

Newfoundland Marine Refuge Fish Classification Dataset (N-MARINE)

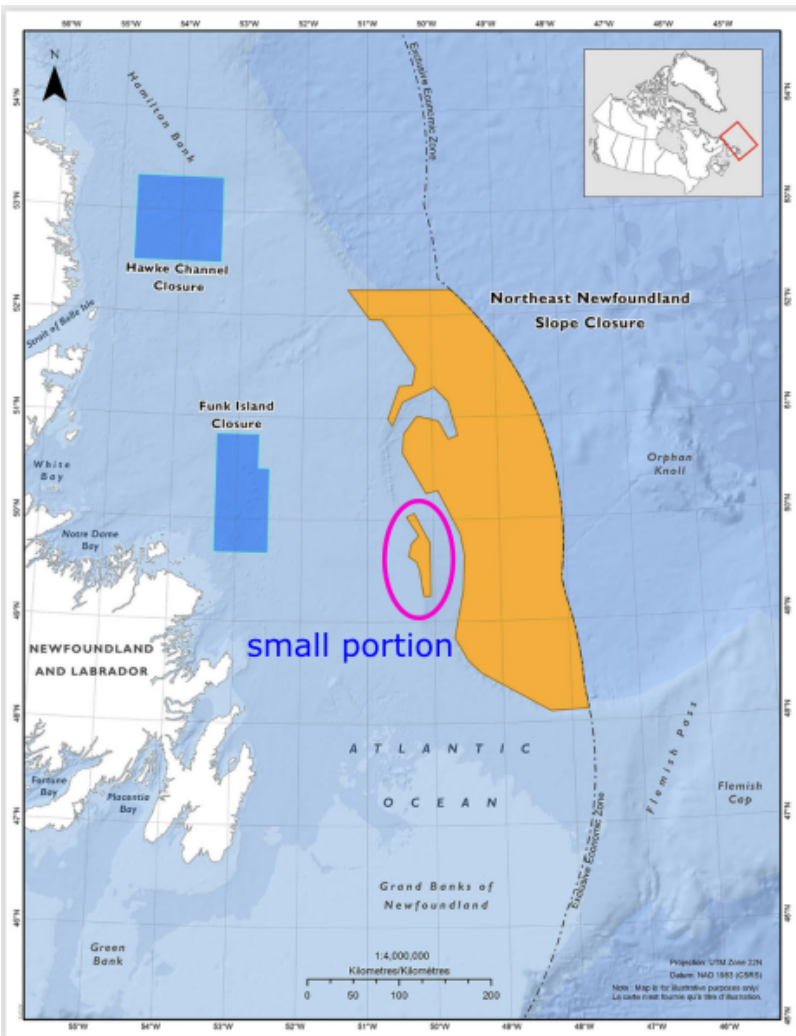
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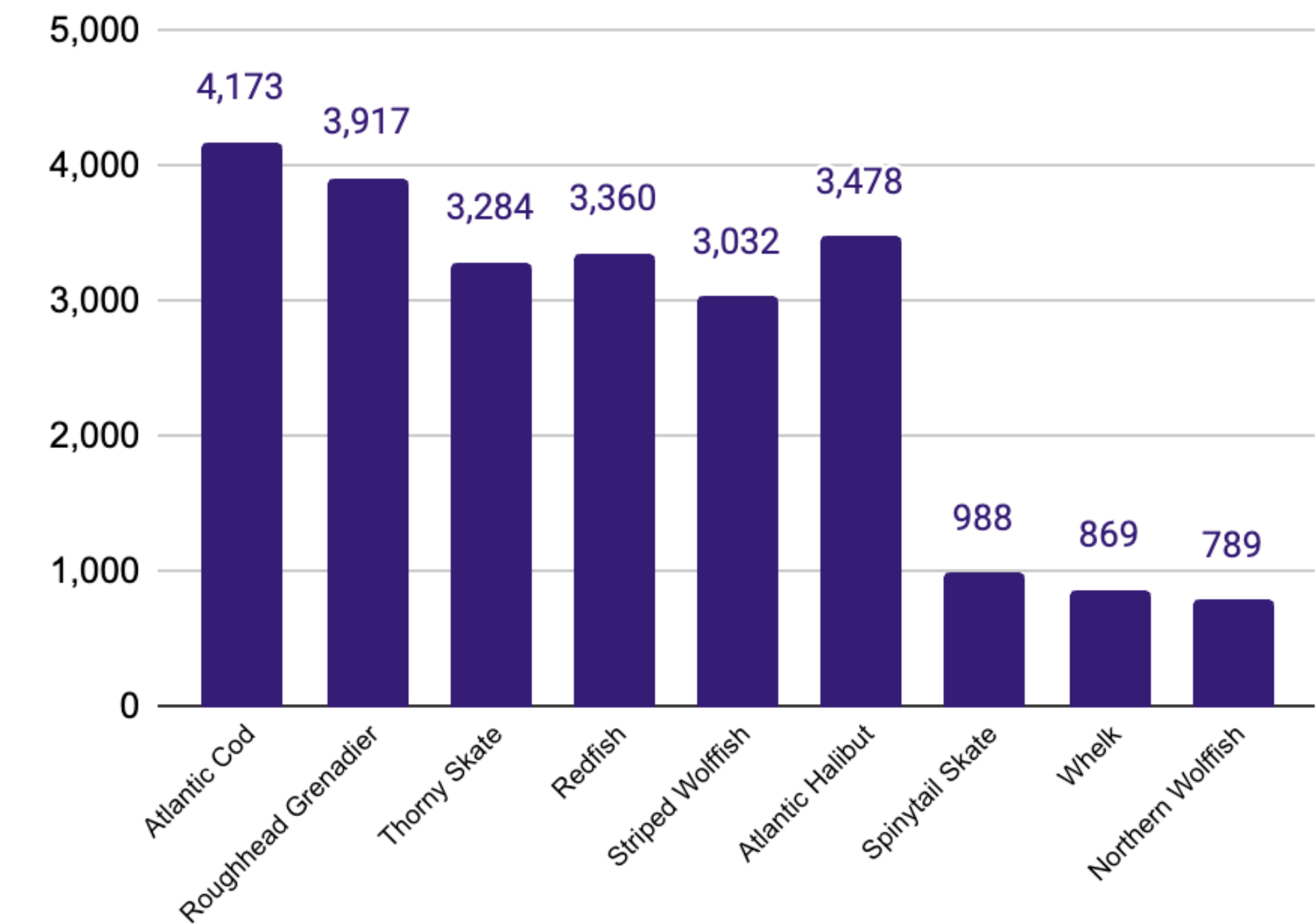
Dataset Description

N-MARINE is the first open-source North Atlantic underwater vision dataset designed for teaching and researching underwater vision marine AI. It contains 23,936 annotated frames across nine groundfish species, captured from 185 baited camera deployments (crab pots with light and underwater camera attached) at depths up to 500 m. Collected to assess the ecological impacts of seismic oil & gas exploration in a protected Newfoundland refuge, N-MARINE serves as a ready-to-use benchmark for deep-sea species detection in low-light, complex underwater conditions. To make the dataset accessible, we also publish YOLOv7 baseline ground fish detection models and curated dataset splits.

- **Location:** Northeast Newfoundland Slope Closure (450–500 m depth)
- **Collection:** 185 baited-camera videos (2021) — 30 fps, 5-min segments
- **Annotations:** 23,936 frames × 9 species labeled in VIAME[1] by DFO ecologist
- **Resolution:** 1920 × 1080 px (~30 GB total)
- **Purpose:** Benchmark for deep-sea monitoring, transfer learning, and model generalization



Species Distribution

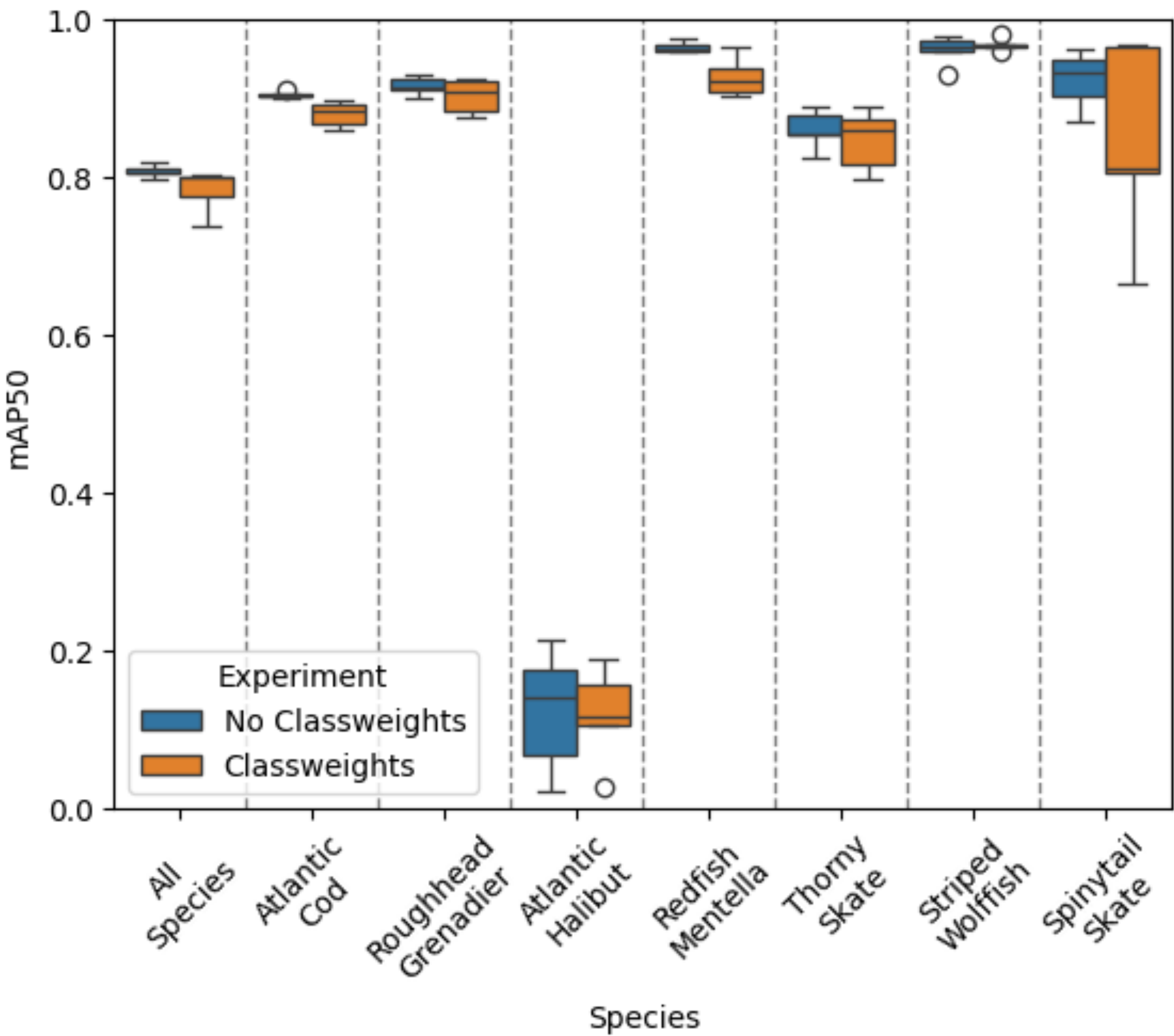


Baseline object detector(YOLOv7)

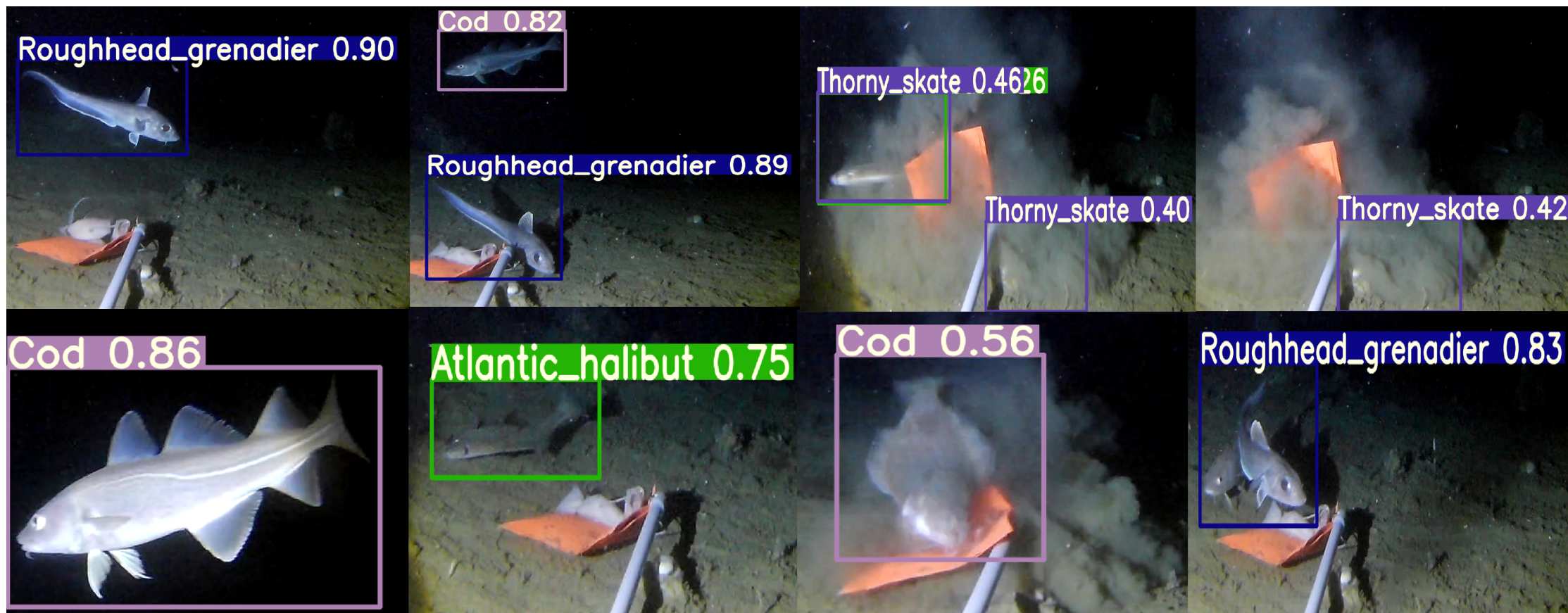
- Trained under fully supervised YOLOv7[2] marine ground fish detector
- **70/15/15** video-level train/valid/test split to avoid data leakage
- 5-fold cross-validation (video-stratified)
- YOLOv7 models trained with and without class weights with default repo parameters until convergence.
- Class imbalance handled using

$$\text{pos_weight}_c = (N - n_c)/n_c$$

Model	mAP@0.5	mAP@[0.5:0.95]
YOLOv7 (no weights)	0.808 ± 0.007	0.494 ± 0.008
YOLOv7 (+class weights)	0.784 ± 0.025	0.464 ± 0.020



Dataset and Model predictions



Example detections from the best YOLOv7 baseline on N - MARINE: columns 1–2 show correct detections; columns 3–4 show typical errors (misses and misclassifications)

Discussion and Outlook

- **Dataset imbalance and environmental variability are key bottlenecks.**
- Model generalization across sites will require domain adaptation, data augmentation, and active learning
- **N-MARINE** serves as a benchmark for developing scalable, non-invasive AI monitoring pipelines in the North Atlantic.

Key Takeaways

- First open-source **North Atlantic** underwater vision dataset.
- **23k annotated frames** across 9 species, video-level splits.
- YOLOv7 baseline mAP@0.5 = 0.808.
- Provides foundation for transfer learning, domain adaptation, and scalable monitoring.

References

1. Matthew Dawkins, Linus Sherrill, Keith Fieldhouse, Anthony Hoogs, Benjamin Richards, David Zhang, Lakshman Prasad, Kresimir Williams, Nathan Lauffenburger, and Gaoang Wang. An open-source platform for underwater image and video analytics. In 2017 IEEE Winter Conference on Applications of Computer Vision (WACV), pages 898–906, 2017.
2. Chien-Yao Wang, Alexey Bochkovskiy, and Hong-Yuan Mark Liao. Yolov7: Trainable bag-of-freebies sets new state-of-the-art for real-time object detectors. In Proceedings of the IEEE/CVF conference on computer vision and pattern recognition, pages 7464–7475, 2023.

Resources

Baseline
groundfish
detector



N-MARINE
Dataset



Digital Research
Alliance of Canada

Alliance de recherche
numérique du Canada

