Electronic Monitoring Advancements in the Eastern Pacific Ocean

Developing baseline EM technical standards on longline and small class purse seine vessels, and mobilizing edge AI technology in electronic monitoring footage review.

Presentation agenda

1. **Electronic Monitoring Pilot on Small Class Purse Seine Vessels in Ecuador *(ECUAVESSEL / G.DEGFER)***
   - Project objective: to develop a baseline EM Technical Standard for Small Class PS in the Eastern Pacific Ocean (EPO).

2. **Pilot Plan for On-Board Monitoring (human and electronic) *(INCOPESCA)***
   - Project objective: to develop an onboard monitoring plan (human and electronic) with a baseline EM Technical Standard for Longline vessels in the EPO.

3. **Edge AI EM research on Costa Rica Longline *(TNC)***
   - Project objective: developed and deployed an AI-powered system that analyzes electronic monitoring (EM) footage of longline fishing activity directly onboard vessels, delivering near real-time insights that significantly enhance fisheries transparency.

4. **Benefits of EM *(TNC)***
   - Discussing the benefits of EM and possible recommendations to the EMWG.

Electronic Monitoring Pilot on Small Class Purse Seine Vessels in Ecuador

Alvaro Teran (TNC) and Luis Neira (EcuaVessel)

August 2025

Partners:

Vessels:

- 3 Purse Seiners (32, 44 and 46 meters in lenght)

Pilot Goals:

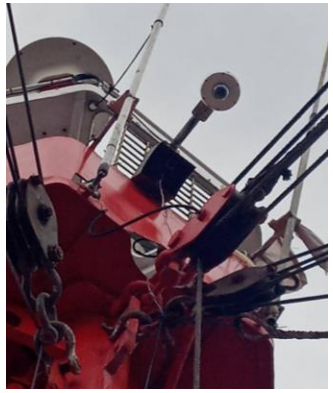
- To compare quality and effectiveness EM data vs HO data on 1 PS
- To develop EM Technical standards for this category of PS

Project Status:

- EM hardware installed on 3 vessels (1.5 years of data collected)
- Project is increasing its scope:
  - FAD characterization and ID
  - Shark BHP verified by EM

Aligned with IATTC Standards

The Vessels and their hardware (Satlink)



Vessel Name	Amalis	Joselito	Ariete
Length (m)	44.05	32.56	46
Fish Hold Volume (m3)	340	220	493
Carrying Capacity (tons)	289	211	434
Human Observer	NO	NO	YES
Electronic Monitoring	YES	YES	YES
Annual catch (tons)	1100	1400	2800

Direct Benefits: MSC Certification and VOSI List

Vessel Name	UVI Number	UVI Type	FAD buoy position data	FAD echosounder biomass data	Electronic Monitoring	In a FIP?	In an ITM?	In an MSC-Certified Fishery?	Initiative Type	Initiative Name
JOSELITO	8212415	IMO#	✓	✓	✓			✓	MSC-certified	Eastern Pacific Ecuador Purse Seine Tropical Tuna Fishery (FSC and FAD set fishery)

Vessel Name	UVI Number	UVI Type	FAD buoy position data	FAD echosounder biomass data	Electronic Monitoring	In a FIP?	In an ITM?	In an MSC-Certified Fishery?	Initiative Type	Initiative Name
AMALIS	8800808	IMO#	✓	✓	✓			✓	MSC-certified	Eastern Pacific Ecuador Purse Seine Tropical Tuna Fishery (FSC and FAD set fishery)

Vessel Name	UVI Number	UVI Type	FAD buoy position data	FAD echosounder biomass data	Electronic Monitoring	In a FIP?	In an ITM?	In an MSC-Certified Fishery?	Initiative Type	Initiative Name
ARIETE	9212280	IMO#	✓	✓	✓			✓	MSC-certified	Eastern Pacific Ecuador Purse Seine Tropical Tuna Fishery (FSC and FAD set fishery)

Pilot Plan for On-Board Monitoring (human and electronic) Costa Rica

Jose Miguel Carvajal

August 2025

Partners:

Vessel:

- 1 longliner (22mts)

Pilot Goals:

- To compare quality and effectiveness EM data vs HO data
- To develop EM Technical standards for this category of LL

Project Status:

- EM hardware installed on vessels (4 months of data collected)
- Human Observer data collected an in process of digitalization
- 1st Project meeting being organized for October 2025

Aligned with IATTC Standards

Human Observer data

Data of travel: March to May, 2025
Number of fishing days: 93 days
Effective fishing days: 52.7 days
Number of sets: 31 sets

Retained catch

Mahi-mahi (*C. hippurus*)
Swordfish (*X. gladius*)
Blue marlin (*M. nigricans*)
Striped marlin (*K. audax*)
Blue shark (*P. glauca*)
Silky shark (*C. falciformis*)
Bull shark (*C. leucas*)
Bigeye thresher shark (*A. superciliosus*)
Pelagic thresher Shark (*A. pelagicus*)
Indo-Pacific sailfish (*I. platypterus*)
Wahoo (*A. solandri*)
YFT (*T. albacares*)

Catch released or not retained

Dolphin unidentified (Delphinidae)
Manta rays (*Mobula* spp)
Giant manta (*Mobula birostris*)
Oceanic whitetip shark (*C. longimanus*)
Longtail stingray (*Hypanus longus*)
Smooth hammerhead shark (*S. zygaena*)
Scalloped shark (*S. lewini*)
Olive ridley turtle (*L. olivacea*)
Black/Green turtle (*C. mydas agassizii*)

Electronic Monitoring Data and Review Framework

Trip #1: March to May, 2025
Number of fishing days: 93 days
Effective fishing days: 52.7 days
Number of sets: 31 sets

Review done by Bureau Veritas:

- Vessel has 3 cameras on board
- 100% of fishing operations
- Review components:
  - Set and haul (date, lat&long, duration)
  - Catch and discard data (species data, fate, condition, BHPractices, measurements, hook type, sex and comments) .

Advancing Industrial Fisheries Innovation:

Mobilizing edge AI technology in electronic monitoring footage review

Presenters: Alvaro Teran and Vienna Saccomanno (TNC)

Partners: FSP, INCOPESCA, Tryolabs, Thalos, Deckhand, CVAT, and Bureau Veritas

August 2025

EDGE INNOVATION

Innovative Tech Solution

- **Compatible** with IATTC EMS Interim Minimum Standards
- **Better technology is needed** to flag possible IUU fishing activity in EM footage before vessels return to port
- Edge computation refers to the deployment of **AI models directly on local computer processors** close to where data gets collected *(i.e., on vessels)*
- **Edge enables real-time EM footage processing and analysis** without reliance on cloud or shore-based infrastructure.

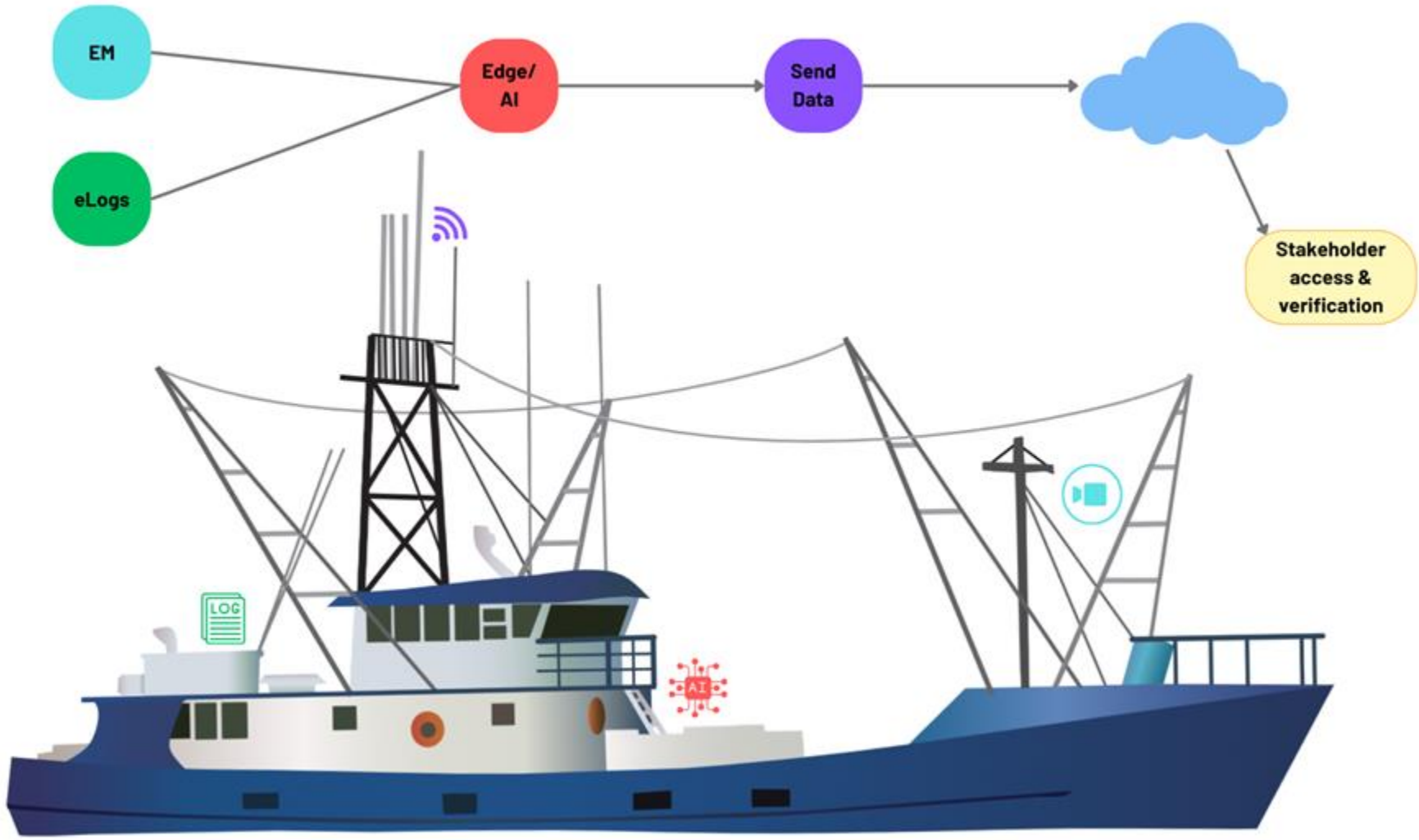
EDGE INNOVATION

TNC's Edge AI Objective

We aim to **develop a repeatable, edge-based EM footage review system that provides near real-time, verified information on the sustainability of a vessel's catch** *before* products enter global supply chains.

EDGE INNOVATION

Edge proof-of-concept visual

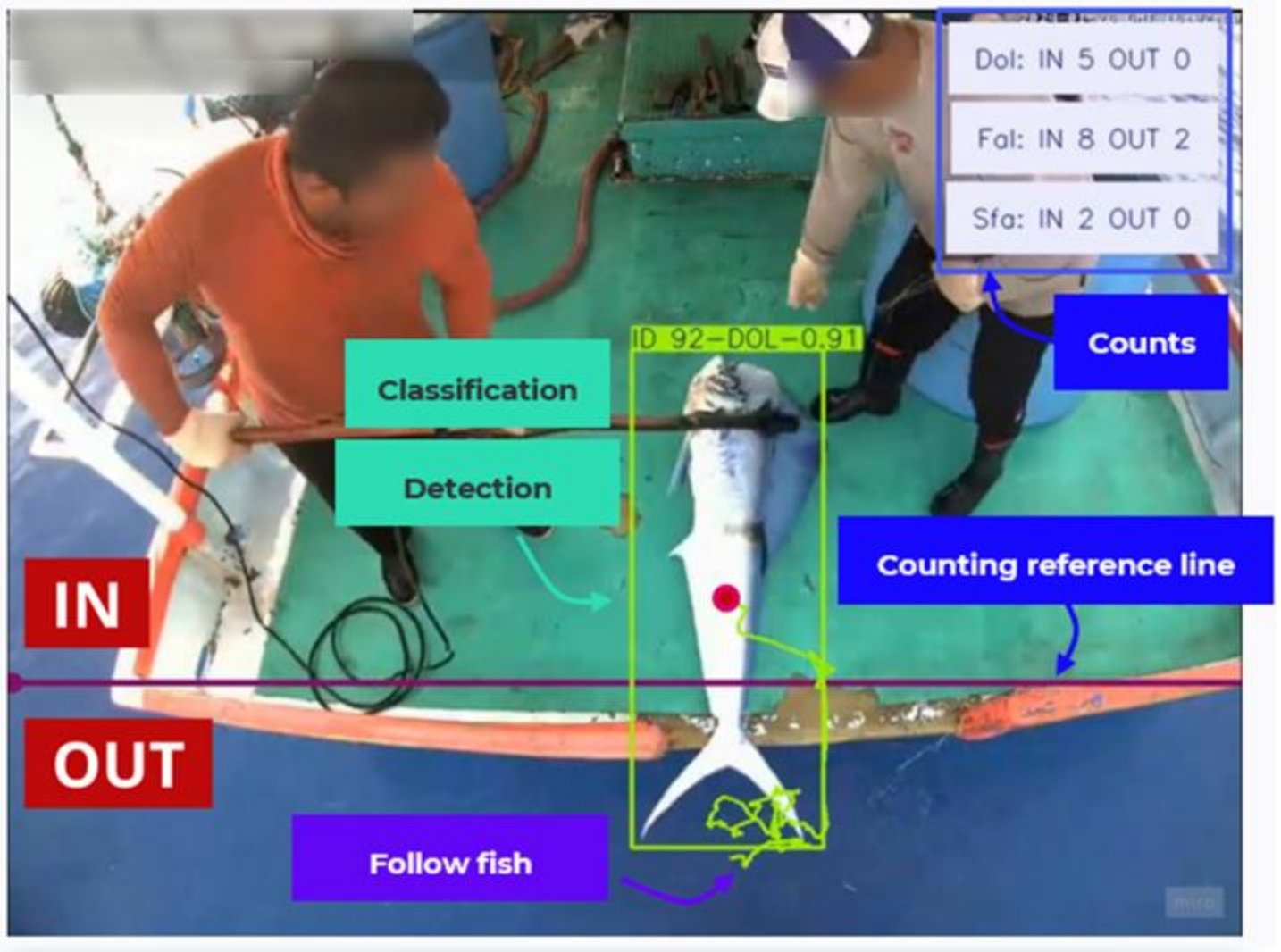


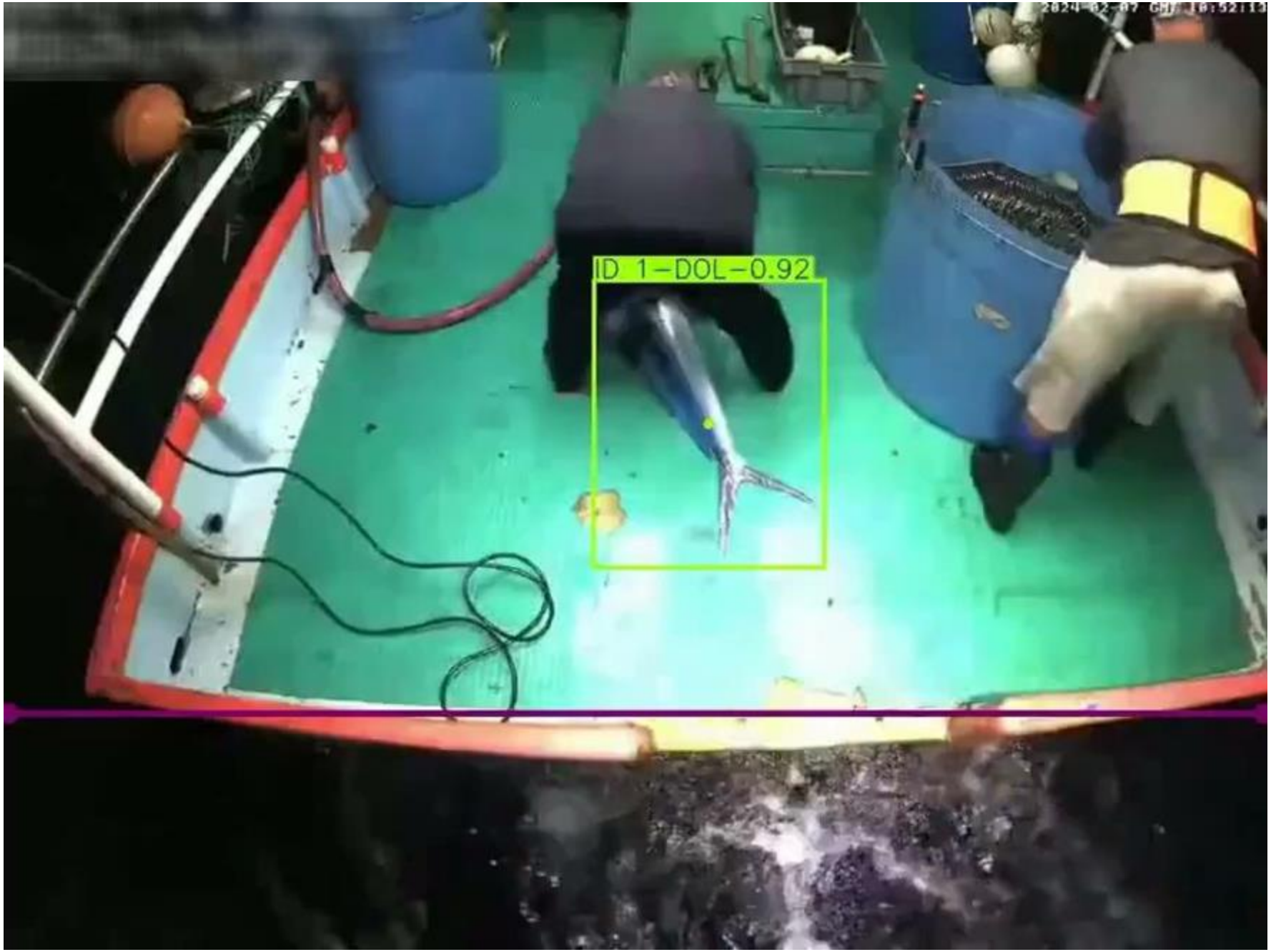
EDGE INNOVATION

AI Model & Model Components

YOLO 11m Object Detection Framework

- Fish Detector
- Fish Tracker
- Fish Counter

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EDGE INNOVATION

Model Performance

			Count								
Icon	Class	Event	GT	Pred	TP	FP	FN	Precision	Recall	f1-score	Error
	CATCH	IN	140	142	132	10	8	93%	94%	94%	1%
	CATCH	WATER DISCARDS	33	46	20	26	13	43%	61%	51%	39%
	CATCH	VESSEL DISCARDS	5	15	2	13	3	13%	40%	20%	100%
	CATCH	RETAINED	135	127							5%

Model: Final model | Test set: Final test set (6 haulings) | Icons: Tryolabs - M&D Team

GT = groundtruth count from EM analyst
Pred = model's predicted catch count
TP = count of model's true positive predictions
FP = count of model's false positive predictions (i.e. counted a fish that wasn't there)
FN = count of model's false negative predictions (i.e. missed a fish that was there)

EDGE INNOVATION

Daily Report & Risk Profile

DATE | 2025-06-02

Daily Report

Summary | Aggregated Risk Score | Catch Sequence | GPS Locations of Catches | Additional Information

Summary

Total Catches Retained
Catches that were caught and retained
10

Total Catches Discarded
Catches that were caught and returned to the water
3

Total Discards from Water
Catches that were discarded from the water
0

Risk Score
Weighted risk score of the day
1.71

Aggregated Risk Score

Risk Category	Value	Risk
Elog Risk	3	High Risk
Model Underprediction Risk	3	High Risk
Illegal Species Risk	1	Low Risk
GPS Location Risk	1	Low Risk
Overall Risk	**1.71**	

EDGE INNOVATION

Daily Report & Risk Profile

Catch Sequence

Export Table to CSV | Export Evidence Frames

Species	Event Type	Confidence	Time	Evidence
Yellowfin tuna	IN	80%	04:22:34	
Yellowfin tuna	IN	84%	05:00:31	
Common dolphinfish	IN	23%	05:28:59	

Benefits of EM

100% Continuous Coverage

In most fisheries, human observers are deployed on a portion of fishing trips. A boat with EM has cameras running nonstop – deterring IUU and other illicit activities.

Cost Effective

Ex. To install EM systems on all EU vessels >10m (18,735 vessels) and complete 10% data review, cost is $111 million/yr – compared to $743 million/yr. for the same coverage with the human observer program.

Drive Compliance

Following the passing of the 2018 Discard and Bycatch Law, EM was attributed with helping to reduce the discard rate from 35% to less 1% in the Chilean hake fishery in 3 years.

Better, Verified, And Timely Data

More and improved data helps scientists and fisheries managers better understand the status of fish stocks, assess the impact of fishing activities on bycatch, and monitor the effects of climate change on fisheries.

Market Access

Help fisheries secure certificates (MSC, FIP) or import control requirements by demonstrating compliance with management measures, monitoring and data collection requirements, and other obligations

Reduce Supply Chain Risks

Increase confidence to both businesses and consumers that seafood products have been harvested legally, sustainably and without labor abuses.

Thank you/Gracias!