

Powered by  **INNOVASEA**

HYDROAI

Massachusetts Herring Counting Workshop

March 12 | New Bedford, MA
Maine Division of Marine Fisheries



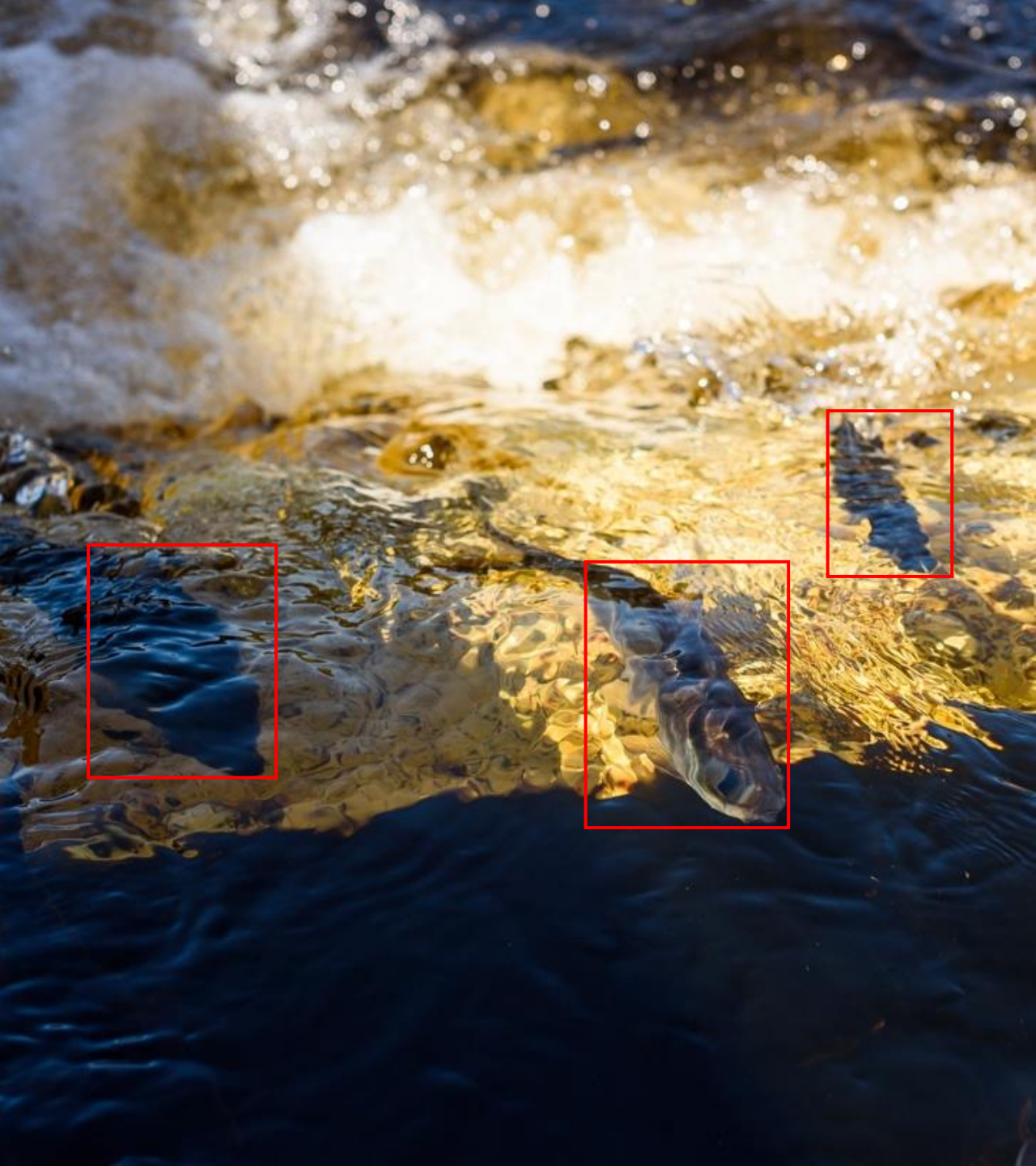
- 300+ employees worldwide
- Head Office in Boston
- Fish Tracking office and production facility in Halifax, Nova Scotia
- 30+ years in fish tracking and monitoring technology



Fish Counting Challenges

- Manual fish counting
- Imprecise sampling and extrapolation
- Tedious reporting
- Shutdowns and restrictions
- Limited data to share with stakeholders





HydroAI

High resolution video cameras with AI-powered, cloud-based software that provide accurate real-time fish counts and species identification.



Key Components

- **High-Resolution Camera(s)** capture 24/7 footage
- **Edge Device** sends footage to the cloud
- **AI Model** counts/identifies fish
- **Counts** available in real-time via web portal
- **Reports** that are easily exportable for stakeholders



New Brunswick Power, 2024



Cameras & Starlink Dish



New Brunswick Power, 2024



New Brunswick Power, 2024



HydroAI Testing and Validation



Nova Scotia Power, 2024

Nova Scotia Power Partnership

2021

- Started counting upstream migrating Alewife
- Paired HydroAI with acoustic telemetry studies

2023

- Custom camera mount "insert" created for Pool-and-Weir style fish ladder
- Three Additional systems added on Tusket River

2025

- HydroAI systems at 11 dams, 21 cameras
- Continue to pair HydroAI with acoustic telemetry
- ~4 million upstream Alewife at one site in 2025



Nova Scotia Power, 2023

Counting River Herring in a Fish Ladder

- Computer vision model identifies fish in the ladder
- Individuals are tracked frame to frame
- Counts are provided for upstream and downstream traveling fish



Nova Scotia Power, 2024



Temp = 55



White LED / Auto / W: 10% / Focus: 55 / T: 33



HydroAI Validation Using Manual Count

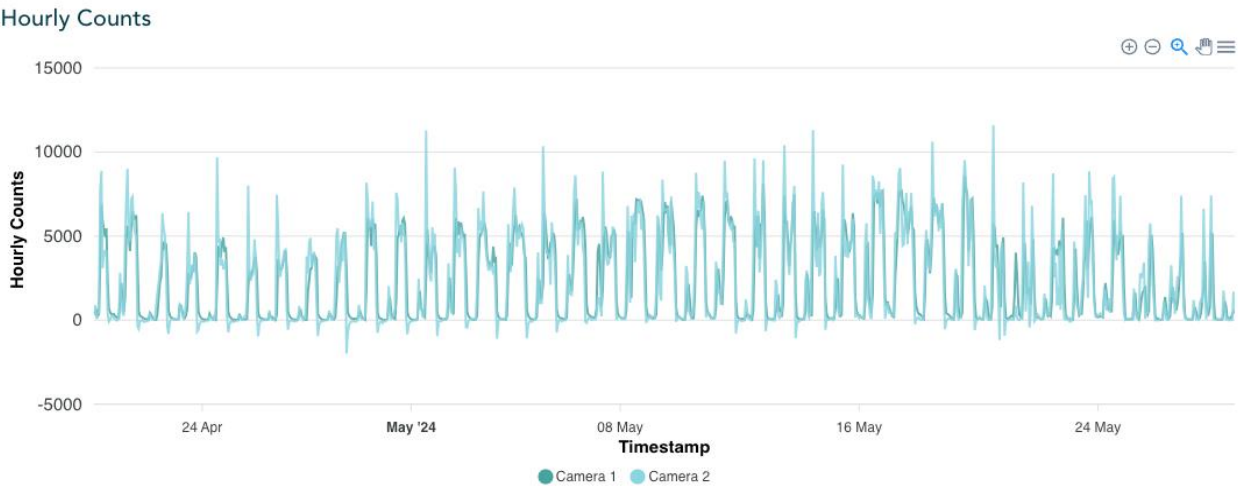
5,620 random samples from 2024 season

Human (Manual) Count	HydroAI Count
97,906 fish	97,990 fish

84 fish difference between manual counts and HydroAI system counts

Web Portal

- Count Summary Data across the full season.
- Real-time and cumulative counts
- Minute-level granularity
- Videos for any minute of the season available on-demand



Select a Date
05/09/2024

Daily Summary



Camera 1			Camera 2		
Upstream	Downstream	Net	Upstream	Downstream	Net
82725	701	82024	133149	31997	101152

Hourly Report

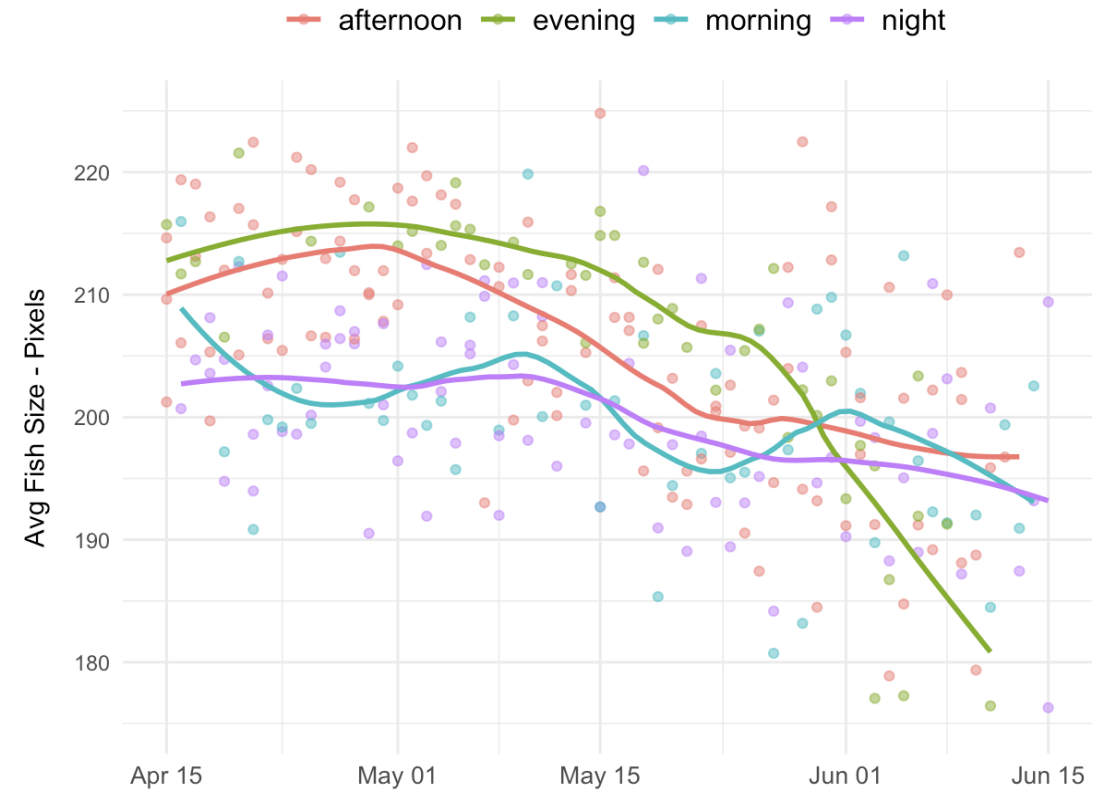
EXPORT

May 9, 2024		Camera 1		Camera 2	
Expand	Time Range	Upstream	Downstream	Upstream	Downstream
^	00:00 - 01:00	204	21	902	385
	00	3	0	10	2

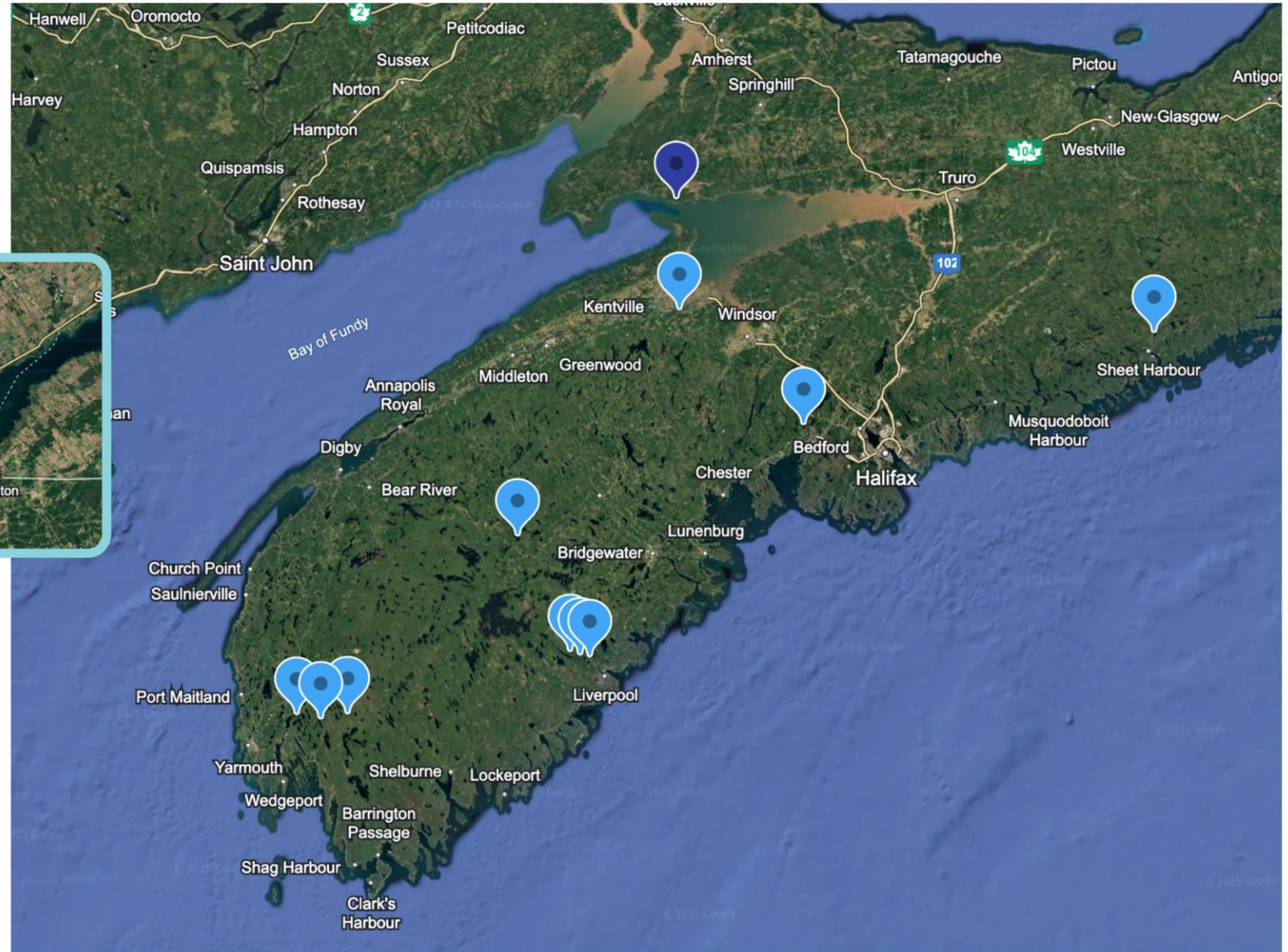
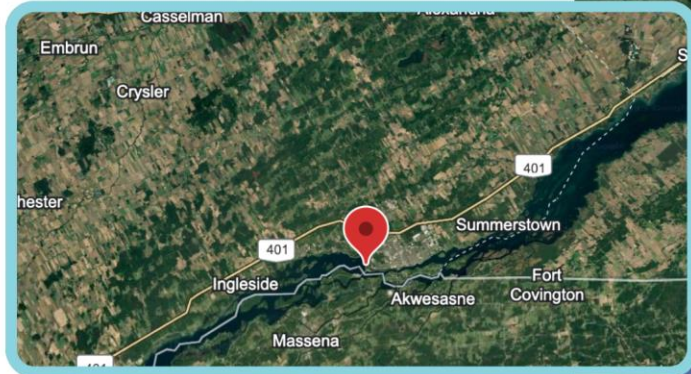


Examples of Insights from 24/7 Counting

- Fish per minute/minute level granularity
 - Day/night distribution
 - Peak travel times, days, weeks
- First/last fish of season
- Ladder efficiency
- Season-over-season comparison
- Flag unusual behaviour



Ontario



2024 Herring Run: Plimoth Grist Mill



Innovasea - Town of Plymouth Partnership

- Innovasea processed footage from 2022 & 2024 runs with HydroAI
- Benefits to Innovasea
 - Sideview camera dataset to learn, train our model
 - Partner to learn about local, state counting priorities
 - Build awareness for new technology
- Benefits to Plymouth
 - Increased efficiency, accuracy
 - Full-season fish count
 - Comparison for crowd-sourced counts
 - Richer data before/after restoration
 - Fine-tune volunteer counting window



2025 Plimoth Grist Mill Counts

- 2024 Herring Run
- Side-view camera
- Crowd-sourced online
- 10-second clips
- 175 hours of video
 - 100% of video counted using HydroAI
 - 15 % of video had manual counting



Town of Plymouth, 2024



Count Herring

- WELCOME
- INSTRUCTIONS
- CURRENT DATA
- START COUNTING

2024 Estimated Total Run (so far): 227,720 +/- 6,378 ⓘ

Video Recorded: 4/22/2024, 3:59:41 PM

FPS: 9.24 4/22/2024 2:59:43 PM



Enter Count

Jenney Grist Mill 2024 – HydroAI vs. Manual Counts

COUNTING SOURCE	COUNTED FISH IN SUBSET (5,306 VIDEOS)	COUNTED FISH TOTAL (36,684 VIDEOS)
Human/Manual	27,342 fish	-
HydroAI	29,525 fish	218,757 fish



2024 Plimoth Grist Mill – Speciation

- Fish-size algorithm detects 1,000 largest fish
- Biologist manual check of largest candidates
- Multi-species examples found on first pass
- Further AI-based speciation could be done based on physical traits
 - Colour
 - Patterns
 - Body/fin shape



Bluegil or Pumpkinseed



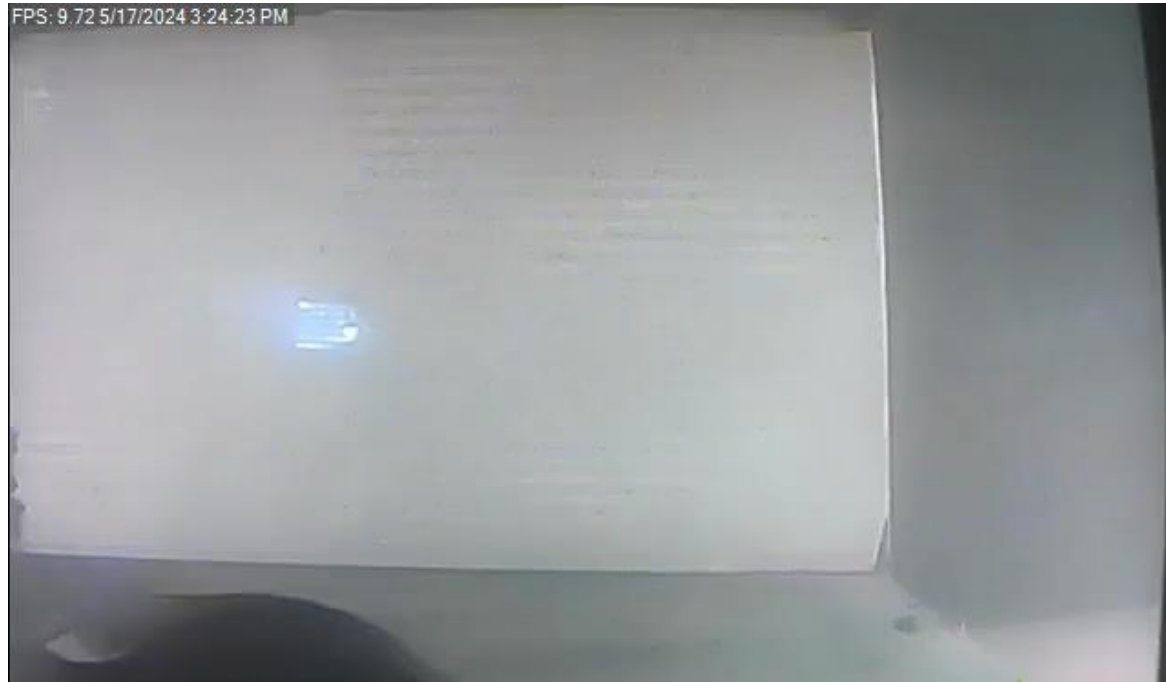
Salmonoid



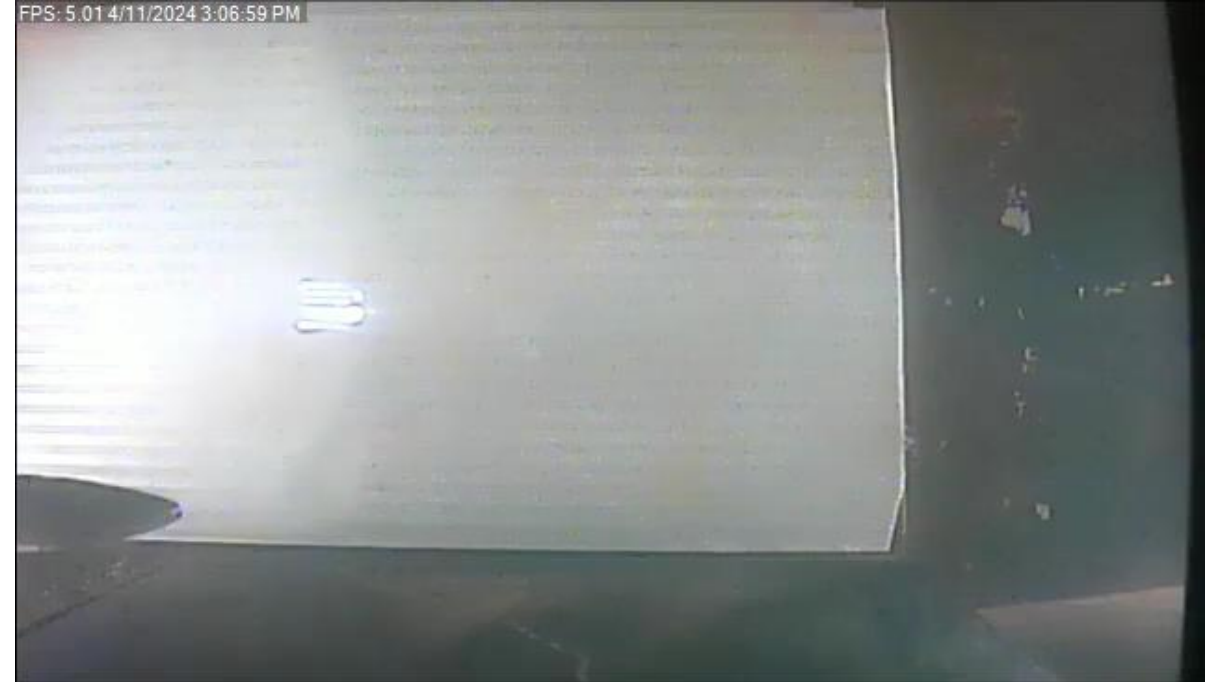
River Herring



Video Clips



Town of Plymouth, 2024



Town of Plymouth, 2024

Other Applications



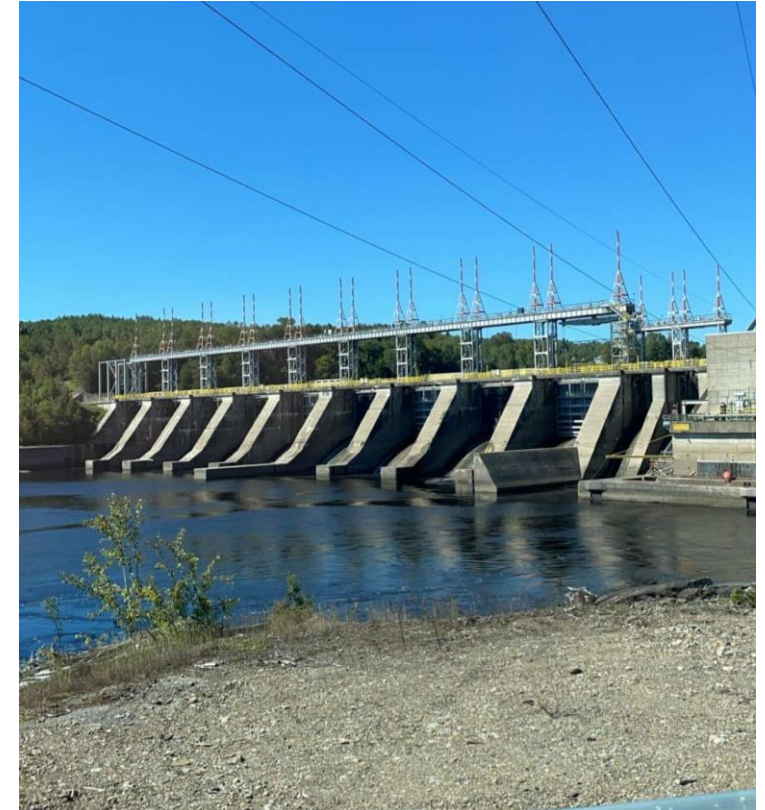
Salmon Passage

Counted salmon using different types of bypasses

- Beechwood Dam
 - 113 MW capacity
 - Upstream Fish lift/Elevator
- Tobique Narrows Dam
 - 20 MW capacity
 - Downstream bypass via collection tank
 - In water and out-of-water cameras



Énergie NB Power



Beechwood Dam, 2024







Clipped Fin?



Salmon Parr



Adult Salmon



Salmon Smolt

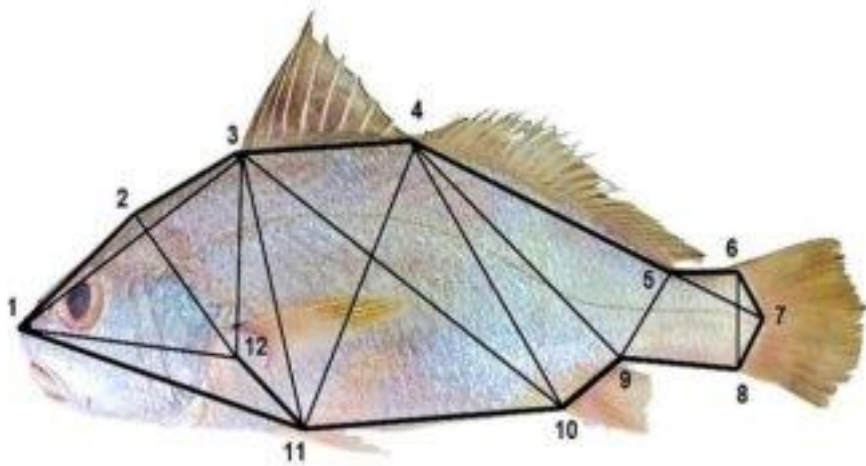


Striped Bass



Species Identification - Truss Keypoints

- Ratios and distance used to identify species
- Currently under development
- Adding new species in 2025



New Brunswick Power, 2024



Eel Passage

Ontario Power Generation

- Saunders Generating Station
 - Summer 2025
 - Optical cameras
 - Counting eels & sizing eels for aging
 - Using infrared lights to count at night
- Hosting "demo day" at Saunders dam to show HydroAI in action
 - 2nd week of September
 - Remote attendance, or in-person
 - Cornwall, Ontario



Moses-Saunders Power Dam



Eel Ladder, Saunders Dam, 2024



HydroAI at Remote Sites



HydroAI is currently deployed at several remote sites with no power access.

- **Starlink internet** used for all HydroAI applications
- **Solar power** installations used by Nova Scotia Power
- **Real-time and offline** options available



Open Ocean Application – 2025 Feasibility Investigation

- Deploying cameras in Minas Passage in 2025
- Fundy Ocean Research Center for Energy
- High flow
- Goal is to understand what level of speciation and counting is possible



Parrsboro, Nova Scotia, 2024



Service Delivery

- Counting and Speciation provided as a service
- 8-month or 12-month fish passage season
- Service includes:
 - Initial site visit
 - System installation
 - Support & Maintenance
 - Data Delivery via Web Portal

Additional costs for solar power and consulting services(if needed)



What's Next for HydroAI in 2025

- Model/speciation development
 - Salmon model
 - Keypoint Truss speciation model
- New Environments/Applications
 - Ontario Power Generation upstream eel trial
 - FORCE open ocean trial
- Nova Scotia Power
 - 4 new sites in 2025
 - Trialing new hardware



Questions?

Peter MacLeod

Peter.MacLeod@innovasea.com



Acknowledgements

