Alaska's Electronic Monitoring Programs

National EM Workshop – February 2020

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Electronic Monitoring in Alaska's Groundfish and Halibut Fisheries

- EM systems for compliance

- EM systems for catch accounting

- Intelligent Monitoring Systems (IMS) in development

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Fisheries Monitoring in Alaska

Full Coverage

- 100% Observer coverage
- Observers **combined with:**
  - VMS
  - At-sea Flow Scales, and
  - **Video for compliance monitoring**

Funding:
- Monitoring Costs Paid Directly by Industry

Scope:
- 159 vessels; 3,400 trips
- 36,729 observer days

Partial Coverage

- Vessels either:
  - in Observer Selection Pool **or**
  - opt into **EM Selection Pool**
- Random deployment of observers or EM
- Deployment rates set thru Annual Deployment Plan

Funding:
- Industry Fee pays for observer deployment and (eventually) EM

Scope:
- ~600 vessels; 5,400 trips
- 3,783 observer days

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Full Coverage – longline & trawl catcher processor vessels

65 vessels 110'-365' Length

Primary Objective: monitor compliance

Observers on boat or in processing plant for all trips and deliveries.

Video for compliance monitoring

- **At-Sea Scales** weigh all/most catch at-sea. Video monitoring evaluates scale tampering.
- **Bin monitoring** ensures no pre-sorting prior to observer sampling.
- **Salmon monitoring** ensure observers can sample salmon for prohibited species catch limits.
- **Halibut deck sorting** ensure observers are present if desk sorting and can sample halibut for prohibited species catch limits.

Successes, Challenges, Upcoming Changes

- Mature, single-objective EM program

- Combined with existing observer program to enhance observer data quality

- Relatively low cost because review is done randomly or when deemed necessary through observer reports

- Expansion of EM systems for deck sorting compliance

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Partial Coverage – "small" fixed-gear vessels

Primary Objective: catch estimation

📹 EM for catch estimation

- **Vessels chose** to have EM instead of observers.

- **EM provides catch** and discard information

- **Trips** are randomly selected for monitoring.

- **Data collected** from EM used together with observer data to estimate catch of entire partial coverage fleet.
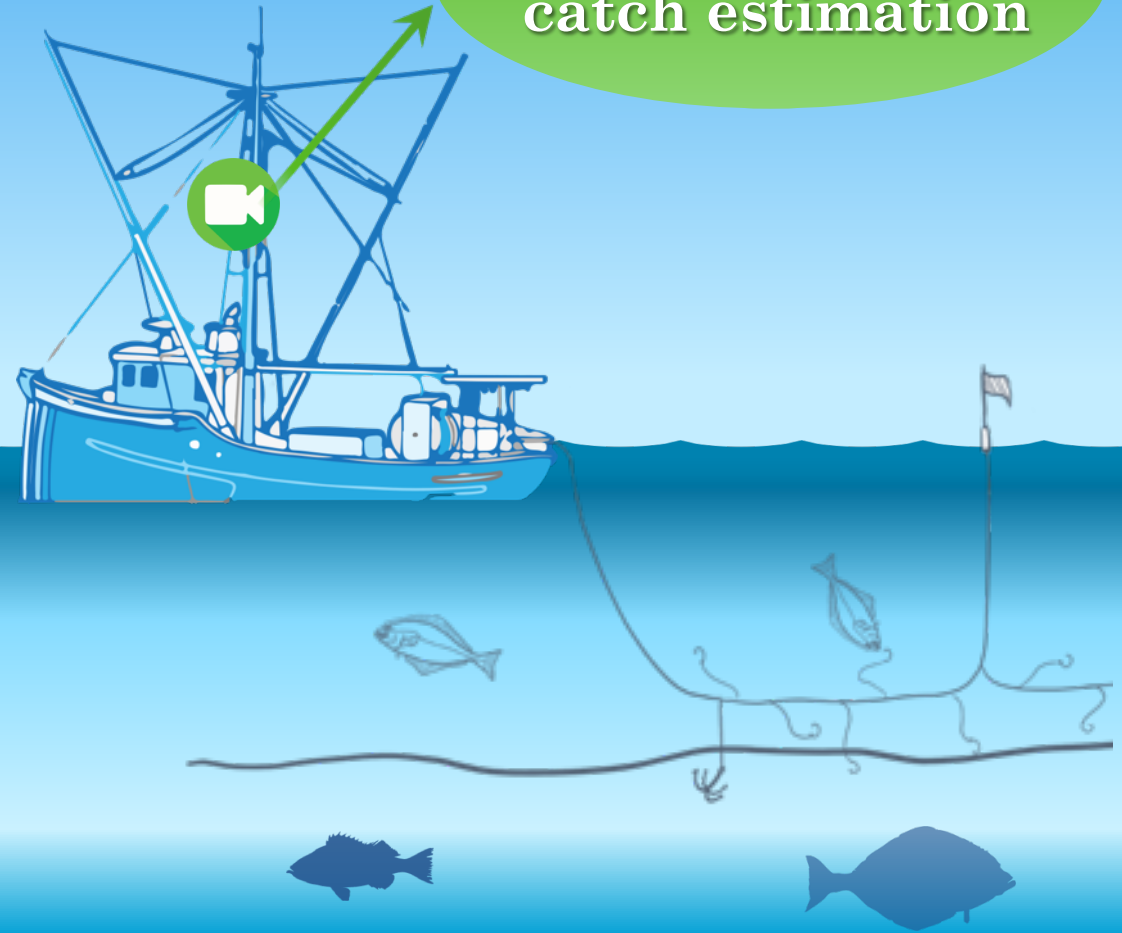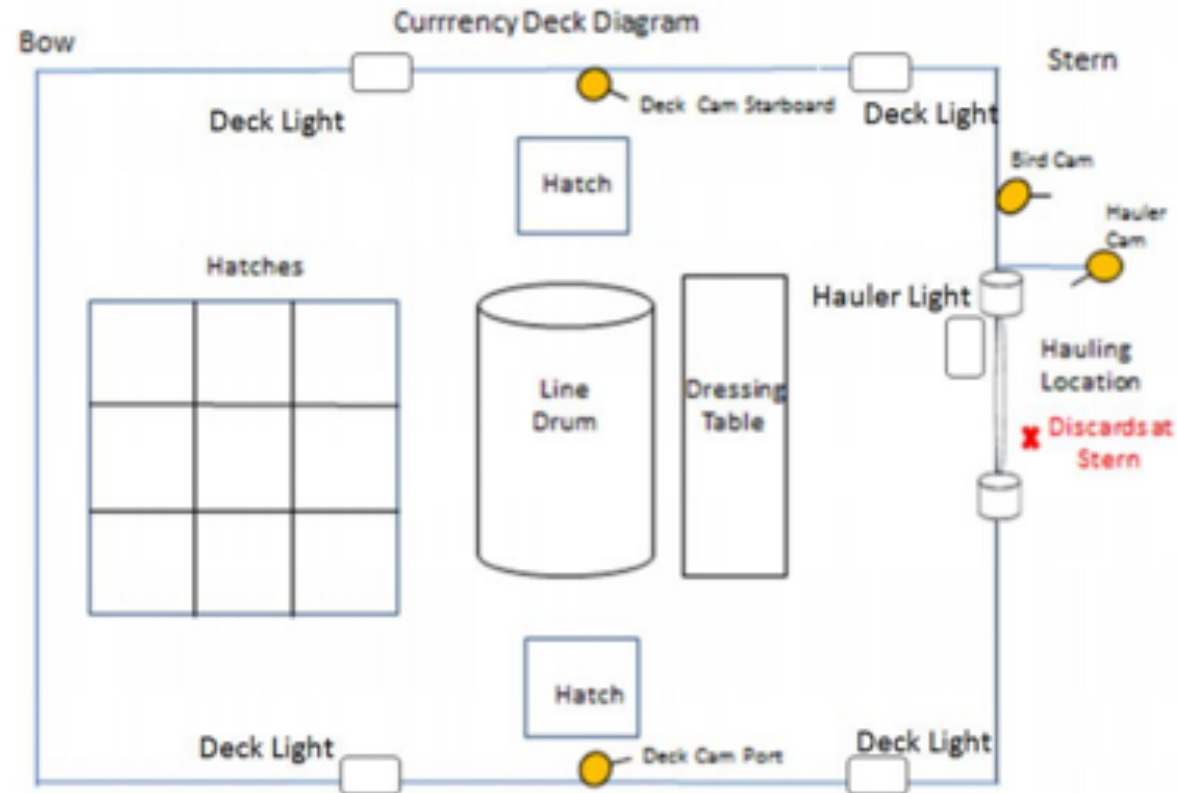
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EM on small fixed gear vessels

- 172 (out of 641 eligible) fixed gear vessels > 40ft volunteered in 2019

- 155 have approved Vessel Monitoring Plans (VMP's).

- Mix of Longline and Pot catcher vessels; primarily Longline vessels.
  - ~254 randomly selected EM trips (8/22/19)
  - ~17 EM non-randomly selected EM trips. (8/22/19)
  - EM coverage at 30%.
  - Targets are IFQ halibut, IFQ Sablefish, and Pacific Cod.

- Vessels mails hard drives to Pacific States Marine Fisheries Commission (PSMFC). They review and annotate the video, log data issues, and send the catch event data to FMA.

- FMA does initial QA/QC on data, requests feedback when needed, and translates the EM data to format required by Alaska Region and Office of Law Enforcement.

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Deck Diagram

Currrency Deck Diagram

Bow — Stern

Deck Light · Deck Cam Starboard · Deck Light

Hatch

Bird Cam

Hauler Cam

Hatches

Hauler Light

Line Drum · Dressing Table

Hauling Location

X Discards at Stern

Hatch

Deck Light · Deck Cam Port · Deck Light

Catch Handling Description

Catch will come onboard via the stern hauling location and retained catch will be placed on the dressing table or port or starboard side checkers for processing. Discards will occur at the stern hauling location.

2019-2020: Improving fixed-gear EM data quality

- Industry, reviewers, OLE, quota managers: *ALL* users need to know the true impacts of data issues
  - *Example*: if the cameras have water on the lens, entire catch events may be un-reviewable. Data in Catch Accounting default to the 'next best available level'.
- Reviewers and EM providers log issues so we can better quantify these situations.
  - Issues are directly linked to catch events and logged trips in the database
- 2019: Improved timeliness of data turnaround:
  - ~1 month from catch-event-to-catch-accounting (~3 months in 2018)
- Improved integration/utilization into Catch Accounting

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Successes, Challenges, Upcoming Changes

- Stakeholder support – required for a voluntary program

- Combining EM collected information with observer information for a robust monitoring program for Catch Accounting

- Identifying best monitoring tool for vessel profiles: observers or EM?
  - Maximizing cost efficiency while minimizing data gaps

- Cost efficiencies yet to be fully realized

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Pilot Program: Partial & Full Coverage – Pollock pelagic trawl vessels

Primary Objective: monitor compliance

Observers in processing plants randomly sample deliveries to collect catch & biological data.

Video for compliance monitoring

- **Video monitoring** to ensure retention (few discards).

- **Vessels chose** to have EM on their boats instead of observers.

Intelligent Electronic Monitoring: Project Goals

- Develop **intelligent monitoring systems (IMS)** that support **machine learning**

- Systematically improve monitoring system functionality and reliability to offer potential solutions

- Different than the standard camera systems used for typical surveillance systems

- Focus in machine vision cameras deploy for visual detection (agriculture, factory QA/QC etc.)

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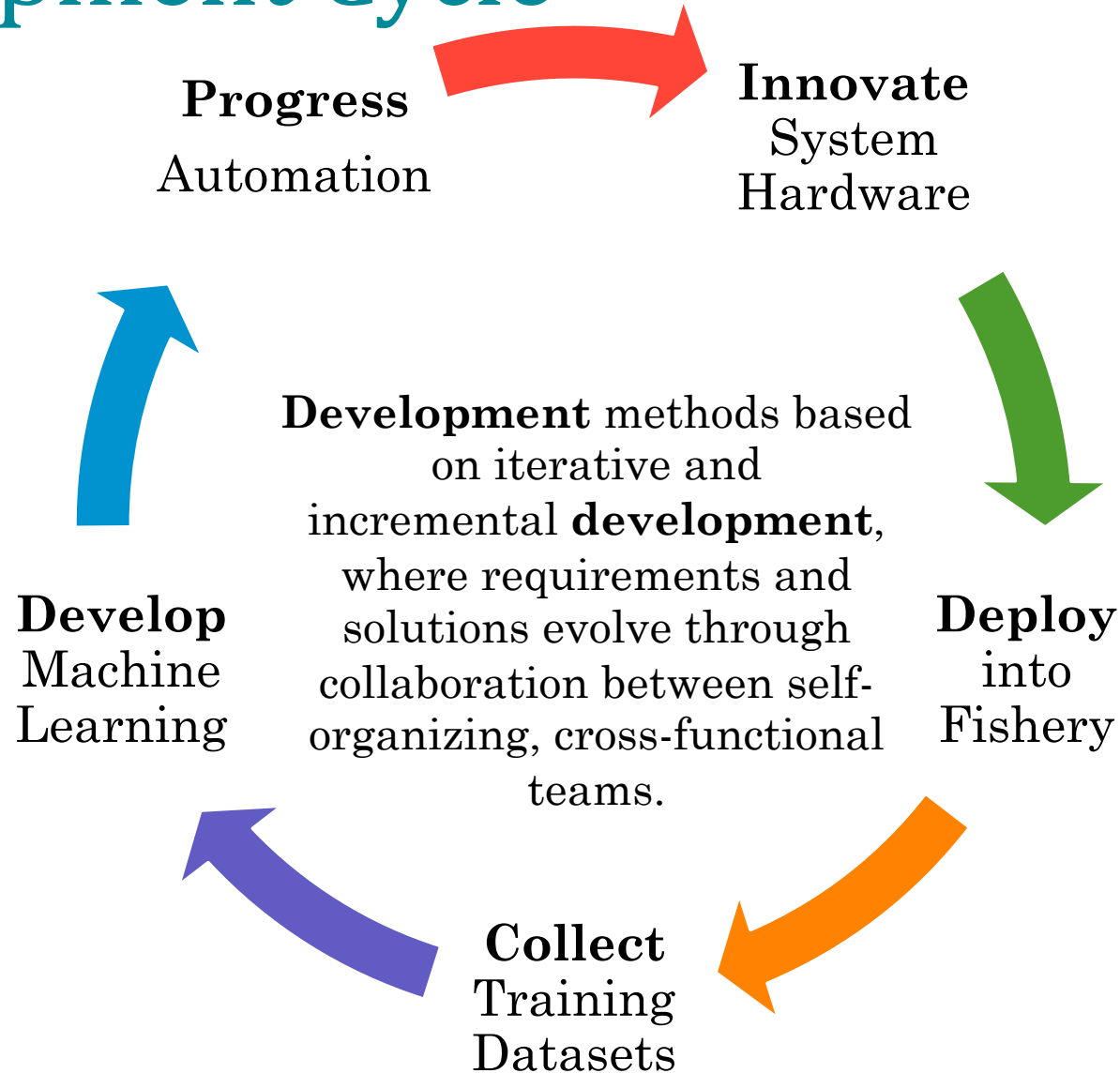# IMS: Specific Project Goals

- **Automate image** processing so only relevant images are saved in real time.

- **Automate sensor** processing to identify hauls (effort)

- Automate processing of saved images:
  - Determine **image quality**
  - Provide **catch count**
  - Measure **length (weight)**
  - Identify **species**
  - Provide **disposition**

- **Automate transmission** of data and system health (satellite)

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Iterative Development Cycle

Progress
Automation

Innovate
System
Hardware

Develop
Machine
Learning

Development methods based on iterative and incremental **development**, where requirements and solutions evolve through collaboration between self-organizing, cross-functional teams.

Deploy
into
Fishery

Collect
Training
Datasets

Agile Product Management

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IMS testing/annotation progress

- **Stereo Rail Camera Systems:**
  - deployed on 6 vessels in 2019
  - UW created a program called LabelTrack that is showing promise

- **Salmon Identification Chute:**
  - Used to identify salmon to species
  - Final goal is to use in conjunction with the salmon detector in plants.

- **Halibut sorting chute:**
  - currently deployed on F/V Arica

IMS testing/annotation progress

- ## *Codend Volumes:*
  - Replica cod ends were made with a known volume and dragged in front of stereo cameras.
  - Aim is to accurately collect volume of cod ends.

- ## *Birds*
  - Birds collected by observers have been photographed in the multi-spectrum chute and on the rail stereo system
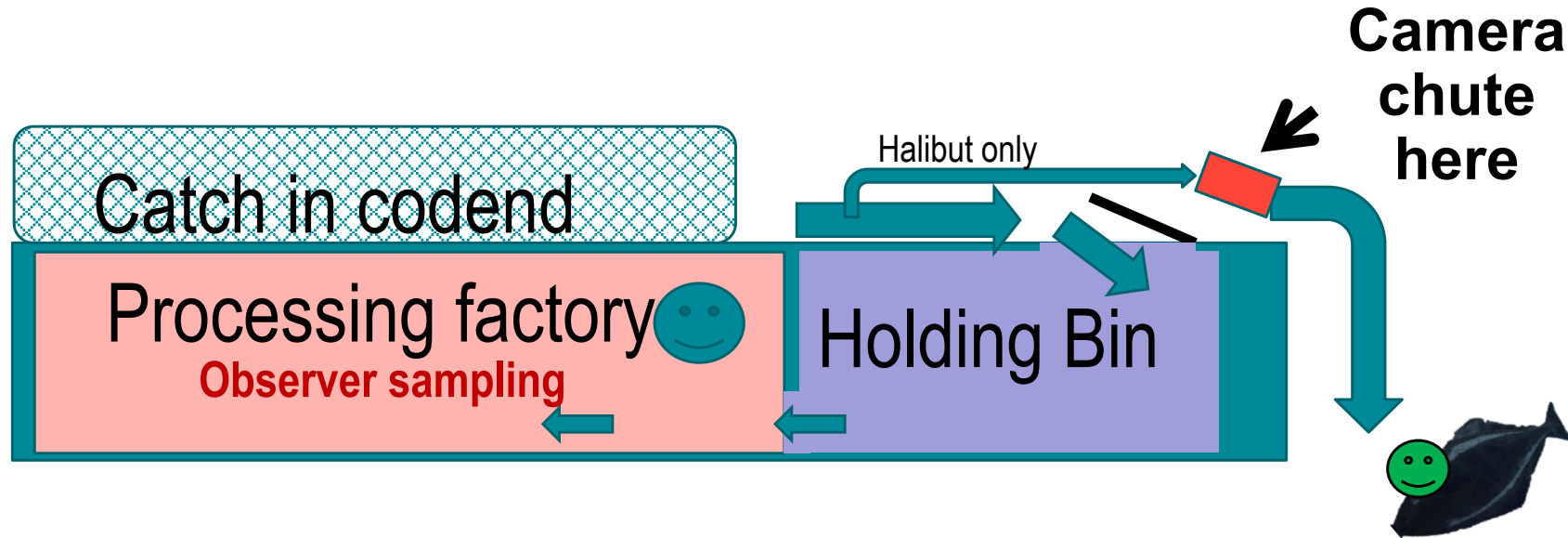
- ## *Rougheye/Shortraker/Blackspotted RF:*
  - Images collected in multi-spectrum chute
  - Genetics taken of each specimen and used to train the program
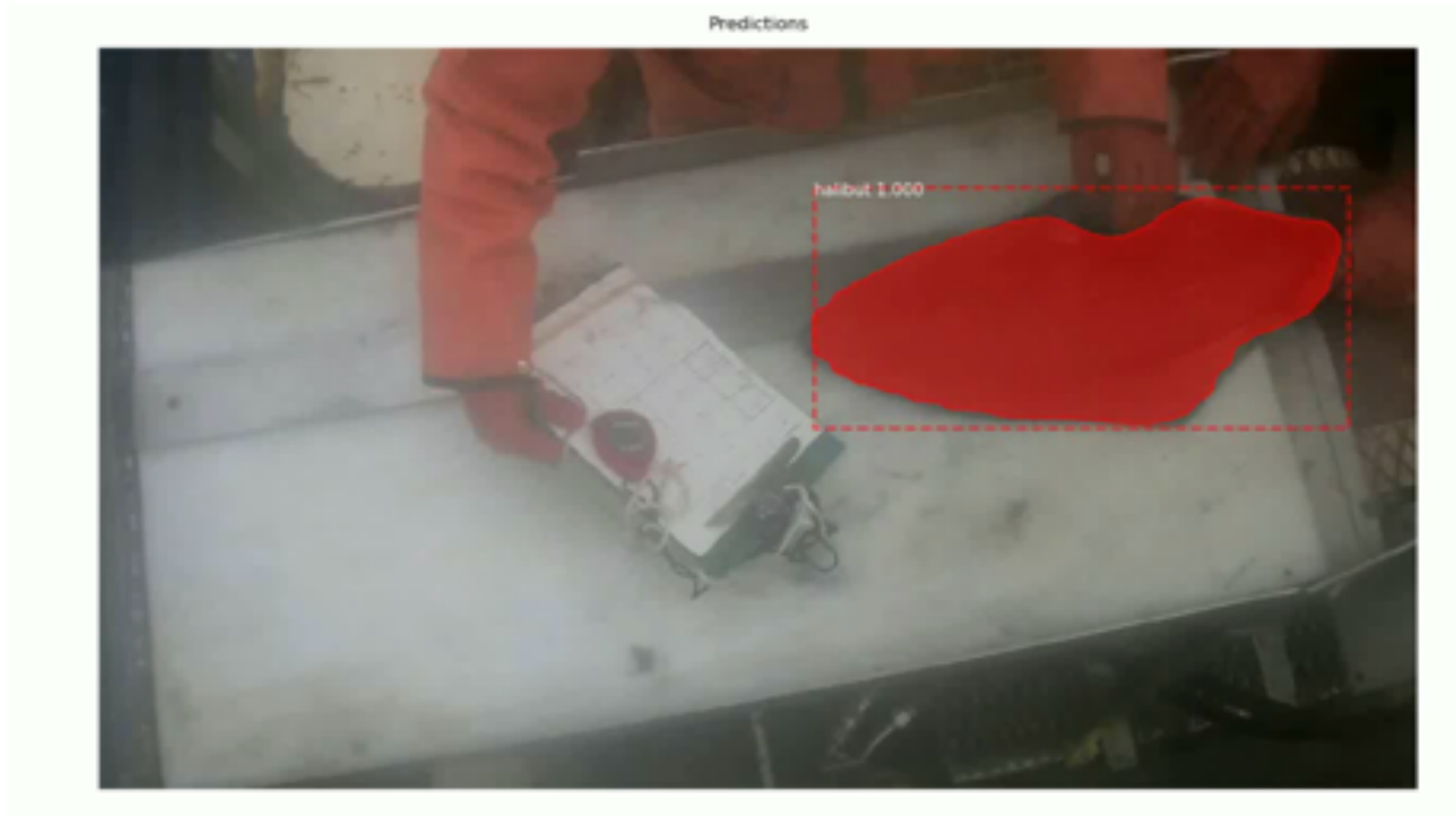 - Results have been promising
  - More data will lead to higher accuracy

Chute IMS systems for Halibut Deck-sorting on CP trawlers

Camera chute here

Catch in codend

Processing factory

Observer sampling
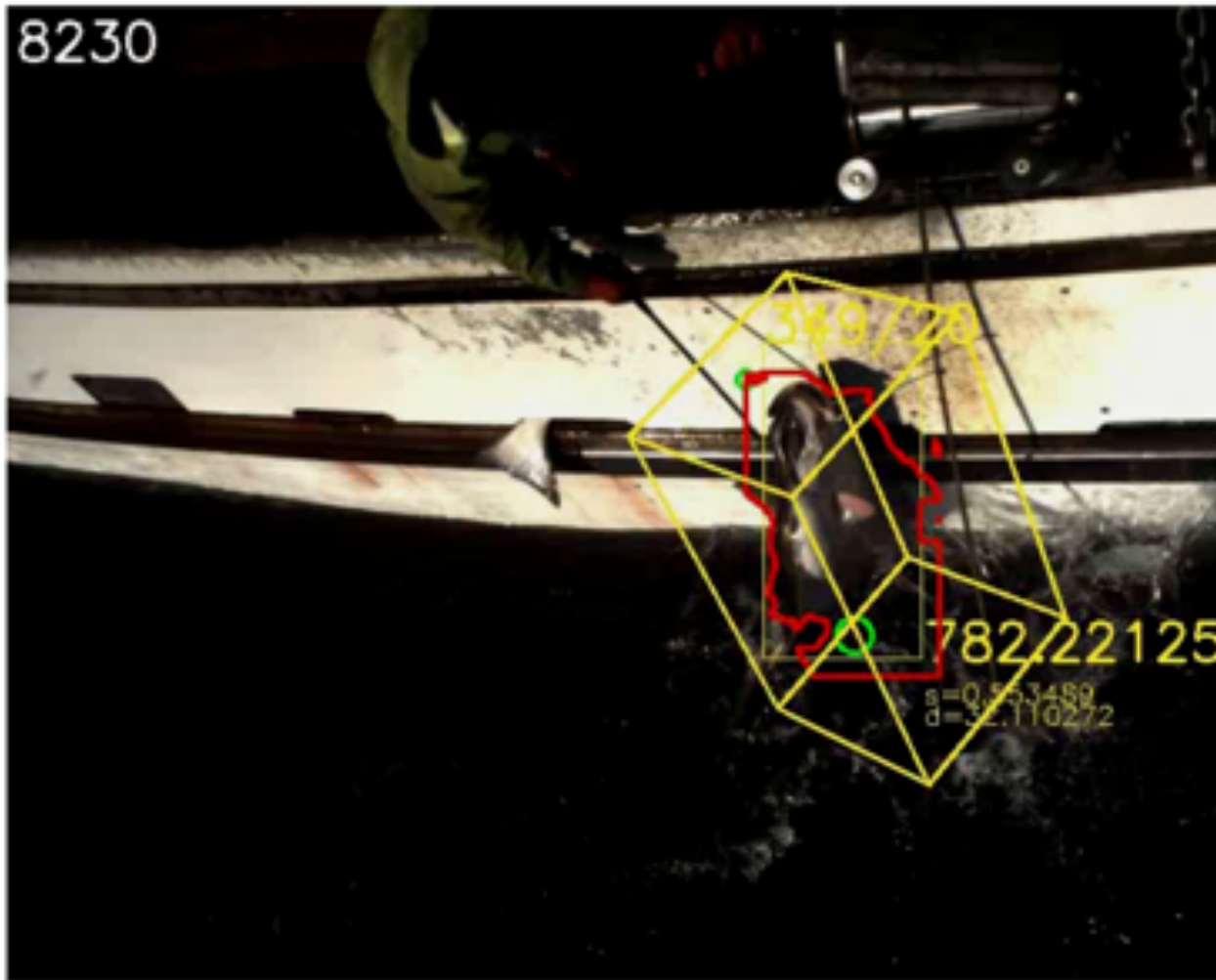
Holding Bin

Halibut only

Camera chute collects halibut lengths and time-on-deck
Observer will still need to collect mortality information

Using compliance cameras to detect halibut

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Length Measurement (Stereo IMS)

Salmon detector: processing plant cameras

Training: 5897
Validation: 1475

Testing: 1326
Recall: ~70%

Human presence detector

Ground Truth
Prediction

Successes, Challenges, Upcoming Changes

- We need to take a "breather" and:
  - *Evaluate* which projects have the most potential for operational success
  - *Understand* how operational EM systems will be successful in the context of data needs for stock assessments, catch accounting, protected resources, etc.
    - AFSC Observer Science Committee looking into data gaps and gains associated with increased EM
  - *Focus* on implementing those 'low-hanging-fruit' projects and gaining those successes that do not compromise data collections needed by stock assessors etc.
  - *Integrate* IMS successes into existing monitoring programs iteratively (e.g., speeding up data review)
  - *Change* observer data collections as needed to successfully implement EM without compromising critical data components (e.g., deploy shoreside observers to collect biological data)

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Summary

- EM systems are proven in Alaska for single-objective programs, and are gaining ground in our multi-objective monitoring program

- EM use is expanding and the roles of EM and observers will likely change as the technology evolves and data users adapt

- IMS systems are getting better, but still a ways off

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Acknowledgments

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