Towards
Low Cost Automated Monitoring
of
Life Below Water to
De-risk Ocean-Based Carbon
Dioxide Removal and Clean Power

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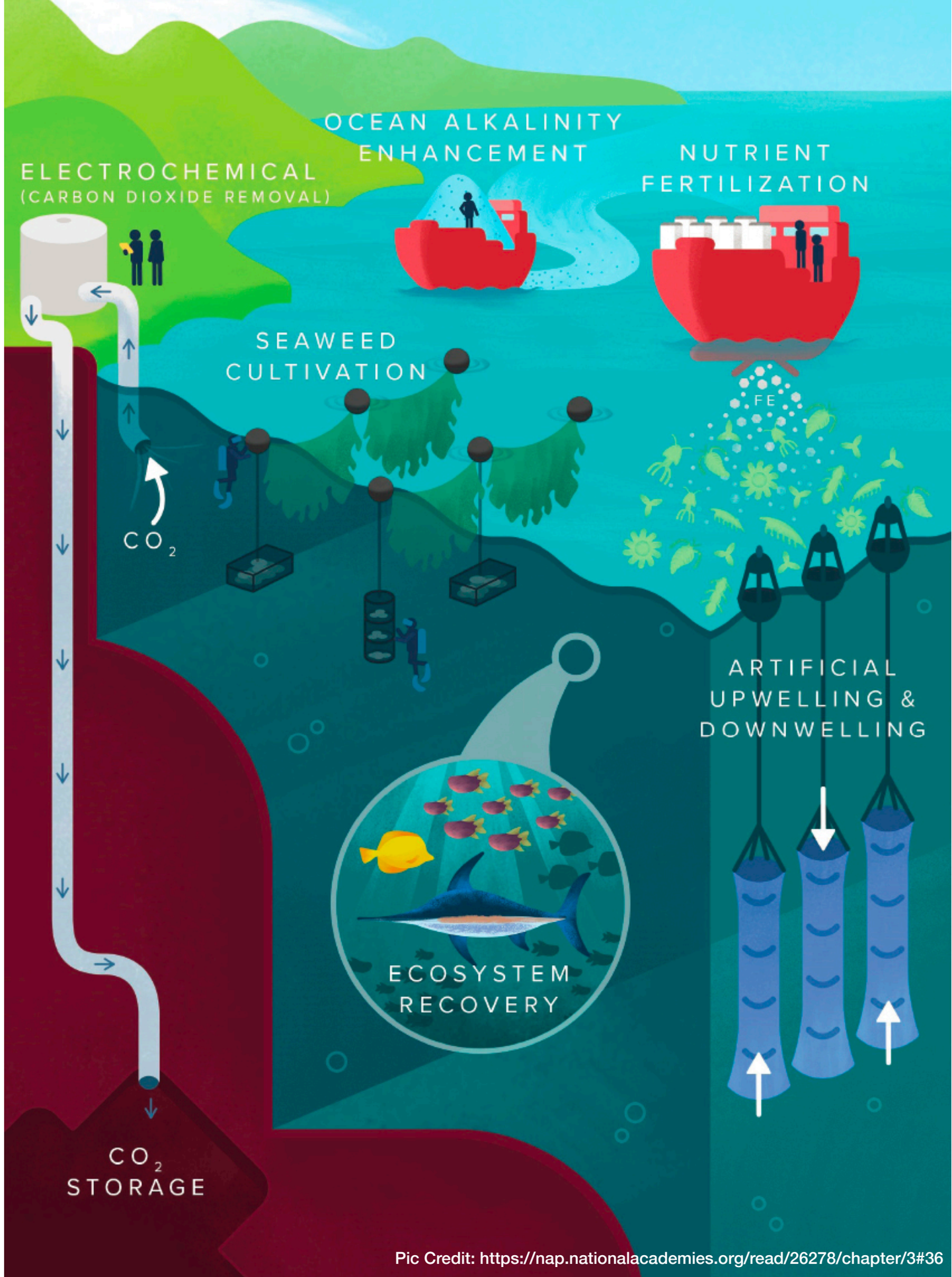
Pic Credit: NASA/JPL-Caltech

Problem

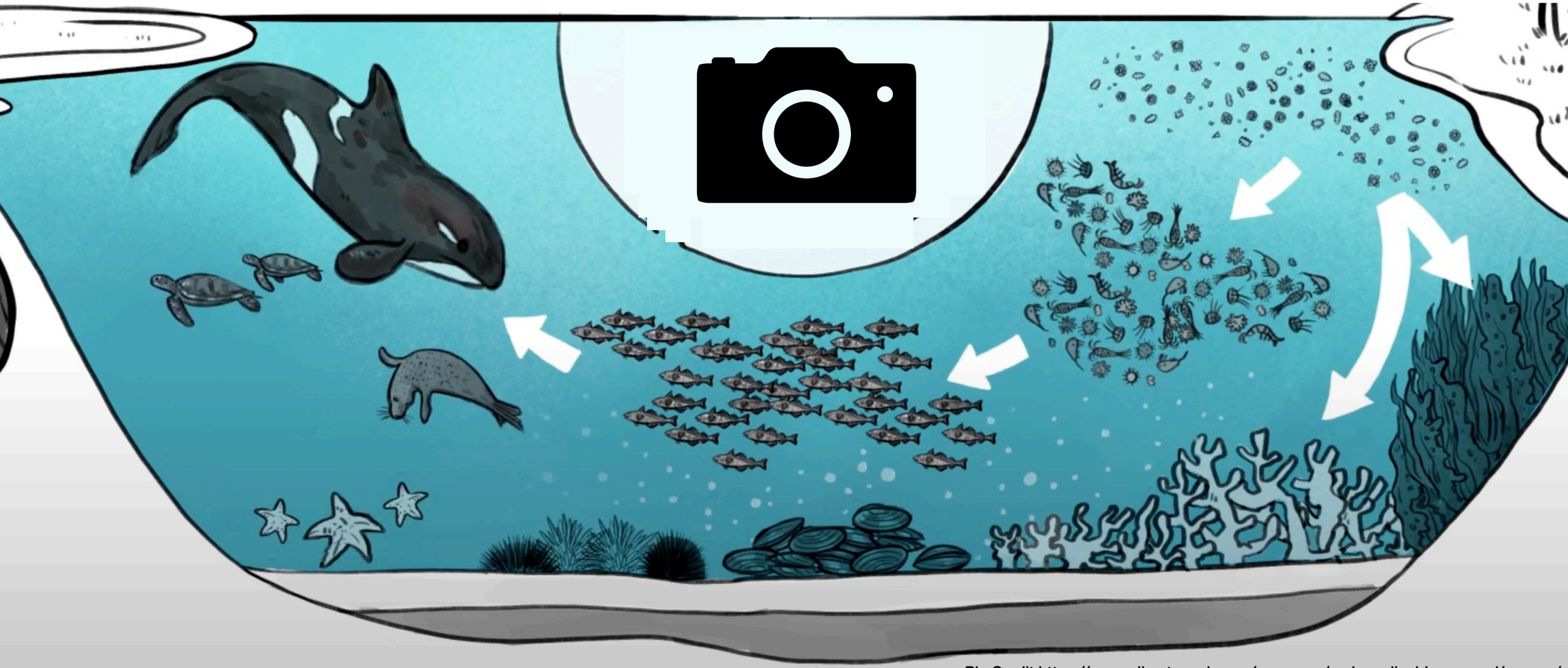
- Oceans will play a crucial role in our efforts to combat the growing climate emergency
- Immediate need for tools to monitor the health of marine ecosystems



Pic Credit: https://nap.nationalacademies.org/read/26278/chapter/3#36

Proposed Solution

Automatic monitoring of marine ecosystems



Pic Credit:https://www.climateworks.org/programs/carbon-dioxide-removal/oceans/

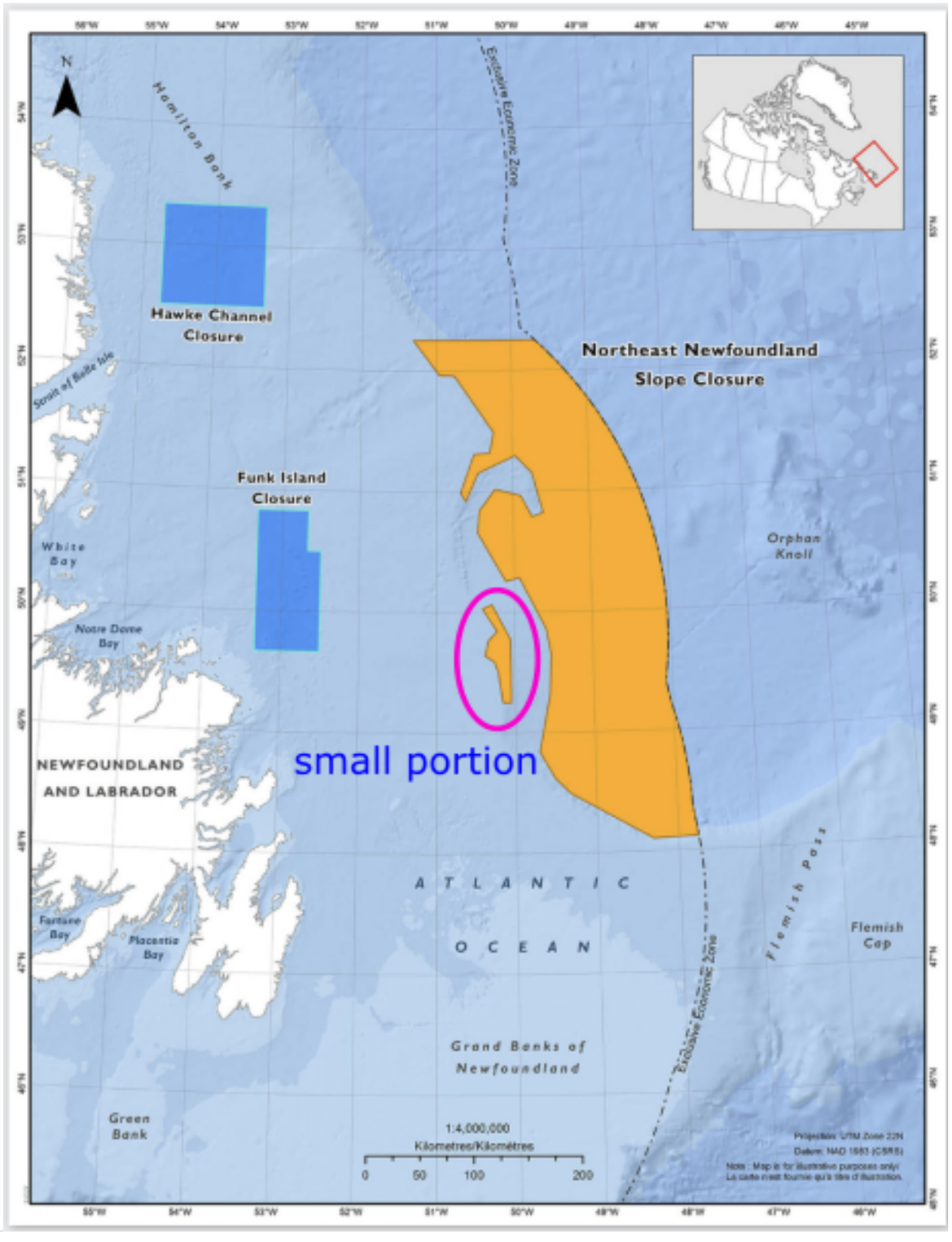
Data

Dataset: Deep underwater camera videos

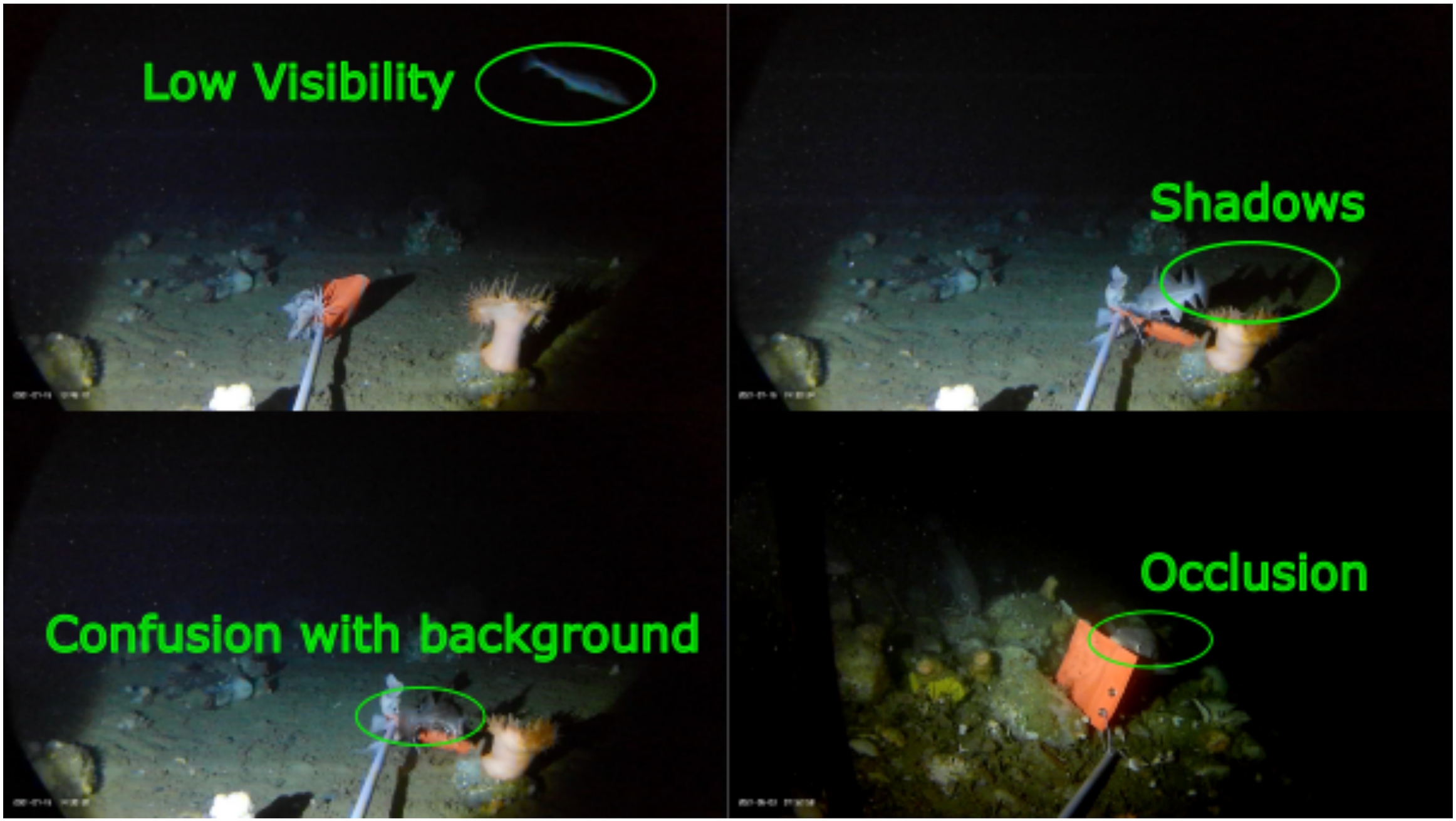
Depth:
450 - 500 m

Count: 1105 minutes of video data

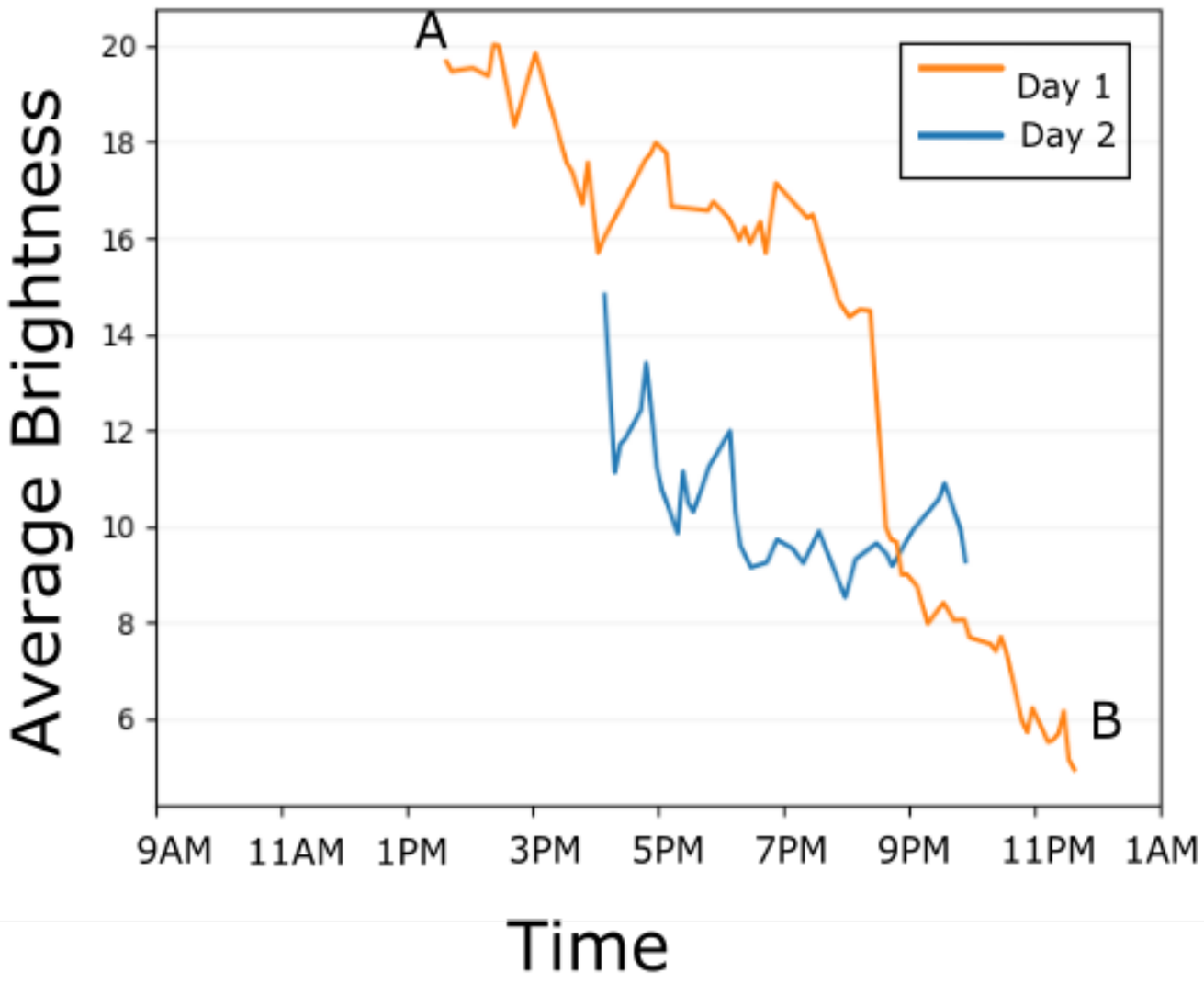
Location: Small portion of the *Northeast Newfoundland Slope Marine Refuge*



Artifacts


Low Visibility
Shadows
Confusion with background
Occlusion

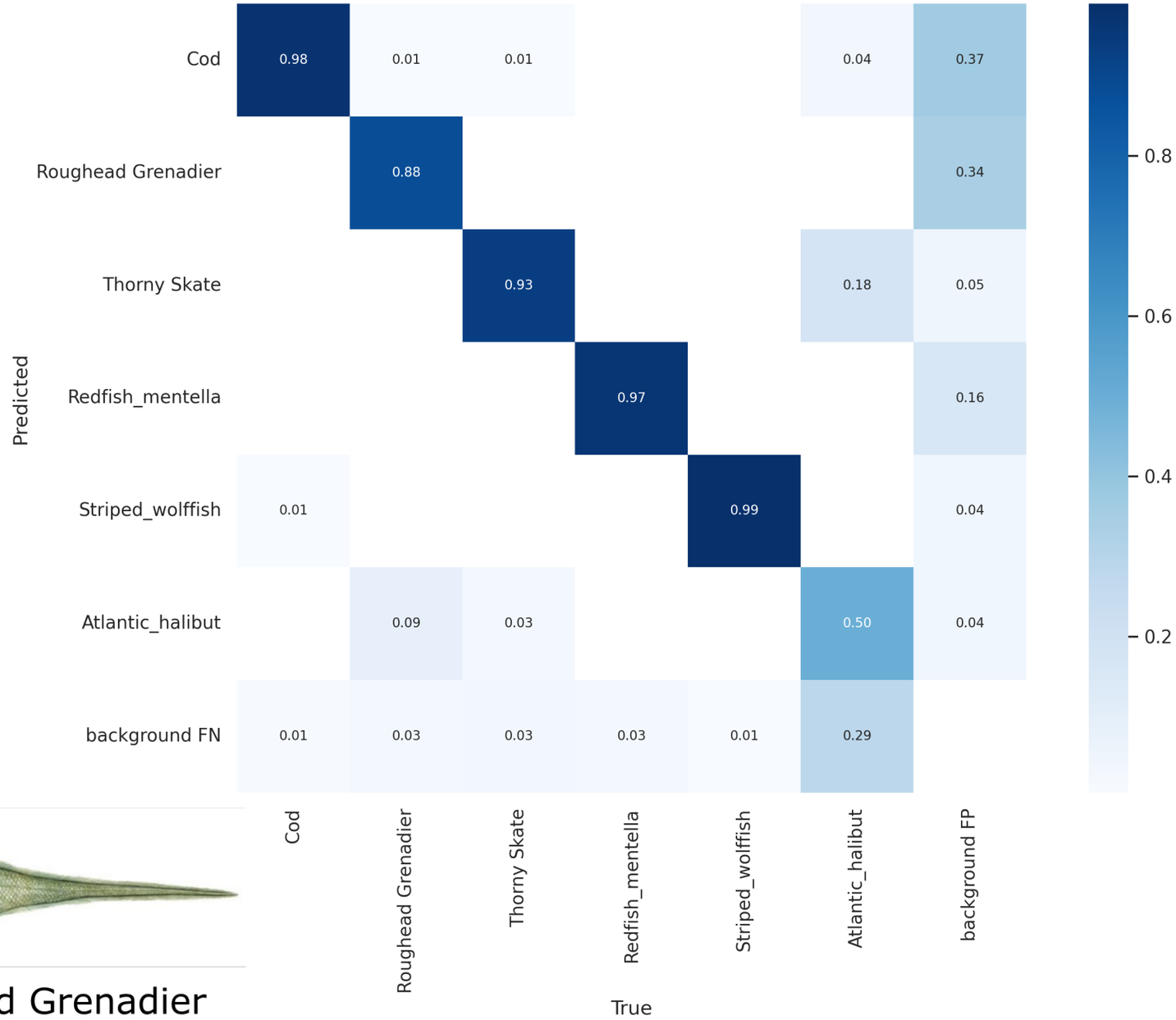
Brightness



Sample A

Sample B

Results: yolov7



Redfish Mentella

Cod

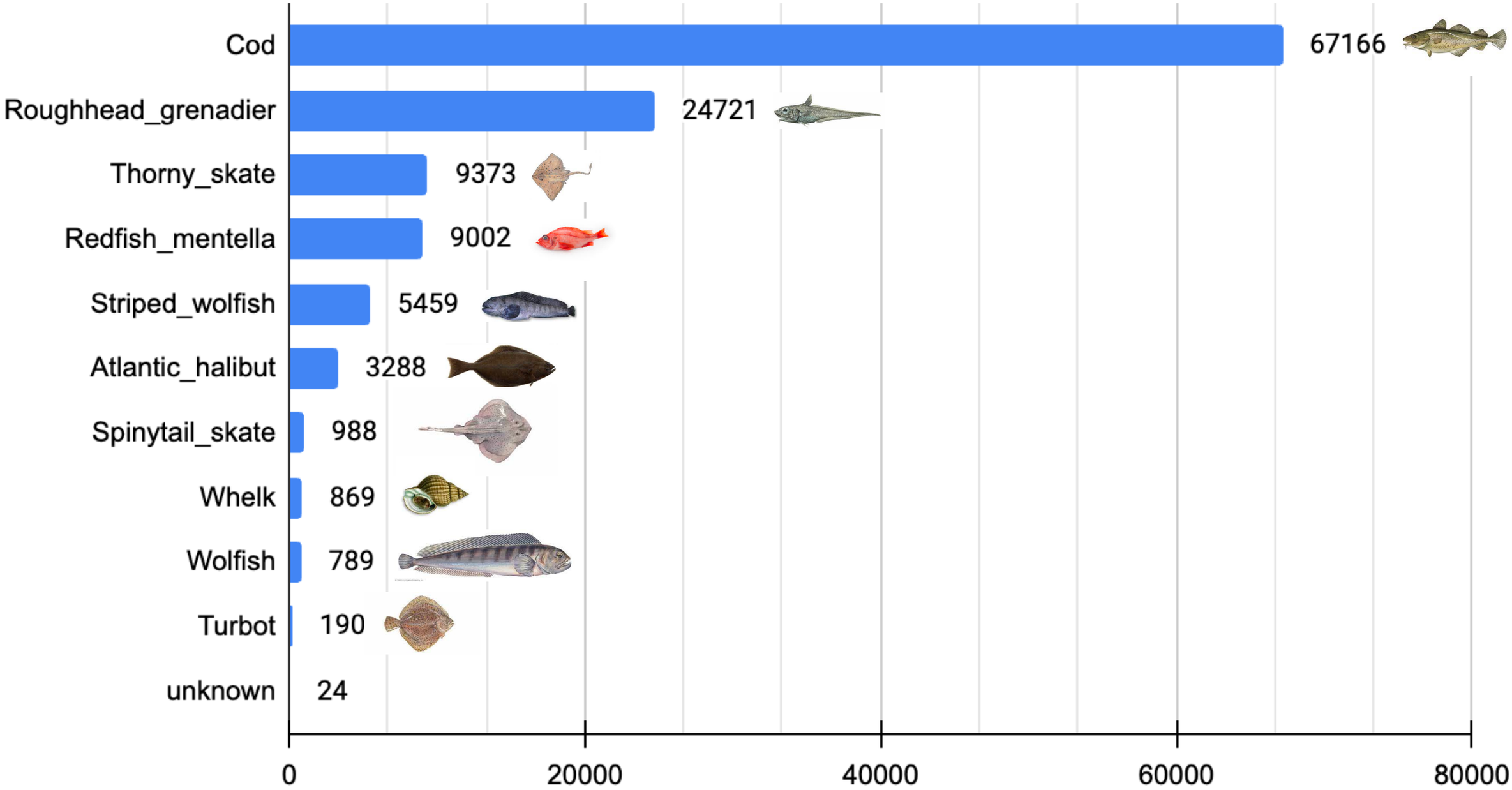
Roughhead Grenadier

Thorny Skate

Atlantic Halibut

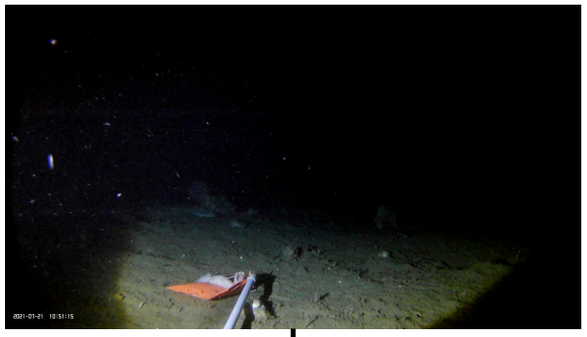
Striped Wolfish

Future work: Class imbalance



Class imbalance: Generative algorithms

Prior



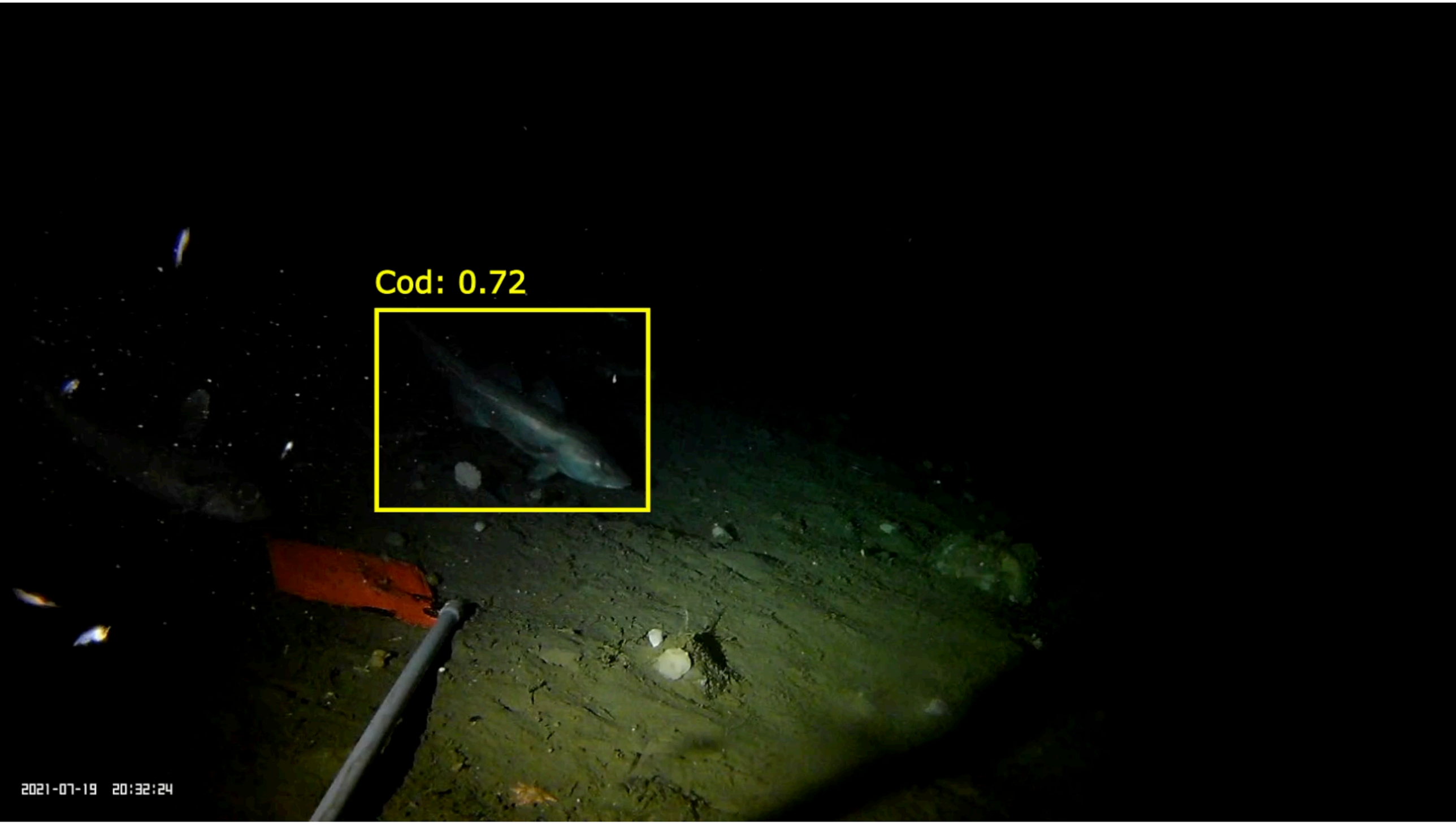
Number of samples: 5

Generative Models

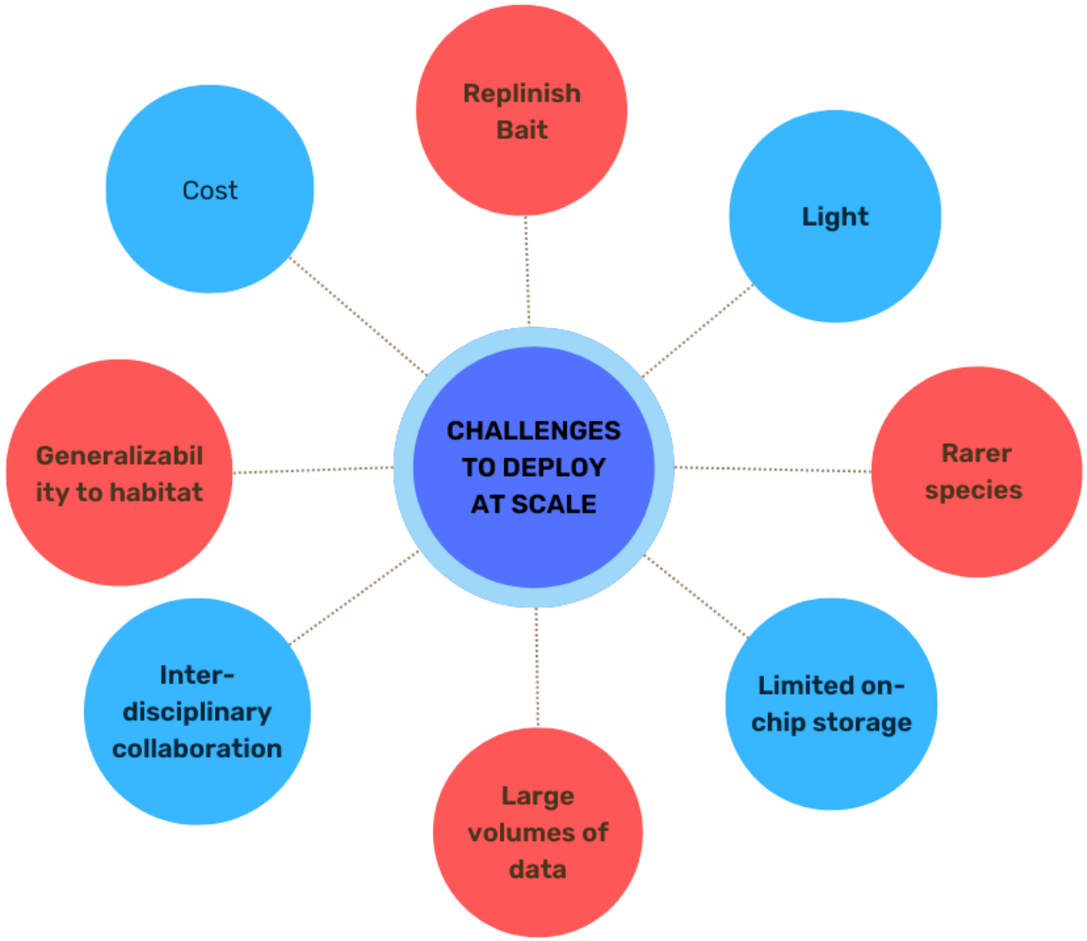
Photo realistic image of
Turbot
swimming under water
in low light

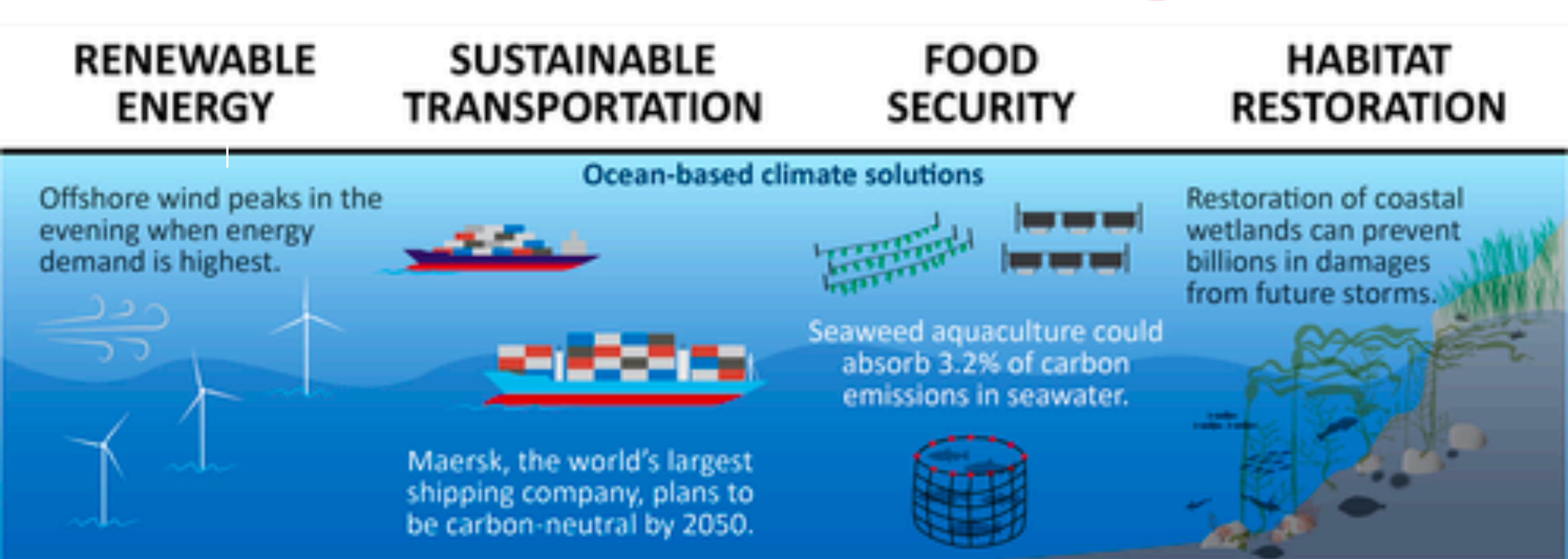
Text Prompt

Future work: Smoothing Labels and Counting fish



Conclusion


CHALLENGES TO DEPLOY AT SCALE
Replinish Bait
Light
Rarer species
Limited on-chip storage
Large volumes of data
Inter-disciplinary collaboration
Generalizability to habitat
Cost


RENEWABLE ENERGY
SUSTAINABLE TRANSPORTATION
FOOD SECURITY
HABITAT RESTORATION
Ocean-based climate solutions
Offshore wind peaks in the evening when energy demand is highest.
Maersk, the world's largest shipping company, plans to be carbon-neutral by 2050.
Seaweed aquaculture could absorb 3.2% of carbon emissions in seawater.
Restoration of coastal wetlands can prevent billions in damages from future storms.