County	33,535	15,810	303	580	3,911	31,948
Bath	9,825	4,402	28	117	1,365	29,892
Waldo County	33,018	14,172	663	1,722	1,042	23,148
Belfast	6,355	2,653	82	345	164	19,884
Washington County	35,308	13,271	1,009	1,446	806	19,993

Table E.50 – Selected demographic characteristics of Maine communities with sardine canneries (Source: U. S. Census, 1990)

The canneries are important to the economy of their communities and provide steady employment in an area with few other options. In 1997, for example, the unemployment rate in Washington County (location of canneries in Lubec and Milbridge, ME) was 13 percent. The heavy reliance of Washington County on cannery employment can be seen by the limited number of other manufacturing jobs available in the county. A similar reliance can be seen in Belfast, ME, where manufacturing jobs account for nearly 20 percent of employment—non-durable goods manufacturing employment (which includes the sardine cannery) accounts for 13 percent of employment.

The importance of the canneries to the their employees is illustrated by their reliance on cannery earnings. In February 1998, a survey of 123 workers at two sardine plants was conducted to develop a socio-cultural profile of the industry (Dyer and Poggie 1998). 71 percent of those surveyed were born in the state of Maine, while a total of 88 percent were born in Maine or other New England states. 66 percent were full time workers. The estimated factory earnings for 1998 ranged from $2,500 to $34,000, with a mean of just over $11,000. 61 percent replied that their total income was earned in the cannery, with an average of 2.2 persons per household dependent on the factory income.

Reiling and Bennett (1998) estimated the overall economic impacts of the sardine industry.

The output produced by the three firms totaled $40 million in 1996. Using the IMPLAN input-output model, the sardine canneries were estimated to have direct effects on the Maine economy of $50.8 million. Induced effects of the industry increase the total impact to $62.8 million. If the industry did not exist, overall employment in the state would decline by 1,378 to 1,800 (1995 state employment was approximately 432,000).

Another important fisheries sector that is linked to the herring fishery is the lobster fishery. In 1996, 71.6 million pounds of lobster worth $241.8 million were landed on the east coast. This fishery is heavily dependent on a ready supply of fresh bait, which comprises a significant share of the fisherman's variable costs. While a variety of species can be used, with each locality having a preferred species based on availability and price (NEFMC 1983), herring is the major lobster bait used in many areas. In 1981, only 1,460 mt of herring were used for bait (Maine Department of Marine Resources, 1997, quoted in Reiling and Bennett 1998). With the decline of redfish landings over the next ten years, the industry increasingly relied on herring. Alternatives to fresh herring are more expensive and not as readily available. Frozen herring is not only more costly, but is not preferred because it is difficult to handle (White, pers. comm). Any lengthy interruption to the supply of herring for bait would adversely impact this key industry. Not only is the value of lobster landings high, but lobster is a key part of the tourism culture important to the New England states (Dyer and Poggie).

The herring fishery has been suggested as an alternative to vessels in other fisheries that are under severe restrictions to do poor condition of the resource. Aguirre (1996) describes the pressures experienced by the groundfish industry in New England due to a declining resource and increasing regulation. This has caused significant changes in the fishing community as many fishermen have been forced to seek other employment. Herring, on the other hand, is an under-utilized resource that could absorb increased fishing effort. To the extent the management scheme allows entry of participants from other fisheries, it may provide a way to preserve the fishing community until groundfish stocks recover. It is not clear, however, that fishermen in stressed fisheries will be able to make the investment necessary to convert to fishing for a pelagic species that sells for pennies a pound.

The possibility of a large number of new entrants into the herring fishery causes concern in some long term participants. These fishermen have carefully developed markets in a high volume, low value fishery. In some instances, they have focused completely on herring and have limited opportunities to move into other fisheries because of limited entry provisions. The influx of new entrants is viewed as a threat to what has been a small industry niche that they have developed.

The size of the available resource attracted one company to consider using a large factory trawler in the herring fishery. This vessel obtained the letter of authorization necessary to use a small mesh mid-water trawl in the Gulf of Maine and Georges Bank, but never actually fished for herring. Intense opposition to the introduction of a large factory trawler led to a number of initiatives to prevent it from entering the fishery, including legislative action by Congress to rescind this authorization letter (section 2.1). During development

of the FMP, this issue attracted considerable public comment (see Appendices VII and VIII). Many of the comments in opposition focused on the perceived disruption to communities that would result from the introduction of at-sea processing vessels. These comments expressed concern that a large at-sea processor would prevent the development of shoreside processing capacity that would benefit their communities. They also argued that large factory trawlers would eventually control the herring resource and force out smaller, traditional owner/operators from the fishery. Counter-arguments focused on the ability of a large factory trawler to freeze herring at sea, using the underutilized offshore resource and selling the product into international markets. The possibility that a large factory trawler could be used in a "joint venture" with other U.S. catcher vessels, providing them a relatively easy way to enter the herring fishery, was also noted. Because of the lack of experience with similar large scale fishing vessels in the northeast, it is difficult to evaluate their impacts. Dyer and Poggie (1998) noted community interest in increased development of shoreside processing, as well as in using the herring fishery as an alternative for the stressed groundfish fishery. The difficulty will lie in balancing these interests which, to many, are in conflict.

E.6.5 Impacts of Human Activity (Fishing) on the Environment

The impact of fishing for herring is described primarily as fishing mortality. Particularly with respect to forage species, however, the impact may extend to other species through complex predator-prey relationships. Weinrich (1997), for example, has identified changes in the distribution of whales apparently caused by shifts in the abundance of prey species. Fishing for herring at levels that result in a change in species abundance in certain areas may result in changes in marine mammal distributions. Payne et al. (1990) speculated that the recovery of the northern right whale may be inhibited by competition with herring and sand lance for its prey species. These examples show the complexity of this issue; it is difficult to predict how herring fishing will impact other species, but the impacts are not expected to be major as long as the herring biomass is maintained in a healthy state.

Because herring are a pelagic species, the gears used are not expected to have significant impact on the sea floor. These issues will be explored in detail through the Council's review of essential fish habitat.

E.6.5.1 Impacts of Human Activity Other Than Fishing on the Environment

The Council will identify impacts of non-fishing activity on the environment through its review of essential fish habitat.

E.7.0 Environmental Consequences of the Proposed Action

E.7.1 Summary of Consequences

In general, the proposed management actions should have a positive impact on the biological, economic, and social components of the herring fishery. Spawning stock

biomass is projected to continue to increase at the same time that landings of herring could double. In the long-term, the establishment of a total allowable catch and effort controls should develop a sustainable herring fishery.

The social impacts of the proposed actions are not expected to be large in scale, long-term, or far reaching. Fishermen in the Gulf of Maine may be the most affected by the proposed actions, primarily by forcing a redistribution of fishing effort from the inshore area. Some fishermen in other fisheries will have the opportunity to enter the herring fishery, which may alleviate problems caused by increasing restrictions in those fisheries.

E.7.2 Biological Impacts of the Alternatives

The following sections describe the expected biological impacts for the proposed management actions listed in section 3.0. Most of the analysis is focused on the primary management measures that will control fishing mortality: establishment of an overfishing definition (section E.7.2.1), a TAC (section E.7.2.5.1), the TAC distribution system (section E.7.2.5.2), mandatory days out of the fishery (section E.7.2.5.3), and vessel size limits (section E.1.1.1.1). The impact of spawning area closures (section E.7.2.4) is also addressed. In many instances, the Council considered variations of the proposed measure. These variations are discussed in the same section as the adopted measure. Section E.7.2.10 addresses the expected biological impacts of those measures that were not adopted in any form – primarily the limited entry/controlled access system.

The herring resource is currently underutilized and overall fishing mortality is at an extremely low level (NEFSC, 1998a). For this reason, the management measures are not designed to reduce fishing mortality, but to establish controls so that as fishing effort increases, the mortality is held to levels consistent with the overfishing definition. Prior to adoption of this plan, there are no limits on the harvest of herring by domestic vessels. While herring is not currently overfished, as noted in section, there is increased interest in the fishery. The history of the management of this stock (section 2.1) clearly demonstrates that absent appropriate controls, fishing mortality can exceed acceptable levels and can damage the resource. Another impact of the proposed measures is that they will distribute fishing effort across fishing areas. This will help protect the different spawning components as effort will not be concentrated on any one segment.

E.7.2.1 Overfishing Definition

The establishment of an overfishing definition is required by the Magnuson-Stevens Act. The term "overfishing" or "overfished" means a level or rate of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis. Absent a statement that defines the appropriate level of fishing mortality, it is problematic to determine whether a fishery is overfished and a rebuilding effort is necessary. The overfishing definition reference points are described in section 2.6.

The target fishing mortality should prevent the overfishing of the herring coastal stock complex. When combined with estimates of natural mortality, the target fishing mortality

(at B_{MSY}) will result in the annual removal of 38 per cent of the stock on an annual basis. This will preserve sufficient resource for successful spawning in the future. This definition is more conservative than the overfishing definition in the Commission's 1994 management plan for herring.

One weakness in this definition is that the fishing mortality target applies to the entire coastal stock complex. It may be possible to stay within the mortality target for the entire coastal stock complex while overfishing a particular spawning component. For this reason, attempts are being made to develop a separate assessment for the Gulf of Maine spawning component. This will facilitate a separate definition for this component, reducing the likelihood of overfishing. Until this assessment is developed, the plan addresses this concern by incorporating other measures (primarily through distribution of the TAC by area) that are intended to limit the effort on any individual spawning component.

Implicit in the determination of the overfishing definition is consideration of the needs of other species in the ecosystem. The definition insures that fishing mortality will not adversely impact the needs of other species. As noted in section E.6.3.1.6, herring play a key role as a forage species. For example, Gannon et al. (1998) estimated that herring are 44% of the total mass in the diet of non-calf harbor porpoise in the Gulf of Maine during the fall. Overholtz et al. (1991) estimated that from 1988 through 1992, five species of whales, three species of dolphins, harbor porpoise and harbor seals consumed, on average, 19,300 mt of herring annually. The development of the MSY estimate and the target fishing mortality take into account the natural mortality from all causes, including the needs of predator species. Because the entire management program hinges on the target fishing mortality specified in the overfishing definition, the concerns of forage species are addressed.

E.7.2.2 Specifications

The plan bases all specifications (OY, DAH, DAP, JVPt, JVPs, IWP, BT, USAP and the Reserve) on the overfishing definition—specifically, the target fishing mortality. Allowable biological catch (ABC), which is F_{Target} times the estimated biomass, must be determined before any other specification can be defined. When the stock size is larger than B_{MSY}, ABC could be significantly larger than MSY. However, in the early years of the plan, the ABC is artificially limited to no more than MSY. For example, the stock biomass in 1997 is estimated to have been 2.5 times the biomass necessary to support MSY. Applying the target fishing mortality (F=0.28) to this stock size would give an ABC of well over 500,000 mt. There is concern this biomass is overestimated, based in part on the low level of fishing mortality and on a pronounced positive bias observed in estimation of recent year biomass and a negative bias in fishing mortality (NEFSC, 1998). Rather than allow rapid buildup to a large harvest in the initial years of the plan based on uncertain stock estimates, the plan takes a precautionary approach and artificially limits the ABC to a level consistent with ABC at B_{MSY}. This will allow the development of the fishery at a slower pace, reducing the likelihood that high levels of harvest in the early years of the plan will result in a rapidly declining biomass. This conservative approach should reduce the possibility of overfishing in the early plan years while allowing fishing mortality to

gradually increase, improving the precision of assessments. This is consistent with the recommendation of the SARC that the catch should be increased in an incremental fashion (NEFSC 1998a and b).

A surplus production model was used to estimate the impact on the biomass of different harvest scenarios. These models show that an immediate high catch could result in a rapid decline in the biomass level. This rapid decline could be problematic if there are errors in the assessment or reporting, or a sudden change in environmental conditions. While any increase in the catch will be in response to market conditions, the simulation shows that current high biomass levels can be rapidly depleted if catches are allowed to increase rapidly. The plan chooses, instead, to cap the catches at a level well below the theoretical ABC at B_{MSY} until catch reporting, spawning restrictions, permit requirements, and other management measures have a chance to be evaluated. These measures should lead to improved assessment precision.

Optimum yield (OY) is specified in this fishery consistent with the overfishing definitions. As a result, the specification of OY should have little biological impact. The key is that OY does not exceed the ABC. A second reason that OY should have little impact is that it cannot exceed MSY. This means the long term ability of the fishery to produce MSY should be maintained. The remainder of the specifications distribute the OY to various industry sectors and should have little biological impact.

Because the preferred alternative does not provide the opportunity for TALFF, the OY definition may have a positive impact on other marine resources in the area. Directed foreign mid-water fisheries have a well-documented impact on marine mammals (Waring 1990). The reasons for these impacts are not clearly understood, but preventing foreign vessels from participating in this fishery removes any impact these vessels may have. Given the lack of understanding about the causes of the marine mammal takes this approach is consistent with the precautionary principle.

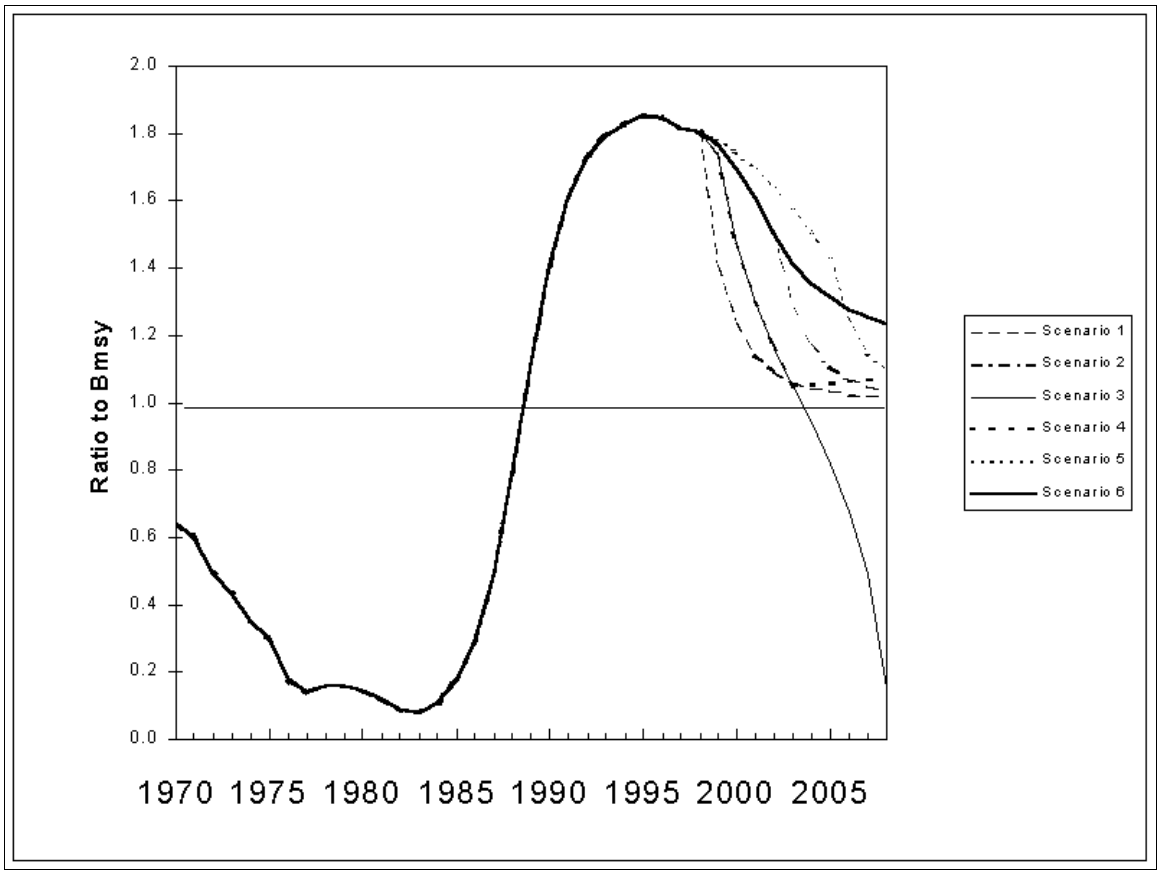


Figure E.17 - Biomass predictions based on different annual harvests

Scenario 1: Harvest at F_{MSY} in all years
Scenario 2 Catch increase by 50K mt each year, followed by F_{MSY}
Scenario 3: Catch of 400K mt in 1999, held constant
Scenario 4: Catch of 400K mt in 1999, then MSY in 2003 and beyond
Scenario 5: Catch increase by 30K mt each year, followed by F_{MSY}
Scenario 6: Catch increase of 50K mt each year, up to MSY level

E.7.2.3 Management Areas

The management areas adopted by the plan are based on knowledge of the various spawning components. This allows the development of management measures that specifically target a particular spawning component. It also provides some flexibility, as specific measures can be adopted in an area of concern.

The subdivision of Management Area 1 refines the areas that were initially adopted by the Commission in its 1994 management plan. This identifies areas of concern for herring from the Gulf of Maine spawning component. During the winter and early spring, most of the fish in Management Area 1A are believed to be from the Gulf of Maine spawning component. In the early summer, some fish from the Georges Bank/Nantucket Shoals spawning component are also in this area. Defining this area facilitates development of TACs for these areas that will account, in part, for stock mixing. This provides a measure

of protection to individual spawning components - particularly the Gulf of Maine spawning component.

To some extent, the proposed areas are a compromise that do not precisely represent the geographic areas occupied by the various components during spawning season. A presentation of fall trawl survey data by Melvin et al. (1996) shows that there is a continuum of herring from Cape Ann, Stellwagen Bank, Great South Channel, Nantucket Shoals and out across Georges Bank. As noted by Tupper et al. (1998), the line dividing Management Area 1 and Management Area 2 cuts through this continuum. They suggest that this dividing line should be moved to the north and closer inshore so that catch statistics from Area 1 more closely represent removals from the Gulf of Maine spawning component, rather than a mix of herring. This approach was not adopted by the Council, which preferred to use the same area boundaries that were adopted by the Commission in 1994. As a result, the TAC assigned to Management Area 1 must consider the mixing of herring from different components. The location of the area boundaries is a measure that can be adjusted through framework action as more information is developed on the structure of the coastal stock complex.

E.7.2.4 Spawning Area Closures

One of the goals of the FMP is to protect individual spawning populations consistent with the National Standards. The desirability of establishing closed areas to protect spawning aggregations of herring was recognized and articulated by the Council in the original FMP (43 FR 60533). The Council prepared a recommendation for spawning closures while drafting Amendment 4 to the original FMP; this amendment was never adopted because approval of the FMP was withdrawn by the NMFS. The concept of a spawning closure was adopted by the Commission in its FMP for Atlantic herring in 1994, and has been implemented through state landing regulations and closure areas.

There is considerable support for the concept that successful management of herring requires protection of individual spawning stocks to insure successful recruitment in the face of wide stock size fluctuations common to pelagic species (Sinclair 1985; Stevenson 1997 pers. comm.). Because the recovery of a collapsed spawning population may take a long period of time (Sinclair 1985), it is important that the individual populations be protected and monitored. For such an approach to be successful, the individual populations should be monitored so that evidence of overfishing can be readily detected (Pope 1980).

Spawning closures reduce the impact of fishing on aggregations of spawning fish, when the fish are most susceptible to capture. They afford the resource the opportunity to aggregate and spawn with minimum disturbance. Anthony and Waring (1980) theorized that sequential fishing on spawning herring contributed to the collapse of the Georges Bank fishery not only due to excessive mortality but because intense fishing effort reduced the ability of the remaining fish to spawn. The implementation of spawning area restrictions will reduce this danger. At the same time, the removal of fishing pressure will help the assessment of individual spawning populations. It will be easier to accurately

evaluate the extent and size of spawning populations if they are not disturbed by fishing activity. Annual variations in spawning populations can be monitored and adjustments to the management system can be made to protect individual populations. This will help achieve the FMP's goal to protect individual spawning closures.

The proposed spawning closures are based on the existing Commission spawning closures, locations of known egg beds, knowledge on larvae distribution, and the locations of ICNAF gonadal stage 5 and 6 herring from commercial catch samples. The locations of egg beds and larval distribution are summarized in Reid et al. (1998). This information was used to determine the essential fish habitat for these life stages in the Council's Essential Fish Habitat (EFH) amendment, reproduced in Figure E.18 and Figure E.19 (NEFMC 1998a). In addition, Maine Department of Marine Resources scientists plotted data from commercial catch samples obtained from 1964 through 1997 to show the observed locations of stage 5 and 6 herring (Figure E.20 and Figure E.21). The closures were chosen to include most of the areas identified by examining this data.

The original (pre-amendment) Commission spawning closures allowed some herring fishing to continue during the closures, in both state and federal waters. Vessels were allowed to fish for herring during the closures as long as no more than s25 percent of the catch contained spawn fish (spawn or milt). It was up to the individual states to choose whether to enforce this provision – in some areas, states instead closed the directed fishery and allowed only a bycatch of herring. Maine allowed fishing subject to a tolerance in the waters north of Portland, reducing the percentage of spawned fish to 20% in 1998. For the area south of Portland, state closures (Maine, New Hampshire, and Massachusetts) did not include a tolerance, limiting vessels to a bycatch of herring. The Commission has altered its closure scheme to apply this tolerance provision in all state waters of the Gulf of Maine for the period August 1 through October 31. Once again, it will be up to individual states to choose whether to enforce the tolerance provision or adopt an equivalent conservation measure.

Considerable herring spawning occurs in the EEZ, an area not included in the Commission's draft amendment. The Council closures are intended to augment the state waters closures at the time of peak spawning. The closures adopted by the Council do not include the "tolerance" provision. Any catch that would have been taken under the tolerance provision will not be harvested during the Council's closures. Fishermen can be expected to change their behavior to compensate for the loss of landings from the Central and Western Maine areas. The easiest way to compensate would be to fish in a different area. During the Council's closures off the coast of Maine, fishermen will be able to fish either in state waters (subject to the tolerance provision enforced through state regulations), or in the area off the coast of New Hampshire and Massachusetts that remains open. Maine fishermen are likely to fish in state waters as they will be closer and transit time will be lower. This may result in increased fishing pressure in these areas during these periods, with a negative impact on pre-spawning aggregations. The overall impact of this redistribution of effort is unclear.

An alternative approach to protect individual spawning components of herring suggested

by Sinclair et al. (1985) is to reduce fishing mortality during the periods that spawning populations are mixed together. Since there is currently no way to identify individual populations when they are mixed together outside of spawning seasons, the concern is that an entire spawning population may be caught even though overall TACs have not been reached. The best time to identify the size of individual populations is when they are aggregated for spawning; a "survey, assess, fish" protocol (as used by Canada) could then insure that the individual populations are protected. This method limits the harvest in the spawning period. Another issue is that the extent to which populations remain aggregated during the mixed phases of the fishery is unclear. If, during a mixed phase, individual populations remain in discrete groups, the chances of a small population being overfished rapidly may be high. On the other hand, if the mixing of herring populations during these phases is complete, there may be a greater hazard to individual populations if they are targeted while aggregated on the spawning grounds and survey information is incomplete.

Herring eggs are typically laid on the bottom in large masses. These egg beds attract feeding schools of fishes and invertebrates (Caddy and Iles 1973), which can, in turn, attract mobile gear fishermen. There is a possibility that bottom tending mobile gear may damage or dislodge herring eggs. The extent of damage to egg beds, and the effect this has on survival of the eggs, is uncertain. In addition, there is limited information on the precise location of herring egg beds on an annual basis. Ultimately, it may prove desirable to identify small, discrete egg beds and prohibit all fishing activity in these areas until the eggs hatch. Information is not currently available to support such an approach, and this approach may not provide sufficient protection to pre-spawning aggregations of herring.

A number of variations were considered for the timing and location of spawning areas. One alternative included starting the closures on dates determined by biological sampling, in order to be certain the closures protected peak spawning activity. The logic behind this approach is that spawning periods could change from year to year, depending on stock and oceanic conditions. Fixed dates do not respond to these annual changes, so the closures may miss the time of peak spawning. This proposal was rejected because of the necessity for accurate sampling programs to estimate the correct dates. By using four week closures (eight weeks on Cashes Ledge), it is likely the closures will cover at least part of the peak spawning period. If the closures consistently miss the time of spawning, the dates can be revised through a framework adjustment.

The Council also considered different boundaries for the spawning closures in Management Area 1A. The draft measures included three areas off the Maine coast, one large area that covered all of coastal Massachusetts, New Hampshire, and southern Maine, and a different closure area on Cashes Ledge. Because two of the proposed areas off Maine had the same closure dates, they were combined for the proposed alternative to make one area. The Maine areas were also slightly modified to make use of existing regulatory areas, with no expected impact on their effect. The Massachusetts/New Hampshire closure area was significantly reduced in size. The adopted areas make use of existing regulatory areas, but also focus on the primary spawning areas within the original proposed area. The Cashes Ledge closure was increased to include several offshore banks that have some spawning activity. The net result of these changes is that while the reduced

size of the Massachusetts/New Hampshire closure can be expected to provide less spawning protection than the original proposal, the benefit is that it allows fishing effort to be spread over more area during this closure.

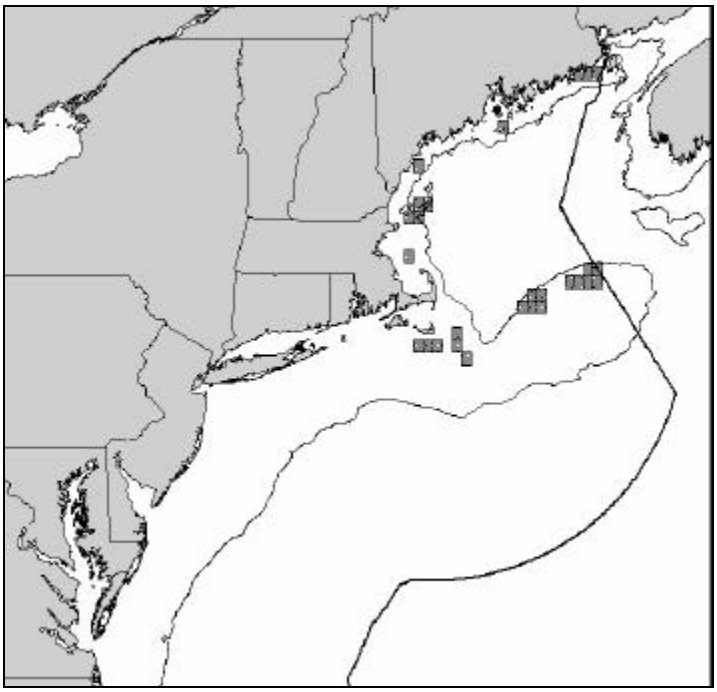


Figure E.18 – Essential fish habitat designations for Atlantic herring eggs (NEFMC 1998a)

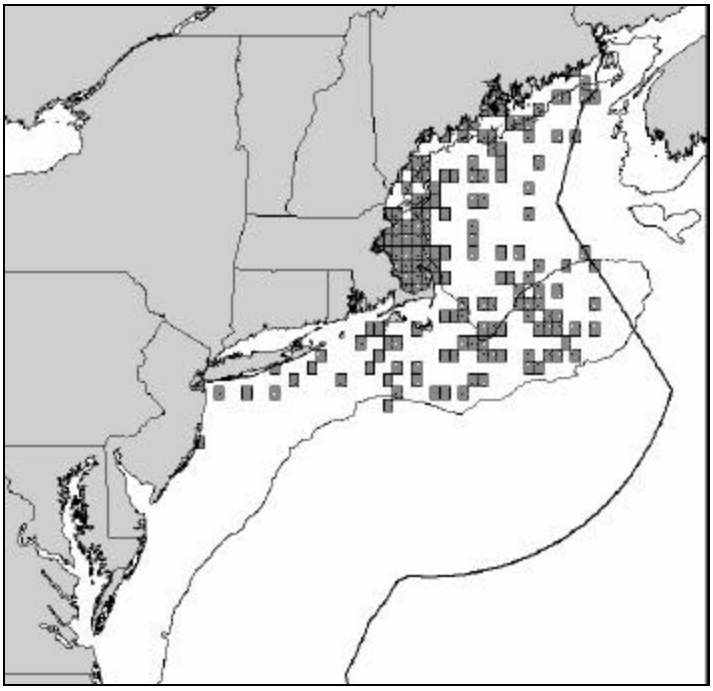


Figure E.19 – Essential fish habitat designations for Atlantic herring larvae (NEFMC 1998a)

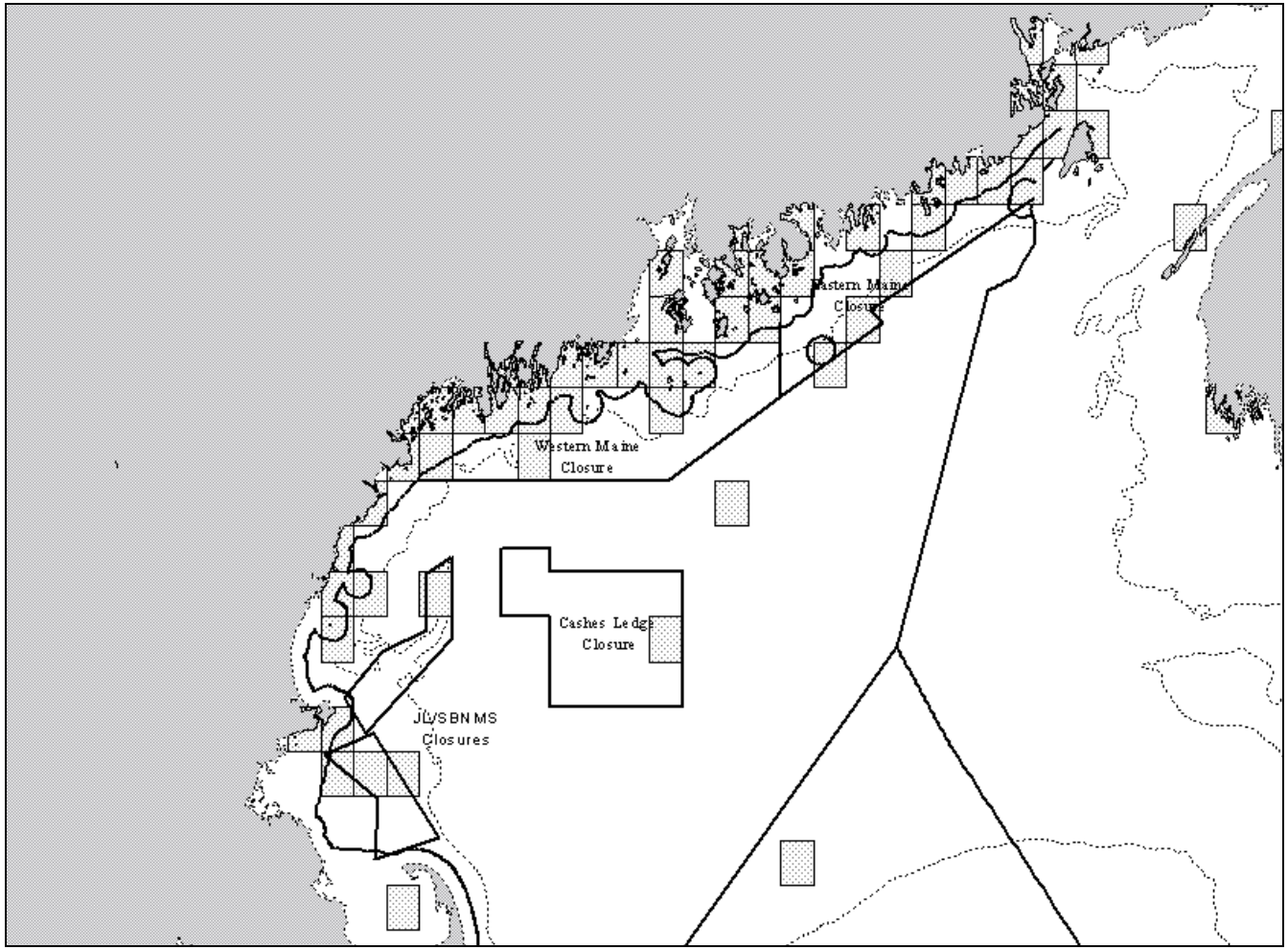


Figure E.20 – Distribution of ICNAF gonadal stage 5 herring from commercial catch samples, 1964-1997 (Source: Maine DMR)

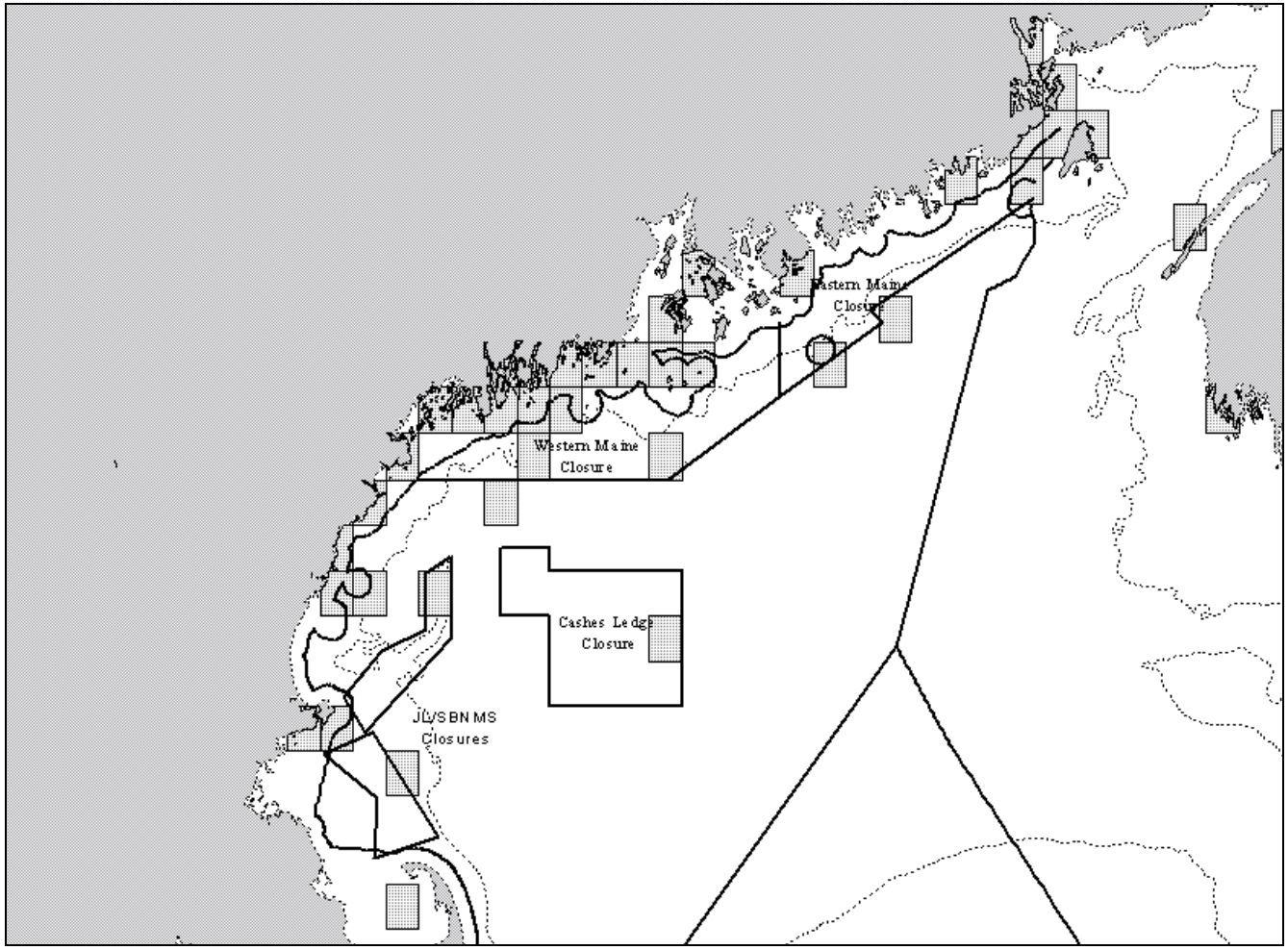


Figure E.21 – Distribution of ICNAF gonadal stage 6 herring from commercial catch samples, 1964-1997 (Source: Maine DMR)

E.7.2.5 Catch Controls

The primary management measure adopted by this plan is a system designed to control fishing mortality through specification of a total allowable catch (TAC). This system includes a requirement to close the directed herring fishery when the TAC is approach, the distribution of the overall TAC to different management areas, and the imposition of mandatory days out of the fishery to slow catch rates. The system is designed to not only control overall fishing mortality for the coastal stock complex, but to spread fishing effort throughout the range.

E.7.2.5.1 Total Allowable Catch

Based on the optimum yield in the fishery, the plan establishes a total allowable catch (TAC) to limit the catch of herring to levels consistent with the overfishing definition. The establishment of a "hard" TAC provides a firm limit on fishing mortality. The management plan proposes to prohibit large-scale directed fishing for herring when 95 percent of the TAC is reached in an area during a time period. As the TAC is approached, effort controls are imposed which will slow catch rates, extending the fishing season and making it easier to determine when the TAC will be attained. This insures that regardless of fishing effort, the fishing mortality of herring will be tightly controlled. Some herring, limited to 2,000 pounds per trip (with a one trip per day limit), may be taken in other fisheries after an area was closed (or subject to effort controls) when the TAC is reached.

At various levels of the TAC, effort controls are imposed. Possible high catch rates make it important to accurately identify when these catch controls should be implemented. Rather than wait until the landings are reported that equal the trigger points, the TAC system relies on projections of the catch. The requirement that vessels report landings on a weekly basis through an IVR system is also intended to help determine the appropriate time to implement effort controls. Recent changes to the NMFS dealer reporting system will also require weekly telephonic reports. For the first time, there will be both dealer and vessel statistics available on a weekly basis to use in projecting when the TAC will be reached.

According to a Food and Agriculture Organization (FAO) report, the use of a TAC where the quota "…is not individually assigned to operators in the fisheries has not had an impressive track record in either resource conservation or in economic optimization of fisheries" (Morgan, 1997). This report cites an Organization for Economic Cooperation and Development study of 22 fisheries managed with catch quotas, showing that only 6 were maintained at steady catch levels. Some of the conclusions of this report, however, are not directly applicable to the proposed measures. This same report noted that typically (24 of 37 stocks examined) the TAC is set too high. At least for the initial year of this plan, however, the herring TAC is being set at a very conservative level - 75% of the MSY for a stock that is believed to have a biomass far in excess of B_{MSY}. Some of the other problems noted in this report are also addressed in this management plan. Many of the fisheries studied used quotas to monitor multispecies complexes, rather than an

individual species as in this plan. In addition, very few (only 2) of the fisheries included a system for an annual adjustment of the TAC based on stock status. A key element of this herring proposal is that the TAC will be determined on an annual basis after a review of the status of the coastal stock complex. Finally, the plan does not rely solely on a TAC, but uses effort controls to slow the catch of herring.

In establishing the TAC system, the Council carefully considered the impact of the TAC on other fisheries. While in 1997 over 97 percent of reported herring landings were caught by 16 vessels, over 185 additional vessels reported some landings of herring. These vessels primarily participate in the groundfish, shrimp, and mackerel fisheries, using mid-water and bottom trawls. The Council considered prohibiting the landing of herring in these fisheries after the TAC in an area is reached, or closing any fishery that has an incidental catch of herring. If the first approach was chosen, the effect will be to increase regulatory discards of incidentally caught herring. The second approach, while very effective in protecting herring, would impose severe hardships on other fisheries with little additional protection provided to the herring resource. As a result, it is not considered to be cost effective. Another difficulty in this approach is the reliance of the lobster and tuna fisheries on bait herring. A prohibition on the possession of herring after the TAC is reached would cripple these industries with no benefit to the herring resource.

The proposed action is a compromise. After 95% of the TAC is reached in an area, vessels will be limited to a small incidental catch of herring. While directed fishing for herring will cease, exceeding this 5% set aside will not result in a prohibition on the landing of herring or closure of these other fisheries. This could result in exceeding the TAC in a given area. A rough analysis, however, indicates this is unlikely.

Most herring landings are from purse seine, mid-water trawl, or fixed gear (stop seine and weir) fisheries. Bottom trawl, sink gillnet, and shrimp trawl fisheries, however, do catch some herring. Observer/sea sampler observations on the ratio of herring catch to total landings (from the dealer weighout database) were used to determine rough approximations of the catch of herring in bottom trawl, shrimp trawl, and sink gillnet fisheries. The range of estimates for annual catches (landings and discards) from these gear types in all areas is 2,294 mt to 7,342 mt. Catch ratios could not be determined for mid-water trawls due to a lack of observer/sea sampler reports. As a comparison to the predicted estimates, the reported herring landings for bottom trawl and sink gillnet gears (from the dealer weighout database) are also listed in Table E.51 and Table E.52. Upon implementation of the management plan, the management area most likely to have catches approach the TAC is Area 1. Management Area 1 vessel trip report data was examined to estimate the magnitude of incidental reported landings by all gear types.

These estimates should be used with caution. The incidental catch ratios have not been examined to determine whether sampling was adequate to characterize each fishery. Some monthly ratios do not accurately represent catches of the gear in use, illustrated by actual landings of herring exceeding the estimate predicted by the ratio. The lack of estimates from the mackerel fishery, whose vessels have occasional large landings of herring, may result in an underestimate of actual

incidental catches. Summing the observations over the range of the fishery may gloss over local variations. There are also differences between landings attributed to bottom trawl gear in the dealer and vessel trip report databases. The dealer weighout database attributes more landings to bottom trawls than the vessel trip report database. A cursory review indicates some landings in the dealer database may have been mis-assigned to bottom trawls. To the extent the dealer weighout database overestimates bottom trawl landings of herring, this analysis may actually overestimate the incidental catch of herring by bottom trawl vessels. Finally, some large herring landings from bottom trawls indicate some bottom trawl trips may be directed on herring and may not be incidental catches. To the extent these trips are included in the various "incidental catch" definitions, they will overestimate the true incidental catches during a closure.

The Northeast Fisheries Science Center (NEFSC) examined the observer and sea sampler databases for information on the catch of herring by gears that do not normally target herring (see Appendix II). Four gears were identified to be of interest: bottom trawls (gear code 50), shrimp bottom trawls (gear code 58), sink gillnets (gear code 100), and mid-water trawls (gear code 370). Estimated ratios of herring catches to total landings were determined for the first three gear types. These ratios were determined for the entire time period (1989-1997) by statistical area, month, and an overall ratio for the time period. Annual trends in the ratio were also computed. Ratios could not be estimated for mid-water trawls because of the limited number of observations.

The monthly, annual, and overall ratios were applied to total landings (all species) obtained from the dealer weighout database to estimate herring catches for bottom trawls and sink gillnets from all areas. The estimates were not broken down by statistical area because the dealer weighout database does not include location of catch. The results are shown in tables Table E.51 and Table E.52. The actual reported herring landings for the various gear types were obtained from the same database for comparison. Incidental catches of herring in shrimp trawls are estimated by applying the annual landing ratios to landings of northern shrimp.

The estimated catches of herring in bottom trawls range from 2,205 mt to 6,794 mt, depending on year and which catch ratio is used. Shrimp fishery incidental catch estimates range from 80 to 588 mt for the period 1989 – 1996. In the sink gillnet fishery, the estimates range from 9 mt to 278 mt. These estimates include all catches, regardless of disposition.

By using bycatch ratios computed on an annual basis, this approach may gloss over differences in bycatch ratios in different areas. To get a sense of the magnitude of this potential problem, incidental catches in Management Area 1 were examined. The vessel trip report database was examined to estimate the amount of herring reported landed from Management Area 1 as an "incidental catch." "Incidental catches" were identified in three ways: herring landings from vessels that landed no more than 50 mt of herring from all areas, herring landings from vessels that landed no more than 20,000 mt of herring from all areas, and herring landings from vessels that landed less than 2,000 pounds of herring per trip that landed herring from Management Area 1. Under any of these definitions, "incidental catches" does not include vessels that may land more than 50 mt of herring in the course of the year while targeting herring for a small number of trips

– a practice that some whiting vessels pursue in the late summer. In 1996 and 1997, the average herring incidental catch landings per trip for vessels identified in these three ways was less than 800 pounds. A trip-by-trip analysis was not performed to determine herring landings as percentage of the value of each trip or the distribution of landings.

The conclusion from this analysis is that in recent years, the estimated incidental catch (landings and discards) of herring over all areas in the bottom trawl, shrimp, and gillnet fisheries ranged from 2.5% to 6.6% of reported herring landings. In Management Area 1, the estimated incidental landings of herring were less than 200 mt in 1996 and 1997. It should be noted these percentages are for the entire year, not just the period after an area closure or imposition of effort controls. Consequently, the proposed action should prevent the TAC from being exceeded. It is possible that in the future, the percentage set-aside may need to be adjusted. While these estimates do not include incidental catches in the mackerel fishery, the character of that fishery will minimize its impact on the overall TAC. The overwhelming majority of mackerel landings occur at the start of the herring fishing year, from January through May. It is unlikely that any area will be closed or subject to effort controls during this period. Any herring landed in connection with this fishery will be counted against the TAC, not the 5 percent set-aside. These landings will be caught before the imposition of the trip limit. Because the mackerel fishery will be essentially over, the trip limit should not encourage regulatory discards by mackerel vessels.

Two other factors should be considered when evaluating the impact of this approach. First, many of the fisheries that report incidental catches of herring are under increasing regulatory restrictions. Reductions in fishing effort should result in a reduced level of incidental catches of herring. Second, the plan has adopted a conservative approach to harvest levels in the initial year. OY is established well below the MSY level. Given current conditions, in most management areas there is some flexibility to monitor the incidental catch estimates and adjust as necessary (through framework action) in later fishing years. One area of possible concern is Management Area 1A, where the resource may be fully utilized. The proposed 45,000 mt TAC will result in an incidental catch set-aside of 2,250 mt. This is nearly three times the estimate of incidental catches of herring from all of Management Area 1 in 1999. It is nearly equal to reported landings of herring by bottom trawl vessels from all areas in 1997. Given increasing effort restrictions on other fisheries, it's unlikely that this amount underestimates the incidental catches that can be expected after the directed fishery is closed.

The Council originally considered closing the directed herring fishery only when the projected landings reached 100% of the TAC, without providing any allowance for incidental catches in other fisheries. Under that scenario, the TAC would always be exceeded by any incidental catches taken after closure of the directed fishery. The adopted approach makes it more likely that catches of herring will be within the TAC limits, while allowing some flexibility for other fisheries to continue.

Bottom trawls, fish																
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Sum**	**Overall**	**Year**	**Est.**
Catch/Landings Ratio	0.044	0.086	0.035	0.039	0.043	0.020	0.010	0.008	0.022	0.021	0.014	0.115		0.033		
1997 - Est. Herring Catch	443	859	334	437	337	146	112	85	228	217	98	799	4,097	3,668	0.0196	2,205
1997 - Reported Landings	*402*	*474*	*229*	*410*	*74*	*109*	*186*	*68*	*119*	*51*	*145*	*102*	*2,368*			
1996 - Est. Herring Catch	491	488	547	428	431	537	489	445	475	546	450	324	5,651	4,171	0.0531	6,794
1996 - Reported Landings	*281*	*505*	*217*	*150*	*143*	*25*	*6*	*10*	*433*	*159*	*597*	*442*	*2,969*			
1995 - Est. Herring Catch	372	375	506	471	383	535	607	413	371	480	401	292	5,205	3,840	0.0318	3,746
1995 - Reported Landings	*202*	*357*	*322*	*156*	*514*	*0.3*	*82*	*42*	*54*	*0.4*	*245*	*466*	*2,440*			

Table E.51 - Estimated herring catch from bottom trawls, gear code 50. (Shaded areas highlight months that actual reported landings exceeded estimated catch.) (Source: Herring catch to landings ratio from NEFSC letter date February 20, 1998; total landings from the NMFS dealer weighout database.)

Sink gillnet																
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Sum**	**Overall**	**Year**	**Amount**
Catch/Landings Ratio	0.0002	0.0003	0.0007	0.0008	0.0021	0.0065	0.0129	0.0217	0.0055	0.0022	0.0016	0.0002		0.0084		
1997 - Est. herring Catch	1	1	2	2	6	21	48	69	16	5	3	0	173	278	0.0007	23
1997 - Reported Landings	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*28*	*0*	*3*	*0*	*0*	*35*	*35*		
1996 - Est. Herring Catch	0	0	1	1	6	27	62	77	15	5	3	0	197	249	0.0073	216
1996 - Reported Landings	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2*	*0*	*0*	*0*	*0*	*2*	*2*		
1995 - Est. Herring Catch	0	0	1	1	7	32	70	65	14	5	3	0	200	251	0.0003	9
1995 - Reported Landings	*0.1*	*0.0*	*0.0*	*0.1*	*0.1*	*0.2*	*0.0*	*15.7*	*21.7*	*1.7*	*15.3*	*0.0*	*55*	*55*		

Table E.52 - Estimated herring catch from sink gillnets, gear code 100. (Shaded areas highlight months that actual reported landings exceeded estimated catch.) (Source: Herring catch to landings ratio from NEFSC letter date February 20, 1998; total landings from the NMFS dealer weighout database.)

Year	Shrimp Landed (MT)	Herring Bycatch Ratio	Estimated Herring Bycatch (Bycatch Ratio X Shrimp Landings)
1989	3,610	.1629	588
1990	4,385	.0254	111
1991	3,377	.0593	200
1992	3,382	.0363	123
1993	2,270	.0094	21
1994	3,718	.0091	34
1995	6,829	.0117	80
1996	9,524	.0221	210
Total	40,176	.0327	1313

Table E.53 - Estimated herring catches in the northern shrimp fishery 1989-1996. Bycatch ratios based on 856 hauls sampled between 1989 and 1996. (Source: Herring catch to total landings ratios from NEFSC letter dated February 20, 1998; shrimp landings from NMFS Fisheries Statistics and Economics Division, pers. comm.)

Criteria for identifying "incidental catches"	Number of trips landing herring from Area 1		Herring landed from Area 1 (mt)		Number of Vessels		Herring lbs/trip (Area 1)	
	1996	1997	1996	1997	1996	1997	1996	1997
Total herring landed by each vessel less than 50 mt from all areas	706	432	192	155	99	64	599	789
Total herring landed by each vessel less than 20,000 lbs from all	532	368	71	45	94	60	292	267
Average Area 1 herring trip less than 2,000 pounds	659	408	103	74	93	58	248	399

Table E.54 - 1996/1997 Reported landings of "incidental catch" herring, Management Area 1 (Source: NMFS VTR database, unpublished data)

E.7.2.5.2 TAC Distribution

The distribution of this TAC to different management areas and seasons provides a measure of protection to individual spawning components. The range of options considered by the Council provided different levels of protection. The proposed action specifies an annual TAC for each of the management areas and sub-areas (1, 1A, 2 and 3, Figure 4). The distribution of the overall TAC is based on existing knowledge of stock structure, mixing, and current fishing patterns. The proposal acknowledges that over time the information on stock structure may change, and allows the PDT/TC to revise the distribution pattern to take into account new information.

The TACs in this option are based on current fishing patterns and estimates of stock mixing. The TACs established in Area 1A, 1B and 2 take into account the mixing of Gulf of Maine herring with those from other components in the summer and winter. By controlling the catch in Area 2, some control is exercised over the amount of Gulf of Maine fish caught during the winter months. If the catch in this area during this time period were unlimited, it is possible that the Gulf of Maine spawning component could be rapidly depleted without notice. The assignment of part of the Area 2 TAC to a TAC reserve provides some control over this winter fishery.

Mistakes in estimating the relative size of the various spawning components, or in estimating migration of herring during the course of the year, could result in establishing a TAC that does not provide protection to specific spawning components. The cautious approach taken in establishing OY helps to reduce the likelihood that any such mistake will result in severe damage to the resource.

A number of different options were considered for the TAC system. The options are described below (identified as in the draft management measures).

Option 1 proposed assigning a TAC to Management Areas 1A, 1B, 2A, and 2B/3. (the proposed Management Area 2A – the northern part of management Area 2 – is not adopted by this plan). The seasonal (winter) TAC assigned to area 2A would have explicitly considered the mixing of Gulf of Maine and GB/NS fish in this area. By limiting the catch in this area, some control is exercised over the amount of Gulf of Maine fish caught during the winter months. If the catch in this area during this time period were unlimited, it is possible that the Gulf of Maine spawning component could be rapidly depleted without notice. Similarly, the TAC in Area 1A protects the Gulf of Maine fish in this area during the remainder of the year. TACs for the other areas insure that the overall catch does not exceed the OY. This option was rejected because of uncertainty over the migration of Gulf of Maine fish into the proposed Management Area 2. While the migration patterns can be estimated based on the location of herring in this area during the winter months when the Georges bank stock had collapsed, the exact location of fish in this area is unknown.

Option 3 proposed assigning TACs to all four areas for each of three seasons. It makes explicit

use of knowledge on stock structure and relative stock sizes to control catch in each area and time period so that individual spawning components are not damaged. In theory, this option provided the greatest protection to individual spawning components of herring. In practice, however, this option relied on a level of detail on stock structure that is lacking. The complexity of the scheme also made it less likely that it could be accurately monitored and implemented, reducing it is effectiveness.

Option 4 proposed assigning TACs to the three major management area based on an estimate of the amount of fish that is present in these areas on an annual basis. It does not have as close a relationship to current knowledge on stock structure. It does provide some measure of protection to the individual spawning components, primarily through the use of conservative TACs. Because this method puts less emphasis on seasonal migrations of herring, any amount of herring assigned to Management Area 1B reduces the amount of herring available for Management Area 1A. TACs must be set at a conservative level to prevent overfishing on specific spawning components. This option was rejected because of its reliance on historic fishing patterns that may change.

Option 5 proposed assigning one overall TAC to the entire CSC based on the ABC and OY. This option ignores any information on stock structure, and assumed that the entire coastal stock complex is one homogenous stock. For this reason, it provides no protection whatsoever to individual spawning components. In theory, the entire OY could be taken from the Gulf of Maine in the summer months. Harvests at this level far exceed historical catches from this area and could not be supported. This approach could decimate herring stocks if all fishing effort is concentrated in one management area.

E.7.2.5.2.1 Initial TAC Distribution

The specific TAC distribution for the first year of the plan can be examined to gain a qualitative sense of the likelihood it will meet the objectives described in the previous section. For the initial year of the plan, the recommended TACs for the individual areas are as follows (from 3.6.3.1):

Area	TAC
Area 1A	45,000 mt
Area 1B	25,000 mt
Area 2	50,000 mt
Area 3	50,000 mt
Area 2 TAC Reserve	54,000 mt
Total TAC	224,000 mt

Table E.55 – Initial TAC distribution

In the last twenty years, the herring fishery has concentrated in the inshore Gulf of Maine area, Area 1A. Landings in Management Area 2 the southern New England area) were less than 20,000

mt until 1997 and 1997, and landings on Georges Bank have been negligible until 1997 (1998 landings from this area are expected to approach 20,000 mt). Landings exceeded 70,000 mt in 1996 and 1997 from the inshore Gulf of Maine area. The SARC noted in its advisory report that "It is currently unknown whether the fishing mortality rates in Management Area 1 are sustainable" (NEFSC 1998a). Further, the SARC cautioned that any increases in catch should not come from the Gulf of Maine stock component. The proposed initial TACs consider this advice. In particular, the proposed 45,000 mt TAC for Area 1A is lower than the reported catch from this area for any year since 1989.

Fishing effort has concentrated on the inshore area of Management Area 1A due to convenience (lower operating costs) and the ready availability of herring. In 1996, approximately 8,700 mt were caught in statistical area 515, which roughly corresponds to Area 1B. The proposed TAC of 25,000 mt from this area is a substantial increase, based on the belief that during some periods of the year, there are considerable herring in this area from several spawning components that are available. The restrictive TAC in Area 1A, which will move fishing effort out of this area, will force vessels into Area 1B to catch these fish. The result should be additional protection for the Gulf of Maine spawning component as effort is moved onto other components of herring.

For the other two management areas, the TACs represent the estimate of SAW 27 that 65% of the stock complex occupies Nantucket Shoals and about 10% (increasing in recent years) occupies Georges Bank during the spawning season. While all three spawning components mix during the year, these herring are most susceptible to harvest in the winter months or during the spawning season. The assigned TACs, while a substantial increase over recent catches from these areas, take into account mixing throughout the year. Only 66% of the overall TAC (including the TAC reserve) is assigned to Management Areas 2 and 3, taking into account the fact some of these herring are caught in the other management areas due to mixing.

E.7.2.5.3 Mandatory Days Out of the Fishery

Fishing effort will be reduced as the TAC is approached by requiring vessels to take mandatory days out of the fishery. The number of days taken out of the fishery is determined by how close the catch is to approaching the TAC. This regulation should reduce catch rates as the TAC is approached. This will facilitate a more accurate prediction of when the TAC will be reached, helping to prevent the TAC from being exceeded before the fishery can be closed. The greater the accuracy that attainment of the TAC can be projected, the more likely that mortality targets will not be exceeded.

This measure also redistributes fishing effort to other areas, further reducing effort in a particular area. As the number of days out of the fishery increases, some vessels may choose to relocate to areas that remain open. This is likely to be an option for the larger vessels that fish in Management Area 1A, who can easily move into Management Area 1B and continue to fish on the mandatory days out of the fishery. Whether they will choose to fish in both areas, or shift operations into areas where they can fish without interruption, is uncertain and will be based in large measure on

market conditions caused by the imposition of effort controls.

Most herring trips for both mid-water trawl and seine vessels are one day or less in length. The number of consecutive days taken out of the fishery is based on an analysis of the number of trips that would have been effected in 1996 if these measures were in place. This analysis demonstrated that taking a certain number of consecutive days out of the fishery would have affected a percentage of the total trips taken. If two consecutive days are taken out of the fishery, 12.8% of the fishing days were removed; if three consecutive days were taken out of the fishery, 26.5% of the days were removed. The relationship between landings and number of trips is not clear. If, in 1996, all trips examined landed the maximum amount of herring possible, then a reduction in the number of trips should have a proportional reduction in the amount of landings, but an examination of trips that landed in Maine in 1996 shows that many trips land only a fraction of the documented hold size. If a vessel can increase its landings on an open day, replacing the landings that would have been caught on a closed day, it will reduce the impact of days out of the fishery. This means the exact impact of the consecutive days out of the fishery cannot be accurately predicted. Should this effort control be ineffective the TAC will still limit the overall harvest.

In analyzing the economic impacts of the alternatives, the impact of this measure was modeled on the catches from Management Area 1 in 1996 and 1997. The results of the model indicate that this measure may slow the rate of landings. Once again, this model should be viewed with caution as it does not predict any compensatory action by fishermen to make up reduced revenues caused by the days out of the fishery. The actual reduction in landings will be less than predicted by the model by some unknown amount.

When directed herring vessels cannot fish in an area because of mandatory days out of the fishery, some herring will continue to be taken by vessels in other fisheries. These vessels will be subject to a 2,000 pound limit per trip. It is unlikely any vessel will target herring at this low level, equal to about $120 in ex-vessel revenue. This limit will allow the landing of incidental catches of herring, minimizing discards. As shown in Table E.54, the average landings of herring for incidental catches in 1996 and 1997 were less than 800 pounds per trip.

E.7.2.5.4 Vessel Size Limits

Domestic vessels catching, taking, or harvesting herring are limited to less than 165 feet in length and 750 GRT. No vessel catching herring can have more than 3,000 shaft horsepower. While this measure is primarily designed to limit the entry of excessive fishing capacity into the fishery, it may also have beneficial biological impacts.

SAW-27 (NEFSC 1998a) expressed concern about the precision of current estimates of fishing mortality and spawning stock biomass for the coastal stock complex. The SARC's management advice further stated that any increase in landings should occur incrementally so that the precision of these estimates can be improved. The large estimates of biomass are, in part, a result of very high recruitment in the 1990's. The SARC believed that a rapid increase in catches could have a

detrimental impact on the stock.

Large harvesting vessels entering the fishery could have exactly the impact that the SARC cautioned against. According to public testimony, some vessels in the 300-foot range are estimated to be capable of harvesting 200 to 300 mt of herring each day, limited by processing capacity. Based on this daily harvest, one such vessel could be capable of catching as much as 40,000 to 60,000 mt of herring if fishing for 200 days in a year. This would be an immediate increase in catch of nearly 40% over the 1996 and 1997 reported landings. While vessels of this size may choose to fish only part of the year for herring, even a harvest of 20,000 mt – possible with only 100 days of fishing by one vessel - is an immediate increase of 20% over recent landings. While there could be a similar impact if a large number of smaller vessels simultaneously enter the fishery, because of economic limitations on converting vessels and market limitations it is less likely that the increase will occur in as rapid a fashion. Generally, smaller vessels are also more likely to be limited in the number of days they can fish due to weather, carrying capacity, and the endurance of the vessels. This also tends to reduce the overall catch of these vessels. No single vessel fishing for herring in 1996 harvested more than 20,000 mt even though some vessels fished for over 190 days in the year. The average daily landings of the twenty vessels that landed the most herring in 1997 were only 77 mt, far less than the possible 200 mt average catch of a large fishing vessel (see Table E.14). This illustrates that both catch rates and overall landings for existing vessels are likely to be significantly less than for a vessel that exceeds the size limitation.

With respect to overall fishing mortality, the size of vessel (and resultant catch rates and overall harvesting capacity) becomes less important with the establishment of a "hard" TAC. As long as effective catch control measures are in place, from a biological standpoint, the size of the vessel should make little difference to the management of the herring resource. Large vessels may, however, reduce the effectiveness of those catch controls. If a number of large vessels enter the fishery, it is possible that the resultant high catch rates may make it difficult to accurately assess the industry's progress towards reaching the TAC. This may result in overshooting the TAC, with resultant damage to the resource. As noted above, existing vessels in the fishery have lower catch rates than the estimated catch rates for vessels over the size limit. By limiting the size of vessel in the fishery, it may be easier to accurately determine when effort controls should be imposed. Because of the lower catch rates of the smaller vessels, the magnitude of error caused by missing reports from any one vessel is likely to be less. The opposing view is that it may actually prove easier to monitor a small group of large vessels than a large group of smaller vessels.

The current OY is based on estimates of existing DAH and DAP in the New England area. It is a conservative figure, less than the estimated MSY for the resource. Part of the reason for choosing this MSY is because of the uncertainties highlighted in the SARC report. If a an immediate increase in DAH and DAP is allowed into the fishery through the entry of large domestic fishing vessels, the increase in DAH and DAP could result in a corresponding increase in OY. This would not be consistent with the SARC's recommendation to increase landings in an incremental fashion.

Another possible impact of not allowing large vessels to enter the fishery is that overall fishing

effort may be distributed over a wider area and longer time period, helping to protect individual spawning components. The reduced catch rates of smaller vessels may result in spreading the effort over longer time periods. This may occur, in particular, on the offshore areas, where the limited capacity, seakeeping ability, and endurance of smaller vessels will reduce the number of days spent actually fishing. If a large number of small vessels enter the fishery, however, their total effort could approach the average catch rates of several vessels over the size limit.

The plan proposes to limit at-sea processing by U.S. vessels that exceed 165 feet or 750 GRT to a specific allocation. Catch rates by vessels supporting at-sea processors can be expected to be similar to the catch rates for a large harvesting vessel, as the processors have similar processing capacity and can be expected to hire enough catcher vessels to support that capacity. Restricting those vessels to a specific allocation will insure that a high catch rate by vessels support large processors does not result in exceeding the TAC, resulting in some limited biological benefits to the measure.

E.7.2.6 Use Restrictions

The plan allows the harvest of roe from herring as long as the carcass is not discarded. The requirement that the carcass be retained is intended to reduce waste in the herring fishery. During initial development of the pollock roe fishery in the North Pacific, harvesters discarded male pollock and the carcasses of female pollock; this practice is now prohibited (Witherell 1997). This practice complicates the enforcement of the overall TAC, as it is difficult to accurately estimate the quantity of male fish discarded. It also makes it difficult to estimate the overall harvest of herring in such an operation, as there is no accurate way to compare the roe on board a vessel with the operator's reported total catch. There isn't any way to estimate how many herring were discarded without removing the roe. By requiring the retention of all carcasses, it is possible to develop a relationship between the weight of the roe product and the weight of the carcass, creating a more accurate estimate of the actual harvest. This will help insure that the catches remain within the established TAC.

One potential biological impact of allowing the harvest of roe is a direct result of the high economic value of this product. Because of spawning closures and state spawning restrictions in the Gulf of Maine, it is unlikely that a significant roe fishery will develop in this area. The high value of the product may encourage vessels to conduct a roe fishery on Georges Bank or Nantucket Shoals. This could have the beneficial effect of moving fishing effort into other areas, reducing mortality in Management Area 1.

The amount of herring harvested for roe, if excessive, could have an adverse impact on spawning. This fishery will be monitored and, if necessary, further controls implemented through framework action. The simplest way to control the roe fishery is to limit the amount of herring that can be harvested for this purpose.

E.7.2.6.1 Other Roe Fishery Alternatives

The Council considered several options for managing the development of the roe fishery, including a complete prohibition on harvesting herring for roe. A prohibition would reduce the incentive to fish on spawning fish (outside of the spawning closures) and would provide the most protection to the resource. The Council also considered establishing a limitation for the amount of herring that could be harvested for roe. There is little information available to determine an a appropriate level for this activity, however, so the Council instead chose to allow this activity and to monitor its development. The Council also considered establishing regulations for a roe-on-kelp fishery. In these activities, herring are confined in some manner, allowed to spawn on artificial or real kelp, then released. This provides an opportunity to profit from herring roe while minimizing the mortality of herring. The Council decided not to regulate this activity, however, since it is more likely to occur in state waters and should therefore be regulated by the states.

E.7.2.7 General Administrative Provisions

While the administrative provisions of the plan do not have a direct impact on the resource, they should improve management of the resource and help prevent overfishing.

The establishment of vessel, dealer and operator permit requirements will identify participants in the herring fishery. It also enables managers to identify participants in the fishery who should be reporting landings or purchases of herring. These requirements are necessary if management of the resource will be based on an accurate knowledge of landings and effort.

There is no current comprehensive reporting requirement for vessels fishing for herring in the EEZ. Many herring vessels possesses a federal permit of some sort and must report all herring landings through the vessel trip report system. There are some vessels that may not report all herring landings in a timely fashion, or do not report because they do not possess a federal permit. The requirement for vessels and dealers to report catches and purchases will indirectly have a positive biologic impact. Developing a comprehensive reporting system is needed to monitor catches. This, in turn, will lead to better estimates of fishing mortality and assessments of the status of the herring resource. The requirement that dealers or vessels report herring landings on a weekly basis will help managers track progress towards achieving the TAC. By making this requirement more frequent than standard monthly report, the likelihood that the TAC will be exceeded is reduced. As a result, managers will be better able to tailor measures to insure the target fishing mortality is not exceeded.

The establishment of an annual review of the plan reduces the likelihood that any negative impacts of the fishery on the herring or other resources will be undetected for any length of time. The periodic adjustments to the specifications, in a similar fashion, will make it easier to achieve the targeted fishing mortality. The framework management measures will make it easier and quicker to implement and adjustments to the management measures. A more rapid response to problems or changes in the fishery is the result.

E.7.2.8 Vessel Monitoring System (VMS)

The adoption of a VMS requirement is needed to enforce the area specific TACs. While a VMS position does not prove fishing activity, the ability to track vessel locations when underway provides NMFS a limited capability to confirm that vessels are operating in the same areas that they are reporting their catches. This will encourage accurate reporting of catch locations, a key element of the TAC distribution scheme. Accurate catch reports will insure that the area specific TACs are not exceeded, with the result that fishing mortality on specific spawning components will be limited to acceptable levels.

E.7.2.9 Measures to Reduce/Monitor Bycatch

Because of the limited information available on bycatch in the herring fishery (summarized in section E.6.4.2.6), there are no management measures proposed specifically to reduce bycatch. There are several measures, however, that will encourage reduction in bycatch and help to identify the extent of the problem. Bycatch and incidental catch will be considered when developing herring TACs. Vessels are required to report all herring caught (including discards) on the vessel trip report. In this manner, there will be an incentive for the industry to reduce the amount of herring discards as all amounts of herring caught will be applied to the TAC; it will be to the advantage of the industry to develop fishing practices and methods that maximize the economic value of the herring caught. The plan also encourages the development of an observer program to collect additional information on discards and incidental catch, and acknowledge that such programs may be developed through industry initiatives.

Provision also is made in this plan to allow the landing of herring in other fisheries. If an open access management system is selected for the herring fishery, there will not be any limits on the amounts of incidentally caught herring that can be landed, as long as vessels possess a permit and report all herring catches. During periods when the directed fishery is closed, vessels in other fisheries will be allowed to land up to 2,000 pounds of herring per trip. Similarly, if a controlled access system is implemented for the herring fishery, vessels in other fisheries will be allowed to land the same 2,000 pound incidental catch limit per trip.

One possible adverse result of the use of TACs may be the mis-reporting of catch. If vessel operators know that discarded herring will count against the TAC if it reported, they may choose not to report these catches, particularly in those areas that may be subject to closure or effort controls as the TAC is reached. Ultimately, this practice will reduce the estimates of catch included in the assessment. The impact this mis-reporting will have on estimates of stock size and mortality depends on many factors and cannot be predicted. The possibility this will occur makes it essential that accurate information on discards be obtained from objective observers of the fishery.

E.7.2.10 Biological Impacts of Alternatives Not Selected

E.7.2.10.1 No Action

Under the no action alternative, Atlantic herring would continue to be managed through a combination of the Commission's Atlantic Herring FMP, a Preliminary Management Plan in federal waters, and state regulations.

The existing management mechanisms do not include any controls on the harvest of herring by domestic vessels. Herring landings have increased rapidly in the last five years, particularly in the inshore Gulf of Maine area, and may continue to do so as markets are developed. Without controls on the harvest of herring by domestic vessels, herring could be overfished. Intense fishing pressure from foreign fleets in the 1970's resulted in the collapse of the herring resource on Georges Bank. The resource took over ten years to recover from this collapse. Given the key role of herring as a forage species in the ecosystem, a similar collapse in the Gulf of Maine could have far-ranging impacts on other species, from marine mammals to rebuilding groundfish species.

For the most part, under the existing management regime most herring fishing has occurred in the inshore Gulf of Maine. Landings from Georges Bank have been less than 3,000 mt since 1977, but are expected to exceed 20,000 mt in 1998. In the southern New England area, landings were less than 10,000 mt between 1977 and 1994, increasing to 20,000 mt in 1996 and 1997. By contrast, landings from the Gulf of Maine have steadily increased from a low of nearly 25,000 mt in 1983 to a high of over 81,000 mt in 1996. Under the no action alternative, fishing effort is expected to continue to concentrate in the inshore Gulf of Maine area until the resource can no longer support it.

In addition, existing management plans do not adequately protect individual spawning components. The existing Commission FMP implements spawning restrictions that can only be enforced by the states that have adopted the regulations (Massachusetts, Net Hampshire, and Maine). Vessels from other states that fish in the EEZ during the spawning closures are only subject to the restrictions if they choose to land their catch in one of these three states. The spawning restrictions in the Commission's proposed amendment are designed to complement closures in the EEZ. By limiting the spawning restrictions to state waters in the Gulf of Maine, the states are leaving it to the Council to provide protection in the EEZ. If action is not taken by the Council, individual spawning components could be eliminated, weakening the ability of the resource to survive normal population fluctuations. Almost all of the recent increase in landings is from harvest of herring in the Gulf of Maine. Current landings exceed an estimate of the long term yield of this spawning component. Continued fishing at this level, or increased fishing pressure, could collapse this resource. As a key forage species, overfishing the herring resource would also adversely impact other fisheries in the northeast.

The Commission's pending amendment to its FMP adopts many of the same measures that are being proposed by the Council. These measures will apply in state waters. Without action by the Council, many of the measures could be extended into federal waters as well. This would require additional action by the Commission's herring section and the Secretary of Commerce which would delay implementation of the FMP. Another difficulty is that absent action by the Secretary

of Commerce, the ability to enforce any of these measures is constrained by a lack of jurisdiction in the EEZ, and a lack of enforcement resources.

E.7.2.10.2 Controlled Access

The Council considered establishing a controlled access or limited entry system for the herring fishery, particularly in the Gulf of Maine. The system proposed would have matched effort to the available resource. The system would have included establishment of a TAC and effort controls to complement the limits on capacity. Because the primary control on fishing mortality was the use of a TAC, as in the adopted open access system, there should be little difference in the biological impacts on the resource of the two approaches to management. One potential advantage to a limited entry or controlled access scheme is the limited number of participants in the fishery may make it easier to monitor the TAC.

Days at sea limitations, considered as part of the controlled access option, would help to limit harvests by restricting fishing effort. Vessels would be allowed to fish a specific number of days of their own choice.

E.7.2.10.3 Other Management Alternatives

There were several additional management measures considered for use in the open access system. Closed seasons and closed areas could be used to restrict harvests. Both closed season and closed areas must be implemented for extended periods to significantly reduce landings and fishing mortality. In the case of herring, a closed season or area may be more effective if scheduled when herring are aggregated and easy to catch—such as just prior to spawning.

Establishment of a minimum fish size can discourage the harvest of juvenile fish. The biological benefit of this measure is that more fish may grow to adults and spawn before they are caught. Such a measure may be problematic in this fishery, however, as it is difficult for fishermen to target herring by size during periods when adults and juveniles are mixed. The danger is that this provision may result in excessive discards of juvenile fish that are taken while fishing for larger fish.

In theory, gear restrictions may help limit catches, reduce bycatch, target specific fish sizes, or address other concerns. The reality is that during plan development, the only specific measure that was identified was the use of a trynet to determine if a particular school of fish should be harvested. The use of a minimum mesh size is not viewed as an effective way to control mortality on juvenile fish because the large catches soon prevent escapement through the mesh. No bycatch reduction devices were identified. These techniques merit additional inquiry an may be adopted in the future through framework adjustment action.

E.7.2.11 Impacts of the Proposed Action on Protected Species

The management measures proposed in the Atlantic Herring Plan are found in Section 3.0. There have been no limits on the harvest of Atlantic herring prior to the adoption of this plan, although there is increased interest in the development of the fishery. The primary management measures are intended to control fishing mortality on a resource that is considered to be underutilized and where fishing mortality is currently assessed at low levels. Accordingly, management measures do not reduce fishing mortality, but establish controls so that as the fishery expands, there is protection for individual spawning components and fishing mortality is maintained at levels consistent with the overfishing definition. The impacts of establishing a conservative overfishing definition, from both a herring resource and ecosystem perspective, are discussed in section E.7.2.1. Other measures are discussed below relative to their impacts on protected species, either ESA-listed species or those managed under the MMPA.

E.7.2.11.1 Impacts of the Management Measures

E.7.2.11.1.1 Background on Recent Management Actions Affecting Protected Species in the Northeast

Right Whales: Following an unprecedented number of northern right whale deaths in 1996, NMFS determined that the continued operation of fishing under the Council's Northeast Multispecies FMP was likely to jeopardize the continued existence of the northern right whale. To remove the threat of jeopardy, the Council adopted the reasonable and prudent alternative provided by NMFS in their December 13, 1996 Biological Opinion. The action was implemented as Framework 23 to the Northeast Multispecies FMP and closed right whale critical habitat in Cape Cod Bay and the Great South Channel to sink gillnet gear during times of peak whale abundance.

In addition, in July, 1997 NMFS published the interim rule for the Atlantic Large Whale Take Reduction Plan (ALWTRP), a program to reduce takes of right, humpback fin and minke whales in four east coast fisheries, including the multispecies sink gillnet fishery. Accordingly, consultation was reinitiated again in 1997 to consider the ALWTRP and the operation of the sink gillnet fishery, among others. With the conclusion that the fishery may affect but would not jeopardize the continued existence of any listed species of whale or turtle under NMFS jurisdiction, the ALWTRP was substituted as an expanded reasonable and prudent alternative. It is anticipated that implementation of the ALWTRP in November, 1997, in concert with other recovery efforts by NMFS and other agencies, will remove the threat of jeopardy to the northern right whale represented by the multispecies fishery. The ALWTRP final rule was published in February, 1999. Several improvements were made to enhance the effectiveness of the plan, but none that affect any gear types operating under the Atlantic Herring FMP.

Harbor Porpoise: Although NMFS has made a final determination that listing the Gulf of Maine/Bay of Fundy population of harbor porpoise as threatened under the Endangered Species Act is not warranted at this time, concerns remain because of the high level of bycatch in gillnet as

well as several other fisheries. Because of the historic bycatch problem, a number of framework adjustments to the Multispecies FMP (4, 12, 14, 16 and 19) were proposed by the Council and implemented specifically to protect harbor porpoise beginning in 1994.

Building on several of the time/area closures implemented under the Northeast Multispecies FMP, NMFS published a Harbor Porpoise Take Reduction Plan (HPTRP) for the Gulf of Maine and mid-Atlantic waters in December, 1998. The plan is intended to meet the Potential Biological Removal level of 483 animals established for this species by requiring the expanded use of acoustic deterrents, in addition to time and area closures. The effect of HPTRP is further enhanced by the implementation of Framework Adjustments 25 and 26 to Multispecies FMP, actions that reduce catches of Gulf of Maine cod and protect the stock during the spring spawning season. Coupled with the HPTRP, these closures of additional areas to all gear capable of catching groundfish provide more protection for harbor porpoise as well as endangered whales by reducing the risk of entanglement.

In addition to the Gulf of Maine and mid-Atlantic coastal gillnet fisheries, harbor porpoise interact with the Canadian herring gillnet and weir fisheries. These fisheries occur mostly in the western Bay of Fundy, in summer and early autumn. Trippel et al (1996) reported that estimated bycatch levels in gillnets in 1986 were 116 animals, and 130 animals in 1989. Based on information collected through an observer program, porpoise bycatch in the Bay of Fundy during 1993 was estimated to be 424. In the mid-1990s, fishery closures, required pinger use, expanded observer coverage and outreach and education programs contributed to a significant reduction in the Bay of Fundy bycatch. The Canadian Department of Fisheries and Oceans has subsequently formalized these activities by publishing a *Harbor Porpoise Conservation Strategy for the Bay of Fundy*. Since implementation of the program, bycatch has been reduced to approximately 20 to 50 harbor porpoise per year.

E.7.2.11.1.2 Specifications

After consulting with the Council, the NMFS Regional Administrator will determine the annual specifications for OY, DAH, DAP, JVPt, JVP, IWP, BT, USAP and the Reserve, using the best available scientific information. The Council acknowledged the key role of herring in the ecosystem by setting the 1999 specifications at a conservative level based on historic fluctuations in herring abundance, uncertainty about current stock size, which, according to SAW 27 could be overestimated, and a possible negative bias in fishing mortality. To avoid overfishing in the early years of the plan, catch levels are capped well below ABC until information becomes available through required reporting and record keeping and can be evaluated.

With OY set at 224,000 mt and a total herring biomass estimated at 2.9 million mt, scientists project a 39 percent increase overall in stock size. This initial allocation should function as the Council intended, allowing controlled industry growth and ensuring an adequate forage base for numbers of marine species in the Northeast and mid-Atlantic regions, including those that are listed as threatened and endangered under the ESA.

By adopting this precautionary approach, based on the Goals and Objectives which are articulated in section 2.3 of this document, the Council also provides clear guidance to the Regional Administrator in determining the annual specifications after 1999. The Regional Administrator is further bound by NMFS's responsibilities under the Endangered Species Act --- to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved --- and by the Marine Mammal Protection Act, to achieve optimum sustainable populations keeping in mind the carrying capacity of the habitat (commensurate with sound policies of resource management).

E.7.2.11.1.3 General Administrative Provisions --- Permit Requirements, Observers/Sea Samplers, Reporting and Record Keeping Requirements, Foreign Processing Vessels, FMP Monitoring and Framework Adjustment Measures

Permit requirements for the various sectors of this fishery which include vessels, operators, dealers, and processors are not expected to have any detrimental impacts on any protected species, although they should contribute toward better resource management and help prevent overfishing. Indirect benefits may accrue because no comprehensive reporting requirements for vessels fishing for herring in the EEZ currently exist. Participants in the fishery will be identified and landings and purchases of herring will be reported. Vessels that transport herring from catcher vessels to a dealer or processor and foreign processor vessels must submit fishing logs and reports.

With the level of detailed reporting required (see section 3.3.3), catches will be better monitored enabling managers to more accurately calculate estimates of fishing mortality and resource status. Weekly reporting will facilitate tracking of TACs, reducing the likelihood that they will be exceeded. The use of observers or sea samplers in the fishery, including those required aboard foreign processor vessels, similarly will contribute to more accurate tracking of catches, catch rates and bycatch. Information collected, along with improvements in state and federal reporting that will be adopted through ACCSP, should improve the quality and reliability of information used to manage this resource.

The FMP monitoring system calls for an annual review of the status of the stock and the fishery as well as the development of any necessary adjustments to the management measures, including recommended specifications. Negative impacts of the fishery on the herring resource or any protected species would therefore be addressed in a timely manner.

As in other Council FMPs, the framework adjustment process allows changes to be made to specified management measures over the course of two Council meetings. While still providing opportunities for public input and requiring biological and economic analyses, this process avoids some of the more lengthy aspects of amendment development and permits the Council to address problems in a timely manner. Framework adjustments have been used to protect harbor porpoise and right whales in the Northeast Multispecies FMP. Measures to address issues related to protected resources are also available in the Herring FMP. The plan specifies that closed areas may be approved via a framework adjustment for purposes of providing adequate forage, to

reduce marine mammal/fishery interactions or to limit fishing mortality on a particular stock component. Other measures that may be implemented through frameworks are listed in section 3.3.6. If proposed by the Council, these actions would be evaluated at that time in an Environmental Assessment using the most current information available to make a determination of the impacts on protected resources.

E.7.2.11.1.4 Management Areas

Management areas identified in the plan (section 3.4) provide the basis for TAC distribution and have been established to avoid the over-exploitation of individual spawning components that are included within the stock complex. The sub-division of Management Area 1 makes it possible to protect herring in the fully exploited inshore Gulf of Maine region during spawning periods and from over-fishing, particularly if the fishery expands.

The careful use of area management may benefit protected resources in that the distribution of several species, but especially harbor porpoise, overlaps with the period of greatest fishing activity in Management Area 1 --- principally June through November. The majority of the porpoise population (minimum population estimate 48,289) is concentrated in this area and the lower Bay of Fundy between July and September (Waring et al 1997) and is heavily dependent on herring as a prey species during this period. Gannon et al (1998) described herring as the most important prey of porpoise during autumn, contributing 44 percent of the prey mass in the stomachs of the 95 animals examined in the study. While the complexities of predator-prey relationships have not been adequately studied and are not fully understood, this example illustrates the importance of using management areas to protect spawning components. This, in combination with effort controls, will maintain herring biomass at levels that will sustain a healthy ecosystem and ensure adequate forage for protected resources.

E.7.2.11.1.5 Spawning Closures

While they are intended to protect fish when they aggregate to spawn and become especially vulnerable to fishing gear, spawning closures also may provide short-term protection to endangered and threatened species and other marine mammals that have the potential to become entangled in the gear types used in the herring fishery. These are most likely to be mid-water trawls and purse seines given that the use of stop seines and weirs has declined dramatically in recent years. The duration of the closures are short-term, just less than a month, but overlap with the distribution of marine mammals that are feeding in the Gulf of Maine in late summer and early fall.

Alternatively, negative impacts on protected species could result from effort shifts as fishermen compensate for the loss of landings during the closure periods. Maine fishermen could move inshore of the closures or the open areas off the coasts of New Hampshire and Massachusetts, although the most likely scenario would be to fish inside state waters because of the closer proximity to ports and processing facilities. Potential negative impacts could be mitigated, however, by the year-round Western Gulf of Maine Closure implemented under the Northeast Multispecies FMP to conserve the stock of Gulf of Maine cod, and the management measures in

the Harbor Porpoise and Atlantic Large Whale Take Reduction Plans, each recently finalized by NMFS.

E.7.2.11.1.6 TACs and Effort Controls

Although the Herring Plan will not limit entry into the herring fishery in federal waters, the plan will restrict harvest through a TAC system. The TACs will provide information necessary to evaluate the condition of the resource and indicate the need for modifications. The TAC will be distributed in different areas, both to protect various spawning components and to encourage the development of the offshore fishery.

A limit on days-at-sea, “no fishing days”, will slow catch rates when 95 percent of the TAC is projected to be taken (see section 3.6.4). At that time, the directed herring fishery will close and the remaining 5 percent will be set aside to allow the incidental catch of herring in other fisheries to continue. Incidental catch in an area closed to fishing will be limited to 2,000 pounds per trip. An analysis provided in Section E.7.2.5.2.1 demonstrates the low probability that the continued harvest of herring in the bottom trawl, shrimp and gillnet fisheries will cause the TAC to be exceeded. This system of slowing down the harvest within a management area is not likely to have a detrimental impact on protected species. This is not a certainty, however, because exceeding the TACs will not result in a prohibition on the landing herring nor will it result in the closure of the fisheries that are not targeting herring. If not addressed, overfishing could occur to the point where the abundance of herring as a marine mammal prey species is affected.

E.7.2.11.1.7 Transfers at Sea

The Herring FMP allows U.S. vessels to transfer up to 2,000 pounds of herring per day in areas subject to spawning closures or effort controls. As stated in the plan, the measure may complicate enforcement, but is proposed so that lobster and tuna fishermen may obtain fresh bait. There is little possibility that this measures will affect protected species, except that it could reduce potential marine mammal encounters with small untended bait nets that are commonly used throughout the Gulf of Maine when bait for sale is in short supply.

Under Framework Adjustment 16 to the Northeast Multispecies FMP the deployment of bait nets is limited, but only in areas where gillnets are prohibited for the purpose of reducing the bycatch of harbor porpoise. In those areas vessels may fish with a single pelagic gillnet which is no longer than 300 feet. The net also must be attached to the boat and deployed in the upper two-thirds of the water column. The majority of vessels that are likely to sell herring as bait use gear types that may pose less of a threat than nets that are often left to soak for several hours, in areas where protected species are likely to occur and which have accounted for at least one documented take of an endangered species. This may not hold true if observer coverage aboard mid-water trawl vessel determines that the gear type poses significant risks to protected species.

E.7.2.11.1.8 Vessel Size Limits

The relationship between vessel size, towing speed, length and width of the net and other parameters such as horsepower --- and the likelihood of marine mammal interactions --- is very

poorly documented in the available literature. The Council's decision to limit vessel size to 165 feet is probably appropriately precautionary from both a herring resource conservation and protected species perspective. It is possible, however, that the potential for entanglements exists in vessel size classes that are already represented in the domestic fleet (Berrow et al. 1998). Such sparse evidence runs counter to the anecdotal information provided by herring fishermen at public meetings of the Council. Industry representatives have consistently indicated that the small boats used by the majority of the fleet are neither large enough nor have the ability to tow at speeds that would have the potential to entangle marine mammals. Observer coverage on the mid-water trawl vessels may answer the outstanding questions that are associated with this controversial management measure.

E.7.2.11.1.9 Roe Fishery

No prohibition on a roe fishery exists in this plan to date, but harvest for this purpose could be controlled by the authority of the Regional Administrator if the Council recommends such an action. Roe fisheries have been a cause for concern because of the wasteful practice of discarding the carcass, the associated difficulty in monitoring catches and discards of male herring. The Council has elected to monitor this fishery by requiring the retention of carcasses. The action should not affect protected species.

E.7.2.11.1.10 Measures to Reduce and Monitor Bycatch and VMS

No measures are proposed to specifically reduce bycatch in the herring fishery, although vessels are required to report all herring caught, including discards. Potential negative impacts could result if misreporting occurs, not only forestalling closures as TACs are caught up, but affecting stock size and fishing mortality estimates. The use of Vessel Monitoring Systems as well observers could provide a system of checks and balances to improve the quality of the data collected and the overall effectiveness of the management program. As proposed, the measure should not have any direct negative impacts on protected species, but could result in indirect impacts if accurate calculations of stock status are jeopardized because fishery catches are misreported.

E.7.2.11.1.11 Joint Venture Restrictions

Observers aboard foreign joint venture processing operations that were conducted 1980's in the squid and mackerel fisheries documented takes of marine mammals in the catches transferred from pelagic trawl vessels. It is uncertain whether similar impacts will occur in the herring fishery, but data reporting and observer requirements as well as the implementation of management area restrictions will provide monitoring to determine of the level of interactions with protected species, if any.

E.7.2.11.1.12 Impacts of the Alternatives, Including No Action

The biological consequences of taking no action, and the associated impacts on the herring resource as prey species, are discussed in section E.7.2.10.1. The major difference between the proposed action and other alternatives not selected is the inclusion of a controlled access system (see section E.7.2.10.2). The potential impacts on protected species are largely dependent on not

only how many participants engage in the harvest of herring, but the types of gear used and the allocation of TACs within the three management areas. With the low level of protected species interactions documented in the major gear types used in the herring fishery to date, a controlled access program may have very little impact on protected species. Of the other measures considered under alternative management scenarios --- closed areas, minimum fish sizes, and gear restrictions, the use of closed areas has the greatest potential to affect protected species. Without greater detail, however, it is not possible to draw any meaningful conclusions about impacts in this discussion.

E.7.2.11.2 Impacts of the Herring Fishery

A description of the major commercial gear types used in the herring fishery is provided in sectionE.6.4.2.2. As discussed, in recent years purse seine and mid-water trawl gear has accounted for the majority of landings, while the use of fixed gear (stop seines and weirs) has declined significantly since 1994. A large number of bottom trawl vessels fish for herring on a sporadic basis, but actually account for a fraction of the overall landings (Table E.13). Although poorly documented, herring fishing to obtain bait for the lobster and tuna fisheries has increased along with the expansion of those fisheries. The issue is discussed earlier in this section in more detail under the proposal to allow the transfer of herring at sea.

The impacts of bottom trawling on endangered and threatened species of cetaceans, sea turtles and fish under NMFS jurisdiction, as well as the impacts on northern right whale critical habitat were considered in formal consultations pursuant to Section 7 of the Endangered Species Act (ESA) for Northeast Multispecies Plan Amendment 5 in 1993 and Amendment 7 in 1996, and in the National Marine Fisheries Service Biological Opinions issued on November 30, 1993, and February 16, 1996. The Biological Opinion issued on December 13, 1996 following an unusual right whale mortality event earlier in that year altered the conclusion that existing fishing activities and related management measures proposed under these amendments may affect, but were not likely to jeopardize, the continued existence of any endangered or threatened species. The Council’s response to the jeopardy opinion and the implementation of the ALWTRP are discussed above.

As required by Section 118 of the MMPA, NMFS issues an annual List of Fisheries (LOF) which classifies U.S. fisheries according to the rate of serious injury and mortality of marine mammal stocks taken incidentally in each fishery. Rates are quantified relative to a Potential Biological Removal level (PBR) assigned to each stock. (PBR is the number of animals that can be removed from a stock annually by human activities without preventing the stock from reaching or maintaining its optimum sustainable population size.)

Fisheries are placed in one of three categories, with Category I representing the highest level of take (50 percent or more of PBR). Consistent with their evaluation in previous years, NMFS listed the North Atlantic bottom trawl as a Category III fishery in 1999, one with a remote likelihood of causing incidental mortality and/or serious injury to marine mammals. While long

and short-finned pilot whales, white sided dolphin, striped dolphin and the coastal and offshore stocks of bottlenose dolphins are listed as marine mammal species that have been either incidentally injured or killed in the bottom trawl fishery, there are no documented takes of endangered or threatened cetaceans. Similarly, the Gulf of Maine Atlantic herring purse seine fishery is classified as Category III, with takes of harbor porpoise, harbor seal and grey seal listed. Because of the low levels of takes and observer coverage, there are no estimates of marine mammal bycatch in these fisheries.

The herring mid-water trawl fishery, however, has been added to the 1999 LOF as a Category II fishery, one that has an occasional likelihood of causing incidental mortality and/or serious injury to marine mammals. The change from the 1998 Category III classification to Category II is an interim action that allows collection of data to more accurately determine levels of takes in this fishery through observer coverage. No estimates of marine mammal bycatch are currently available for this fishery. The Council supported the revision based on the potential for incidental takes of marine mammals, particularly the Gulf of Maine/Bay of Fundy harbor porpoise, and the likely increase of the number of vessels currently participating in the fishery.

The Council also noted that the practice of pair trawling in the herring fishery has increased over the last several years and that vessels fishing in pairs in other fisheries have accounted for takes of marine mammals and sea turtles. A Maine Department of Marine Resources study conducted during the summer and fall of 1997 (Stevenson and Scully 1999) documented the take of a harbor seal by herring pair trawlers operating off Portland Head, Maine. Vessels fishing singly for herring also may be associated with some level of harbor porpoise bycatch given the close predator/prey relationship between porpoise and herring.

Concerns over the bycatch of marine mammals in mid-water trawl gear are based on a number of studies of bycatch in pelagic fisheries, both in the U.S. and in Europe. Waring et al. (1990) discusses a significant number of takes of pilot whales and common dolphins by foreign vessels operating in the DWF Atlantic mackerel and squid fisheries during between 1977 and 1988. The authors attributed the timing and location of the interactions (mid-winter to late spring) of these species to their seasonal distribution, which is concentrated along the southern New England shelf edge and coincident with the operation of these fisheries. It also should be noted that a juvenile right whale was taken in the *Loligo* fishery during this period.

In summarizing information collected on the few observed trips taken aboard domestic mid-water trawl vessels in the herring fishery to date, the Northeast Fisheries Science Center advised the Council that “the working hypothesis should be that mid-water trawling for pelagic species will result in some marine mammal bycatch. Arguments based on the lack of observations on herring trawlers are not sufficient basis for disregarding this possibility.” Further basis for this position may be found in Morizur et al. (1997). Observations of marine mammals caught in four pelagic trawl fisheries led the authors to conclude that the bycatch of (oceanic) cetaceans was not insignificant and recommended regular monitoring of these fisheries. Their report also included an account of a herring trawl fishery in which four grey seals were caught during approximately 100

hours of towing. White-sided dolphins were the primary species incidentally caught in the Dutch pelagic trawl fishery for mackerel during 1992-1994 southwest of Ireland (Couperous 1997). In conducting a review of the global data on cetacean interactions with trawl gear, Fertl and Leatherwood (1997) found that at least 15 cetacean species, including minke, fin and humpback whales feed in association with trawling, both in association with the same prey species caught in commercial fishing gear or when scavenging in or around the trawl nets.

Critical information lacking in nearly all of the studies reviewed, but identified as a significant determinant of cetacean bycatch by Morizur et al. (1997) included target species, prevalence of mammals coincident with the fishery, susceptibility of mammal species to entrapment, tow duration, level of tow in the water column, size of net opening, haulback speed, gear design and time of day.

E.7.2.11.3 Ecological Relationships

Generalities and assumptions concerning the impacts of marine mammals on fisheries and fisheries on marine mammals are possible, but in reality are neither straightforward nor easily predictable. This is further complicated by the fact that there is insufficient data with which to determine cetacean population trends (Waring et al., 1997). Most recently, Kenney et al. (1997) discusses the trophic impacts of cetaceans on the Northeast Shelf ecosystem, describing them as significant predators and estimating their annual consumption of fishery resources as approximately one-third to more than three times greater than the annual harvests in fisheries. The authors maintain that direct competition may be low, but also point out that some cetaceans may compete directly for some resources, such as herring and mackerel.

Cetaceans most likely to have such direct interactions are endangered humpback and finback whales, minke whales as well ad several species of small cetaceans --- harbor porpoise, white-sided and white-beaked dolphins. Perhaps the most noteworthy event affecting these species was the large-scale decline of herring and mackerel on Georges Bank and the associated trophic level changes that appear to have occurred as a result. As the abundance of sand lance increased in response to the absence of predators, a shift in humpback whale distribution from the northern Gulf of Maine to the southwestern Gulf of Maine took place in the late 1970s and early 1980s --- reflecting a shift in diet from herring to sandlance (Weinrich 1997).

Payne (1990) speculated that declining sand lance populations in Massachusetts Bay in 1986 and an increase in dense swarms of copepods caused plankton-eating right and sei whales to replace the piscivorous humpback and fin whales. Kenney et al. (1996) further suggest that the distribution of harbor porpoise shifted away from Georges Bank to inshore areas after the herring stock collapse. The increase in the bycatch of porpoise in the multispecies sink gillnet fishery may have occurred as densities of porpoise increased in coastal and nearshore Gulf of Maine waters. The potential impacts of overfishing, coupled with natural shifts in fish stock abundance and the complex predator-prey linkages in the Gulf of Maine/Georges Bank ecosystem argue for the conservative management of herring stocks under the proposed FMP.

E.7.2.11.4 Sea Turtles

Based on information collected in similar fisheries, the major gear types used in the herring fishery may have interactions with sea turtles, although information is inadequate to determine impacts because of the extremely low level of observer coverage. There is no reason to conclude, however, that the herring fishery represents a major source of human-induced serious mortality at this time.

E.7.2.11.5 Shortnose Sturgeon

The potential for takes of shortnose sturgeon in this fishery is unknown, but is likely to be low, given the distance between the rivers which this species inhabits and the operation of the majority of vessels in the herring fishery

E.7.2.11.6 Seabirds

Like marine mammals, seabirds are vulnerable to entanglement in some types of commercial fishing gear. The interaction has not been quantified in the New England and Mid-Atlantic herring fishery, but impacts are not considered significant. Human activities such as coastal development, habitat degradation and destruction, and the presence of organochlorine contaminants are considered the major threats to some seabird populations. Endangered and threatened bird species, which include the roseate tern and piping plover, are unlikely to be impacted by the gear types employed in the herring fishery.

E.7.2.11.7 Right Whale Critical Habitat Designation

The National Marine Fisheries Service acted on a petition from the federally-appointed Right Whale Recovery Team and designated critical habitat for the northern right whale on June 3, 1994. Two of the areas designated are in the Northeast. The area in Cape Cod Bay is located principally in Massachusetts state waters. The other is in the exclusive economic zone, in a region known as the Great South Channel. It has been identified as a spring and early summer feeding and nursery ground for a majority of the population. Actions have been taken to reduce the likelihood of entanglements in fishing gear first by the Council through Framework Adjustment 23 to the Northeast Multispecies FMP and subsequently by NMFS through implementation of the Atlantic Large Whale Take Reduction Plan. The proposed action should not affect the area or right whale utilization of the area.

E.7.2.12 Impacts on Habitat and Other Biota

The Council has prepared a comprehensive review of essential fish habitat and the impacts of fishing and other activities on this habitat. Applicable elements of that review are incorporated by reference into this FMP.

E.7.2.13 Impacts on Stellwagen Bank National Marine Sanctuary

The designation of Stellwagen Bank as a National Marine Sanctuary does not restrict commercial fishing in the area and is intended to protect and enhance sanctuary resources. To the extent the proposed action is expected to protect fish stocks, the impacts are expected to be positive and consistent with sanctuary objectives. Other specific measures, such as the establishment of spawning area restrictions under various alternatives, are also consistent with the resource protection mission of the Sanctuary.

E.7.3 Economic Impacts of the Alternatives

Economic assessment requires consideration of the benefits and costs of the proposed action. The following discussion is a qualitative analysis of the impacts of the proposed action on net benefits, as well as an estimate of the administrative costs for implementing the management plan. Because of the lack of an analytical assessment model for herring that links fishing effort, landings, and fishing costs, a quantitative assessment of all expected costs could not be developed. There is limited information available on fishing costs for the mid-water trawl and purse seine fishing sectors, the primary gears used to land herring. This makes it difficult, if not impossible, to accurately quantify the impacts on vessel costs that may result from the proposed management measures.

Another difficulty with comparing the economic impacts of the alternatives is that in every alternative (including the no action alternative), gross revenues of herring are expected to remain constant or increase if the offshore fishery is developed. The primary economic benefit of the preferred alternative is that it reduces the likelihood of overfishing and protects individual spawning components of herring. This is of most value with respect to the inshore Gulf of Maine (Management Area 1A) and, to a lesser extent, the offshore Gulf of Maine (Management Area 1B). These areas have provided the majority of herring for the domestic fishery, most taken during the late summer and early fall while herring are aggregating for spawning. Landings from this area peaked in 1996 at over 80,000 mt as demand for herring increased. Under the status quo, there are no limits on the domestic harvest of herring and there is a risk that the fishery in this area will be overfished. This would have a negative impact on both operating costs and total revenues. Because of the lack of an assessment model for individual spawning components, it is impossible to determine if present landings would lead to overfishing of this component. As a result, a quantitative comparison between total revenues under the status quo and the preferred alternative cannot be made. The key difference in the proposals is their impact on the costs to the industry. Because of a lack of information on the cost structure of the industry, a quantitative estimate of the differences between the alternatives could not be determined.

E.7.3.1 Specifications

The FMP does not allow directed foreign fishing. Under open access this may be preferable in order to have benefits from the fishery accrue to domestic fishermen. The expansion of the herring fishery will require domestic fishermen to develop markets and invest in the vessels and

processing capability to enter those markets. Any foreign fishing in U.S. waters will directly compete with the attempts of fishermen to enter those markets. According to the testimony of industry personnel, directed foreign fishing would discourage additional U.S. investment in the herring fishery.

The plan does provide for some foreign participation in the fishery through joint venture or internal waters processing. JVs and IWPs provide alternative processing platforms to land-based processing. Restricting JV/IWP amounts at the beginning of a fishing year through fairly arbitrary formulas which depend on estimating DAP may complicate finding markets. JV and IWP operators would not want to operate without some assurance of having herring to process but these arrangements are left to negotiations between the JV/IWP operator and domestic harvesters or their representatives.

A separate specification for the amount of herring transported to Canada by Canadian herring carriers (vessels) establishes a basis for accounting for these herring. The allocation insures that the U.S. and Canadian sardine industries will be able to continue a long-standing relationship that has provided economic benefits to both. At the same time, the specification reduces the concern of U.S. processors that an unlimited transfer of herring between these two groups would adversely impact their supply of herring.

Under the controlled access/limited entry system not selected by the Council (with conservation and development permits issued to some fixed group of domestic interests), this restriction is not necessary. The main purpose of the controlled access option is to discourage the building of permanent herring fishing capacity for the portion of the stock that may be temporary (in time, not area). When herring are abundant in offshore areas, holders of development permits could contract other vessel owners to harvest herring on a temporary basis. In theory, these contracts could be with domestic or foreign vessels. If they are foreign vessels, then some benefits still accrue to the domestic permit holder.

E.7.3.2 Management Areas

The designation of management areas is not expected to have any direct economic impacts. The establishment of the areas does not impose any additional requirements on vessel operators, does not directly limit participation in the fishery, and does not restrict catches. The areas are, however, used to guide the distribution of the TACs, which will determine how much herring can be caught in a particular area. This distribution will have economic impacts on vessels that are discussed in section E.7.3.4.1.

E.7.3.3 Spawning Area Closures

In general, the proposed spawning area closures increase fishing costs and may decrease revenues. Herring aggregate prior to spawning, making them easier to catch. This is also the period when fat content is the highest and the fish are most valuable to the market. The value of a roe fishery

cold be even higher than that of high fat content herring. By limiting fishing on spawning aggregations, these provisions force fishing activity when the herring are not as easy to catch and are worth less, reducing vessel revenues. Spawning closures also make it more difficult, if not impossible, to develop a roe fishery.

The proposed spawning closures may also have an impact on total landings and revenues, subject to the ability of fishermen to locate herring in other areas or at other times. Under the existing Commission management plan, there are four spawning closures along the coast from Cape Cod to Maine. All of the existing closures extend from the coast to the seaward boundary of Management Area 1. The three closures along the Maine coast allow directed herring fishing, subject to the limitation that no more than 20 per cent, by number, of the herring harvested may contain spawn (roe or milt). This allows the harvest of either spent or juvenile herring that can be used in the bait and sardine markets. In recent years, a significant amount of the annual catch and revenues have been harvested from the Maine closure areas 1B and 1C (similar to the proposed Western Maine area) during the closure periods (Table E.56).

Year	**Area 1A**		**Area 1B**		**Area 1C**	
	Total	**Closure**	**Total**	**Closure**	**Total**	**Closure**
1995	322	36	22,136	4,896	8,757	125
1996	470	0	21,492	5,055	18,493	643
1997	411	70	34,862	7,521	11,275	5,084

Table E.56 - Catches in Maine Spawning Closure Areas 1A, 1B, 1C (metric tons) (Maine closure area designations should not be confused with the proposed Council management areas) (Source: Maine DMR)

In preparing this FMP, the recommended spawning closures were closely coordinated with the Commission to insure that complementary closures would be adopted in state and federal waters. As noted in section 3.12.1, for state waters of the Gulf of Maine, the Commission has adopted restrictions that will prevent a vessel from landing herring if more than 20 percent of the load contains spawn herring. This restriction will apply for the period August 1 through October 31. Similar to the closures in place in Maine waters in 1996 and 1997, this measure allows herring fishermen to continue to fish as long as they direct their efforts away from spawn herring. In order to evaluate the impacts of the proposed Council spawning closures when combined with the Commission's new measures, 1997 landings were plotted by ten-minute squares of latitude and longitude for the time periods of the proposed closures. These landings were examined to determine the amount that fell within state waters and those that were taken in federal waters. The results are summarized in Table E.57. For the period August 1 through October 12, the landings in 1997 totaled 31,606 mt. One-third of these landings were taken in areas that will be closed to herring fishing under the Council's proposed action.

The actual decline in landings due to the spawning closures is likely to be less, however. First, this review is based on landings from only one year of data and may not represent average fishing

conditions. Second, it makes no allowance for the displacement of effort from the closed areas. Fishermen will try to locate herring in other open areas – either in state waters or in the open portions of federal waters. Third, the Council's proposed action actually opens to fishing a large area south of 42° 30' N. that was closed to fishing in 1997 for a three week period starting September 15. Fishermen are likely to catch herring in this area that will partially offset losses from other areas. Finally, because of the lack of detail provided by assigning landings to ten minute squares, the analysis assumes all landings from the Mt. Desert rock area were taken in federal waters. Based on discussions with fishermen, at least some of these landings were probably taken from state waters in 1997.

Time Period	1997 Landings, All Areas (mt)	Proposed Closure Area	Total 1997 Landings from Proposed Closed Area	1997 Landings from EEZ within Closed Area	Percent of 1997 landings that were from the EEZ in an area that will be closed (Column 5/Column 2)
August 1 – August 14	6,558	Cashes Ledge	1,260	1,260	19%
August 15 – August 31	7,062	Eastern Maine Cashes Ledge	1,976 1,148	1,976 (986) 1,148	44%
September 1 – September 11	5,212	Eastern Maine Western Maine Cashes Ledge	634 2,897 23	634 (Source:634) 1,955 23	50%
September 12 – September 14	780	Western Maine Cashes Ledge	175 0	0 0	0%
September 15 – September 28	6,582	Western Maine Cashes Ledge JL/SBNMS	3,716 0 1,361	1,965 0 1,361	51%
September 29 – October 12	5,412	JL/SBNMS	0	0	0
August 1 – October 12	31,606		13,190	10,322	33%

Table E.57 – 1997 landings from areas of the proposed spawning closures (Note: Table assumes all landings from the Mt. Desert Rock area were caught in federal waters in 1997. Mt. Desert Rock area landings are shown in parentheses.)

E.7.3.3.1 Other Spawning Area Closure Alternatives

The Council originally considered four areas that closely matched the boundaries of the existing Commission closures, and, through complementary Commission action, may have extended to the shore. These proposed spawning restrictions along the coast did not include any provision to allow directed fishing subject to the limitation on catch of spawning fish—the only herring fishing allowed would be limited to 2,000 pounds per trip. The original proposal area also created an offshore boundary, providing a limited opportunity for fishermen to move into these offshore areas. Because these open areas consist of deeper water, it is unlikely that fishermen would find herring in quantities similar to those encountered in the closure areas. Vessels that were unable to travel to these areas (approximately 30-40 miles offshore) may move to other open areas along the coast or may shift into other fisheries during this time period. Smaller herring vessels in Maine ports would have greater difficulty landing herring during the spawning closures than larger herring vessels that may be able to move into other areas. Because of the steep competition in herring markets, smaller vessels that cannot continue to fish during the closure would be at risk of losing their market, and may not regain it when the closed areas re-open.

For all of the above reasons, the Central, Western, Eastern Maine, and Massachusetts/New Hampshire closures, as originally considered, would have resulted in a significant decline in landings from the status quo since directed herring fishing would not be allowed in these areas. The expected result of the original Council proposal was the potential loss of all herring landed during the Commission's existing closures. This loss would have been mitigated by the opportunity of the fishermen to fish seaward of the closure boundaries. Fishermen may also have been able to harvest the herring after the closure – a delay in the catch, rather than a complete loss.

The proposal adopted by the Council makes significant changes. All closure areas only apply to federal waters (the Commission's plan allows herring fishing in state waters, subject to a limit on the amount of spawn fish that can be landed). The closure area off Massachusetts/New Hampshire has been significantly reduced in size to two areas that cover Jeffreys Ledge and the Stellwagen Bank National Marine Sanctuary. The impact of these changes is to significantly reduce the negative economic impacts of the spawning closures. By reducing the area covered by the closures, the Council's proposed action should reduce the impact of the closures on landings. The Council plan will also open an area south of 42° 30'N that had previously been limited to an incidental catch limit. While the amount of catch in this area cannot be predicted due to a lack of information on harvest rates and effort in this area, this should result in higher catches of herring, further reducing the economic impact of the closures. In a qualitative sense, the proposed alternative should also reduce impacts on smaller vessels, as it provides options to fish seaward of the boundary, in state waters, or in areas of federal waters that remain open, and reduce the necessity for any vessel to fish seaward of the closure boundaries. Both of these results will help maintain operating costs at current levels.

The Council considered a number of variations for determining the starting dates of the closures. These alternatives determined the starting or ending dates of the closures by determining biological condition of the fish. This would have resulted in the actual closure dates being announced just prior to the implementation of the closures. This would allow the closures to be timed to peak spawning activity, providing the greatest protection. While the economic impacts of the alternatives are not likely to differ significantly from the chosen alternative (closure length and area would be the same as the adopted proposal), this approach would introduce uncertainty into the timing of the closures. The fixed date alternative chosen by the Council allows vessels and dealers to plan fishing operations around known closure dates and was preferred by many in the industry. It also avoids the administrative costs necessary to operate a sampling program that would determine the closure dates.

The Council also considered not establishing any spawning area restrictions in Management Areas 1A or 1B. In the short term, landings and revenues would have increased if this option had been selected. Over a longer period, the practice of fishing on spawning aggregations in this intensely fished area is expected to have a negative impact on the biological condition of the resource. Failure to provide protection during the spawning periods could result in the elimination of individual spawning components, even while remaining within overall mortality goals set by the TAC. This would have either resulted in lower TACs to reduce effort on spawning fish, or, in the extreme, could damage the resource sufficiently that no fishing would be allowed in the area. Either result would reduce revenues from this area. As vessels moved into other areas to find herring, operating costs would be expected to increase with the additional transit time offshore.

E.7.3.4 Catch Controls

Under the open access alternative, with all proposed restrictions adopted, the herring FMP will consist of:

1) area TACs;
2) closed spawning areas;
3) days out of the fishery if TACs are expected to be exceeded;
4) vessel size limits;
5) roe fishery restrictions;
6) JV/IWP location restrictions.

The area TACs and the closed spawning areas are the major conservation provisions. For the foreseeable future, the total of the assigned TACs will be an increase over recent landings of herring – in 1999, the OY of 224,000 mt more than doubles the recent highest landings (104,000 mt in 1996), resulting in a potential increase in gross revenues of $13.6 million at an average price of $0.05/pound (1997). Under the management plan, revenues are able to increase. Whether this occurs will be a result of market conditions rather than due to the management measures adopted.

The mandatory days out of the fishery will be used to spread the TAC in each area over an annual

time period. Vessel size limits – while they will not have the same conservation effect as if they were applied to a fixed number of vessels – are also intended to limit overall capacity and harvest rates. With this set of restrictions under open access, an incentive is created for fishermen to take as much of the available TAC as possible before the area is closed. This pattern has been seen in a number of fisheries managed through quotas. "At best, this has resulted in reduced economic rent being generated from the fishery and, at worst, has resulted in declines or collapses in the stock" (Morgan, 1997). There are factors in the Atlantic herring fishery that may limit the extent of this behavior, such as market conditions, weather, and the mandatory days out provisions. Particularly in the herring fishery, market conditions will be a key determinant of the speed with which the TAC is obtained.

With any open access system, there is a concern that there will be a rapid increase of fishing capacity into the fishery that can lead to overfishing, or that prevents realizing the maximum economic benefits from the resource. There is a long list of fisheries that followed this pattern. There is some evidence, however, that in the Atlantic herring fishery there may be factors that reduce the likelihood of this happening. For sixteen years, landings of herring have not been limited by anything other than availability and market demand, yet there has not been a significant increase in harvesting capacity until recently. Figure E.11 shows the relative landings of herring by major gear type. The percent of the harvest from each gear type is relatively constant until the introduction of mid-water trawl vessels into the fishery within the last four years. Some of the reasons may be the cost of converting a bottom-trawl vessel to a mid-water trawler (estimated at between $150,000 to $250,000), the limited price for herring, and the difficulty in developing markets. Average ex-vessel prices have been essentially unchanged for over twenty years. The limited market available may serve to inhibit the introduction of new capacity.

E.7.3.4.1 TAC Distribution

Under the existing management scheme, there are no limits on the domestic harvest of herring. While overall revenues could increase under the management plan, there will be changes in what management areas supply those revenues. Historically, most herring landings have come from the inshore Gulf of Maine area, now defined as Management Area 1A. Landings from the Gulf of Maine (Management Area 1) were an estimated 81,000 mt in 1996 and 73,000 mt in 1997. Of these totals, an estimated 8,700 mt came from statistical area 515 in 1996, and 2,300 mt came form this area in 1997. Area 515 corresponds closely to the proposed Management Area 1B. This gives an estimate from the proposed Management Area 1A of 73,300 mt in 1996, and 70,900 mt in 1997. The initial TAC established for Management Area 1A is 45,000 mt. Other options considered by the Council also reduced the expected landings from Management Area 1A from current levels. Table E.58 provides estimates of the loss in revenues from the inshore Gulf of Maine that may be experienced under the various TAC distribution options (including the preferred option). The management system is designed to encourage fishing in other areas which may replace the loss in revenue from the Gulf of Maine. These estimates do not include revenues that may be taken outside Management Area 1A; thus, declines should be viewed as a maximum lost revenue.

TAC Option	1999 Area 1A TAC (mt)	Gain (loss) in revenue from Area 1A compared to 1996 ($0.6/lb)	Gain (loss) in revenue from Area 1A compared to 1997 ($0.05/lb)
1	59,250	($1,858,815)	$22,050
2	60,000	($1,759,590)	$121,275
3	60,000	($1,759,590)	$121,275
4	60,000	($1,759,590)	$121,275
5	N/A	N/A	N/A
Proposed Action	45,000	($3,744,090)	($1,863,225)

Table E.58 - Potential changes in revenue under various TAC options, Management Area 1A (estimated average 1999 ex-vessel price $0.06/lb)

E.7.3.4.2 Mandatory Days Out of the Fishery

As the TAC in an area is approached, the plan proposes to limit the number of days that vessels are allowed to fish in the area by establishing mandatory days out of the fishery – "no fishing" days. This measure is intended to slow the rate of harvest so that the herring TAC is not reached as quickly. The primary advantage of this approach is that it provide a supply of herring to the market for a longer period than if there were no controls put in place until the overall TAC is reached and the fishery is closed. By using area specific TACs, it is likely that there will be some areas that remain open when one area is closed. Vessels may shift their effort into those areas, providing a steady supply of herring to markets even during the days out of the fishery. One possible negative impact of this approach is that it may encourage larger vessels to fish exclusively in the near shore areas until the effort controls are put in place, than shift to offshore areas to continue to supply markets. This may place smaller vessels unable to move offshore at a disadvantage in retaining their markets in the competitive herring fishery.

The effort controls gradually increase the restrictions on fishing time until 95% of the TAC is attained, when fishing is restricted to an incidental catch amount. This approach places significant administrative burdens and costs on the NMFS to monitor reported landings, project when the TAC will be reached, and notify the industry of the imposition of effort controls. To assist in that effort, the plan adopts mandatory reporting requirements for vessels and dealers that will improve timeliness of the information used by managers to monitor the fishery. Through the Commission, state fisheries agencies have agreed to assist in disseminating notification of effort restrictions. Finally, the relatively small size of the current herring fishery (with less than 20 vessels landing 97 percent of the catch) make it easier to monitor landings and notify major participants of restrictions.

Throughout development of the plan, the Council was cautioned that while a TAC would protect

the resource, it could also lead to interruptions in the supply of herring provided to the market. The Council attempted to find a way to extend the TAC and reduce the likelihood of a "race to fish" by imposing effort controls that would slow the catch rate. An early suggestion was the use of trip limits, rejected because of concerns over discards, enforcement difficulties, and difficulty in creating an equitable system. Another alternative considered was to apportion the TAC over a shorter time period – for example, over a three month period rather than an annual basis. This alternative was rejected because it would result in increased administrative costs to monitor the TAC. The gradual imposition of days out of the fishery was selected by the Council over other alternatives because it minimizes impacts on the industry while extending the season. It allows fishing activity to continue unfettered in management areas where landings are at a lower level and are not approaching the TAC. This will encourage a shift in effort from areas with restrictions into other open areas, particularly when three or four days are closed to the directed fishery. The boats most likely to move into the other areas are the larger vessels that can catch the most herring. Moving these vessels into other areas should slow the catch rates in the areas subject to effort controls, extending the season even more. This will insure a supply of herring to the markets.

The impact of the initial step in the controls (two days out of the fishery) will vary each year. In 1996 and 1997, for example, herring in the Gulf of Maine were easily located and many vessels routinely did not fish on Saturday or Sunday until the peak part of the season in mid-summer. In these circumstances, the initial effort control may have only a limited impact on catch rates. Preliminary reports in 1998, however, show that as vessels had increasing difficulty locating herring, many fished through the weekends. Under these conditions, the first two days out of the fishery will have more of an impact on the catch rates and will extend the season. The next two steps – three or four days out of the fishery – will significantly slow catch rates, particularly during the summer months when most herring landings occur. Few vessels in recent years have fished less than four or five days a week during this period.

At plan implementation, Management Area 1A will be most susceptible to early closure under open access. Processing facilities on the coast of Maine, which rely on a steady flow of product, could be adversely impacted by having periods of product gluts and shortages. Some amelioration is possible by the ability of these companies to supplement their supply of herring with Canadian herring, or by trucking fish from other ports. This could be made worse or better depending upon how the TAC is divided by area. Regardless, if market conditions improve, then incentives for peak load processing will exist. This problem can be mitigated if offshore processing alternatives existed simultaneously, encouraging vessels to fish offshore rather to supply these processors rather than inshore. It may also be mitigated if alternative open areas are identified that have sufficient herring to support the processors if Area 1A is closed. In 1998, increased landings from the Georges Bank area indicate that this may be the case. The following section describes the expected overall impacts on the effort controls in Management Area 1A using the first year TAC of 45,000 mt.

As noted above, the effort control system imposes significant administrative burden on NMFS to

monitor and announce the closings. There is the potential for at least three notice actions in each of the four areas once total catches approach the overall TAC. The measure is structured to allow NMFS to project and announce the closure of the directed fishery at the same time the agency announces the imposition of four days out of the fishery, eliminating the requirement for four notices to announce the closure of the fishery. Another factor that will help ease the burden is the current pattern in the fishery – herring fishing occurs in different areas at different times of the year, spreading out the notice actions and allowing NMFS to focus its attention on a few areas at a time. For example, the Area 2 fishery occurs primarily in the winter months. Generally, the Area 1A and 1B fisheries occur in the mid-summer and early fall, while the Area 3 fishery occurs in the summer into late fall and early winter. NMFS has had mixed success projecting landings for other quota managed fisheries. None of these fisheries, however, have used the IVR system that is required for herring fishing vessels. This should help speed the collection of catch information necessary to accurately project landings.

E.7.3.4.3 Overall Impact of Catch Controls

The effectiveness of mandatory days out will be depend largely on the time of year the restrictions are imposed. If it is during the summer months when vessels are normally fishing for the entire week, there will be substantial reductions in effort. If they are imposed during times of the year when vessels are typically not fishing for portions of the week then a mandatory day out may be taken when the vessel would not have fished anyway. Vessels may also be able to compensate by making larger trips during the days available for fishing. Mandatory days out will principally affect vessels fully employed in herring fishing. This is a relatively small number of vessels, but these vessels do catch a large portion of the annual harvest.

Several options considered by the Council would have divided the TAC into shorter time periods to help spread harvesting over the year. However, these options would have increased operating and administrative costs and would have caused more frequent disruptions to the industry (as effort controls are imposed more frequently). Regardless of these efforts to make the TAC last, the incentive still remains to catch the TAC too quickly in whatever period is defined. This could result in a shutdown of the fishery in a particular area and an interruption in the supply of herring to the market that reduces overall economic benefits. It is unlikely that in the initial years of the plan that all areas will be closed at the same time, so market should be supplied by open areas even if a management area is closed to directed fishing.

The most likely area to be subject to effort controls when the plan is adopted is the inshore Gulf of Maine area, Management Area 1A. Most landings have come from this area in recent years. An attempt was made to estimate when the TAC would be reached in Management Area 1A using the proposed management scheme. The reported landings in 1996 and 1997 in Management Area 1 were first plotted against dates (note that in 1996, some of the apparent jumps in the amount landed is due to an inability to assign all landings on a trip basis). Landings reported from the proposed Management Area 1B were removed, and the estimated impact of the proposed effort controls was applied to the remaining landings. Two methods for estimating the impact were

attempted. The first method (Model 1, described in section E.7.2.5.3) estimated the percentage of fishing trips that would have been impacted by the proposed effort controls, and subtracted the same percentage in landings. The second method (Model 2) subtracted landings made on the days that would have been closed to fishing if the effort controls were in place. The two models gave similar results that are almost indistinguishable when plotted together. Finally, an estimate of the impact of the spawning area closures was applied to these reduced landings (Model 3). The impact of the spawning closures was assumed to be the loss of 50% of the landings from the Central and Western Maine closures in 1996 and 1997. The results of these three models are shown in the figures at the end of this section.

The catch rates in 1997 would have resulted in closure of the Area 1A fishery by the middle of September (if the TAC had been set at 45,000 mt). Effort controls as proposed by the plan would have extended the season until early October. With a complete spawning closure (that is, no replacement in lost landings from areas that remain open to fishing), the area would have remained opened until the beginning of November. In 1996, the catch rates without effort controls would have resulted in closure of the Area 1A fishery in the beginning of September (if the TAC had been set at 45,000 mt). Effort controls would have extended the fishery until the end of the month, December, and a spawning closure as proposed in the plan would have extended the fishery until the first week of October (Figure E.22 and Figure E.23).

This analysis assumes the effort controls are perfectly effective (for Model 1, a percentage reduction in the number of trips results in the same percentage reduction in landings from Management Area 1A; for the second model, fishermen cannot make up lost landings on other days). It does not account for any compensatory actions that may be taken by fishermen to replace landings lost due to the effort controls. Model 3 is optimistic in assuming that none of the catch during the spawning closures is replaced by fishing effort in the open areas of Area 1A. The combined impact of the management measures, then, is that absent a significant change in fishing activity, the Area 1A directed fishery can be expected to close sometime between September and the beginning of November in 1999. If the TAC prompts a race for fish as has occurred in some quota fisheries, the closure could be even earlier. This is a significant change for both vessels and processors in the herring fishery. The August/September period is typically one of the most productive periods for herring fishermen in the Gulf of Maine, so any limitation on harvest during this period can be expected to decrease revenues and may increase vessel operating costs. Overall revenues may not decline if vessels are able to locate and catch herring in other open management areas. For the same reason, the supply of herring for the market may not be interrupted because of herring that may be caught in other areas.

While this discussion has focused on the impact on the directed fishery in Management Area 1A, there also will be impacts on other vessels that obtain some of their revenue from herring. Some vessels in the whiting fishery target herring at certain times of the year. This is done using a small mesh bottom trawl in the whiting grate fishery, or by fishing in the small mesh exemption areas. In 1998, 42 vessels had permits for the experimental grate fishery. Seventeen of these vessels landed a total of 59 mt of herring. The vessels that use small mesh in the small mesh areas do not

have a special permit category and their landings cannot be specifically identified in the vessel logbook database. To get a sense of the possible herring landings from these vessels, landings were examined from vessels that landed both herring and whiting. In 1997, there were 100 vessels that caught 823 mt of herring, while also landing 4,000 mt of whiting. The average herring landings were 3.5 mt (worth approximately $470 at an ex-vessel price of $0.06), with a minimum of 0.01 mt and a maximum of 30.4 mt (worth approximately $4,000) . According to the vessel rip report database, herring caught by all bottom trawl vessels (126 vessels) totaled 915 mt in 1997 (the dealer weighout database attributes additional landings to bottom trawl vessel, possibly due to miscoding of entries). The mean for these vessels was 7.3 mt, and the maximum was 368.8 mt. The fishery in the small mesh area is only allowed during the period July 15 through November 15. If the herring fishery closes in Area 1A closes in September, it will limit the ability of this group of vessels to target herring using a whiting net. Many of these vessels are small and are unlikely to relocate to other areas to fish for herring.

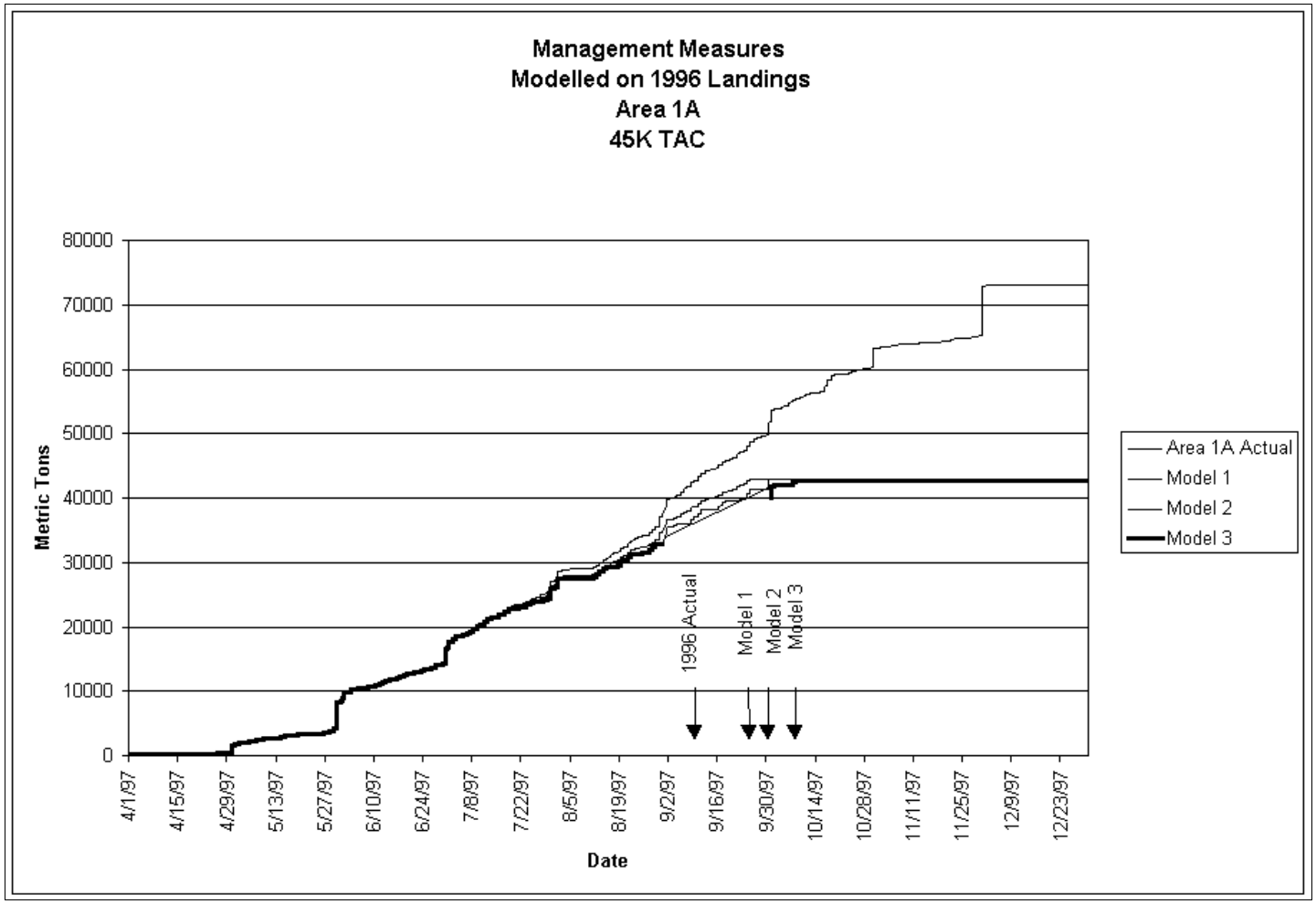


Figure E.22 - Management measures modeled on 1996 catch (Source: Maine DMR)

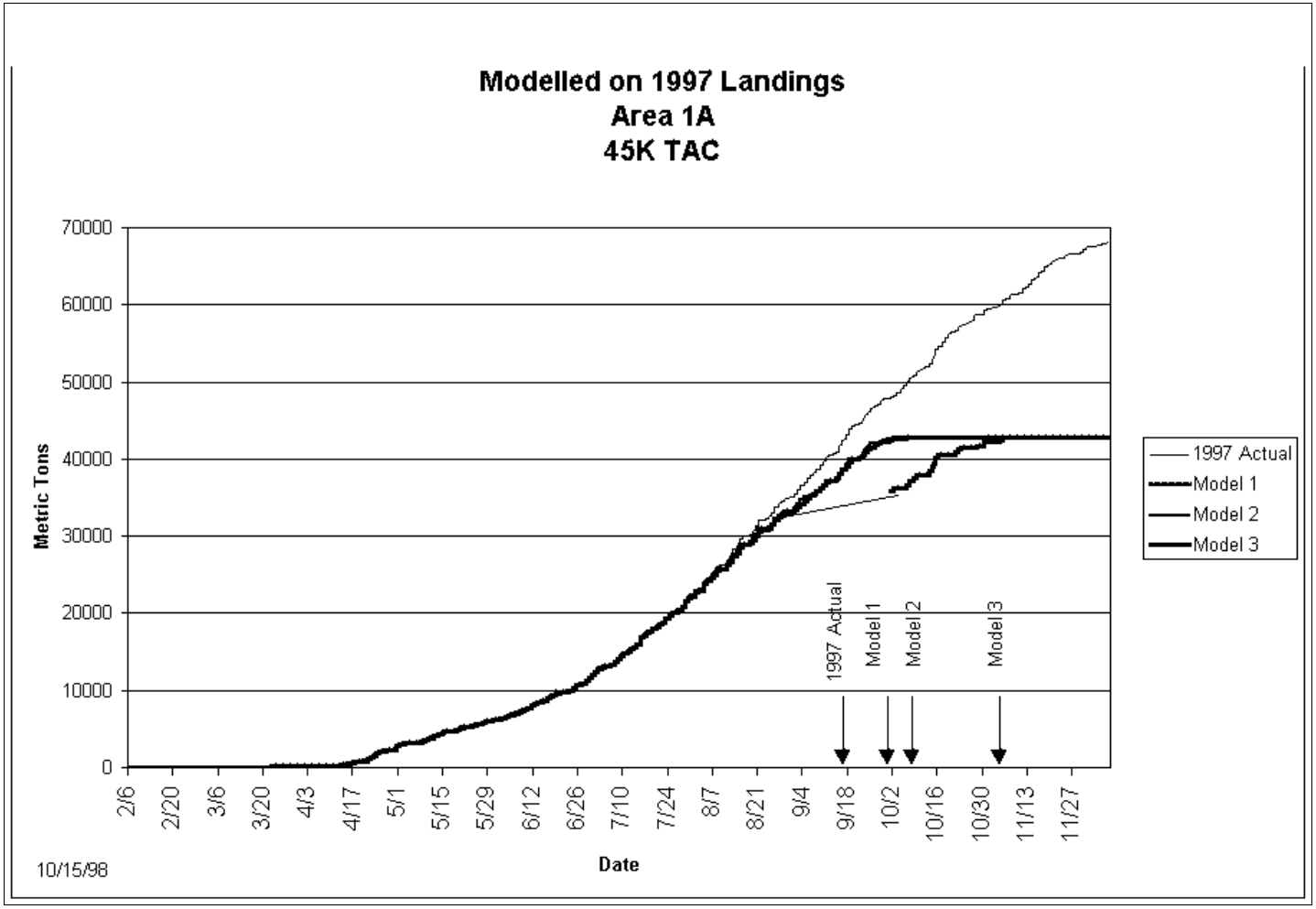


Figure E.23 - Management measures modeled on 1997 catch (see text for explanation of models) (Catch statistics source: Maine DMR)

E.7.3.4.4 Vessel Size Limits

The proposed size limit for domestic vessels was based upon current participants in the region's pelagic fisheries. For the vessels identified as having caught herring in 1997, the maximum length was 126 feet, the maximum horse power was 2,100, and the maximum GRTs was 246. There are mid-water trawl vessels that exceed these averages that may desire to participate in the fishery in the future, but there were no vessels that exceeded the proposed limit. This limit establishes a preference for existing vessels in the region to enter the fishery, while allowing some room for upgrades for current participants. It does not eliminate any of the current participants in the fishery. No vessel over the proposed size limit has a recent record of landing Atlantic herring. One vessel over the limit was planning to enter the fishery but was prevented from doing so through congressional action.

Total effort is comprised of the number of vessels in the fleet, the harvesting power and capacity of individual vessels in the fleet, and total fishing time. Limiting vessel size addresses the average capacity of the total fleet and not the total capacity. In the open access fishery the size limitation is really a limitation on each vessel's share of the catch. While vessel size limits may be ineffective in controlling total capacity under open access where the number of vessels could increase without limit, it may slow the development of the fishery. Existing large vessels that are currently participating in other fisheries could easily enter the herring fishery with limited additional investment. By contrast, the smaller vessels in the New England and Mid-Atlantic region that do not currently participate in pelagic fisheries must make a considerable investment – estimated between $100,000 to $250,000 – to convert to mid-water trawling. An analysis of existing harvesting capacity in the Northeast Region indicates that there is sufficient capacity to harvest the available herring resource should vessels choose to do so (see sectionE.1.1.1.1). Many of these vessels are under increasing restrictions in other fisheries and may desire to enter the herring fishery to supplement their income. In order to enter the fishery, these vessels will have to develop markets for herring and may need to alter their vessels to improve their ability to deliver quality herring to shore. The time it takes for them to do so will slow the introduction of harvesting capacity into the fishery.

There are advantages to allowing large domestic vessels into the fishery. Large vessels typically process on board, can remain at-sea for longer periods and in worse weather, and produce a product that can be sold into foreign markets. There are economies of scale, resulting in lower production costs per unit. They may help develop transportation infrastructure as they ship their cargo to other locations. At-sea processing may be cheaper than shoreside processing, helping at-sea processors to compete successfully in the world market furthering the development of additional markets for U.S. herring. A disadvantage is that large vessels rapidly introduce additional capacity into the region and increase catch rates. Allowing these vessels to enter the fishery may result in early attainment of the TAC and resultant interruptions in supply. Because of limited entry provisions in many northeast region fisheries, they have less flexibility to shift into other fisheries in the area during resource downturns. While not all existing herring fishery participants have permits in limited access fisheries, Table 6 shows that many of the vessels that

currently land herring do have a permit in another Northeast Region fishery.

Because the herring fishery is being managed as an open access fishery, however, a large number of small vessels entering the fishery could also result in excess harvesting capacity. Emphasizing this concern is recent experience with the development of excess capacity. There has already been one buyout of groundfish vessels in the northeast region, at a cost of over $24 million - a clear demonstration that a large number of small vessels can lead to overcapacity. The Council recently asked NMFS to consider a buyout for the scallop fishery. There are also examples of excess capacity in fisheries that use large factory trawlers. In the North Pacific, a negotiated agreement will result in a $90 million buyout of large factory trawlers ($20 million of federal funds) in order to address capacity concerns caused by large factory trawlers. While the question of excess capacity is not solely one of vessel size, given the existence of available capacity in the region and these recent attempts to reduce overall capacity in other U.S. fisheries, it makes little sense to introduce large domestic vessels until it is certain that the capacity they represent can be accommodated.

One of the objectives of the FMP is to provide opportunities to vessels in other New England and mid-Atlantic fisheries. As noted above, the limit on vessel size is a limit on each vessel's share of the catch. A limit on vessel size will help meet the plan's objectives by allowing a greater number of vessels into the fishery, regardless whether a controlled access or open access approach is chosen. For a given harvest level, this will increase the number of participants in the fishery. From a fishery specific viewpoint, the restriction may result in an inefficient use of resources. It may, however, help ease impacts of fishery rebuilding plans on vessels in other fisheries. The size limit also allows the fishery to expand under the existing business and social environment. The introduction of large vessels would significantly change the harvesting and marketing structure with the attendant social and economic disruption.

The plan creates an allocation for U.S. at-sea processing by vessels larger than 165 feet in length or 750 GRT. At the present time, there are not any domestic vessels in this size category in the Atlantic herring fishery. The creation of an allocation for a new category of processing participants provides the Council the opportunity to carefully consider the impacts of this activity on herring management. Because the current fishery does not have any vessels in this category, the benefits and risk are not clearly understood. This argues for a cautious approach, as the impacts of a rapid expansion in processing capacity can be as difficult a management problem as an increase in harvesting capacity. Recent efforts by the North Pacific Fishery Management Council to address inshore/offshore allocation issues culminated in legislation that defined the allocations and authorized $90 million to reduce both at-sea processing and harvesting capacity. Legislation establishing the buyout also restricts the development of additional shoreside capacity by restricting who can purchase Alaska groundfish.

One of the advantages to at-sea processors is that if there is a resource downturn, they can move to another area or shift into another fishery. In the Northeast Region, there are limited opportunities for such shifts due to the regulation and resource status of other fisheries. At-sea

processors are not limited to one geographic area, however, and could relocate to take advantage of resources in other areas. In the herring fishery, this could be an advantage as large processors – foreign or domestic – could be encouraged to enter the fishery on a short-term basis to take advantage of a "bloom" or temporary increase in abundance without developing permanent processing capacity. This option remains available for both foreign and domestic processors because the plan allows the specifications for USAP and JVPt to be set at on an annual basis.

For the 1999 fishing year, the allocation for large U.S. at-sea processing vessels is recommend as 0 mt. This will prevent large at-sea processors from entering the fishery, favoring participants that are similar to those currently in the fishery. Those vessels and processors that have made plans based on the current industry structure to implement their plans without a radical shift in processing capacity. The impacts of management measures – designed with the existing industry structure in mind – can be evaluated and adjustments made as necessary.

In addition to these concerns, the herring fishery in the Northeast Region has become inextricably tied to the lobster fishery. There are limited alternatives to fresh herring for bait. With an estimated 70% of the herring harvested being used for bait, any reduction in the amount of herring reaching land will negatively impact the lobster fishery. There is a concern that large domestic vessels, catching and processing at-sea, will reduce the amount of herring available for bait.

The negative impacts of the restriction on size of harvesting vessels, and the recommendation to allocate 0 mt to domestic at-sea processors in the first year of the plan, are due to the restriction on the free workings of the market to resolve allocation issues. Generally, measures which allow competition, including competition between shoreside and at-sea processing activities, are more likely to promote economically efficient use of herring. Less control over processing activities may ultimately result in more markets filled by a wider variety of industry participants. The best way to decide the optimal mix may not be by controlling participation, but by allowing market signals on prices to fishermen, processors, or bait dealers to decide the allocation of herring to different industry sectors. Attempting to engineer the market by limiting vessel size or banning offshore processing may result in inefficient outcomes.

As an example, there has been little interest by foreign vessels to participate in herring joint ventures in recent years (see section E.6.4.3.3). A large domestic at-sea processing vessel could hire catcher vessels to supply it with herring. This would provide an opportunity for some vessels in those fisheries subject to increasing restrictions (scallops and groundfish, for example) to supply herring to at-sea processing vessels. These vessels will now have to find shoreside markets for their herring if they want to enter the herring fishery. This may require additional investment to convert vessel holds to refrigerated sea water systems (RSW) if they intend to enter anything other than the bait market, or if they desire to fish offshore. The absence of a large at-sea processing vessel may also slow the marketing of frozen herring for human consumption. While this niche may eventually be filled by shoreside processors, higher shoreside processing costs may make it difficult for them to compete in the world market. A further illustration can be seen in the concern by the lobster industry that an at-sea processor will reduce the availability of lobster bait

because herring will be sold at-sea rather than transported to shore. If a shortage of bait were to develop, the price should increase, attracting additional vessels into this market and resolving the shortfall. By preventing vessels from having the opportunity to provide herring to an at-sea processing market, the plan may hold the price of herring bait to a lower level.

E.7.3.5 Roe Fishery

Allowing a roe fishery will provide additional flexibility for fishermen to pursue the optimal mix of outputs. Market conditions could change so that roe could be profitably pursued. If the resource is managed properly there is no reason to limit certain product forms. This provision may also encourage development of the offshore fishery, as a highly profitable roe fishery could encourage investment in the size and type of vessels necessary to pursue the offshore resource. The requirement to retain the carcass may slow production in the roe fishery and increase costs, but provides a needed way to monitor the catch.

In the Pacific Northwest, the price per pound of roe in the roe-on-kelp fishery has approached $30/pound. While a roe-on-kelp fishery could develop in the EEZ, it is more likely that the harvest of roe will be similar to the sac roe fishery in Alaska or the east coast of Canada. 1997 prices in the herring sac roe fishery in Alaska ranged from $180/ton to $600/ton (Alaska Department of Fish and Game, June 8, 1998; http://www.cdf.adfg.state.ak.us). This is higher than the average value for Atlantic herring of $110/mt in 1997. Average ex-vessel revenues in the herring fishery have remained nearly constant since 1980. Any development of a roe fishery will increase that average value and result in increased economic benefits. Prices are dependent on international markets, particularly those in Asia; any roe fishery would be subject to fluctuations based on international market conditions as well as demand. Development of an Atlantic herring roe fishery is likely to be more similar to the roe fishery in Canada. While the west coast product is primarily used for holidays in Japan, the east coast roe is used year round. (Kurita, pers. com.). Prices in the east coast Canadian roe fishery have ranged from $0.18 - $0.20/pound (Canadian) for whole herring for the roe market, though it declined to only $0.06/pound (Canadian) due to Japanese financial instability in 1998.

E.7.3.6 Joint Venture/Internal Waters Processing Restrictions

While joint venture operations may occur in any area, the Council has reserved the option to restrict them to certain areas through the allocation process. The purpose of this option is to encourage development of or protect employment and investment in current shoreside processing activity or reserve the harvest for shoreside processing in certain areas. By doing so, these options limit the flexibility of the harvester to pursue alternative markets. The result of these limits may be increased harvesting and processing costs because locations may be selected that are less than ideal. Sufficient product may be reserved for domestic processors through use of the allocation of DAP and JVP, but these allocation processes may not be sufficient to guarantee product to domestic processors when needed. There may also be other social or cultural reasons to implement these restrictions such as to support shoreside processors in rural communities.

E.7.3.7 Vessel Monitoring Systems

E.7.3.7.1 Vessel Costs

The FMP includes a requirement for a vessel monitoring system (VMS) for vessels that landed in the previous year, or intend to land in the current year, more than 500 mt of herring. Such a system allows the tracking of the vessel, facilitating the enforcement of closed areas or area TACs, reporting of catches, and tracking of days-at-sea. Vessels must declare their intention when entering the fishery and must have the VMS on board when they begin fishing. If a vessel does not have a VMS on board, it cannot catch more than 500 mt of herring during the fishing year.

The system is designed to record a vessel's hourly position throughout the year, including when the vessel is at the dock or on a mooring. While power requirements may be low there is a continuous drain on batteries, which can be a problem during port time, especially in cold weather. Many vessels do not have an independent electrical source (generator), and those that do would have to run the generators continuously to keep the batteries charged, even when on a mooring or sitting idly at the dock for an extended period. To avoid the additional costs and operational problems that result from requiring a VMS to transmit when moored, this FMP requires a VMS to transmit only when the vessel is underway in state or federal waters.

Vessels may experience some benefits to VMS that have not been quantified. The system provides excellent an excellent communications link that may improve coordination between vessels and their markets. In addition, the improved communications link may provide some safety benefits – with the Boatracs system, for example, continuous satellite communications are possible with facilities ashore. This link is not as likely to be disrupted by weather or atmospherics as the HF-SSB and VHF-FM radios commonly used by the fleet. Unlike an Emergency Position Indicating Radiobeacon (EPIRB), the a VMS system not only determines the vessel location in case of an emergency, but allows a two-way communications link between the vessel and the shore.

The fixed costs of the system represent a proportionally larger part of the annual revenues of a small or part-time boat than a larger or full-time boat. For vessels that land a small amount of herring, the herring revenues will not fund the costs of a VMS. If these vessels are required to purchase a VMS, they may choose to forego herring revenues to avoid the VMS requirement. The requirement, as established, only applies to those vessels that harvest a minimum of 500 mt of herring. At this minimum level, VMS costs over a five year period are less than 5% of vessel revenues for one hourly transmission every day of the year. Actual costs may be less because the herring FMP does not require VMS messages when the vessel is in port.
The costs for the purchase, installation, and operation of a VMS required by the Atlantic herring FMP are estimated at $2,700 per year, per vessel. VMS systems selected for use must be approved by the Regional Administrator. Currently there is only one vendor that offers VMS equipment approved for use in the Northeast Region - Boatracs, Inc. There is the possibility,

however, that equipment based on the Inmarsat C communication system may be approved in the future. Boatracs system purchase and installation costs about $6,000. Boatracs offers a lease – to – own option at $4,258 / year for a 24-month lease or $3,029 / year for 36 months.[1] An Inmarsat C system installation will range from $3,400 to $5,400 because of various options available, with an additional $400 charge for installation. The annualized equipment costs based on a five-year amortization of the purchase and installation price is $1,200 for Boatracs and $1,160 (maximum) for an Inmarsat C system. These costs should be compared with the potential benefits from the regulations as will be discussed below. Table E.59 summarizes the total costs of VMS monitoring to the public under the proposed regulations.

The primary costs after purchase and installation of a VMS is the charge for the messages that communicate the vessel's position. The total costs for these messages depends on the system chosen for operation, either Boatracs or an Inmarsat system. There is no estimated maintenance charge for either system. Boatracs, Inc. currently charges a flat rate for messaging of $125/month, based on one message each hour of every day. In the case of the herring fishery, vessels will not have to transmit position reports when moored in port so the number of messages will be reduced, but it is uncertain if the company will reduce costs for fewer messages. Message costs are about $0.10 per message for Inmarsat, or about $75/month for a message each hour of every day.[2] Total annualized costs of VMS per vessel messaging are estimated to be $1,500 for Boatracs and $900 for an Inmarsat C system based on one message each hour of every day.

The costs to the industry from the VMS monitoring are expected, however, to be lower than estimated above. Cost estimates include message costs for one hourly message every hour of the year; the plan will only require messages when the vessel is underway, reducing communications costs. Some of the herring vessels have already installed VMS for private use. VMS will also have positive impacts on the industry through improved enforcement, compliance, and management of the fishery resources as summarized under item 1 of this analysis. VTS monitoring will also provide numerous benefits for vessels operations in terms of improved safety, flexibility, and vessel record keeping. Although these benefits to the public cannot be estimated in estimated in monetary terms, they are outlined below:

<u>Benefits for vessel operations</u>

- Improved safety
  - More precise location allows faster response by rescue platforms
  - 2-way communication allows vessels to communicate precise nature of problems
- Improved vessel record-keeping - more accurate plotting of tow results - catches, bottom characteristics and potential obstructions

- More accurate monitoring of vessel operations by owners who are not aboard the vessels
- Would provide secure 2-way communications between vessels and shore

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[1] Information is based on personal communications with Bob Negroni of Boatracs, Inc.
[2] Information is based on personal communications with Sandra Yin of NMFS.

- Allows vessels /companies to communicate valuable information about catches, markets, logistics, etc.
- The VMS would back-up global positioning systems currently used by vessels - this benefit will be greater when the LORAN system is eliminated in the future.
- As closed areas become more enforceable, they could be smaller - yet still result in an equivalent level of conservation.
- Would increase the flexibility of vessels operations by making area closure smaller or by making feasible measures that apply trip limits to specific areas.

Elimination of future requirements with VMS monitoring

- Landings data could be handled electronically
- Would reduce administrative costs
- Would improve timeliness of data

Estimated Herring Fleet VMS Costs - Boatracs			
Number of Vessels	Annualized Cost per Vessel (Installation and Operation)	Total Costs	Percent of 1997 Fleet Revenues
20	$2,700	$54,000	0.5%
40	$2,700	$108,000	1.0%
60	$2,700	$162,000	1.5%

Table E.59 – Estimated fleet VMS costs based on Boatracs system. Annualized costs include installation and operation.

E.7.3.7.2 NMFS Costs

The annualized costs to the government for VMS reporting requirements under the Atlantic herring FMP are estimated at $20,000. The NMFS Northeast Region currently operates a VMS system for the Atlantic sea scallop fishery. The estimates of the annual administrative and enforcement costs to the federal government from this program are summarized in Table E.60. The costs were estimated by extrapolating the costs of the VMS experimental program to a year. The ongoing (recurring) costs amount to $300,00 a year and include staff costs, internet connection, training, travel and the annual costs for equipment and the back-up system.[3] These costs are not expected to increase with the VMS requirement for Atlantic herring fishermen. No additional costs are expected to be incurred from the requirement to monitor reports received from Atlantic herring fishing vessels, as the system is highly automated and is already established.

[3] Salary costs are those minimally associated with two GS-13 computer specialists and one GS-11 VMS technician required for daily operation and maintenance of the system. The costs include benefits.

The costs for expanding this program to another fishery are not well defined. The primary cost will be in the labor necessary to revise operating software to monitor another fishery with different regulations, protected areas, and other requirements. NMFS estimates that it costs approximately $100,000 to add 50-100 boats from another fishery to an existing VMS system. These costs were amortized over five years and added to the ongoing costs. The total annualized costs of VMS monitoring amount to $320,000. Only $20,000, however, is due to the requirement for VMS in the herring fishery since the other operating costs support the system's current use in the sea scallop fishery.

It is not possible to predict precisely at this moment if these costs would change in the future as more and more vessels are eventually added to the program. The NMFS Enforcement Office believes, however, that the present VMS monitoring capacity developed for the scallop program can handle a high number of vessels, including the 442 vessels with scallop limited access and multispecies individual days-at-sea permits, with no substantial increase in costs. At the present time, the system is only monitoring about 230 vessels in the sea scallop and multispecies fisheries. The addition of 25 vessels in the herring fishery is well within the capability of the existing system.

The overall administrative and enforcement costs, however, are expected to be lower than can be quantified within the framework of the present analysis. First, without the VMS system, the only way to verify reported catch locations is by examining sighting reports from enforcement units, a laborious process that is unlikely to be performed due to manpower limitations. Second, vessel-generated geographical information will allow more efficient deployment of enforcement resources and would, therefore, increase efficiency and effectiveness in the use of current resources.

Finally, VMS monitoring would reduce the need for expensive Coast Guard over-flights to enforce spawning area closures or mandatory days out of the fishery. A VMS system could potentially enable the Coast Guard to fully meet its fisheries program standards without additional resources. Consequently, VMS is expected to result in significant savings in enforcement costs if its use is broadened to include vessels under Atlantic herring FMP.

In addition to these monetary benefits, VMS in the herring fishery would significantly improve the Coast Guard's ability to detect violators and respond with the appropriate action. While the system does have some limitations, it will be of tremendous use in the enforcement of spawning and other area closures and effort controls. Herring vessels are allowed to fish in areas closed to groundfish vessels; the VMS requirement will help enforcement units sort vessels detected in the closed areas and determine who is fishing legally. It will augment cutter and aircraft patrols and allow them to be used to enforce other management measures. A VMS will also make boarding efforts more efficient, as it will help Coast Guard distribute boardings in a more equitable manner across all fleet sectors.

The actual life cycle costs to the government and users for a VMS system are not fully understood. The VMS used by a vessel must be approved by the Regional Administrator. In the

Northeast Region, only one vendor (Boatracs, Inc.) is currently approved for the multispecies and scallop VMS requirement. With only one certified vendor, and a regulatory requirement to use the VMS, there is no inherent cost-controlling mechanism such as would exist in a competitive marketplace with two or more vendors. This is a problem for the lease/purchase cost of the equipment, but is perhaps a greater problem for embedded, or hidden variable costs such as messaging charges or insurance. On the other hand, any further delay in the requirement to use VMS, may discourage other potential vendors from further development of their competing systems. In the future, other vendors may be able to receive approval for systems using the Inmarsat C system.

VMS Monitoring		
Annual Costs		
	Salary and Benefits[1]	$230,000
	Internet Connection[2]	$7,500
	Equipment [3]	$20,000
	Back-up System [4]	$38,960
	Software Licensing	$3,500
	Supplies[5]	$11,000
	Training and travel	**$8,000**
	Total Ongoing Costs	**$300,000**
Start-up Costs		
	Software adaptations	$100,000
	Total Fixed Costs	$100,000
	Annualized Start-up Costs (at 5 year amortization)	**$20,000**
Total Annual Costs [6]		**$320,000**
Previously Committed Costs		
Total Annual Costs[7]		**$300,000**
Net Annual Costs to Government from Herring VMS Monitoring		**$20,000**

Table E.60 – VMS costs to the government (Source: Data supplied by NMFS, Office of Enforcement, Northeast Regional Center, and NMFS Headquarters)
1. Salary and benefits, three program support personnel.
2. 24-hour maintenance of secure internet node at Gloucester, MA.
3. Lease and maintenance contract on CPU and monitor.
4. Lease and maintenance contract on CPU and monitor
5. Optical storage disks, repairs and supplies associated with non-lease equipment (modem, router, printer, thermal paper, WORM drive).
6. Estimated by adding up annualized start-up costs ($2,383) to total ongoing costs.
7. System operating costs currently funded to support program for the sea scallop fishery.

E.7.3.8 General Administrative Measures

The requirements for permits, vessel and dealer reporting, and monitoring of the FMP impose costs on both participants (vessels, dealers, and processors) and the government. The primary costs for participants in the herring fishery is due to the time necessary to complete forms in order to comply with the requirements. These costs are detailed in the Paperwork Reduction Act analysis (PRA), section 7.7 and Appendix VI. To summarize, vessels, dealers and processors will be required to obtain permits and comply with mandatory reporting requirements. Since some participants in the fishery already have a federal permit and comply with reporting requirements established by another fishery, the costs are estimated for new participants only. In the case of these management measures, the compliance costs are primarily due to the time required to complete and submit the necessary forms. Total vessel costs for these requirements are estimated as $7.80 for vessel permits, $25.32 for operator permits, $27.00 for vessel trip reports, and $52.00 (maximum) for interactive voice reports. Total costs per vessel are thus $112 per vessel. The total cost for dealers is estimated to be $1.58 for permits and $78.70 for weekly landing reports, for a total of about $80 per dealer. The costs for processors is also estimated to be $1.58 for permits and $7.83 for an annual report, or a total of $9.41 per processor. This costs are considered insignificant. The government will also incur some costs to monitor these programs, estimated to be $6,929 for all of these requirements.

E.7.3.9 Other Costs

E.7.3.9.1 Costs to Processors

Currently, the two primary uses of herring are as bait and as sardines (section E.1.1.1). While there are a number of fish that can be used for bait, herring is currently the only one that is plentiful and readily available. The sardine canneries require herring for their raw material. The management plan does not restrict the overall supply of herring, which could double under the proposed regulations. The plan does, however, allocate TACs to different areas in a way that may change existing fishing patterns. Processors may need to adapt their sources of supply as a result of these restrictions. For example, the inshore Gulf of Maine area will not supply as much herring as in recent years. Processors will need to identify vessels that harvest herring from other areas. If vessels are unable to locate herring in these areas, there may be temporary shortages.

E.7.3.10 Enforcement Costs

The management measures for Atlantic herring include area specific TACs, closed spawning areas, mandatory days out of the fishery, incidental catch limits, and limits on transfers at sea. All of these measures will impose additional enforcement burdens on enforcement agencies. The economic costs of these measures will depend on whether new revenues must be raised from taxpayers to pay for the added enforcement burden. The more likely scenario is that there will be opportunity costs for enforcement services that must be diverted from other activities.

In the event that no new revenues are raised from the public to pay for Atlantic herring enforcement, from a budgetary perspective, Atlantic herring enforcement costs are a transfer payment from one enforcement activity to another. Adding enforcement responsibilities with a new management plan will take away enforcement services that are devoted to other fisheries. The cost of adding Atlantic herring regulations is measured by the opportunity cost (i.e. foregone benefits) of reducing the enforcement services devoted to other activities. Unfortunately, no empirical studies have been conducted to measure the value of enforcement services provided in northeast region fisheries, making a quantitative estimate of enforcement costs impossible.

The primary management measure for preventing overfishing is the establishment of a TAC and its distribution by management area. Enforcement of this provision is complicated by the difficulty in proving that a vessel accurately reports the location that it catches herring. This would require comparison of sighting information from cutters or aircraft to be compared to catch locations reported by the vessel through the IVR or VTR system. Given the relatively few vessels that fish for herring and the wide area over which the range, significant enforcement resources would have to be devoted to locate vessel and confirm their fishing activity. Even this effort would be complicated since much herring fishing occurs at night. In order to facilitate this effort and reduce enforcement costs, the plan requires the vessels that land the majority of herring to be equipped with a VMS. This system will reduce enforcement costs in two ways. First, a record will be generated that tracks the location of herring vessels when underway. While VMS does not confirm fishing activity, it can be compared to reported catch locations to confirm that a vessel was located in that position at a given time. Second, the VMS will reduce the amount of time necessary for enforcement units to search for herring vessels, making it easier to confirm activity. In a similar fashion, the VMS will reduce the costs of enforcing the spawning area closures or mandatory days out of the fishery. Cutters and aircraft will be able to rapidly locate herring fishing vessels and make certain that they are not fishing in an area that is closed, either due to the imposition of effort controls or because of a spawning closure.

Vessels that intend to harvest more than 500 mt of herring, or that harvested 500 mt of herring in the previous year, will be required to operate a VMS (section 3.10). The costs for a VMS are described in section E.7.3.7.1. The annualized cost per vessel to purchase, install, and operate a VMS is estimated to be $2,700. Additional costs are incurred due to burden-hour estimates of the requirements associated with VMS, estimated as an additional $111 per vessel. At the 500 mt threshold, this is about 4% of annual revenues. When compared to the average herring revenues of the 19 vessels that landed most of the herring in 1997 and who would be required to have a VMS if based on 1997 landings, this cost is equal to about 0.5% of the average revenues for this group. Additional costs to the government to adapt the existing VMS system to the herring fishery is estimated as $20,000 per year (section E.7.3.7.2).

The small number of participants in the herring fishery will also tend to keep enforcement costs low. Even if the number of vessels landing more than 500 mt of herring were to double, there would still be less than 50 boats landing the majority of the herring catch – far less than the

thousands of boats that participate in other fisheries in the region. Because of the small number of participants, the opportunity costs to enforce the herring regulations are likely to be a small portion of the overall enforcement effort.

E.7.3.11 Alternatives Not Selected

E.7.3.11.1 No Action

Under the no action alternative, landings of herring are likely to increase in the short term if market demand increases. This will result in increased revenues from the fishery. Vessels can be expected to minimize costs while attempting to fill this demand, concentrating fishing effort in inshore areas and during spawning seasons when herring are most aggregated. Administrative and enforcement costs would be minimized.

Increased effort in the inshore areas could be expected to result in overfishing on those spawning components. The likely area that this may happen is in the inshore Gulf of Maine. As the resource is exhausted, vessels and dealers would be forced to locate herring in other areas. This would increase vessel costs and may result in interruptions of supply to herring markets. After collapse of the herring fishery on Georges Bank, the resource took nearly ten years to rebuild. A similar collapse in the inshore areas would be disastrous to the traditional herring fishery.

E.7.3.11.2 Limited Entry/Controlled Access

The controlled access/limited entry proposal limits the number of participants in the herring fishery. One approach to removing the incentive for using up the TAC at the beginning of the period is to distribute the TAC among the participants in days-at-sea equivalents (or individual effort quota) and allow fishing to take place in whatever manner was appropriate for each fishermen. This type of system would not replace the hard TAC however. It is the assurance that each fisherman's "balance" will not be taken by others that keeps them from going out to "get their share". Keeping the hard TAC makes it more difficult to assure fishermen that an area won't be shut down due to TAC being used up. As described, the controlled access option will only be effective in removing the derby incentive to the extent that fishermen believe that the days-at-sea allocation was done correctly. If days-at-sea allocations are correctly matched to the TAC and fishermen believe an area will not close, then the derby incentive is effectively removed. If days-at-sea allocations are too high and areas close early then the derby incentive remains.

The main difference between open access and controlled access is that controlled access allows for some control of the physical capital that can be applied to the herring resource. Open access allows permanent capacity to enter without any restrictions and leads to excessive harvest capacity development even with a hard TAC. The controlled access option allows herring to be used as it has been traditionally and as an alternative fishery for vessels in distressed fisheries but without the infusion of permanent harvest capacity. In addition, the controlled access option moves the fishery one step closer to establishing property rights by accounting for permits and

tying them to an effort allocation.

Other features of the controlled access alternative are discussed in that section 3.0. In general it provides flexibility by allowing transferability of either permits and or the days at sea (DAS) associated with the permanent and temporary permits, permit controlled harvest of “blooms” without generating permanent harvesting capacity and also flexibility in processing options.

Neither the controlled access nor the open access alternative control how the fishery will develop to one in which vessels of various sizes find appropriate and profitable niches in which to operate.

E.7.3.11.2.1 Controlled Access Qualification Criteria

The controlled access system proposed several possible qualification criteria. By definition, the entry criteria will exclude some vessels from the directed fishery for herring. The following tables characterize the vessels that would qualify for a Management Area 1 controlled access fishery under the various qualification criteria.

The adoption of any of these criteria limits the opportunities for other fishermen to enter the herring fishery. Particularly for the more restrictive criteria, this will restrict the benefits of increased herring landings to a small group.

Qualifying Option 1 – fished in area 1 in 1996 or 1997 and possessed herring exemption letter
(see table on following page for vessels qualifying under this option)

Gear	Vessels	Avg. horse power	Avg. length (ft.)	Avg. tons	Home state	Avg. yearly trips in area 1	Avg. yearly herring catch (mt) in area 1
Bottom otter trawl	2	512 425 min 600 max	62 45 min 79 max	50 32 min 69 max	MA	17 6 min 28 max	5 1.2 min 8.9 max
Mid-water trawl	11	928 348 min 1,300 max	90 49 min 126 max	157 39 min 199 max	MA	44 1 min 114 max	2,221 136 min 6,195 max
Purse seine	2	355 260 min 450 max	51 23 min 79 max	88 2 min 173 max	1 MA 1 ME	68 3 min 80 max	5,334 9.4 min 10,660 max

Table E.61 - Description of vessels qualifying under option 1 by principal herring gear

Qualifying option 2 - fished in area 1 in 1996 or 1997 and averaged > 2,000 lbs per trip in either year

Gear	**Vessels**	**Avg. horse power**	**Avg. length (ft)**	**Avg. tons**	**Home state**	**Avg. yearly trips in area 1**	**Avg. yearly herring catch (mt) in area 1**
Bottom otter trawl	18	379 180 min 730 max	57 42 min 80 max	63 11 min 180 max	9 MA 3 NH 2 ME, RI 1 DE, VA 1 unknown	9 1 min 75 max	30 1.2 min 216 max
Mid-water trawl	14	877 333 min 1300 max	88 49 min 126 max	159 39 min 199 max	12 MA 1 WV 1 unknown	44 1 min 114 max	2,316 2.2 min 7,303 max
Purse seine	15	435 200 min 970 max	53 23 min 84 max	61 2 min 192 max	6 ME 3 MA 1 RI, VA 4 unknown	42 1 min 162 max	2,795 3.3 min 14,677 max
Sink gillnet	1	480	48	37	MA	1	1
Weir	6	n/a	n/a	n/a	not federally permitted	3 1 min 7 max	56 1.1 min 171 max

Table E.62 - Description of vessels qualifying under option 2 by principal herring gear

Some vessels that landed herring in 1996 or 1997 would not qualify under this qualification criteria. The following table summarizes the characteristics of those vessels that would not qualify.

	TC 1	TC 2	TC 3	TC 4
Number of vessels	1	2	2	10
GRT, Mean	2	35.5	66.5	179
Max.	2	39	69	199
Min.	2	32	64	158
HP, Mean	260	178	412	992
Max	260	600	425	1300
Min	260	248	400	450
Length, Mean	23	47	64.5	96.8
Max.	23	49	79	126
Min	23	45	50	77

TC < 5 GRT; TC2: 5 to 50 GRT; TC3: 50 to 150 GRT; TC4: 150 GRT and over
Table E.63 - Non-qualifying vessel characteristics by ton class, option 2

Option 3 Additional vessels from 1990-1995 that fished in Area 1 and averaged >2,000 lbs per trip in any year from 1990-1995

Under option 3, the qualification period is extended. The total number of vessels that would qualify includes those shown in Table E.61 and Table E.62.

	TC 1	TC 2	TC 3	TC 4
Number of vessels	0	26	13	3
GRT, Mean		30	72	179
Max.		5	50	152
Min.		49	116	198
HP, Mean		324	446	828
Max		135	360	520
Min		600	871	1200
Length, Mean		47	64	89
Max.		31	56	81
Min		60	79	104

Table E.64 - Additional qualifying vessel characteristics by ton class, option 3

Option 4 Vessels that possess a multispecies, squid/mackerel/butterfish
Current (as of 5/12/98) multispecies, scallop, or squid/mackerel/butterfish permit holders. Total of 2,848 vessels.

	TC 1	TC 2	TC 3	TC 4
Number of vessels	1	2	2	10
GRT, Mean	2	35.5	66.5	179
Max.	2	39	69	199
Min.	2	32	64	158
HP, Mean	260	178	412	992
Max	260	600	425	1300
Min	260	248	400	450
Length, Mean	23	47	64.5	96.8
Max.	23	49	79	126
Min	23	45	50	77

Table E.65 - Qualifying vessel characteristics, by ton class, option 4

E.7.4 Social Impacts of the Alternatives

Appendix I, prepared by Dr. Christopher Dyer and Dr. John Poggie under contract to the Council, contains an extended discussion of the social issues surrounding the herring fishery. This paper highlights the social impacts of many of the alternatives considered by the Council. The following discussion highlights the impacts of the management measures and draws from the conclusions in this paper, as well as the entire EIS. The herring fishery has a long history in New England and has been a key part of the state of Maine seafood processing industry since the late 1800's. More recently, it has become intertwined with the extremely valuable lobster fishery ($268 million in revenues in 1997) – as described elsewhere, over two-thirds of all herring harvested is used as bait, the vast majority believed to be in the lobster fishery. The proposed management plan takes into account these social impacts and minimizes any adverse effects.

Under the proposed management action, the current herring fishery will be allowed to nearly double in size. Gross revenues from this fishery could increase by $13 million at current ex-vessel prices, a potential boon to those communities suffering from reduced catches and revenues in other fisheries. An increase of $13 million is equal to one-third the value of cod, haddock, and yellowtail flounder landings in New England in 1997 (Table E.8). The opportunity provided by this fishery is bound to result in some changes in the various fishing communities. It is expected that for the most part, the communities that have been linked to the herring fishery in the past –

Rockland, Portland and other Maine ports, Gloucester, MA and Point Judith, RI – are those that are most likely to benefit from the increased landings. There is a possibility that other fishing communities, such as New Bedford, MA or Cape May, NJ, may also be able to take advantage of the opportunities in this fishery.

In general terms, the management plan should benefit the fishing communities of the mid-Atlantic and New England. By providing for a sustainable herring fishery, the plan will both protect the interests of traditional users of the resource and provide an opportunity for others to enter the fishery. There is room for expansion in shoreside processing that will be supported by increased revenues.

E.7.4.1 Spawning Area Closures

The proposed approach to spawning closures may result in a loss of revenues from some areas (section E.7.3.3). This is because the Council's proposal does not include the tolerance provision which allows fishing in the Commission's existing spawning closures. Many purse seine vessels have adapted to the tolerance provision to take advantage of the high concentrations of herring in the areas during the closures, while avoiding spawning fish. There is a possibility that there will be a reduction in landings and revenues during the closures. By working closely with the Commission, the Council has provided some opportunities for these vessels to minimize the disruption this may cause by fishing either in state waters or in areas of the EEZ that are not subject to the closures. Some vessels that were unable to take advantage of the tolerance provision will also benefit by the Council's action because the Council's closures off Massachusetts and New Hampshire are smaller than those in the Commission's plan, vessels will be able to fish for herring in a wider area. In sum, the spawning closures are not expected to have a significant impact on any of the communities that have grown reliant on herring.

E.7.4.2 Catch Controls

E.7.4.2.1 Total Allowable Catch

Over the long term, the establishment of the TAC will provide for a sustainable herring fishery at a higher level than current landings. The increased revenues that result will benefit fishermen and their communities – both those that have traditionally participated in the fishery, and those that enter the fishery as an alternative or supplement to fishing for other species. This may help counteract the adverse impacts of increased fishing regulations in other fisheries. The establishment of a TAC with an open access fishery, while providing sufficient protection for the resource, may encourage fishing behavior that will adversely impact communities that have grown dependent on herring. One concern is that fishermen may try to harvest as much herring as quickly as possible before any effort controls are imposed or the fishery is closed because the TAC is reached. If a "derby" style fishery results, with the TAC attained early in the season, there may be an interruption in supply of fresh herring from specific management areas. Over the long-term, the

demand for herring even after a closure should encourage investment in the types of activity that can meet this demand during a closure. This could include equipping vessels with RSW systems to preserve the herring until it can be landed, or developing the ability to store herring on shore until sold into the market. The immediate impact could be negative as the interruption in a steady supply raises the costs of herring to lobster fishers and other users. In one sense, this increased cost may benefit those who are able to supply the herring, whose ex-vessel cost has declined in real terms over the past twenty years. The effort control alternative - mandatory days out of the fishery - is designed to maintain product flow to the industry for as long as possible. Estimates still show that a closure in Management Area 1A is likely to occur during the initial year of the plan. This will result in some market disruptions.

The distribution of TACs by area using trimesters or time-specific TACs should not have a significant social impact on herring dependent communities. As long as present harvesters are able to continue seasonal band fishing without significant disruption of tracking of fish populations, then there should be minimal impact to present social yield of the fishery (Dyer and Poggie 1998). An important issue on limitations of the Gulf of Maine catch (Area 1A TAC) is the maintenance of sufficient supply to keep the sardine canneries and bait sectors supplied with herring. The adopted TAC distribution option will significantly reduce overall landings from the inshore Gulf of Maine (Management Area 1A) from the levels seen since 1989. The combined TAC assigned to Management Area 1A and 1B, if harvested, will hold catches in this area to the 70,000 mt level of 1997. This is the second highest U.S. landings in this area since 1980. The uncertain element in this equation is whether the landings from Management Area 1B will really reach the predicted level. Because there was no incentive to fish this area in the past, there has been little effort to fish for herring in this area. About 5,000 mt were taken in 1996, primarily from offshore banks, and there are reports that there has been additional fishing effort in this area in 1998 (Barbara Scully, Maine DMR, pers. comm.).

If the traditional Gulf of Maine harvesters are able to locate and catch enough herring in Area 1B to replace revenues lost from Area 1A, there should be few impacts on any of the Maine communities or sectors that have grown to rely on this herring. A failure to locate enough fish in this area will force these vessels to either temporarily exit the herring fishery or move into different fishing areas.

The initial reaction is likely to be an attempt to relocate to different fishing areas. None of the traditional purse seine vessels are currently equipped with refrigerated sea water systems for preserving herring catches. These boats must land their herring shortly after it is caught in order to land the quality needed for the sardine canneries. If they move into different areas, fishing in Area 2 or Area 3, they may choose to offload their catches in other ports. This may have negative impacts on northern Maine communities. While much of this herring may still be trucked to the canneries, there will be a reduced presence of herring boats in many ports. In the last two years, the port of Rockland has grown increasingly reliant on herring landings. The port increased its volume of herring landings from 13,800 mt in 1995 to 29,054 mt in 1997 (Table E.23). Revenues from herring in 1995 were 32% of the value of all landed species, increasing to 53% in 1997. If

there is a shift in fishing effort into areas other than Management Area 1, it may reduce the landings in this port.

Shifts in the sources of herring are not likely to have a significant impact on the Maine sardine canneries as long as they continue to have access to a supply of herring. As noted in section E.1.1.1, the canneries are an important component of the Maine economy, particularly in some isolated communities. According to a 1998 study (Reiling and Bennett), in 1996 the output from this industry was valued at $40 million. The total impact of this sector on Maine's economy was estimated at $62.8 million. According to public testimony, companies are currently operating at between 50% to 60% of capacity. The TAC system, by encouraging effort to move into other areas, may prove to benefit this industry by increasing the supply of herring that is delivered. This will only happen if herring is of sufficient quality to be used in the canneries, which may require additional investment in RSW vessels. As long as this development occurs, the canneries should be assured of sufficient herring to meet their needs. The move of effort into other areas, then should not have an adverse impact on the canneries.

E.7.4.2.2 Vessel Size Limits

E.7.4.2.2.1 Harvesting

The proposed action limiting vessels in the herring fishery to a maximum size will tend to maintain the existing industry structure. From the view of traditional users of the resource, this measure should minimize the social and economic disruption that would result if large catcher/processors began to harvest a significant part of the resource. Because the herring resource is currently underutilized, there is some room for growth in harvesting and processing capacity. A number of large vessels would rapidly reach the proposed limits on the TAC. At this point, the new entrants would compete with traditional users and there would be conflicts over access to the resource. The resultant rapid attainment of the TAC would reduce the supply of fresh herring to the bait and cannery markets. There is also the possibility that large catcher/processors would monopolize the resource.

One of the objectives of the FMP is to provide controlled opportunities for fishermen in other fisheries in New England and the mid-Atlantic region. Many fishermen are facing additional restrictions in the groundfish, scallop, monkfish, dogfish, and whiting fisheries due to poor resource conditions. The ability to enter the herring fishery provides an opportunity for them to shift their effort onto a robust resource until rebuilding plans in these fisheries can be accomplished. Shifting into herring fishing requires a significant investment in gear and, in some instances, modifications to vessel holds. The number of vessels that can enter this fishery is dependent on each vessel's share of the resource. As noted earlier, the limit on vessel size reduces the effective share of the TAC that can be harvested by each vessel. This will allow the largest number of vessels to enter the fishery, ameliorating the impacts of restrictions in other fisheries.

E.7.4.2.2.2 Processing

The impacts of large domestic at-sea processing on local communities are subject to much speculation. In the short term, restrictions on large domestic processors may limit the opportunity of new entrants into the fishery. If large vessels are allowed to process herring, for example, some vessels that cannot afford to convert to RSW systems could enter the herring fishery by selling fish over the side to processors. This would provide a lower cost way for these vessels to enter the fishery. This approach could be a way for fishermen suffering from reduced stocks and increasing regulation in other fisheries to supplement their incomes until stock rebuilding programs are successful. The increase in incomes would have a positive impact on their communities. It is uncertain, however, which communities would benefit from this activity. If at-sea processors hire local fishing vessels to supply herring, the benefits would accrue to communities that are under stress from increasing regulation in other fisheries. Some are concerned, however, that the companies that own these vessels may bring their own catcher vessels into the region. As a result, the benefits may accrue to regions that are less dependent on the fishing industry and culture.

In a similar fashion, the impact of these at-sea processors on other employment in the industry may prove negative. To the extent that at-sea processors reduce shoreside processing activity, there will be impacts on fishing related communities. Even if the only result is that people employed in shoreside processing shift their work location to vessels at sea, the movement of these jobs will change the nature of employment. For example, in the Maine sardine canneries, employment is often a part-time supplement to other income, with a strong local flavor (Dyer and Poggie, 1998). If the canneries were to lose access to herring and the processing jobs were to move to offshore processors, it is unlikely that the part-time nature will continue, or that the strong local connection will remain. Similar analogies can be made with other communities. If, however, large domestic at-sea processors transship their catch through local ports, some benefits may accrue due to the increase in cargo handling.

Catcher vessels that make conversions to supply domestic processing vessels are likely to do so with the minimum cost necessary. It is likely they will not add refrigerated sea water hold systems, relying on the rapid transfer of herring to the processing ship to insure the quality of the product. This will tend to limit the development of vessels that can travel to the offshore areas and return to land a quality herring product to shoreside processors. As landings in the near-shore areas approach the TAC, the herring available for the bait market and shore-side processors may be reduced. The impact of reduced herring landings if this happens would extend beyond the communities that are directly reliant on the fishery, into those communities that support fisheries that rely on herring bait. As noted in the discussion of economic impacts, a shortage of bait would severely impact the lobster industry. Since lobster has become such a key part of New England's seafood and tourist industry, communities dependent on the lobster industry would suffer (Dyer and Poggie 1998). Even this impact could benefit local communities if the price paid to herring fishermen for bait were to increase.

E.7.4.3 Roe Fishery

The use of herring roe should be considered as part of an overall management program that allows for the rational use of the product for all potential markets. Given the restrictions posed by the European market due to fat content and quality concerns, any alternative product developments should be considered as an overall plan favoring the maximization of domestic economic benefits across the region. Their may be increased social benefits to communities as a result of increased revenues. The roe fishery may prove to be a way for vessels to enter the herring fishery and rapidly recover their investment. In the Pacific Northwest, the price per pound of roe in the roe-on-kelp fishery has approached $30/pound. A more appropriate comparison for the likely development of the roe fishery in New England is the Alaska sac roe fishery, where 1997 prices ranged from $180/ton to $600/ton (Alaska Department of Fish and Game, June 8, 1998; www.cdf.adfg.state.ak.us). This is higher than the average value for Atlantic herring of $110/mt in 1997. In the Canadian east coast roe fishery, prices have ranged from $0.06 to $0.18 (Canadian) per pound (about $130 to $400 (Canadian) per metric ton).

An expanding roe fishery could divert herring from use in the bait market or other processing sectors. If allowed to develop unchecked, such a diversion would adversely impact the bait market and the canneries. The proposed plan will monitor the development of this sector carefully and will allow the imposition of management measures through framework action if necessary to regulate the roe fishery. In addition, the prohibition on roe stripping (discarding all males and female carcasses) will help insure that some herring continues to be available for these markets. The overall impact, then, of the roe fishery regulations should be beneficial and help maximize domestic net economic benefits (Dyer and Poggie 1998).

E.7.4.4 Safety Considerations

National Standard 10 requires that the impact of proposed management measures on the safety of life at sea be considered during the development of an FMP. In this fishery, the imposition of the TAC in an open access system may encourage the development of a derby fishery (section E.7.3.4). Coupled with mandatory days out of the fishery as the TAC is approached, vessels may risk fishing on bad weather days in order to catch their share of the resource. Some vessels may be unable or unwilling to fish in open areas during the mandatory days out of the fishery in a given area, choosing instead to fish, regardless of weather, only in the area subject to effort controls on the days it remains open. Most herring vessels are unlikely to participate in other fisheries during the days off, either because of a lack of permits or because it would be too difficult to constantly change gear types. Concern over loss of revenues and loss of a market may encourage vessels to fish on the open days regardless of the weather encountered. These concerns may also encourage some smaller vessels to transit farther offshore into open fishing areas. All of these possibilities may adversely impact vessel safety.

As the TAC is approached, vessels are required to take mandatory days out of the fishery. The proposed measure adopts Saturday and Sunday as the two consecutive days off, Friday/Saturday/Sunday as the three days off, and Friday/Saturday/Sunday/Monday as the four

days off. The options available to a vessel if an area is closed to directed fishing are to shift into another fishery, fish in a different area, fish during any days that the area remains open, or some combination of these choices. These are not "layover" days –a vessel does not have to remain at the pier. The option to fish in other areas or for other species will mitigate safety concerns to some extent for those vessels capable of moving into these areas.

While these are all possible responses to the TAC and the effort controls, the observed patterns of the fishery can be examined to gain a better sense of the impacts on vessel safety that may result from this regulation. Because the overall herring resource is underutilized, upon implementation of the FMP the TAC is likely to be approached only in Management 1A or 1B. Current landings in Management Area 2 are roughly one-fifth the TAC allowed by the plan. Landings in Management Area 3 in 1997 were also less than one-fifth the recommended TAC, but indications are that 1998 landings will be significantly higher and may approach 40% of the TAC.

If mandatory days out of the fishery are imposed in Management Area 1A, vessels will have to move approximately 30-40 miles offshore (to Area 1B) in order to fish during the days off, or relocate to another management area. If Management Area 1B is subject to effort controls while Management Area 1A is not, vessels will be able to fish closer to shore, reducing their risks; this alternative will not be discussed further. If effort controls apply to all of Area 1 rather than one of the sub-areas, vessels will have to travel to either Management Area 2 or 3 to fish during the days off or if the directed fishery is closed.

Effort controls are unlikely to be imposed in Management Area 2 in the near future. The total TAC available for this area is 100,000 mt and recent landings from this area have been in the range of 20,000 mt. As can be seen from Figure E.12 through Figure E.14, the herring fishery in Management Area 2 is prosecuted primarily in the winter months in areas close to shore, from Virginia to Rhode Island. If landings do increase and the area is subject to effort controls, vessels are likely to continue to fish close to shore, minimizing their risk due to weather. If the area is closed (an unlikely scenario under present conditions in the fishery but possible in the future), vessels may relocate into Management Area 1A or Area 1B in the early part of the year – these are also areas close to shore, minimizing risks due to weather.

Landings from Management Area 3 have only recently increased and it is difficult to draw conclusions on seasonal fishing patterns from this information, but it appears that fishing is concentrated in the summer and early fall (Figure E.12 through Figure E.14). Vessels that cannot fish in Management Area 3 either because it is closed or due to mandatory days out of the fishery will likely relocate to areas closer to shore or will choose not to fish for herring. The proposed measures would have their most potential impact on vessel safety if Management Area 3 were the only area open to herring fishing during the winter months. This is unlikely to occur because of the large available TAC in Management Area 2. There are also only a limited number of large, seaworthy vessels capable of transiting to this area and returning with a quality herring product.

In order to evaluate the hazards this measure may pose, current fishing practices were first

examined to determine the vessels that would be most impacted by these restrictions. Based on an analysis of the landings in 1996 and 1997 (see Figure E.22 and Figure E.23), the restrictions are most likely to be implemented in Management Area 1A in September/October. Herring landings are typically highest during this period, and then decline in November and December. While any mandatory no-fishing day will reduce the options available to a fisherman, they will only suggest unsafe behavior if the vessel would have routinely fished on those days and cannot substitute other days of the week. Using Maine DMR data to analyze herring trips in 1997, none of the vessels that landed herring from Management Area 1 fished every Friday, Saturday and Sunday during this period. Only five vessels fished more than half of these days during the September/October period in 1997. This indicates that few vessels would lose so many of their typical fishing days that they would ignore weather considerations if the three days off are Friday/Saturday/Sunday. 22 vessels fished on at least one day of the Saturday/ Sunday/Monday period during 1997, but again, only five vessels fished on more than half these days during the September/October time frame. The impact of four days out of the fishery is more severe. Twelve vessels fished for four or more days of the week in 1997 during the nine weeks of September through October. Eight of these vessels landed herring on four or more days of the week during more than half the weeks in this period. In this area, the mandatory days out of the fishery are not likely to encourage unsafe behavior, though the risk increases when vessels must take four days out of the fishery.

In Management Area 2, the TAC is not likely to be reached during the initial years of the plan and the mandatory days out of the fishery are not likely to be imposed because recent landings are less than half the proposed TAC. In addition, the primary fishing period is in the winter and a new TAC is assigned at the start of the fishing year in January. Nevertheless, trips during February (the month with the most activity) were examined to determine the possible impacts. In 1997,15 vessels reported landing one mt or more on at least one day during February. Only 5 boats ever landed herring on both Saturday and Sunday during this month, with only two boats doing so more than half the time. Only three boats ever landed herring on Friday, Saturday and Sunday, with only one boat doing so more than half the time. One boat, however, landed herring on every Friday, Saturday, Sunday, and Monday during February of 1997. For this period, only two boats landed herring four or more days per week more than half the month. Based on current fishing practices and landings, it is unlikely the TAC or mandatory days out of the fishery will encourage unsafe behavior in Management Area 2. This may change as landings increase.

The next consideration is typical weather to be encountered during the period the mandatory days out of the fishery may be imposed. For Management Area 1, Figure E.24, Figure E.25, and Figure E.26 summarize the weather patterns for the coastal area off Portland, ME for a ten year period. The weather is characterized by declining air temperatures with the approach of fall, and gradual increases in both average wind speed and average significant wave height. The maximum wind speed experienced actually declines from September to October. Imposition of effort controls is likely to occur at a time when weather is worsening, though it falls short of the weather experienced in the winter months. For Management Area 2, while the fishery occurs during winter weather, there is recent catches from the area indicate there is little likelihood the effort controls

will be imposed during the first months of the year (Figure E.27, Figure E.28, and Figure E.29 show weather for the vicinity of most herring landings from this area in 1997). The controls are likely to be imposed as the weather begins to improve during the spring months. For Management Area 3, the imposition of effort controls in the late fall or early winter would coincide with a worsening of the weather. For the ten year period examined, weather extremes were the worst in October, with average wind speeds of 50 knots and significant wave heights of up to 10 meters (Figure E.30 and Figure E.31).

The size of the vessels to be impacted by this measure also gives a sense of their ability to relocate to other areas. The average size of vessels landing more than 2,000 pounds of herring per trip in 1996 or 1997 was 47 feet for ton class 2 vessels, 64 feet for ton class three vessels, and 91 feet for ton class four vessels. The five vessels that fished more than half of the available Friday/Saturday/Sunday days in 1997 were all ton class three or four vessels. These are the larger vessels that may be more capable of shifting to the other management areas. (Whether they will be able to find fish in other areas is an economic issue considered in the EIS.). The result of this analysis is that the proposed days out of the fishery should not have a significant impact on vessel safety for up to three days out of the fishery.

The Council is also establishing a size limit on vessels participating in the herring fishery. Generally, larger vessels are more seaworthy in adverse weather. They may also be subject to additional regulations on loading, design, inspection, and licensing of crew that may improve vessel safety. The Council is recommending a size limit of 165 feet in length, and 750 GRT for catching, taking or harvesting herring. This limit is larger than any of the vessels that landed herring in 1996 or 1997. Most (if not all) groundfish and scallop vessels that have fished on George Bank since the adoption of the M-SFCMA have been less than 165 feet as well. While there have been a number of accidents involving these vessels over the years in all New England fisheries, most of these vessels have been operated safely and reliably. Many vessels smaller than 165 feet have operated safely in the herring fishery for a number of years. The proposed management measures are not believed to significantly change the ability of these vessels to safely participate in the fishery.

One characteristic of herring vessels that is not directly comparable to other New England fishing vessels is the large catches that must be transported to shore. Some of the herring vessels in the 100 – 130 foot range sometimes land 500,000 pounds or more of herring in a single trip. These large loads create stability concerns that must by considered in the design and operation of these vessels. While they can be handled safely if "tanked" in refrigerated salt water (RSW) holds, they can be dangerous if measures aren't taken to prevent shifting of cargo. If the cargo is stowed "wet" or with melting ice, stability concerns can be exacerbated by the free surface effect as sloshing water and fish effectively raises the metacentric height of the vessel, reducing its ability to resist heeling. These issues must be considered when groundfish boats are converted to herring fishing. In 1997, one herring vessel in the Gulf of Maine was endangered when its cargo shifted unexpectedly, but was able to recover assisted by other vessels (Artie Odlin, pers comm.) In September 1998, one 90 foot vessel loaded with an estimated 180,000 pounds of herring was lost

at sea while returning to port. While there are press reports this loss was caused by shifting cargo, the Coast Guard investigation of this accident is continuing and no conclusions have been released. The concern over shifting cargo is one that must be faced by all vessel operators, regardless of vessel size, but is of more concern in the herring fishery because of the large weight of the catches. The FMP is designed to allow the entry of additional vessels into the herring fishery. There has been interest expressed by groundfish vessels to enter this fishery as an alternative until groundfish stock can be rebuilt. While these vessels must consider the dangers of handling large loads of herring as part of their decision to fish for herring, the regulations do not restrict the ability of fishermen to adapt their vessels as appropriate. There aren't any gear restrictions or requirements, for example, that limit a fisherman's ability to adapt his vessel for herring.

One public suggestion that was not adopted for this plan is for a smaller size limit in other management areas. If future framework actions choose a smaller size limit, it may create a safety concern in the fishery. It is unlikely that a size limit will be selected that is smaller than current participants. Existing vessels have been chosen with regard to the weather conditions that may be encountered. Smaller size limits are also only likely to be adopted in areas that are close to shore, making it possible for vessels to rapidly evade poor weather.

No comments were received during development of the plan that the proposed measures encouraged unsafe behavior. The Coast Guard reviewed the plan and concluded it did not cause any safety concerns.

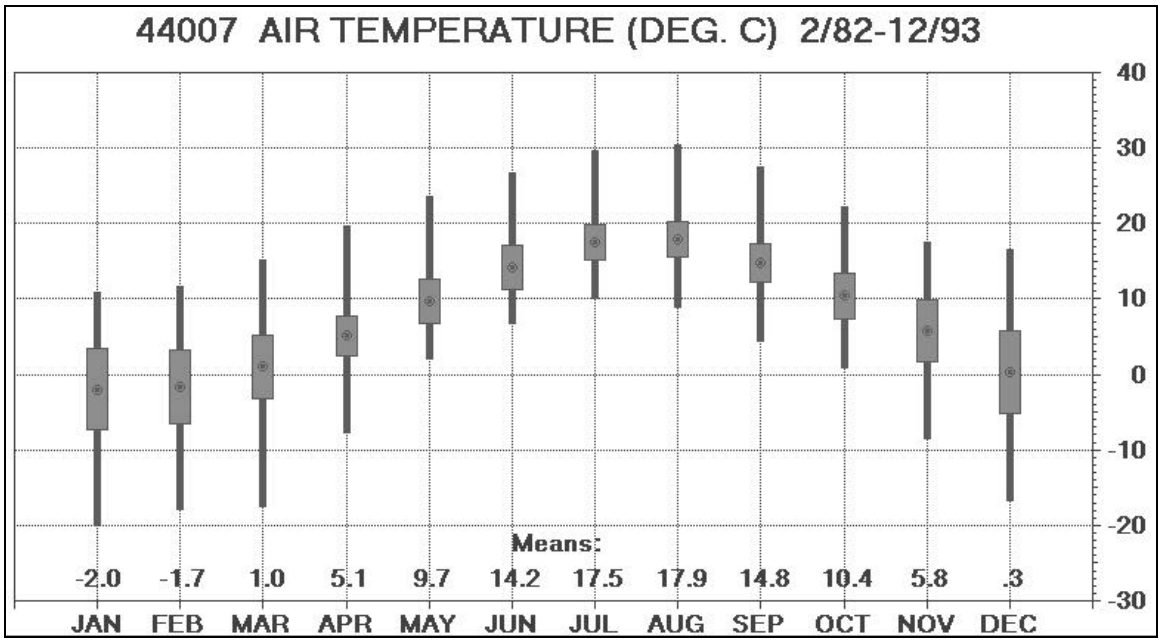

Figure E.24 - Air temperatures off Portland, MA (boxes indicate one standard deviation from the mean) (Source: http://seaboard.ndbc.noaa.gov/realtime.shtml, NDBC buoy 44007, position 43.53N 70.14W)

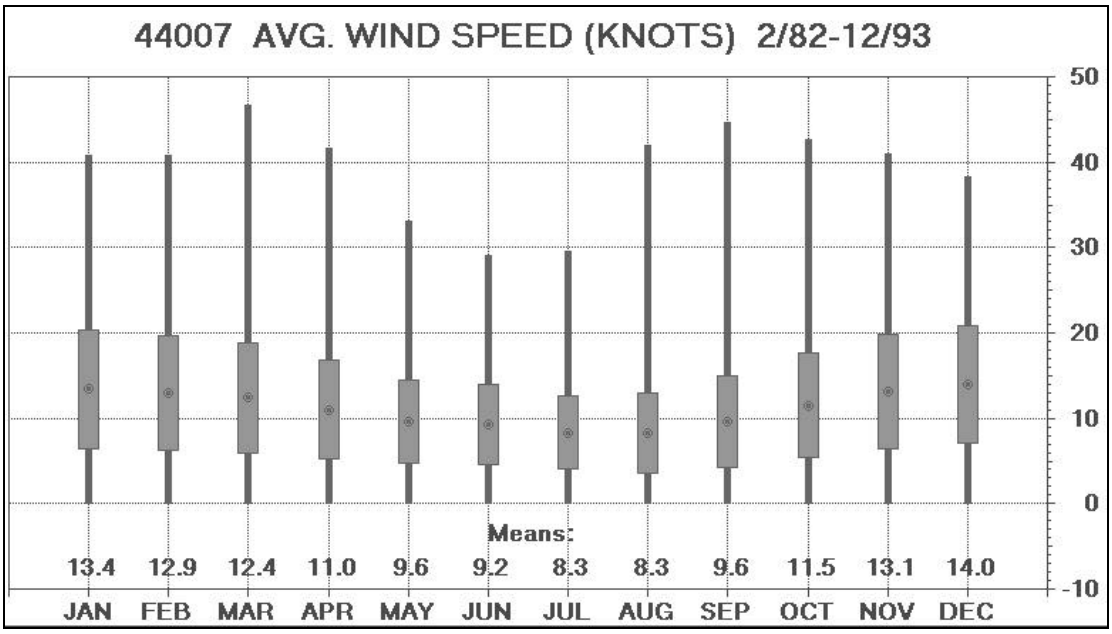

Figure E.25 - Wind speeds off Portland, ME (boxes indicate one standard deviation from the mean) (Source: http://seaboard.ndbc.noaa.gov/realtime.shtml, NDBC buoy 4407, position 43.53N 70.14W)

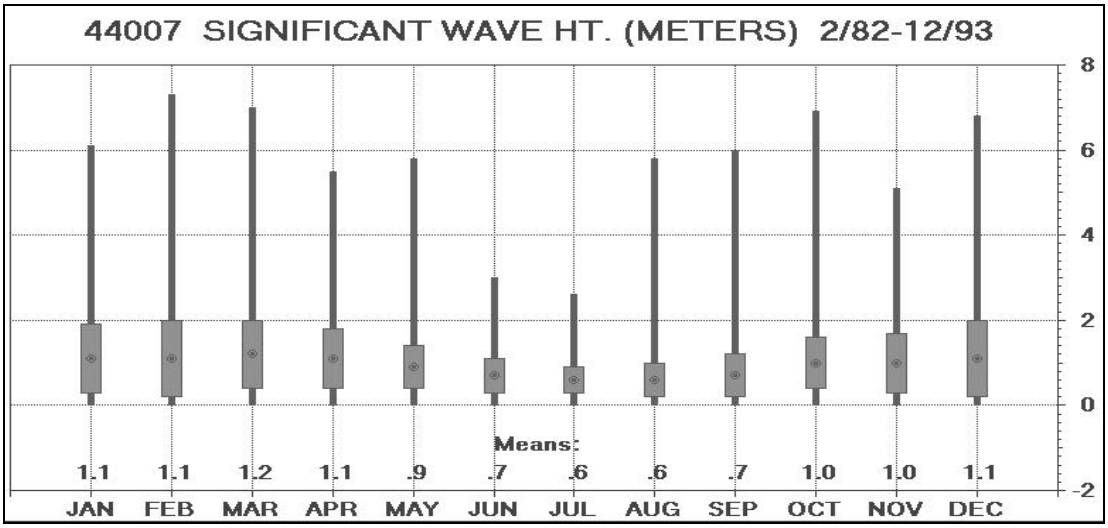

Figure E.26 - Wave heights off Portland, ME (boxes indicate one standard deviation from the mean) (Source: http://seaboard.ndbc.noaa.gov/realtime.shtml, NDBC buoy 4407 position 43.53N 70.14W)

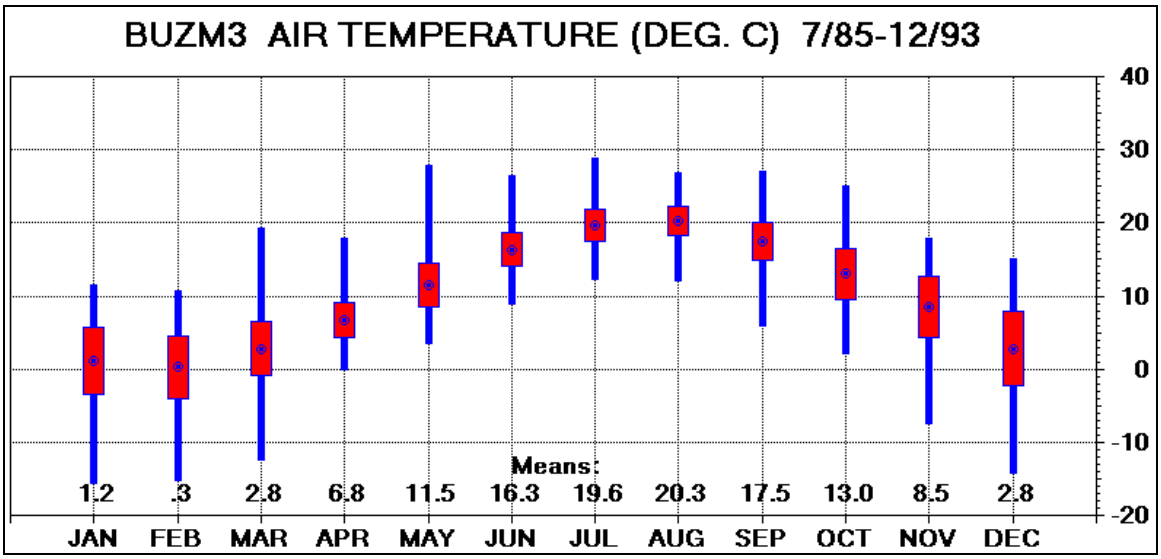

Figure E.27 – Air temperatures off Buzzard's Bay, MA (boxes indicate one standard deviation from the mean) (Source: http://seaboard.ndbc.noaa.gov/realtime.shtml, NDBC station BUZM3, 41.4^{o} N 71.03^{o} W)

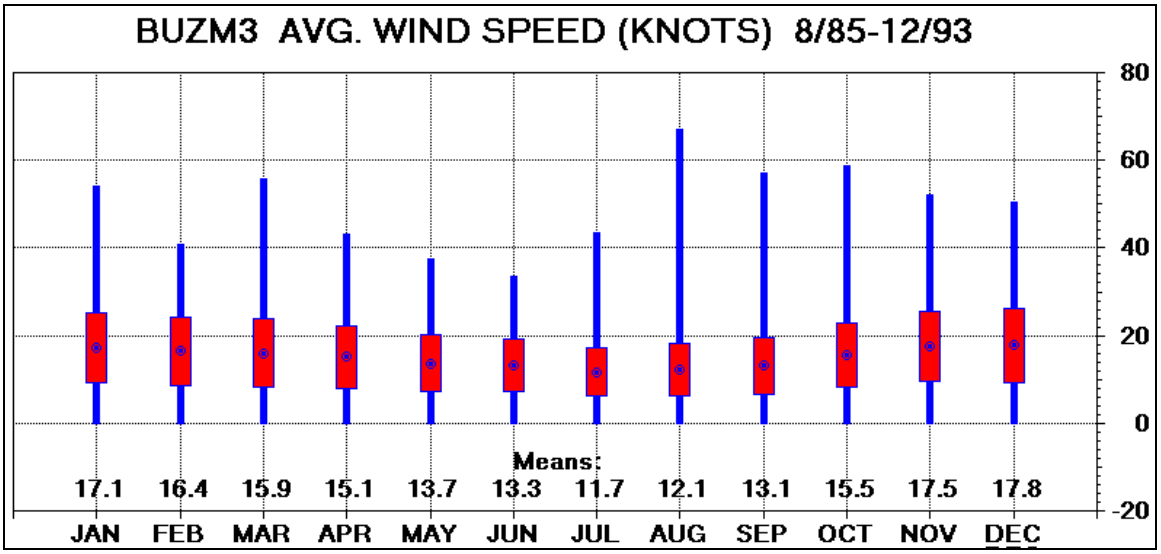

Figure E.28 – Wind speeds off Buzzard's Bay (boxes indicate one standard deviation from the mean) (Source: http://seaboard.ndbc.noaa.gov/realtime.shtml, NDBC station BUZM3, 41.4° N 71.03° W)

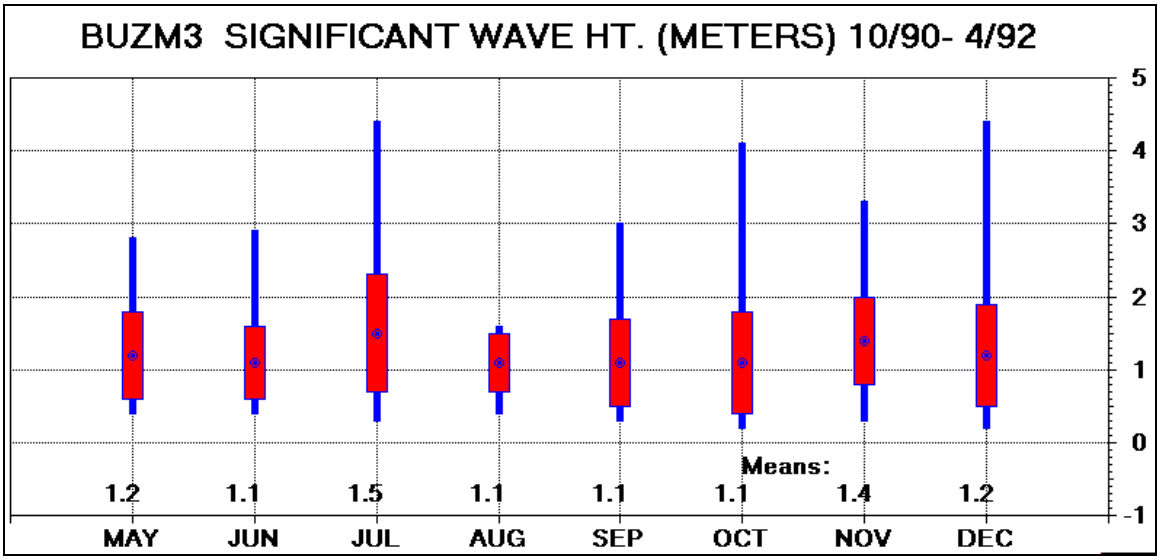

Figure E.29 – Wave heights off Buzzard's Bay (boxes indicate one standard deviation from the mean) (January through April not available) (Source: http://seaboard.ndbc.noaa.gov/realtime.shtml, NDBC station BUZM3, 41.4° N 71.03° W)

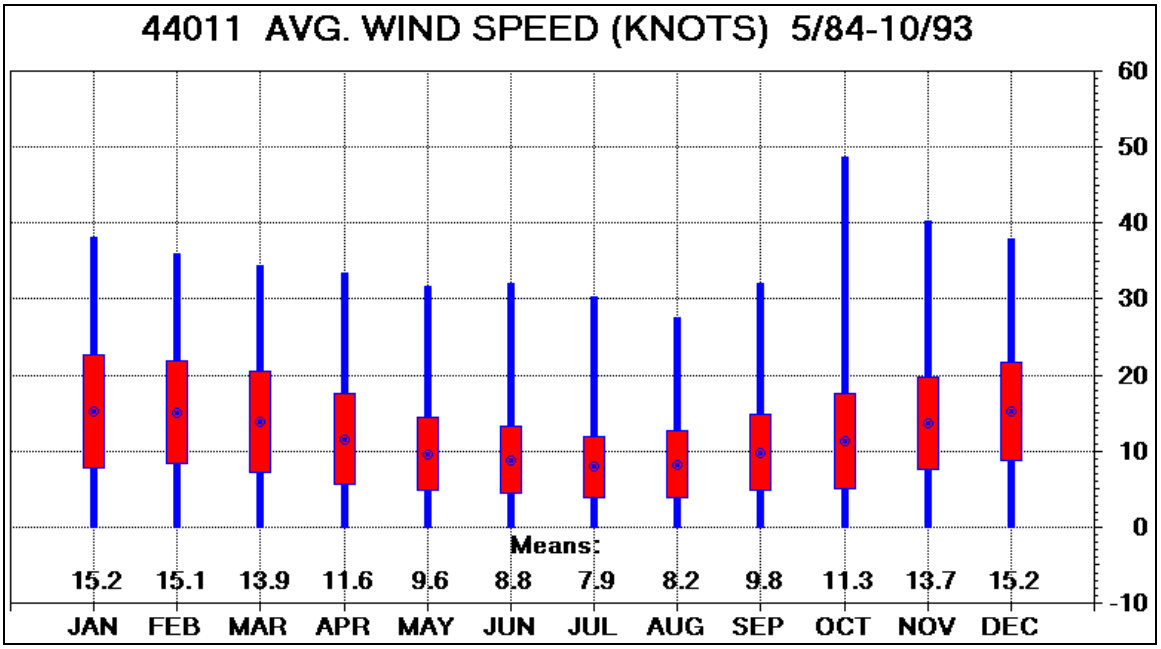

Figure E.30 – Average wind speeds on Georges Bank (boxes indicate one standard deviation from the mean) (Source: http://seaboard.ndbc.noaa.gov/realtime.shtml, NDBC buoy 44011, 41° 04'N 66° 34'W)

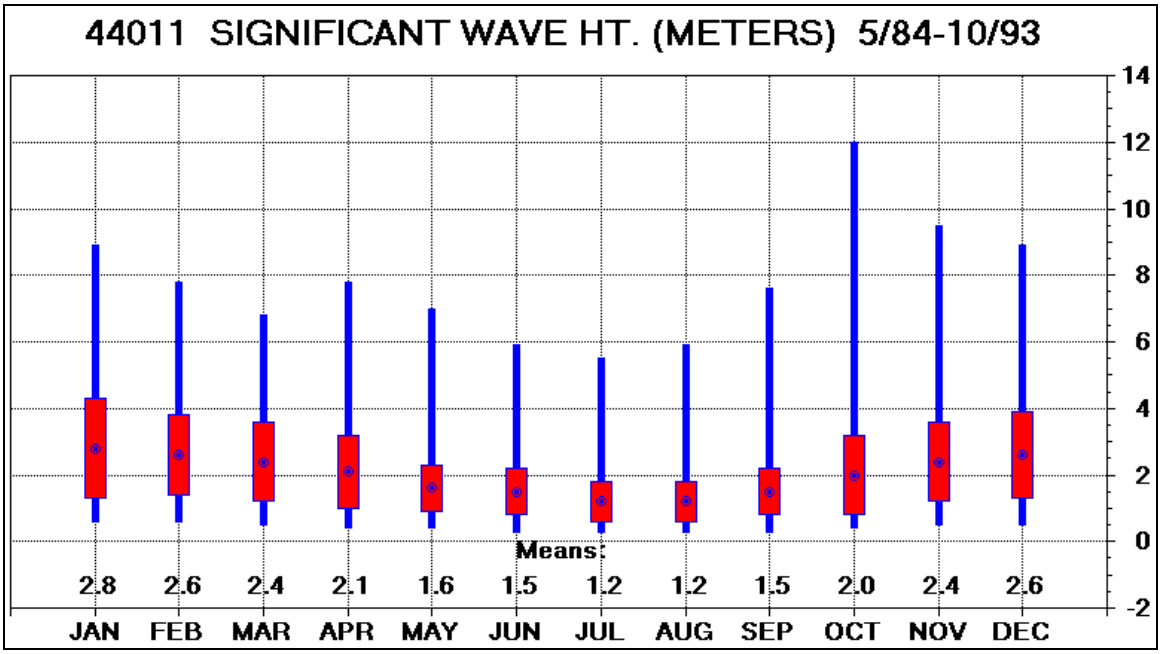

Figure E.31 – Wave heights on Georges Bank (boxes indicate one standard deviation from the mean) (Source: http://seaboard.ndbc.noaa.gov/realtime.shtml, NDBC buoy 44011, 41° 04'N 66° 34'W)

E.7.4.5 Alternatives Not Selected

E.7.4.5.1 No Action (status quo)

The social impacts of the no action alternative would result from the lack of protection this alternative offers to the resource. In particular, the possible negative impacts on individual spawning components could have severe negative impacts on communities that rely on herring. The major area of immediate concern is the inshore Gulf of Maine. The lobster bait and sardine industries have become dependent on a steady supply of herring. The lack of management controls in place has allowed many fishing vessels to meet this demand by focusing their efforts in this area. Increasing demand, primarily in the bait market, resulted in over 70,000 mt of herring caught in this area in 1996 and 1997. Unconstrained effort in this area could result in damage to or collapse of this resource. The likely result would be a lack of herring for the bait and sardine markets. As noted by Dyer and Poggie (1998), the sardine canneries are important elements of several isolated Maine communities. The lobster industry is woven into the very culture of all of coastal New England. Shortages of herring for these markets would have severe disruptive impacts on coastal communities.

In the absence of legislative action, the no action alternative would allow large domestic vessels to enter the fishery. The most likely role would be as processing vessels. While the impacts of allowing large domestic processors into the fishery are not clearly understood, they could result in displacement of shoreside processors that depend on herring and may limit the development of additional shoreside processing capacity. Another possible impact that could result is that the presence of processing vessels offshore would reduce the amount of herring landed for bait, disrupting the lobster industry and the numerous communities that depend on its income.

One possible benefit of the no action alternative is if large domestic processing vessels enter the fishery and hire local catcher vessels to supply them herring. The increased revenues from this activity could be a boon to communities suffering from reduced revenues caused by resource shortfalls and increasing regulation of the fishing industry. There may also be spillover benefits if transportation infrastructure develops to ship the products of these processors to other countries.

E.7.4.5.2 Controlled Access

The impact of a controlled access system depend on the qualification criteria selected for entry. Some of the criteria under consideration would result in relatively few participants in the Gulf of Maine controlled access fishery. This will protect recent users and provide for the sardine canneries and bait markets. Development permits as well as conservation permits in areas outside the chosen Gulf of Maine limited access fishery will allow for development of the offshore resource. Benefits may accrue to fishing communities under stress through both conservation and development permits.

Conversely, if a very liberal qualification criteria is chosen for the Gulf of Maine controlled access area which allows a large number of entrants into the fishery, average revenues will be reduced. Those vessels that rely on the herring fishery for the majority of their income may be forced in other areas or possible in other fisheries. Their options may be limited, as most fisheries in the Northeast Region are controlled through limited access systems.

E.7.4.5.3 Miscellaneous Management Alternatives

The impact of quotas, closed seasons, days at sea limitations, gear restrictions or controlled access is presently difficult to assess. These options should be kept open as the present fishery develops to take advantage of the abundance of herring biomass. As capacity issues are resolved by the direction and magnitude of development strategies, the specifics of these options will become clearer. At present, the viability of the fishery represent an opportunity to maximize the human benefits of the resource in a sustainable fashion, with the challenge being to distribute benefits across the region and not allow the development of over capacity, potentially repeating the scenario of the groundfish fishery.

E.7.5 Cumulative Impacts of the Proposed Action in Concert with Other Laws, Regulations, or Plans on the Target Resource or Related Species

E.7.5.1 Canadian Herring Fisheries

Canada has an extensive herring fishery from New Brunswick to Newfoundland that uses different gears to target several herring stocks. These fisheries land over 70 percent of the herring from the northwest Atlantic Ocean. Canadian management focuses on three general areas, with separate management plans for each: the Soctia-Fundy fisheries 4WX non-stock herring management plan, the Scotia-Fundy Fisheries 4VN herring management plan, and the Scotia-Fundy Fisheries 5Z herring management plan. Within the Gulf of Maine/Georges Bank region, the authorized gear types are purse seine vessels and weirs. Because the coastal stock complex of herring migrates into Canadian waters, the interaction of the U.S. and Canadian management plans must be considered.

The 4WX non-stock herring management plan includes management measures for the New Brunswick weir fishery. This fishery targets juvenile herring believed to be part of the Gulf of Maine spawning component. For this reason, Canadian assessments do not include these catches in estimating the size of the 4WX stock. In 1997, this fishery landed 20,552 mt of herring, but the average catch for this fishery for the past 35 years was about 26,000 mt and exceeded 40,000 mt as recently as 1990. The 1997 catch was dominated by age 2 fish (61% by number, 43% by weight), with only a small proportion ages 4+. (DFO, 1998). This fishery is only restricted by the number of permits that are issued – there are no quotas or TACs. The number of permits issued is declining, as many former weir sites have been converted to aquaculture in recent years.

As described in section E.6.3.1.9, the New Brunswick juvenile harvest is included in the assessment of the coastal stock complex. It is included in the calculation of ABC and is considered in determining optimum yield and TACs. There is considerable opposition to allowing an unlimited catch by Canadian fixed gear fishermen to reduce the size of the TAC for U.S. fishermen. The FMP proposes to limit any allowance for the New Brunswick juvenile harvest to 20,000 mt. If Canadian catches exceed the 20,000 mt level by any significant amount or any length of time, the effect of this artificial limit is that the actual combined Canadian and U.S. harvest could exceed the ABC by the amount that the Canadian catch exceeds 20,000 mt. What exacerbates this problem is that the Canadian New Brunswick catch is believed to be primarily composed of Gulf of Maine fish and does not include significant catches from any other spawning component. Any excess over the TAC, then, may come from one spawning component rather than be spread among different components.

The FMP implicitly recognizes this problem in three ways. First, one of the objectives of the plan is to "promote U.S. and Canadian cooperation in order to establish complementary management practices." Throughout development of the plan, it has been recognized that cross-border cooperation will be necessary to effectively manage this trans-boundary resource. Second, in section 3.2, the Council and the Commission acknowledge that the Canadian harvest must be closely monitored relative to the U.S. catch to prevent damage to the resource. Finally, the amount considered for the Canadian catch can be adjusted through framework action if New Brunswick catches exceed 20,000 mt.

There is a similar situation with respect to the Management Area 3/Georges Bank fishery. Canada manages fishing in this area with the Scotia-Fundy fisheries 5Z management plan. Because there has been little Canadian catch from this area in recent years and Canadian concerns over the assessment of this resource, Canadian harvests are limited to 20,000 mt, with 5,000 mt available for over-the side sales. The management plan deducts 10,000 mt from the ABC for the Canadian Georges Bank catch before determining the U.S. catch, a number that exceeds recent Canadian harvests from this area. It is unlikely that Canadian catches will exceed the quota and result in a possible harvest above the ABC . Should Canada increase the quota for its vessels on Georges Bank, however, the approach of the management plan may need to be revisited. This is unlikely to be a serious concern in the near future because of the lack of catches on Georges bank and the current state of the resource. There have also been informal discussions between the industries of both countries that have resulted in an agreement that either country will notify the other when catches approach 20,000 mt in a year, so that there will be sufficient notice to consider management action if it is necessary.

The trans-boundary nature of the resource also makes it important that both countries reach agreement on the status of the coastal stock complex. Management measures in the two countries cannot be complementary if there isn't general agreement on the status of the stocks. Canadian scientists participated in the 27th Stock Assessment Workshop at both the working group and the SARC level. In addition, the National Marine Fisheries Service has discussed including herring in

a joint assessment with Canada's Department of Fisheries and Oceans. A joint assessment may be conducted as early as spring, 1999.

E.7.5.2 ASMFC Amendment One to the Atlantic Herring FMP

The Atlantic States Marine Fisheries Commission coordinates management of fishery resources in state waters. The Commission recently adopted Amendment One to its management plan for Atlantic herring. As noted above (section 3.12), the Council worked closely with the Commission to insure that management of Atlantic herring in state and federal waters would be complementary. During development, the Commission's Herring Section and the Council's Herring Committee always met together, as did the Council's PDT and the Commission's TC. The same industry advisors were used by both bodies. One public hearing document was developed for both plans to simplify public input and to emphasize the links between them. Finally, the language of each document is nearly identical, particularly for the descriptions of the management measures. Given past history, this coordination was essential to make certain that the resource was protected as the fishery develops.

The key links between the two management plans are that both have adopted the same overfishing definition and both adopt the same TAC system for controlling catches. All landings, in state and federal waters, both adult and juvenile, will count towards the TAC. Because the Commission has adopted the TAC system as a compliance criteria, when the TAC in an area is reached the directed fishery will close in both state and federal waters. This close coordination between the two bodies will result in a management scheme that is consistent in both state and federal waters, avoiding problems experienced in the early 1980's when different interpretations of the quota system led to withdrawal of approval of the Herring FMP.

E.7.5.3 Other Northeast Region Fisheries

There has been considerable discussion that the current robust nature of the herring resource provides an opportunity for fishermen. Indeed, one of the plan goals is to provide controlled opportunities for fishermen and vessels in other mid-Atlantic and New England fisheries. As discussed in the Fisheries Impact Statement (section 6.0), a number of these fisheries are for overfished species and are being managed under programs that restrict fishing effort in order to rebuild the resource. In the scallop fishery, for example, the proposed regulations to rebuild the resource are expected to prevent some vessels from earning enough revenues to cover costs in the early years of the rebuilding program.

The existence of an open access fishery for an under-utilized resource is likely to attract at least some of the vessels in these other fisheries to fish for herring. At least initially, there is an opportunity for this to occur without causing too many management problems. Over the long term, there is the potential that open access will lead to over-capitalization in the herring fishery. One of the possible impacts of this influx of effort is to increase the likelihood of a "race for fish", with the result the TACs will be reached early in the fishing year. This is a particular concern for

many of the historical participants in the inshore Gulf of Maine. The restrictive TAC in this area, coupled with new participants entering the fishery, could result in an early attainment of the TAC and a closure of the directed fishery. Some of the vessels that have fished in this area for a number of years may be too small or not possess the equipment necessary to move operations into the offshore areas.

One possible result of this increase in effort is that it is likely that in the near future, there will be additional interest from some participants for a limited or controlled access system for herring. Such a system may be considered either for the entire range of the fishery, or for the Gulf of Maine areas only. If adopted, the addition of new participants attracted from other fisheries will complicate the decisions on who will be allowed into the limited access fishery. Any vessel that spends a significant amount of money to convert to the herring fishery will not want to be eliminated from the fishery after only a few years participation. The question of who gets continued access to the resource will not be easily resolved.

Over time, the rebuilding strategy of the Northeast Multispecies plan, as well as efforts to protect several species of marine mammals, could have an impact on the herring resource. Cod, whiting and haddock are important herring predators. Herring are an important part of the diets of harbor porpoise in the fall (Gannon et al. 1998), and are also consumed by finback, humpback, and pilot whales (Overholtz et al. 1990). As these stocks rebuild, increased abundance and the resulting predation may impact the herring stock biomass. How these interactions will affect the resource is not clearly understood. While stock size is likely to decline from current historic high levels, it is unclear if there will be changes in the distribution of herring as well. These uncertainties argue for the cautious approach taken in the setting of specifications for the initial years of the plan.

E.8.0 Rationale for the Proposed Alternative

The preferred alternative establishes a management plan for an under-utilized species, as required by section 314(c) of the Magnuson-Stevens Act. It will facilitate the development of a sustainable herring fishery that targets the resource throughout its range while preventing overfishing. The selected management measures are designed to protect individual spawning components of herring while keeping overall fishing mortality below acceptable levels.

The Council considered a number of alternative management strategies. Section E.5.2 describes the major alternatives considered (no action, open access, or a limited entry/controlled access system). The Council rejected the no action alternative because the lack of an existing management plan would allow the development of the herring fishery without any controls to prevent overfishing. Without any controls on fishing mortality, the fishery is likely to continue to concentrate effort in inshore areas (particularly the inshore Gulf of Maine), resulting in an unacceptable risk of overfishing or damage to individual spawning components.

The Council also rejected a limited entry or controlled access system to manage the herring fishery (section E.5.2.2). Under this proposal, participants in the herring fishery would be limited

to those who met a specific qualification criteria. The criteria could be selected to match fishing effort to the available resource. A number of criteria were considered that would have resulted in either a very restrictive set of participants or an extended group that included most vessels in other northeast region fisheries (sections E.5.2.2.3.1 and E.5.2.2.4). The proposal included options to allow some temporary participation in the fishery during periods of abundance while not encouraging the development of excess capacity. The program could be implemented in different management areas at different times to account for the level of exploitation in each area. The Council rejected the limited entry/controlled access approach because it did not meet some of the plan goals. In particular, the Council was concerned that the establishment of a limited entry system would deter further development of the fishery, which is presently under-utilized. The ability of vessels to shift from over-exploited fisheries into the herring fishery would be hampered by the establishment of a control date before they had the opportunity to participate.

The Council's preferred alternative is an open-access system that controls mortality through the use of area-specific TACs. This system allows new entrants into the fishery, providing an opportunity for vessel in other fisheries. At the same time, the TACs, adjusted on an annual basis, will control fishing mortality to levels allowed by the overfishing definition (section 2.6). The area specific TACs and the mandatory days out of the fishery will also encourage the expansion of the fishery into other areas. For example, the recommended first year TAC for Management Area 1A is roughly 64 percent of the 1997 catch in Management Area 1. Vessels will be forced to fish in other areas if they want to maintain their catches at comparable levels. This will benefit the resource, as fishing effort will be spread over different areas and time periods rather than concentrated on the inshore Gulf of Maine just prior to spawning. The spawning closures will also protect individual spawning components.

The preferred alternative imposes restrictions on vessel size for catching, taking, or harvesting herring, and limits processing by large domestic vessels to an amount specified on an annual basis. These two restrictions are intended to provide some control over the development of excess fishing capacity in the region, and to take into account the concerns of fishing communities and historic herring fishery participants. For the first year of the plan, the recommended specification for large at-sea domestic processors is 0 mt. This is a precautionary approach that will give the Council time to evaluate the impacts of the management program before introducing large domestic processors into the fishery. This measure explicitly considers the concerns of those communities in the northeast region that are dependent on the herring fishing industry and the possible impacts that may result from the uncontrolled entry of large domestic processors.

The permitting and recordkeeping requirements will improve the information available to manage the herring fishery. As described in section E.6.1.6, the lack of an existing requirement for permits or logbooks results in uncertainties over the number of participants and landings in the fishery. These requirements will improve the information available to manage herring in the future. The requirement for a processor report will also assist the Council in making allocation decisions connected with the specification of USAP.

The preferred alternative takes into account the uncertainties in knowledge of the resource and the fishery. The recommended TACs for the first year of the plan are based on the estimate of MSY rather than current stock size due to uncertainties in the exact estimate of current biomass. The plan also includes a wide variety of possible management measures that can be implemented through a framework adjustment process, providing flexibility to react to changing conditions in the fishery or with the resource.

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E.10.0 EIS Circulation List

A copy of the EIS is being forwarded to the individuals representing government agencies and industry organizations as shown on the attached distribution list. Copies are also being forwarded to Council members, the Council's panel of industry advisors, and the PDT. Other interested parties may obtain a copy from the New England Fishery Management Council, 5 Broadway, Saugus, MA 01906 (telephone 781-231-0422).

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E.11.0 Public Comments

Comments received from the public are included in Appendices VII and VIII.

7.2 Regulatory Impact Review

7.2.1 Introduction

The Regulatory Impact Review (RIR) provides an assessment of the costs and benefits of the proposed action and other alternatives in accordance with the guidelines established by Executive Order 12866. The regulatory philosophy of Executive Order 12866 stresses that, in deciding whether and how to regulate, agencies should assess all costs and benefits of all regulatory alternatives and choose those approaches that maximize net benefits to the society.

The RIR also serves as a basis for determining whether any proposed regulations are a "significant regulatory action" under the criteria provided in Executive Order 12866 and whether the proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act of 1980 (RFA).

This RIR summarizes the effects of the proposed management plan and other alternatives considered in this amendment developed to rebuild the herring resource. The Atlantic Herring Fishery Management Plan (FMP) document contains some elements of RIR/RFA and the relevant sections are identified by reference to the document. The Initial Regulatory Flexibility Analysis, which evaluates the impacts of management alternatives on small businesses, is provided in section 8.3.

7.2.2 Problem Statement

The problem statement is described under the purpose and need for management (statement of the problem) in section 2.2.

7.2.3 Management Objectives

The management objectives are explained in section 2.3.

7.2.4 Management Alternatives

The proposed action is described in section 3.0. Alternatives to the proposed action are also summarized in section E.5.2.

7.2.5 Analysis of Management Alternatives

The economic impacts are described in section E.7.3 and summarized below under the discussion of how the proposed action is characterized under Executive Order 12866 and the Regulatory Flexibility Act (RFA) (section 7.3).

7.2.6 Enforcement Costs

Vessels, dealers, and processors will incur additional costs in order to comply with the requirements of the management plan. Vessels that intend to harvest more than 500 mt of herring, or that harvested 500 mt of herring in the previous year, will be required to operate a VMS

(section 3.3.6.18). Further discussion on the compliance costs to the industry is provided in section 7.3.6 of the IRFA below and section E.7.3.10.

The government will also incur some costs to monitor these programs, estimated to be $6,929 from the reporting requirements. Additional costs to the government to adapt the existing VMS system to the herring fishery is estimated as $20,000 per year (section E.7.3.7.2).

7.2.7 Summary of Regulatory Impacts

- The proposed regulations are not intended to reduce the herring landings, but to reduce the landings from the Management Area 1A and to protect spawning herring. For these reasons, although the overall TAC exceeds current domestic landing levels, the proposed action reduces the Area 1A TAC by 36.5%, from 70,900 metric tons in 1997 to 45,000 metric tons for 1999. Since this area constituted more than half of the herring landings (70%) and revenues (67%) in 1997, this reduction may have some negative revenue impacts depending on the ability of the vessels to catch herring in other areas. Under the worst case scenario, if vessels cannot recover any of their losses by fishing in other areas, the herring revenues of the fleet may decline by $1.8 million from its level in 1997 (See Table E.58 in section E.7.3.4.3 of the Herring FMP document).

- The actual impact of the Area 1A TAC will probably be less since
    - The vessels may recover part, or all of their revenue loss by fishing for herring in other areas.
    - Under a no effort displacement scenario, the variable costs would decrease as well with reduced effort so that the decline in net benefits would be less than the decline in revenues.
    - If herring landings decline, the ex-vessel prices may increase offsetting some of the revenue loss. Herring ex-vessel prices, however, have remained almost constant in nominal terms for the last twenty years (and declined in real terms), in spite of a wide range of catch levels (section E.6.4.2.2.1). For this reason, it is uncertain if ex-vessel prices would increase if the supply of herring is restricted by the management measures.
    - While the proposed Management Area 1A TAC represents a decline from 1997 catches in this area, it may not reflect a decline from 1998. Preliminary landing statistics for this area in 1998 indicate landings may have been about 30,000 mt, or only two-thirds of the proposed TAC. This indicates the catch of herring fluctuates for reasons that are unrelated to the proposed management measures. Landings in 1997 and 1996 in this area were the highest in the last eighteen years.

- The proposed spawning closures may also have an impact on herring landings and revenues, again depending on the vessels' ability to land herring in other areas/time-periods. A complete discussion of these impacts are provided in section E.7.3.3. Although the total impacts of the spawning closures are estimated to be a reduction of 10,322 metric tons in herring landings,

the actual decline in landings due to the spawning closures is likely to be less due to;

- the displacement of effort to other areas,
- the opening of a large area south of 42° 30'N to fishing by the proposed action,
- the interaction of the spawning closures with the Management Area 1A TAC.

- Since the closures are almost entirely within Management Area 1A, any reduction in landings due to the spawning closures will also count for part of the reduction under the TAC. In other words, the reduction of 10,322 metric tons in landings because of the spawning closures will also take care of about 40 percent of the proposed 25,900 metric tons reduction in Management Area 1A landings.

- A small part of the spawning closures lie within the boundaries of Management Area 1B. The estimated reduction in herring landings from this area due to the spawning closures is 842 metric tons, and estimated reduction in fleet revenues is about $93,000.

- The impacts of Area 1A TAC and the spawning area closures may potentially be negative on herring landings and revenues in the short-term. On the other hand, other measures of the proposed action may offset or more than offset these impacts. Therefore the herring revenues may stay constant, or even increase compared to the no-action alternative for the following reasons:
    - The proposed action manages the herring fishery as an open access (section 3.6) to provide opportunities to U.S. fishermen displaced from other fisheries in the northeast and mid-Atlantic area. The directed foreign fishing for herring is prohibited, although the plan allows for some foreign participation in the fishery through joint venture (JV) or internal waters processing (IWP). If the plan is successful in promoting U.S. development of this underutilized fishery by diverting effort away from overfished fisheries, its impact on net national benefits will be positive. The increase in domestic landings and revenues would increase both the consumer and the producer benefits from the herring fishery.

- For the foreseeable future, the total of the assigned TACs will be an increase over recent landings of herring – in 1999, the OY of 224,000 metric tons more than doubles the recent highest landings (104,000 metric tons in 1996), resulting in a potential increase in gross revenues of $13.6 million at an average price of $0.05/pound (1997). Under the management plan, revenues may be able to increase. Whether this occurs will be a result of market conditions rather than due to the management measures adopted.

- Because of the lack of an assessment model for individual spawning components, and because of a lack of information on the cost structure of the industry, a quantitative estimate of the revenue differences between the no-action alternative and the proposed action could not be determined. Under the status quo (no-action), however, there is a risk that the fishery in some areas (in particular area 1A and the spawning areas) will be overfished. This would have a negative impact on both operating costs and total revenues.

Further analysis on the overall impacts of the proposed measures is provided in section E.7.3.4.3.

Other options considered by the Council would also reduce the expected landings from Management Area 1A compared to the current levels. Table E.58 estimates the loss in revenues from the inshore Gulf of Maine (area 1A) that may be experienced under the various TAC distribution options (including the preferred option). Again, these estimates do not include revenues that may be taken outside Management Area 1A; thus, declines should be viewed as a maximum lost revenue. While in the short term the non-preferred options reduce the revenue impacts, they increase the risk of overfishing the inshore Gulf of Maine herring resource and do not encourage the spreading of effort into other areas. This, however, could make it necessary to impose more restrictive measures to reduce overfishing in the future, and thus may result in more negative impacts on the herring industry in the future periods.

7.2.8 Determination of Significant Regulatory Action

Executive Order 12866 defines a "significant regulatory action" as one that is likely to result in:

a) an annual effect on the economy of $100 million or more or one which adversely affects in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or state, local, or tribal governments or communities;
b) a serious inconsistency or interference with an action taken or planned by another agency;
c) a budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients thereof;
d) novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this executive order.

The preceding analysis shows that the Atlantic herring FMP is not a "significant regulatory action" since it will not adversely affect in a material way a sector of the economy, i.e., the herring fishing industry and the jobs in this industry. The proposed regulations will not have, an annual impact on the economy of $100 million or more, and will not adversely affect the productivity, environment, public health or safety, or state, local, or tribal governments or communities in the long run. The proposed action also does not interfere with an action planned by another agency, since no other agency regulates the level of Atlantic herring harvest. It does not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients. It also does not raise any novel legal and policy issues because it extends the type of fishing restrictions already in place.

7.3 Initial Regulatory Flexibility Analysis

7.3.1 Introduction

The purpose of the RFA is to reduce the impacts of burdensome regulations and recordkeeping requirements on small businesses. To achieve this goal, the RFA requires government agencies to describe and analyze the effects of regulations and possible alternatives on small business entities. On the basis of this information, the Regulatory Flexibility Analysis determines whether the proposed action would have a "significant economic impact on a substantial number of small entities."

The main elements of the RFA are discussed in several sections of the FMP and the relevant sections are identified by reference to this document. The following discussion summarizes the consequences for small businesses of the proposed action and non-preferred management options in the scallop fishery.

7.3.2 Problem Statement

The purpose and need for management (statement of the problem) is described in Section 2.2.

7.3.3 Objectives

The management objectives are enumerated in section 2.3 of this document.

8.3.4 Management Alternatives

The proposed action is described in Section 3.0 of the amendment document. Alternatives to the proposed action are summarized in section E.5.2.

7.3.4 Determination of Significant Economic Impact on a Substantial Number of Small Entities

The RFA recognizes three kinds of small entities: small businesses, small organizations and small government jurisdictions. It defines a small business in any fish-harvesting or hatchery business as a firm which is independently owned and operated and not dominant in its field of operation with receipts of up to $3 million annually.

The herring industry directly affected by the proposed action is composed primarily of small business entities. Section E.6.4 describes the industry (Human Environment) in terms of state, port, vessel and gear characteristics, average size, and landings of the vessels in each subgroup (See Table E.9 to Table E.24 in section E.6.4, Human Environment). Section E.6.4.2.4 describes detailed information by port and the section E.1.1.1 provides information on the herring processing sector. Section E.6.4.3.2 provides information on internal waters processing, and the recreational herring fishery is discussed in section E.6.4.2.1.

Analysis of the impacts of the herring FMP on small businesses is complicated by the lack of an existing reporting system that covers the entire herring industry. As discussed in section E.6.1.6, there are three basic sources for herring data: the NMFS vessel logbook database, the NMFS dealer weighout database, and a Maine DMR database that is constructed from the NMFS vessel logbook database and information obtained from vessels that do not use the logbook system. The

differences between these three databases are summarized in Table 66 below.

In order to perform the IRFA, all three databases were examined. The Maine database was used to identify the 61 vessels in 1997 that landed at least one trip of more than one metric ton (2,205 pounds) of herring. It was combined with the vessel trip report database in order to capture those vessels that may have multiple trips of less than one metric ton. The dealer database was used as an additional source to determine total revenues and herring revenues. Information on the value of catch is in both the logbook and dealer databases, but there are often differences between the amounts in each for a particular vessel. In all cases, the largest value for total revenues and herring revenues was used in the analysis. For those vessels that did not have herring landings reported in the logbook database, the amount of herring landed according to the Maine database was multiplied by the 1997 average price of $0.05 per pound to establish an estimate of herring revenues. This process identified 201 vessels as landing herring, even if by one pound, in the Northeast region in 1997. Total herring revenues identified in these databases is less than that reported for 1997 (section E.6.4.2.2, Table E.10). This may be due, in part, to using the average price for pound rather than the actual (unknown) price per pound for many of the landings.

None of these individual data sources include all of the vessels that landed herring in 1997. If all three databases are examined individually, 257 vessels appear to have landed herring in 1997. An examination of the dealer database identified numerous apparent errors in the data, such as landings recorded under the wrong permit number. As a result, the dealer database was not used to identify vessels that landed herring. In addition, the recorded revenues and landings of each boat differ (usually by only a small amount) in each database. All of the vessels identified are small business entities with annual revenues of less than $3 million.

Most of the vessels that landed herring and are included in Table 67 did not have directed fishing on herring, but landed herring as a bycatch. Because some vessels may target herring for a small number of trips in each year, vessels were determined to participate in a "directed" fishery for herring if they landed at least one trip of one metric ton (2,205 pounds) or more. This criteria coincides with the FMP's general treatment of 2,000 pounds or less of herring as an incidental catch during any of the closures. There were only 61 vessels in 1997 that landed at least one trip of more than one metric ton of herring. The herring landings by these vessels were 214.5 million pounds (97,300 metric tons), amounting to 99% of all herring landings in the Northeast, while the remaining 185 vessels landed less than 0.15 million pounds (71 metric tons) in 1997. Expressing these in terms of revenues, the 61 boats derived about $10.7 million in revenues from herring fishery, while the other vessels' total herring revenues did not exceed $8,000. Therefore, for RFA purposes, the set of affected vessels are limited to these 61 boats in the directed herring fishery. The 61 vessels still included, however, some boats with only marginal activity in the herring fishery. As Table 68 shows, 17 vessels out of 61 derived less than $1,000 from herring. The average total revenues for these vessels were $245,959. The average number of herring trips (landing more than one metric tons) for these vessels was only three trips.

The remaining two groups of boats constitute the majority of the vessels that are likely to be

affected by the proposed regulations. The 25 vessels in Group II (herring revenues of more than $1,000 to less than $30,000) derived, on the average, $5,534 from herring revenues. 19 vessels in Group III ($30,000 or more in herring revenues), earned, on average, $524,000 from herring in 1997. The average revenue per vessel from all species was $361,187 for Group II vessels, and $821,557 for the Group III vessels. Group II and Group III vessels reflect a greater degree of dependency on herring. Group II vessels, on average, obtain 11.5% of their total income from herring, and Group III vessels earn 58% of their total revenues from herring. One vessel in Group II and 6 vessels in Group III earn more than 90% of their total revenues from herring. All of these boats are small business entities with annual total revenues of less than $3 million (Table 2).

The 44 boats included in Groups II and III constitute 22% of the 201 boats that landed some herring in 1997 and 72% percent of the 61 boats in the directed herring fishery (Table 3). The regulations would mostly affect the 19 boats in Group III that landed about 99% of the herring in 1997. These boats alone constitute 31 % of all business entities in the directed herring fishery. Therefore, whether the affected set of vessels is defined to include only 61 boats or all of the 201 boats that landed herring in 1997, the regulations will affect more than 20% of the businesses in the fishery. According to the RFA, if more than 20% of the small businesses in a particular industry are affected by the regulations, the regulations are considered to have an impact on a “substantial number” of these entities. Since the proposed regulations will affect at least 22% percent of all vessels in the herring fishery, the “substantial number” criteria will be met.

Economic impacts on small business entities are considered to be ”significant” if the proposed regulations are likely to cause any of the following:

a) a reduction in annual gross revenues by more than 5 percent;
b) an increase in total costs of production by more than 5 percent as a result of an increase in compliance costs;
c) an increase in compliance costs as a percent of sales for small entities at least 10 percent higher than compliance costs as a percent of sales for large entities;
d) costs of compliance that represent a significant portion of capital available to small entities, considering internal cash flow and external financing capabilities; or
e) a number (two percent as a “rule of thumb”) of small businesses being forced to cease business operations.

The proposed regulations will affect both the revenues and compliance costs of the vessels in the herring fishery. The determination of "significant impacts" is based on criteria ‘a’. The impacts of compliance costs in terms of criteria ‘c’ and ‘d’ are discussed in section E.7.3.10. Because of a lack of current cost data for mid-water trawl and purse seine vessels (see section E.7.3), this analysis does not estimate increases in costs of production.

7.3.4.1 Impacts on Vessel Gross Revenues:

Area 1A TAC

The proposed regulations include area TACs and closed spawning areas as the major conservation provisions for the herring resource. While the proposed overall TAC exceeds current domestic landing levels, the proposed action reduces the Management Area 1A TAC from 70,900 metric tons in 1997 to 45,000 metric tons for 1999, that is, by 36.5%. Since this area constituted more than half of the herring landings (70%) and revenues (67%) in 1997, this reduction will have some negative impacts on the herring vessels that fish in this area. The extent of the revenue reduction will depend on the ability of the vessels to recover some of their losses in other areas. The FMP will allow the landing of up to 2,000 pounds of herring after the TAC is reached in a particular area. For this reason, the analysis assumes that there will not be any impact on vessels that did not land at least one trip of more than a metric ton in 1997.

The impact of the TAC is evaluated on the 61 vessels that constituted the universe of affected vessels in 1997 and caught most of the herring (Table 69). Total revenues could not be determined for ten of these vessels. The analysis assumes that the revenues each vessel obtains from Management Area 1A will decrease by 36.5% due to the TAC established under the FMP. This represents the maximum revenue loss assuming that the vessels will not be able to move their fishing effort into other areas and recover some of their losses, and that the reduction in the TAC will be distributed equally among all vessels. Under these circumstances, 15 of the 61 boats (24.5%) will experience more than a 5% reduction in their total revenues. The total revenues of 13 boats that landed about 90% of all herring in 1997 may decline more than 5% because of this action. These 13 boats that may have more than a 5% decline in total revenues are in the group that depends heavily on herring (70% percent of their revenues, on average). 34 vessels will experience a more than 20% reduction in herring revenues. Based on the first criteria, the proposed TAC will have a significant impact on a substantial number of small business entities in the herring fishery.

The percentage impacts on profits may be less than the impacts on revenues. Without a shift in effort to other areas, the number of days fishing will decline and the operational costs such as ice, fuel, oil, food will decrease. The shares paid to the crew will decrease as well. Fixed costs, however, will remain constant and may become a larger fraction of the reduced total revenues. Due to the lack of cost data for herring vessels, the impacts on net revenues and profits could not be estimated.

Since the estimations shown in Table 69 are based on the assumption of zero effort displacement, they represent the maximum possible losses. It is more likely, however, that vessels will shift their efforts to other areas and recover part of their losses from these areas. The proportion of landings and revenues that can be recovered as a result of an effort shift cannot be estimated with any certainty. One of the fundamental principles of the management program is that effort should be shifted away from Management Area 1A in order to insure a sustainable fishery, and that herring is available in other areas. But given the fact that most of the herring vessels historically derive a major portion of their revenues from Management Area 1A, it will require nearly a 70% percent revenue recovery from the other areas to prevent a more than 5% reduction in the total revenues

of these boats[4]. For these reasons, even with an effort shift, the proposed action may have a significant impact on a substantial number of herring boats, unless the revenue recovered from the other areas completely offsets the revenue losses from area 1A. The opportunities available to the vessels, however, to increase their herring catch in other areas/period are discussed below in section 8.3.8, under the "Mitigating Factors'.

Under the non-preferred options, the Management Area 1A TAC would be reduced between 15% to 16%, therefore, the revenue reduction will be less compared to the proposed option. Given that the 19 vessels in Group III derive, on the average, 43% of their total revenues from Management Area 1A, a 15 percent reduction would result in approximately a 6.5% reduction in total revenues. This would also meet the criteria for significance. While in the short term the non-preferred option reduces the impacts on small businesses, it increases the risk of overfishing the inshore Gulf of Maine herring resource and does not encourage the spreading of effort into other areas. This could result in more severe impacts on small businesses in the future, as it may become necessary to cease all fishing in this area for an extended period until the Gulf of Maine component recovers from a future overfished condition. As an example from recent history, it took over 10 years for the Georges Bank spawning component to recover from overfishing in the 1970's.

Spawning Closures

In addition to the expected reduction in herring landings with the proposed Management Area 1A TAC, the proposed spawning closures will also have an impact on herring landings and revenues. A complete discussion of these impacts are provided in section E.7.3.3. The total impacts of these closures are estimated to be a reduction of 10,322 metric tons in herring landings. The actual decline in landings due to the spawning closures is likely to be less, however. The displacement of effort to other areas, opening of a large area south of 42° 30'N to fishing by the proposed action, and the interaction of the spawning closures with the Management Area 1A TAC will reduce the negative impacts on landings and revenues. Since the closures are almost entirely within Management Area 1A, any reduction in landings due to the spawning closures will also count for part of the reduction under the TAC. In other words, the reduction of 10,322 metric tons in landings because of the spawning closures will also take care of about 40 percent reduction of the proposed 25,900 metric tons reduction in Management Area 1A landings. The net impact of the TAC and spawning closures on Area 1A landings will probably not exceed the 25,900 metric tons reduction. The RFA analysis provided for Management Area 1A TAC impacts includes most of the total impacts of the proposed spawning closures as well. A small part of the spawning closures lie within the boundaries of Management Area 1B. The estimated reduction in herring landings from this area due to the spawning closures is 842 metric tons, and estimated reduction in revenues is about $93,000. Clearly, this additional impact is in the same range of impacts

[4] For example, the 19 boats in Group III derive 43 percent (on average) of their total revenues from Management Area 1A. If 43% of their total revenues come from the area (on average), then recovery in other areas of 68% of revenues lost from Area 1A results in a 5% revenue loss (0.365*0.32*0.43=0.05 of total revenues, a decline of 5% from the original average value).

discussed above for the Management Area 1A TAC, and strengthens the conclusion that the proposed measures may reduce the gross revenues of a substantial number of vessels by more than 5 percent.

	The number of vessels	Herring landings Per Vessel (lbs)* (Mean)	Annual herring Landings (lbs)* (Group totals)	Herring revenues Per Vessel ($) (Mean)	Total Annual Revenue Per Vessel ($) (Mean)
Dealer's Data Only		353,913	19,819,143		21,226
	56			20,411	
Logbook only	77	962	74,088	48	879
Maine Data only		684,936			Missing
	14		9,589,104	34,247	
Maine and Dealer's Data		2,858,779	11,435,115		143,285
	4			142,904	
Dealer's and Logbook	63	1,837	115,724	227	1,275
All Data Sources	37	6,130,031	226,811,134	**317,215	**306,333
Total	257	1,056,564	271,536,848	54,024	55,137

Table 66 - The number of vessels and their activity by database (1997)

Note: The reason the mean herring revenue per vessel seem to exceed total revenue per vessel for this group of 37 vessels is due to the way the revenues per vessel are calculated. Herring revenue per vessel shows the maximum of the vessel's revenues from three databases, i.e., Maine, logbook and dealer's. Since Maine data doesn't have total revenues, the total revenue per vessel is the maximum of revenues from dealer's and logbook data. The herring revenues in the Maine data exceeded the revenues reported in other data (logbook and dealer's) for some vessels, increasing the mean value for all. Since there was not a corresponding total revenue number in the Maine data, the maximum total revenue corresponded to the value in either logbook or dealer's data, falling short of mean herring revenue per vessel.

	Number Of Vessels	Gross Tonnage (Mean)	Herring Revenue as a % of Total Revenue	Herring Landings Per Trip (lbs)	Herring Revenue per Vessel (Mean)	Total Revenue per Vessel (Mean)	Herring Revenue Group Totals	Herring Revenue as a % of Fleet Revenue
1) Directed Fishing[(1)]								
Dependency Class: 0-25%	36	114	72.5%	39,378	$19,046	$446,092	$685,676	6.4%
Dependency class:>25-50%	3	76	37%	33,053	$61,982	$195,012	$185,946	1.7%
Dependency Class: >50-75%	5	86	74%	93,912	$441,919	$572,675	$2,209,597	20.6%
Dependency Class: >75-100%	7	157	99%	144,148	$1,024,816	$1,037,357	$7,173,714	66.8%
Subtotal	51						$10,254,933	
1) Non-directed Fishing								
Dependency class: 0 – 25%	134	39	<1%	185	$50	$134,978	$6,674	<0.1%
Dependency Class:>25-50%	2	17.5	32.5%	364	$72	$239	$144	<0.1%
>50 –75%	3	9	71%	146	$185	$281	$555	<0.1%
Dependency Class:>75-100%[(2)]	1	9	83%	10	$2	$2.60	$2	<0.1%
Subtotal	115						$7,375	<0.1%
Fleet Total	159						$10,262,308	95.5%

Table 67 - 1997 herring vessel revenues (Source: 1997 Combined Maine DMR/NMFS VTR/NMFS Dealer weighout database) (see text for definition of "directed" fishing)

Notes:

(1) Total revenues could not be determined for 10 "directed" herring vessels that caught 9,447,323 pounds of herring worth $472,366. These vessels are not included in the analysis of total revenues.

(2) Total revenues appear in error for this dependency class.

	1997 Herring Revenue Per Boat			
	Group I : Less than $1,000	Group II : $1,000-$29,000*	Group III. Greater than $30,000	All
Total number of vessels	17	25	19	61
Average gross tons	76	106	146	112
Average length	59	70	81	71
Average number of trips per vessel	3	11	78	30
Average total revenue per vessel ($)	$245,959	$361,187	$821,557	$524,886
Annual herring landings (Group totals, in lbs)	157,870	2,767,329	211,620,800	214,545,999
Annual herring revenue (Group Totals, in $)	$7,894	$138,366	$10,581,040	$10,727,300
Average annual herring revenue ($) per vessel	$464	$5,534	$556,896	$175,857
Average herring revenue as a percent of total revenue, per vessel	<1%	11.5%	58%	25.8%
Number of vessels which derived 90 percent or more of their revenues from herring	0	1	6	7

Table 68 - The numbers and the activity of vessels with directed herring fishing by annual herring revenue

Notes:

(1) A vessel is considered to participate in a ‘directed’ herring fishery if it lands at least one trip of one metric ton or more.

(2) Total revenues could not be determined for 10 vessels (5 in Group I, 4 in Group II, and 1 in Group III). These vessels were not considered when determining average total revenues.

(3) Length/GRT could not be determined for 8 vessels (3 in Group I, 4 in Group II, and 1 in Group III). These vessels were not considered when determining average length/GRT.

(4) Herring revenues for a single vessel never exceeded $20,000 in Group II.

	Annual Herring Revenue Per Boat			
	Group I : Less than $1,000	Group II : $1,000-$29,000*	Group III. Greater than $30,000	All
Total number of vessels	17	25	19	61
Average Area 1A Herring Revenues as a % of Total Revenues	0.9%	3.9%	42.8%	16.9%
Area 1A Herring Revenues as a % of All Herring Revenues				
Mean	53%	45%	70%	55%
Median	100%	0%	84%	79%
Reduction in Total Revenues (number of vessels)				
0 - < 5%	12	19	5	36
5 - < 20%	0	2	5	7
> = 20%	0	0	8	8
Reduction in Herring Revenues (number of vessels)(1)				
0 - < 5%	8	13	2	23
5 - < 20%	0	1	3	4
>= 20%	9	11	14	34
Total Herring Landings	157,870	2,767,329	211,620,800	214,545,999

Table 69 - Impacts of the Management Area 1A TAC on the revenues of herring vessels
Note:
(1) Total revenues could not be determined for 10 vessels (5 in Group I, 4 in Group II, and 1 in Group III). These vessels were not considered when determining impacts on total revenues.

7.3.5 Indirectly Affected Industries

As described above, the Management Area 1A TAC and the spawning closures may have a direct impact on vessel revenues if boat operators are unable to catch herring in other areas that will replace the revenues lost due to reduced catches in the closed areas. These management measures could also have an impact on the dealers and processors that purchase herring. Any significant reduction in herring landings may increase the ex-vessel price, increasing dealer and processor costs (while at the same time reducing the impact of reduced catches on vessel operators). How much of this increase can be passed on to consumers is uncertain. With limited alternatives to herring for lobster bait, for example, dealers may be able to increase prices enough to cover their increased costs. This may not be an option for the sardine canneries, however, as consumers can chose from a wide variety of fish products. Hu et al. (1983) developed a simple demand function that estimated a 10% increase in the price for canned sardines would result in a 6% drop in

consumption, but this model has not been updated. Herring ex-vessel prices, however, have remained almost constant in nominal terms for the last twenty years (and declined in real terms), in spite of a wide range of catch levels (section E.6.4.2.2). For this reason, it is uncertain if ex-vessel prices would increase if the supply of herring is restricted by the management measures.

7.3.6 Compliance Costs

Vessels, dealers, and processors will incur additional costs in order to comply with the requirements of the management plan. These economic impacts of the management program are described in detail in sections E.7.3.8 and E.7.3.8. The following discussion summarizes the compliance costs to the industry.

Vessels, dealers and processors will be required to obtain permits and comply with mandatory reporting requirements. Since some participants in the fishery already have a federal permit and comply with reporting requirements established by another fishery, the costs are estimated for new participants only. In the case of these management measures, the compliance costs are primarily due to the time required to complete and submit the necessary forms. Total vessel costs for these requirements are estimated as $7.80 for vessel permits, $25.32 for operator permits, $27.00 for vessel trip reports, and $52.00 (maximum) for interactive voice reports. Total compliance costs per vessel are thus $112 per vessel for these measures. The total cost for dealers is estimated to be $1.58 for permits and $78.70 for weekly landing reports, for a total of about $80 per dealer. The compliance costs for processors is also estimated to be $1.58 for permits and $7.83 for an annual report, or a total of $9.41 per processor. These costs are considered insignificant.

Vessels that intend to harvest more than 500 metric tons of herring, or that harvested 500 metric tons of herring in the previous year, will be required to operate a VMS (section 3.10). The annualized cost per vessel to purchase, install, and operate a VMS is estimated to be $2,700. Additional costs are incurred due to burden-hour estimates of the requirements associated with VMS, estimated as an additional $111 per vessel. At the 500 metric tons threshold, this is about 4% of annual revenues. When compared to the average herring revenues of the 19 vessels that landed most of the herring in 1997 and who would be required to have a VMS if based on 1997 landings, this cost is equal to about 0.5% of the average revenues for this group.

The compliance costs for the FMP will not result in an increase in the total costs of production by more than 5%. All participants in the industry are small entities; therefore, compliance costs for small entities do not differ from those for large entities. Costs of compliance do not represent a significant portion of capital available to small entities. The action is not considered significant according to these criteria.

7.3.7 Mitigating Factors

The management measures are designed to minimize the impacts on the small businesses in the herring fishery. In addition, whenever possible the measures are designed to minimize the impacts on those vessels that land a small amount of herring. Specific examples of actions taken to

mitigate the impacts of the management measures are listed below.

TACs
The TACs are determined for each of four management areas. As the TAC is approached in a management area, the days that fishing are allowed in that area are reduced. Fishing will still be allowed in other management areas, providing an opportunity for vessels to continue to catch herring. While traveling to another area may increase operating costs, it provides an opportunity for vessels to continue fishing as long as the TAC is not reached in all areas. In addition, larger vessels may decide to completely shift their fishing operations to another area rather than be restricted to certain fishing days. This may reduce fishing pressure in one area, extending the season for those vessels that do not choose or are unable to transit into another area. Significantly, industry participants supported the TACs that are being recommended by the management plan, an indication that they believe the benefits of the TAC system outweigh the possible short-term impact on revenues.

When fishing is restricted in an area because the TAC is being approached or has been reached, vessels are still allowed to land up to 2,000 pounds of herring. While this incidental catch allowance on is not sufficient to justify a directed fishery for herring (as the value is only about $100), it does allow vessels that catch small amounts of herring to land their catch rather than have to discard it. This reduces the burden on those vessels that have a small herring catch in the process of prosecuting other fisheries, while helping to minimize discards.

Spawning Closures
The spawning closures target specific areas at specific times. This leaves large areas open to herring fishing so that vessels can continue to fish outside the closures. The proposal actually opens a large area that had been closed to spawning under state regulations, further reducing the impact of the closures on small businesses. The closure boundaries were also designed to extend only to state waters, rather than to the shore. This provides an opportunity for vessels to fish for herring in state waters, subject to restrictions adopted by the states. The measure adopted by the Commission will allow fishing for herring in state waters as long as vessels avoid catching a significant amount of herring with spawn. As with the TACs, vessels that catch only a small amount of herring while prosecuting other fisheries can land up to 2,000 pounds of herring from a closed area.

Reporting Requirements
The reporting requirements are designed to impose the least burden on those vessels that land a small amount of herring. Only those vessels that intend to catch more than 500 metric tons of herring are required to install and operate a VMS. This avoids the cost burden of a VMS on those vessels whose landings of herring would not support the cost of the system, while providing VMS coverage on the boats that landed over 90% of the herring in 1997. Interactive voice response (IVR) reports are required on a weekly basis for those vessels that have a VMS, and on an "as necessary" basis for a boat that catches more than 2,000 pounds of herring on a trip in any given week. Any vessel that does not land 2,000 pounds of herring on a trip does not need to submit an

IVR report.

7.3.8 Identification of Overlapping Regulations

The proposed action does not create overlapping regulations with any state regulations or other federal laws. The FMP was closely coordinated with the Atlantic States Marine Fisheries Commission in order to insure a complementary management scheme in state and federal waters. The Commission has adopted an amendment to its Atlantic herring management plan that will be implemented through state regulations. As noted in section 3.12, the Commission amendment is nearly identical to the FMP. This insures that management of herring will be consistent in both state and federal waters.

7.3.9 Conclusion

The preceding Regulatory Flexibility Analysis and the relevant sections of RIR indicate that the regulations proposed in Atlantic herring FMP will have "significant impacts" on a substantial number of small businesses.

7.4 Endangered Species Act (ESA)

Section 7 of the Endangered Species Act requires federal agencies conducting, authorizing or funding activities that may affect threatened or endangered marine species to ensure that those effects do not jeopardize the continued existence of listed species. The Council has concluded that the Atlantic Herring FMP and the prosecution of the herring fishery may affect several listed species but is not likely to jeopardize their continued existence. See section E.7.2.11 of this document for a discussion of impacts on ESA-listed species.

7.5 Marine Mammal Protection Act (MMPA)

The New England Fishery Management Council has reviewed the impacts of the Atlantic Herring FMP on marine mammals and concludes that this management action is consistent with the provisions of the MMPA and will not alter existing measures to protect the species likely to inhabit the management unit. See section E.7.2.11 for a discussion of these impacts.

7.6 Coastal Zone Management Act (CZMA)

7.6.1 States Contacted and Council Determination of Consistency with State Programs

The coastal zone management plans of the following states were reviewed to determine the consistency of the fishery management plan with the state programs: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina. The FMP documents and the following letters giving the determination were mailed to all affected states.

7.6.1.1 State contacts

Ms. Fran Rudoff
Coastal Program Manager
State Planning Office
State House Station #38
Augusta, ME 04333

Mr. David E. Hartman, Coastal Program Manager
New Hampshire Coastal Program
Office of State Planning
2-1/2 Beacon Street
Concord, NH 03301

Ms. Peg Brady, Director
Coastal Management Program
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Mr. Charles H. Evans, Director
Office of Long Island Sound Programs
Department of Environmental Protection
79 Elm Street
Hartford, CT 06106

Mr. Grover Fugate, Executive Director
Rhode Island Coastal Resources Council
Oliver H. Stedman Office Building
4808 Tower Hill Road
Wakefield, RI 02879

Mr. George Stafford, Director
NY Division of Coastal Resources
41 State Street
Albany, NY 12231-0001

Mr. Richard Kropp, Director
Attention: Mark Fedorowycz
Land Use Regulation Program
NJ Department of Environmental Protection
PO Box 439, 501 East State Street
Trenton, NJ 08625-0409

Ms. Gwynne Schultz, Director
Coastal Zone Management Division
Maryland Department of Natural Resources
580 Taylor Ave., Tawes State Office Bldg, E-3
Annapolis, MD 21401

Ms. Sarah W. Cooksey, Administrator
Delaware Coastal Management Program
Dept of Natural Resources and Env Control
89 Kings Highway
Dover, DE 19901

Mr. E. James Tabor
Pennsylvania Coastal Zone
Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street, 10th Floor
Harrisburg, PA 17105

Ms. Laura McKay, Environmental Program Manager
Virginia Coastal Resources Management Program
629 East Main Street, 6th Floor
Richmond, VA 23219

Ms. Donna D. Moffitt
North Carolina Division of Coastal Management
2728 Capital Boulevard
Raleigh, NC 27604

7.6.2 CZMA Letters

Undated copies of the CZMA transmittal letters follow this section.

7.6.3 State Concurrences

No state concurrences with the Council's determinations have been received at the time of the submittal of this FMP.

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Mr. Charles H. Evans, Director
Office of Long Island Sound Programs
Department of Environmental Protection
79 Elm Street
Hartford, CT 06106

RE: Atlantic Herring FMP Consistency Determination

Dear Mr. Evans:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries Commission in order to insure consistent management of the resource in both state and federal waters. As a result of this cooperation, the Commission recently adopted Amendment One to its

Atlantic Herring FMP. This amendment will extend many of the management measures into state waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Department of Environmental Protection, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. The Connecticut Coastal Zone Management Program objective is to coordinate planning and regulatory activities of public agencies at all levels of government to insure maximum protection of coastal resources while minimizing conflicts and disruption of economic development (Section 22(a)(9)). In Section 22(a)(9)(15)(G) that intention includes the prevention of degradation or destruction of finfish. This objective is consistent with the Atlantic herring FMP, because the FMP will conserve the resource and optimize yield while preventing overfishing.

To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
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Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Ms. Sarah W. Cooksey, Administrator
Delaware Coastal Management Program
Dept of Natural Resources and Env
Control
89 Kings Highway
Dover, DE 19901

RE: Atlantic Herring FMP Consistency Determination

Dear Ms. Cooksey:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries Commission in order to insure consistent management of the resource in both state and federal

waters. As a result of this cooperation, the Commission recently adopted Amendment One to its Atlantic Herring FMP. This amendment will extend many of the management measures into state waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Division of Fish and Wildlife, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. The Coastal Waters Policy is Section 5.A.3 of the Delaware Coastal Program Implementation Plan (CPIP). Among the "Specific CMP Policies for Coastal Waters Management," the state maintains and protects beneficial uses of the coastal waters *including boating and fishing*. Included within this policy is the objective to maintain water quality at a level to *support the propagation of fish species*. Section 5.C.3 of the Program Implementation Plan states that a *sustainable yield of fish* should be assured by establishing harvesting quotas, equipment and seasonal limitations, and licenses and other requirements. The Section also states that the wise use and enjoyment of fish is encouraged.

The Atlantic herring FMP establishes total allowable catch limits in order to prevent overfishing and insure the development of a sustainable fishery. Since a primary objective of the Atlantic Herring FMP is to achieve optimum yield, to the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
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Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Ms. Peg Brady, Director
Coastal Management Program
Executive Office of Environmental
Affairs
100 Cambridge Street
Boston, MA 02202

Dear Ms. Brady:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries Commission in order to insure consistent management of the resource in both state and federal waters. As a result of this cooperation, the Commission recently adopted Amendment One to its Atlantic Herring FMP. This amendment will extend many of the management measures into state

waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Fish and Game Department, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. The Atlantic herring FMP appears to agree with the objectives in Massachusetts's 1997 Ocean Resources Policy #1 to support the development of environmentally sustainable aquaculture, for commercial and enhancement purposes, and to minimize adverse impacts upon the coastal and marine environment.

To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

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Chairman
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Ms. Gwynne Schultz, Director
Coastal Zone Management Division
Maryland Department of Natural
Resources
580 Taylor Ave., Tawes State Office
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Annapolis, MD 21401

RE: Atlantic Herring FMP Consistency Determination

Dear Ms. Schultze:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries Commission in order to insure consistent management of the resource in both state and federal

waters. As a result of this cooperation, the Commission recently adopted Amendment One to its Atlantic Herring FMP. This amendment will extend many of the management measures into state waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Department of Natural Resources, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. Maryland does not have a general fish conservation policy in its Coastal Zone Management Program, however the state has aggressive coastal zone regulations to manage fish stocks. Maryland law section 4-710 specifically restricts methods that can be used for finfishing (types and sizes of nets, when and where trawls can be used, etc.) It may be more restrictive than the proposed FMP regulations, but this does not present a conflict because federal law can be less restrictive than state law. The law also prohibits fish less than specific minimum sizes, however Atlantic herring is not one of the stocks regulated by a minimum size limit. Maryland is also subject to an interstate compact to manage fish stocks. Atlantic herring in state waters will continue to be managed under the Commission's Atlantic herring FMP, developed in close coordination with the Council. The Atlantic herring FMP is not expected to conflict with the Commission's amended FMP.

The Atlantic Herring FMP uses a variety of management measures to achieve optimum yield. To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Ms. Fran Rudoff
Coastal Program Manager
State Planning Office
State House Station #38
Augusta, ME 04333

Dear Ms. Rudoff:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries Commission in order to insure consistent management of the resource in both state and federal waters. As a result of this cooperation, the Commission recently adopted Amendment One to its Atlantic Herring FMP. This amendment will extend many of the management measures into state

waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Department of Marine Resources, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. Section 6.72(54) of Maine's Final EIS addresses *fisheries resources*. Maine's policy is to assure that activity in the coastal wetlands *conserve marine fisheries* through a permit procedure. Section 6.72(57) requires Maine to conserve marine resources in coastal waters. Maine's coastal zone management laws and policies mostly address on-shore activity and development that are not expected to experience major impacts from the Atlantic herring FMP. Since the Atlantic herring FMP aims to conserve the stock as does Maine's policy, no inconsistencies arise.

To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Ms. Donna D. Moffitt
North Carolina Division of Coastal
Management
2728 Capital Boulevard
Raleigh, NC 27604

RE: Atlantic Herring FMP Consistency Determination

Dear Ms. Moffit:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

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Atlantic Herring FMP. This amendment will extend many of the management measures into state waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Marine Resources Commission, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. The Coastal Zone Management Program designates fishery management to the North Carolina Marine Fisheries Commission (Fisheries Commission). Statue 143B-389.51 provides that the Fisheries Commission has the authority to implement law relating to *coastal fishing and coastal fisheries*. Among its duties, the Fishery Commission must manage, restore, develop, *conserve and regulate the marine resources; and implement management measures regarding marine fisheries consistent with authority conferred on North Carolina by the federal government*. Statue 113-134.1 further directs the Fishery Commission to exercise regulatory authority over the conservation of marine fisheries. Statue 113-228 permits the Fishery Commission to adopt federal laws that comply with state law and *exempts* the Fishery Commission from conflicting federal law.

The Atlantic Herring FMP uses a variety of management measures to achieve optimum yield. To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
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Ms. Donna D. Moffitt
North Carolina Division of Coastal
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2728 Capital Boulevard
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RE: Atlantic Herring FMP Consistency Determination

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Atlantic Herring FMP. This amendment will extend many of the management measures into state waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Marine Resources Commission, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. The Coastal Zone Management Program designates fishery management to the North Carolina Marine Fisheries Commission (Fisheries Commission). Statue 143B-389.51 provides that the Fisheries Commission has the authority to implement law relating to *coastal fishing and coastal fisheries*. Among its duties, the Fishery Commission must manage, restore, develop, *conserve and regulate the marine resources; and implement management measures regarding marine fisheries consistent with authority conferred on North Carolina by the federal government*. Statue 113-134.1 further directs the Fishery Commission to exercise regulatory authority over the conservation of marine fisheries. Statue 113-228 permits the Fishery Commission to adopt federal laws that comply with state law and *exempts* the Fishery Commission from conflicting federal law.

The Atlantic Herring FMP uses a variety of management measures to achieve optimum yield. To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Mr. David E. Hartman, Coastal Program
Manager
New Hampshire Coastal Program
Office of State Planning
2-1/2 Beacon Street
Concord, NH 03301

Dear Mr. Hartman:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries Commission in order to insure consistent management of the resource in both state and federal waters. As a result of this cooperation, the Commission recently adopted Amendment One to its Atlantic Herring FMP. This amendment will extend many of the management measures into state

waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Fish and Game Department, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. The Atlantic herring FMP appears to agree with the objectives in Massachusetts's 1997 Ocean Resources Policy #1 to support the development of environmentally sustainable aquaculture, for commercial and enhancement purposes, and to minimize adverse impacts upon the coastal and marine environment. New Hampshire's coastal program policy #7(2) aims to : *conserve, manage, maintain, restore and enhance the fish of the state's waters*. Also included in New Hampshire's coastal laws is Section 483-B:2(VII) which mandates the protection of commercial fishing. Because the Atlantic herring FMP aims to protect the stock's sustainability and future fishing rights, it is consistent with the policy and laws of Massachusetts.

To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Mr. Richard Kropp, Director
Attention: Mark Fedorowycz
Land Use Regulation Program
NJ Department of Environmental
Protection
PO Box 439, 501 East State Street
Trenton, NJ 08625-0409

RE: Atlantic Herring FMP Consistency Determination

Dear Mr. Kropp:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries

Commission in order to insure consistent management of the resource in both state and federal waters. As a result of this cooperation, the Commission recently adopted Amendment One to its Atlantic Herring FMP. This amendment will extend many of the management measures into state waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Department of Environmental Protection, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. New Jersey's state law N.J.S.A. 23:2B-6 regarding fish and wildlife authorizes the commissioner of fish and game to : prohibit, limit, condition, require or establish the use of specified types of fishing gear; regulate the size, number and quantity of specific [fish] species that may be taken; regulate the areas to be opened or closed to their taking, regulate the time and manner of their taking. The commissioner may also prescribe other limitations, conditions, or restrictions as is necessary and appropriate to the policy and purposes of state law; or establish and develop fisheries management areas and prescribe rules governing the use of such areas.

The Atlantic Herring FMP uses a variety of management measures to achieve optimum yield. These measures are consistent with those that can be implemented under New Jersey state law. To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Mr. George Stafford, Director
NY Division of Coastal
Resources
41 State Street
Albany, NY 12231-0001

Dear Mr. Stafford:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons (GRT), and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries Commission in order to insure consistent management of the resource in both state and federal waters. As a result of this cooperation, the Commission recently adopted Amendment One to its Atlantic Herring FMP. This amendment will extend many of the management measures into state waters and will be implemented by individual state regulations. The Council's FMP and the

Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your State Department of Environmental Conservation, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. Policy 9 of the New York Coastal Zone Management Program calls for efforts to *increase use of fish* in freshwater and marine areas. Among the considerations it provides are consideration as to whether an action will impede future utilization of the State's recreational fish resource; and consideration that efforts to increase access *should not lead to over-utilization of the fish resource*. Policy 10 provides for further development of commercial fish occurring within the context of *sound fishery management principles, including consideration of OSY* (optimum sustainable yield) *levels and harvest restrictions*. It also provides the following guidelines: whether an action will impede existing utilization of future development of the state' commercial fishing resource and ensuring that the fishery resources are renewable.

All of the above measures have consistent goals and intended results as the Atlantic Herring FMP. To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Mr. E. James Tabor
Pennsylvania Coastal Zone
Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street, 10th Floor
Harrisburg, PA 17105

Dear Mr. Tabor:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

This FMP was developed in close cooperation with the Atlantic States Marine Fisheries Commission in order to insure consistent management of the resource in both state and federal waters. As a result of this cooperation, the Commission recently adopted Amendment One to its Atlantic Herring FMP. This amendment will extend many of the management measures into state

waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Department of Marine Resources, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. Chapter 57 of Pennsylvania Fishing and Boating Regulations addresses fisheries policy. The general policy of the state is to *protect, conserve, and enhance the quality and diversity of the fishery resources*. To achieve that objective, the State Fishing and Boating Commissioner is assigned to manage self-sustaining fish populations as a *renewable natural resource*. Since a primary objective of the Atlantic herring FMP is to achieve optimum yield, no inconsistency is anticipated. Although Pennsylvania specifically regulates some fish stocks and fishing gear in associated fisheries, Atlantic herring is not among them and there is therefore no conflict. The state also requires fishermen to have a license with the state and a permit to fish some species, but the Atlantic herring FMP will not interfere with this licensing provision.

To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Mr. Grover Fugate, Executive Director
Rhode Island Coastal Resources Council
Oliver H. Stedman Office Building
4808 Tower Hill Road
Wakefield, RI 02879

RE: Atlantic Herring FMP Consistency Determination

Dear Mr. Fugate:
:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

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Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Department of Environmental Management, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. Section 300.11 of Rhode Island's Coastal Resources Management Program is the only part of its policy that directly addresses fisheries. As a section that permits and regulates aquaculture, it does not overlap with the Atlantic herring FMP; thus, there is no inconsistency.

To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

New England Fishery Management Council
5 Broadway, Saugus, MA 01906-1036
Tel (781) 231-0422 • Fax (617) 565-8937

Chairman
Joseph M. Brancaleone

Executive Director
Paul J. Howard

Ms. Laura McKay, Environmental
Program Manager
Virginia Coastal Resources Management
Program
629 East Main Street, 6th Floor
Richmond, VA 23219

RE: Atlantic Herring FMP Consistency Determination

Dear Ms. McKay:

The New England Fishery Management Council is submitting the Atlantic Herring Fishery Management Plan (FMP) to the Secretary of Commerce for approval under Section 304 of the Magnuson-Stevens Fishery Conservation and Management Act. Enclosed is a copy of the plan that establishes measures to prevent overfishing and allows the development of a sustainable herring fishery. The FMP controls fishing mortality by establishing a Total Allowable Catch (TAC) that is distributed to four management areas. As the TAC in an area is approached, vessels are required to take mandatory days out of the fishery in order to slow catch rates and encourage fishermen to move into other areas. Spawning closures are adopted to protect spawning aggregations of Atlantic herring. Vessels catching, taking, or harvesting herring must be less than 165 feet in length, cannot exceed 750 Gross Registered Tons, and cannot exceed 3,000 shaft horsepower. Vessels over 165 feet in length, or more than 750 GRT, can process herring subject to an annual specification. The plan also establishes permit and reporting requirements for Atlantic herring vessels, dealers, and processors. The FMP manages Atlantic herring as an open access fishery.

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Atlantic Herring FMP. This amendment will extend many of the management measures into state waters and will be implemented by individual state regulations. The Council's FMP and the Commission's amendment adopt complementary management measures for Atlantic herring throughout the range of the resource in U.S. waters.

Our approach in assessing the adverse impacts on offshore resources is described in section 7.1 (Environmental Consequences of the Proposed Action). The FMP was developed in concert with your Marine Resources Commission, which is responsible for your appropriate core law. Based on information provided by your office in the past, it appears that the state reserves the responsibility to have its agencies review consistency determination vis-à-vis the appropriate core laws. By way of this letter and the enclosed documents, we believe that we have fulfilled our obligation under your procedure.

We have reviewed the FMP in light of your Coastal Zone Management Plan and applicable regulations. As stated in Part I of the Coastal Resources Management Program Final EIS, Virginia has implemented *its own fisheries management program* that is implemented by the Marine Resources Commission and the Commission of Game and Inland Fisheries. The fishery management policy stresses the *conservation and enhancement of fish resources and the promotion of commercial and recreational fisheries to maximize food production* and recreational opportunities , *particularly for future generations*. Also included in Part II of the EIS are the goals to *minimize damage to productivity and diversity of the marine environment resulting from the disruption of fish population* balances and to *improve or maintain fisheries*. Virginia regulates the fishing of many species however Atlantic herring is not among them. Virginia Code 1950, sec 28.2-300 also requires fishermen to obtain a license from the state to fish and/or use a net, and requires fishermen to report their catch to the state as well. There appear to be no inconsistencies between Virginia regulations and the FMP..

The Atlantic Herring FMP uses a variety of management measures to achieve optimum yield. To the best of our understanding, we believe the FMP will be consistent with your program. We would appreciate hearing from you as soon as possible regarding our determination.

Sincerely,

Paul J. Howard
Executive Director

7.7 Paperwork Reduction Act (PRA)

The proposed management measures include twelve collection of information requirements subject to review by the Office of Management and Budget for compliance with the Paperwork Reduction Act. The proposed measures reference one collection-of-information requirement subject to the Paperwork Reduction Act (PRA) and which has been approved by OMB under control number 0648-0075. The estimated response time for foreign fishing vessel activity reports is 6 minutes per response. A summary of the new burden hours and costs to the public, as well as the costs to the government, for all twelve requirements is shown in Table 70. The supporting statements detailing each requirement are contained in Appendix VI, Volume II .These costs are included in the analysis of costs and benefits contained in section E.7.3. These requirements will not be implemented until OMB approval is received. Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

Requirement	Number of Entities	Items per Entity	Total Number of Items	Response Time	Total Burden	Cost to Public (1)	Cost to Government (2)
Open Access Atlantic Herring Permit	40	1	40	0.5	20	$313.20	$1,320
Operator Permits	40	1	40	1.0	40	$1,013.20	$1,320
Dealer Permits	50	1	50	0.083	4.15	$79.00	$1,650
Processor Permits	50	1	50	0.083	4.15	$79.00	$1,650
Permit Sub-Total					68.3	$1,484.40	$5,940
Processor Product Reports	50	1	50	0.5	25	$391.50	N/A
Dealer Landing Reports	50	52	2,600	0.033	87	$3,905	N/A
Vessel Trip Reports	40	12	480	0.083	40	$1,080	N/A
IVR Reports:							
Weekly							
Occasional	25	52	1,300	.067	87.1	$1,306.50	
	97	9	873	.067	58.5	$877.50	$989
Vessel Reports Sub-Total			2,653		175.6	$3,264	$989
Vessel Monitoring System							$20,000
Installation	25	1	25	1.0	25	$375	N/A
Verification requirement	25	1	25	.033	0.833	$12.50	N/A
Reporting burden	25	4,560	114,000	.0014	159	$2,394	N/A
Purchase and operation	25					$67,500	
Exemption letter	10	1	10	.033	.33	$5	$8.33
VMS Sub-Total					185.4	$70,286.50	$20,008
Total						$79,331.40	$26,937

Table 70 – Summary of response burden and costs for requirements subject to the PRA.

8.0 References

8.1 Public Meetings/Summary of Proceedings

Prior to development of the management plan, a series of scoping hearings was held. After preparation of the DEIS, public hearings were held and a comment period was opened for receipt of written comments. Summaries of all hearings, and written comments (received during the DEIS comment period), are in Appendices VII and VIII. The major comments received, and the Council responses, are summarized below.

1. *There is no logical reason to establish a size limit for vessels catching, taking, or harvesting herring in an open access fishery. A large number of vessels less than the size limit can result in over-capacity as easily as the introduction of large factory trawlers. This prohibition targets one vessel that had plans to enter the herring fishery.*
The Council believes that the introduction of large factory trawlers would rapidly increase the harvesting capacity in the herring fishery. The introduction of these vessels would also reduce the ability of the herring fishery to serve as an alternative for New England and mid-Atlantic fishermen in other fisheries. Finally, the introduction of such trawlers could have adverse impacts on fishing communities in the area if they displace traditional herring fishermen from the resource or prevent herring processors (such as the sardine canneries) from having ready access to the resource. These potential impacts are discussed in detail in the EIS (section E.7.0). For these reasons, the Council proposes that vessels that exceed the size limits not be allowed into the herring fishery.

The Council's action applies to all large fishing vessels, not just the one vessel that is known to have planned to enter the herring fishery. While the American Fisheries Act makes it more difficult to obtain a fisheries endorsement for the documentation of a new large fishing vessel, the Council believes it does not make it impossible to do so. In addition, this Act does not prevent vessels from other U.S. fisheries from entering the Atlantic herring fishery. The entry of a number of factory trawlers would exacerbate the concerns expressed above.

2. *Vessels that exceed the size limit should not be limited to an allocation of herring. These vessels are part of the U.S. processing industry and should have the same access to the resource as shore based processing plants. Herring should not be allocated to foreign joint ventures at the same time that the Council recommends a 0 mt allocation for USAP.*
The Council's rationale for specifying the amount of herring that can be processed by large domestic at-sea processing vessels is described in detail in sections E.7.2.5.4, E.1.1.1.1, and E.7.4.2.2.2. The Council believes that large at-sea processing vessels may have adverse impacts on the management of the herring resource that are not clearly understood. There is no history of large domestic processors in any New England fishery, which makes it difficult to evaluate the impacts. As a result, the Council has chosen an approach that will allow the careful introduction of at-sea processing capacity. By creating the USAP specification, the Council can evaluate the impacts of at-sea processors and control their introduction into the fishery.

The decision to recommend that USAP be set at 0 mt for the first year of the management plan will allow the Council to judge the effectiveness of the overall management scheme prior to allowing large domestic at-sea processors into the fishery. The Council does provide an opportunity for foreign joint ventures. This will allow the temporary introduction of processing capacity into the fishery that can be excluded in future years. Unlike the possible impacts of specifying USAP at a level other than 0 mt, foreign joint venture activity will not encourage the development of processing capacity in the U.S. fishery that may be unnecessary.

3. *Large factory trawlers should not be allowed into the herring fishery, even as at-sea processors.*
The Council's management plan will not allow vessels that exceed the size limits to catch, take, or harvest herring. The plan does provide an opportunity for factory trawlers to enter the fishery by operating as at-sea processors for catcher vessels that meet the size limit. The Council chose this option because there may be a need for large at-sea processors in order to use the offshore herring resource. Recognizing that development of a large vessel offshore processing capability causes concern in local communities that have grown dependent on herring, the Council will control large vessel at-sea processing by specifying the amount of herring that can be processed by these vessels. For the first year of the plan, the Council is taking a cautious approach to the introduction of this processing capacity by recommending this specification be set at 0 mt. The Council believes this balances the concerns of those who oppose large at-sea processors while providing the flexibility to introduce these vessels into the fishery in the future if they will be beneficial.

4. *The natural mortality assumed in the herring assessment is inaccurate and the management plan does not adequately account for the importance of herring as a forage species.*
The herring assessment is conducted through the peer-reviewed SAW process. Questions on the natural mortality assumptions used in the assessment should be addressed to the SAW.

During development of the FMP, the Council's PDT considered the issue of herring natural mortality (M) and the impact of different estimates of M on stock size. Trial virtual population analyses (VPA) were performed using varying values for M. For M values of 1.0 at age 1, 0.3 at age 2, 0.2 age 3 and 0.1 age 4+, fishing mortality rates increased by 10-15% (compared to the *status quo* M=0.2) in all years between 1967 and 1995, but stock biomass remained the same until 1991-95 when it was slightly lower. For a constant M=0.3 at all ages, F dropped by 5-20% and stock biomass increased over most of the time period, especially during the 1990s. Stock biomass was 33% higher in 1993 for M=0.3, but only 10% higher in 1996. Clearly, fairly small changes in M can have an impact on VPA stock size estimates and fishing mortality rate estimates, but under the most likely scenario (higher M values at younger ages and lower ones at older ages), the results do not change to any significant degree.

Natural mortality rates are an important factor in virtual population analyses (VPA), but

are not required in surplus production models such as the one that is currently being used to estimate maximum sustainable yield (MSY) and fishing mortality and stock biomass at MSY for the Atlantic coast stock complex of herring. Surplus production models incorporate natural mortality, growth, and recruitment into estimates of the intrinsic rate of population increase (r), a population attribute that reflects the balance of all biological factors that cause a population to grow at a certain rate over time. Species interactions are accounted for indirectly in terms of how they affect r, which reflects average population processes over time. Surplus production models do not account for deviations from average conditions, such as would be caused by a very strong year class recruiting to the stock. These models also work in the opposite “direction” as VPA models, i.e., from the oldest years forward to the most recent. Thus, MSY for the herring stock complex is a much more stable parameter than an estimate of the exploitable biomass in the most recent year, or in any given year, and it does not depend on knowing the natural mortality rate.

In addition, the Council has recommended an ABC that is based on B_{MSY}, not the current stock size estimate, which is over twice the size of B_{MSY}. In other words, the Council's recommended OY and TAC is roughly half what could be supported by the estimates of current stock size. The Council chose this precautionary approach because of uncertainty over current stock size estimates and the relative size of spawning components, as well as in recognition of the importance of herring as a forage species.

5. *The management plan underestimates DAP and incorrectly allocates herring to JVP.* NMFS guidelines require the FMP to include an estimate of DAP. DAP includes "… The amount of U.S. harvest that domestic processors will process. This estimate may be based on historical performance and on surveys of the expressed intention of manufacturers to process, supported by evidence of contracts, plant expansion, or other relevant information." The NMFS guidelines differentiate between capacity of the domestic processing industry, and DAP. The estimate of DAP in this FMP is based primarily on historic processing levels coupled with information obtained during development of the management plan through public hearings and public comment. It is not based on a survey of processing capacity, such as is used in the mackerel fishery. The Council's recommended specification for DAP (184,000 mt, section E.6.4.3.1.1) reflects an 80% increase in recent domestic processing performance. This estimate allows for U.S. processors to nearly double the amount of herring they process from 1997 levels. The Council believes this estimate is sufficient to allow the domestic industry to develop while providing an opportunity for JV and IWP activities.

6. *A limited entry or controlled access system should be implemented, particularly in the Gulf of Maine.*
One of the management options considered by the Council was a limited entry system. It was not adopted in order to allow the opportunity for some new entrants into the herring fishery. This decision was made in part so that the herring fishery would provide an opportunity for fishermen in other fisheries that are under increasing restrictions. While a limited entry system was not adopted, the Council acknowledged that such a system may be needed in the near future to control fishing effort. In order to implement a limited entry system as quickly as possible, the Council took the unusual step of including a limited

entry system as a possible framework adjustment measure.

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8.3 Glossary

Allowable Biological Catch (ABC) – the amount of fish that can be safely harvested from a stock. It is calculated by applying the target fishing mortality to the estimated biomass size.

Amendment – a formal change to a fishery management plan (FMP). The Council prepares amendments and submits them to the Secretary of Commerce for review and approval. The Council may also change FMPs through a "framework adjustment procedure" (see below). The Commission prepares amendments and submits them to the Commission's Atlantic Herring Section for approval. Implementing regulations are adopted by the states.

Atlantic herring – *Clupea h. harengus*. The species that will be managed by the management plans developed by the Council and the Commission and described in this document. Sometimes referred to as sea herring.

Bycatch - fish that are harvested in a fishery, but which are not sold or kept for personal use. This includes economic discards and regulatory discards. The fish that are being targeted may be bycatch if they are not retained.

Controlled access – a management system that limits the number of participants in a fishery in order to limit the fishing capacity. The system may include entry and exit provisions so that while the total capacity is limited, the actual participants may vary over time. Qualification criteria to enter the fishery may or may not be based on historic participation.

Days –at –sea (DAS) – the total days, including steaming time that a boat spends at sea to fish.

Environmental Impact Statement (EIS) – an analysis of the expected impacts of a fisheries management plan (or some other proposed action) on the environment and on people, initially prepared as a "Draft" (DEIS) for public comment. After an initial EIS is prepared for a plan, subsequent analyses are called "Supplemental".

Exclusive Economic Zone (EEZ) – for the purposes of the Magnuson-Stevens Fishery Conservation and Management Act, the area from the seaward boundary of each of the coastal states to 200 nautical miles from the baseline.

Exploitation rate – the percentage of catchable fish killed by fishing every year. If a fish stock has 1,000,000 fish large enough to be caught by fishing gear and 550,000 are killed by fishing during the year, the annual exploitation rate is 55%.

Fishing effort – the amount of time and fishing power used to harvest fish. Fishing power includes gear size, boat size and horsepower.

Fishing mortality (F) – (see Mortality)

FMP (fishery management plan) – also referred to as a "plan", this is a document that describes a fishery and establishes measures to manage it. The New England Fishery Management Council prepares FMPs and submits them to the Secretary of Commerce for approval and implementation. The Atlantic States Marine Fishery Commission prepares FMPs and implementing regulations are adopted by the states.

Framework adjustments – adjustments within a range of measures previously specified in a fishery management plan (FMP). A change can usually be made more quickly and easily by a framework adjustment than through an amendment. For plans developed by the New England Council, the procedure requires at least two Council meetings including at least one public hearing and an evaluation of environmental impacts not already analyzed as part of the FMP.

Gonadosomatic Index (GSI) – a measure of the stage of spawning condition.

GRT –gross registered tons. Measure of vessel size based on volume.

Internal Waters Processing (IWP) – an operation by a foreign vessel processing fish caught by U. S. vessels. The foreign vessel is located in the internal waters of a state. "IWP" is usually a reference to the fish allocated for these operations.

Joint Venture (JV) - Joint venture means any operation by a foreign vessel assisting fishing by U.S. fishing vessels, including catching, scouting, processing and/or support. (A joint venture generally entails a foreign vessel processing fish received from U.S. fishing vessels and conducting associated support activities.) "JVP" is usually a reference to the fish allocated for joint venture operations.

Limited entry (or access) – a management system that limits the number of participants in a fishery. Usually, qualification for this system is based on historic participation and the participants remain constant over time (with the exception of attrition).

Mortality

Fishing mortality (F) – (see also exploitation rate) a measurement of the rate of removal of fish from a population by fishing. Fishing mortality (F) is that rate at which fish are harvested at any given point in time. ("Exploitation rate" is an annual rate of removal, "F" is an instantaneous rate.)

$\mathbf{F_{target}}$ – the fishing mortality that management measures are designed to achieve.

Natural mortality – a measurement of the rate of fish deaths from all other causes other than fishing such as predation, disease, starvation and pollution. The rate of natural mortality may vary from species to species.

Minimum biomass level – the minimum stock size (or biomass) below which there is a significantly lower chance that the stock will produce enough new fish to sustain itself over the long term. If a stock is at this level, fishing mortality must be reduced to as near zero as possible until the stock rebuilds.

Optimum Yield (OY) – the amount of fish which—

(a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;

(b) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and

(c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Plan Development Team (PDT) – a group of technical experts responsible for developing and analyzing management measures under the direction of the Council or the Commission. Both the Council and the Commission have herring PDTs that usually meet together to discuss the herring plans. The Commission uses the term **Plan Review Team** after a plan is adopted.

Proposed rule – a federal regulation is usually published in the *Federal Register* as a proposed rule with a time period for public comment. After the comment period closes, the proposed regulation may be changed or withdrawn before it is published as a final rule, along with its date of implementation and response to comments.

Rebuilding schedule – a plan to increase the biomass of a fishery stock, based on a target fishing mortality applied over a period of time.

Recruitment – the amount of fish added to the fishery each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to fishing gear in one year would be recruitment to the fishery.

Regional Administrator – Regional Administrator, NOAA/NMFS Northeast Region, Gloucester, MA.

Secretarial review process – a process which normally takes 140 days from the time the Council submits a plan or amendment to the Secretary of Commerce until its implementation. The Secretary of Commerce reviews and possibly approves the plan or amendment which must meet the National Standards established by the Magnuson Stevens Fishery Conservation and Management Act as well as other federal requirements (the National Environmental Policy Act, the Marine Mammal Protection Act, the Endangered Species Act and other applicable law.)

Spawning component – reference to a group of herring that spawn in a general location. There is evidence herring return to the same areas to spawn. These fish may, in fact,

comprise different "stocks" but the evidence is ambiguous; they are identified as components to allow the development of measures for their protection. A healthy herring resource depends on maintaining spawning in as many areas as possible.

Stock – a grouping of fish usually based on genetic relationship, geographic distribution and movement patterns. A region may have more than one stock of a species.

TAC – the total allowable catch from a stock of fish based on stock size and a specified management objective.

Technical Committee – a group of biologists assembled by the Commission to assess the (herring) resource.

Tolerance – a reference to a management measure used in the original Commission herring management plan. This measure allows fishing in a spawning closure as long as only a certain percentage of the fish caught contain spawn (roe or milt).

VMS – an electronic vessel monitoring system, which may also be used for communications. Previously referred to as a vessel tracking system, or VTS.

9.0 Draft Regulatory Text

Draft regulatory text is contained in Appendix V (Volume II).