Electronic Monitoring in the Atlantic Pelagic Longline Fishery

Atlantic Highly Migratory Species Management Division

Electronic Monitoring Workshop
Portsmouth, NH

November 13, 2019

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Atlantic Pelagic Longline Fishery

- Use of pelagic longline gear requires an Electronic Monitoring (EM) system.
- 113 vessels with installed EM systems.
  - In 2018: 76 active vessels.
- Fishery targets swordfish and yellowfin and bigeye tunas.
- Typically fish one set per day with sets averaging 700 hooks.
- Vessels fish in the Atlantic and Gulf of Mexico.

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Timeline and Milestones

- EM implemented as part of Amendment 7 to the Atlantic Highly Migratory Species Fishery Management Plan.
  - Final rule published December 2, 2014.
  - Operational EM systems required as of June 1, 2015.
  - No initial pilot program—straight to final.
- Implemented a catch share program for bluefin tuna bycatch. Individual Bluefin Quota (IBQ) Program requires pelagic longline vessels to account for all retained bluefin and those discarded dead.
- Bluefin set reports submitted via Vessel Monitoring System after each pelagic longline set.
- Video EM required in support of the catch share program: To verify the accuracy of counts and identification of bluefin tuna reported by the vessel operator.
- 2019—Program changes currently under consideration through Amendment 13.

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Program Objectives and Design

Objective

Verification of vessel reported data on bluefin tuna, in support of the IBQ Program; *Subsequently: shortfin mako disposition*.

Program Design—Audit Program

- Video only recorded when pelagic longline gear is being retrieved.
- All gear retrievals recorded.
- Hard Drives mailed at the end of each fishing trip.
- Subset of videos reviewed—based on stratified sample protocol.

Program Execution—Audit Program

- NMFS—Oversight and coordination, high level data analysis.
- NMFS-SEFSC—Audit design and selection.
- NMFS contractors:
  - Saltwater, Inc.—EM system installation and servicing.
  - ERT, Inc.—Hard drive management, data storage, video review, software development.

School of Atlantic bluefin tuna northeast of Provincetown, MA.

Sample Design

Selection of Longline Sets for Auditing

- At least one set annually for each pelagic longline vessel.
- Bluefin interactions are rare events.
- Stratified sampling to maximize chance of sampling data with bluefin interactions (targets locations and times where bluefin likely to be present, based on historical data).
- Samples allocated among vessels in proportion to their annual fishing effort.
- Quarterly samples (sets to be audited) selected using VMS data from previous quarter, based on historical data (by contractors working with SEFSC).

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EM Review Methodology

Full Review:

- Consists of watching all video files that contain a "set" a period of fishing activity, when a crew is pulling in and processing a longline.
- These files may contain periods of "empty" time when fishermen momentarily stop processing the line or may not be catching fish.
- Review capacity of 3–4 sets/day (30–40 footage hours/day).

Activity Recognition (AR) Review:

- Consists of watching processed video files which only include clips where actual fishing activity is occurring.
- Files are sped up and compressed.
- Review capacity of 8–10 sets/day (80–100 footage hours/day).

Results:

- AR review is more efficient and less time consuming allowing more videos to be reviewed without losing data.

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HMS Electronic Monitoring – Scope of Audit (examples)

	Audit Period (Quarter)	
Numbers of Pelagic Longline Sets	**Oct—Dec 2018**	**Jan—Mar 2019**
# of sets selected for audit (video review)	183	107
# of sets successfully reviewed	164	91
*Percentage successfully reviewed	90%	85%

*100 percent of sets selected for audit not reviewed due to multiple reasons: Hard drives not received, no set data, and quality issues.

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Shortfin mako. Photo by Alessandro De Maddalena/Getty Images.

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EM Policy impacts

- EM has contributed to a robust system of vessel accountability for bluefin tuna catch in the Individual Bluefin Quota Program.
- Dead discards of bluefin reduced substantially.
- Current consideration of modifications to other regulatory requirements.
  - Gear restricted area and weak hook rules in the Gulf of Mexico.
  - Northeast gear restricted area.

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EM Successes

- Program objective met (*verification of vessel data on bluefin catch*); deployment of EM systems on 113 vessels.
- Software development.
- Use of federal funding by NMFS-contractor to advance program.
- Expanded to include verification of shortfin mako shark disposition; EM capabilities of fleet facilitated international negotiating position on retention of makos.

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EM Challenges

- Future funding.
- Improvement of EM detection of discards.
- Refinement of program metrics. *(Bluefin are rare events: What level of matching between vessel data and EM is acceptable?)*
- Implementing advanced software & artificial intelligence.
- Objectives "creep" (i.e., program formed and designed based on a narrow objective. Subsequent interest to expand uses).

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HMS Electronic Monitoring Under Development

- Amendment 13—Management options that may be considered (scoping recently completed):
  - Deployment of rail camera to be mounted on a boom, to obtain a better view of the side of the vessel and capture/discard events.
  - Specification of fish handling techniques and/or use of a standardized mat of deck to serve as a size reference.
- Refinement of activity recognition software to enable full implementation.

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CANADIAN VIDEO MONITORING PROGRAMS

Amy Williams

Senior Program Officer, Enforcement Programs, DFO

November 13, 2019

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- Pacific Ground fish EM Program
  - Overview
  - How it works
  - Cost
- East Coast Pilots
  - Gulf Tuna
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- Challenges
- The Future

Introduction

Authority

- Subsection 61(3) of the *Fisheries Act* authorizes Fisheries and Oceans Canada (DFO) to impose terms and conditions of any licence issued under this *Act* to require that fish harvesters keep a log of their catches and their fishing efforts and submit them to DFO.
  - ASOP, DMP, logbooks, e-logs, VMS, hails, EM, etc.

EM Overview

- West Coast (Pacific Region):
  - Established programs in crab, prawn, and ground fish fisheries
- East Coast (NL, Maritimes, Gulf & QC regions) and Arctic:
  - No established programs, pilots in Bluefin Tuna, Scallop and Snow Crab fisheries

Pacific Ground fish: Overview

Objective: Provide a verification tool for the fisher's logbook.

Fishery Type: Trawl, Trap and Hook & Line fisheries

Species: Groundfish (Halibut, Hake, Rockfish, Sole, Flounder, Sablefish, Lingcod, Dogfish, etc) and Prawn

Size: Approximately 300 vessels

Coverage: 100%

Cost: 100% industry paid

Pacific Ground fish: How it works

Development

- Developed 10 years ago through a collaboration between DFO, AMR & the fishing industry.
- Response to declines in certain species, wanted an efficient & effective manner to monitor catch that could be integrated with other systems (quota management, e-logs, etc).

Hardware Specifications & Installation:

- DFO describes hardware specifications in the condition of licence for specific fisheries. DFO does not qualify hardware or identify specific hardware to be used.
- Installation of hardware is done by the EM service provider (AMR).
- The Integrated Fisheries Management Plans (IFMPs) for each fishery describe the monitoring requirements for each fishery in more detail, including what services must be acquired from service providers such as AMR.

Data Collection

- Collection of hard drives done by either AMR technicians or dockside monitors.

Pacific Ground fish: How it works

Data review & analysis

- All data review/analysis is done by AMR.
- For each trip, a random 10% of the sets are reviewed.
- Results of the review are compared to the fisher's log book. If the logbook is found to be within pre-determined standards for accuracy then it is used as the official record of catch for management purposes.
- If there are discrepancies between the video and the fisher's log book then DFO *may* request AMR to review 100% of the video for that trip. In these cases, data from the video will be considered the official record of the catch for that trip. Additional costs for this review is paid by the fisherman. Depending on the discrepancies, enforcement action may be taken.
- Procedures for data review and analysis, including thresholds for accuracy, were developed collaboratively between DFO and AMR.

Pacific Ground fish: How it works

Data Transmission:

- Transmission to DFO is done via a dedicated data portal developed and managed by a third party data management company (VeriCatch). Data is transmitted directly into a DFO database.
- “Occurrence Reports” are transferred into an access database that DFO access via a portal.

Data Storage

- Raw data is stored at AMR for 2 weeks, unless needed for enforcement purposes.
- Original hard drive is held until DFO gives permission to scrub it, then it is put back into circulation.
- Processed data is stored at AMR for 3 years, then archived. Archive goes back to 2012.

Pacific Ground fish: Cost

Equipment:

1. Lease: $60 to $70 per day (control panel), plus purchasing of peripherals (keyboard, monitor, GPS, sensors, cameras).
2. Purchase: EMO v5 system with all of the required peripherals and wiring for a two camera set up is approximately $11,000.

Services:

- EM Equipment Services (includes data retrievals for each trip and equipment repairs and services): $59.75 per sea day
- EM Data Processing (EM sensor data and imagery review): $21.63 per sea day
- Data/Audit Reporting and Quota Status Report Production: $26.75 per sea day

Gulf Blue Fin Tuna Pilot: Overview

Objective: To increase compliance with license conditions.

Fishery Type: Hook & line commercial fleet and hook & release fleet

Size: The two fleets consist of approximately 650 boats, mostly commercial.

Species: Bluefin Tuna

Coverage: Currently about 10%.

Cost: 100% DFO paid.

Gulf Blue Fin Tuna Pilot: How it works

- The pilot was developed by DFO in 2016 to determine if EM was a viable enforcement tool for monitoring this fishery.
- DFO purchased 65 camera's (Plot Watcher Pro) and installed them on selected vessels. Camera takes a photo every 3 seconds, and review can be fast forwarded at 5x speed for quick review.
- Camera's install in 10 minutes using a clamp. Software is user friendly.
- Whole system costs approximately $600/boat.
- All data collection and analysis is currently done by Fishery Officers at DFO.
- 100% of active fishing is reviewed. Review focuses on ensuring condition of licence are being adhered to. Compliance issues are identified for possible enforcement action.

Gulf Blue Fin Tuna Pilot: Results & Next Steps

Pilot considered a success. It is proposed that it be transitioned into a program, with gradual coverage increases to 100%.

Next Steps:

- Governance/Capacity issues to resolve.
- Industry engagement.
- Partner with a service provider to do camera installation, battery changes, memory card retrieval, and data analysis.
- Unknown if image quality is sufficient for court purposes.

Successes

- Implementation of 100% EM coverage in the ground fish trawl, hook & line and trap fleets in the Pacific region.

- Robust and integrated EM program that was co-developed by DFO, AMR and the fishing industry, resulting in strong industry buy-in.

- Successful pilots in Gulf Bluefin Tuna, Gulf Scallop, NL Bluefin Tuna and NL Crab.

Challenges

- Cost.
- Capacity.
- Oversight to ensure national consistency in application of EM.
- Resistance (cost, privacy, fear of new technology).
- Proper application.
- Integration of EM into current reporting and monitoring programs.
- Outdated or inadequate information management systems.

The Future

- Development of national guidelines for the creation of EM programs.
- Engagement, Consultation with industry on the East coast.
- Privacy Impact Assessment.
- Modernization of DFO systems.
- National Catch Monitoring Policy.
- Conducting more pilots and applications.

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West Coast Region

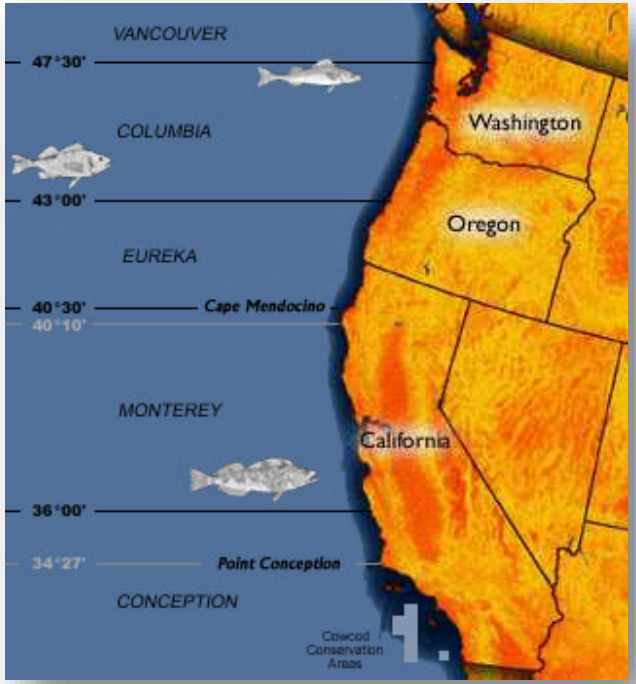
Electronic Monitoring in the West Coast Groundfish Trawl Fishery

Implementing EM for At-Sea and Shorebased Catch Shares

Neil Riley
West Coast Groundfish Observer Program
Northwest Fisheries Science Center

West Coast Groundfish Fishery - Overview

- Limited Entry Fishery
  - Limited Entry Fixed Gear
  - Limited Entry Trawl
    - At-Sea Catcher Processor Sector
    - At-Sea Mothership Sector
    - Shorebased Trawl IFQ Sector
- Open Access Fishery
- Recreational Fishery
- Tribal Fishery



West Coast Groundfish Trawl Fishery: Sectors

Trawl Catch Share Program Goal and Purposes

GOAL: *Create and implement a capacity rationalization plan that increases net economic benefits, creates individual economic stability, provides for full utilization of the trawl sector allocation, and achieves individual accountability of catch and bycatch.*

1. Provide a mechanism for **total catch accounting**.
2. Provide for a viable, profitable, and efficient groundfish fishery.
3. Promote practices that reduce bycatch and discard mortality and minimize ecological impacts.
4. Increase operational flexibility.
5. Minimize adverse effects from an IFQ program on fishing communities and other fisheries to the extent practical.
6. Promote measurable economic and employment benefits through the seafood catching, processing, distribution elements, and support sectors of the industry.
7. Provide quality product for the consumer.
8. Increase safety in the fishery.

West Coast Groundfish Trawl Fishery: Monitoring requirements

- 100% At-sea observer coverage for all sectors
  - MS & C/P: 2 observers >125ft
  - C/Vs (MS and IFQ): 1 observer
- Shoreside processing plants: Catch Monitors
  - 100% monitoring of all IFQ landings

Catch Share Observer Duties

- Fishing activity
  - Haul locations, depth, gear deployment and retrieval times
- Species catch composition
- Biological samples
- Protected species bycatch
  - Marine mammals & seabirds

Electronic Monitoring Program

- Catch Share observer challenges:
  - costs and logistics
- Quest for less expensive and/or more flexible alternative to human observer coverage in meeting 100% monitoring requirement
- Exempted Fishing Permits
  - Costs under EFPs

Timeline

- EFP started in 2015 (34 vessels)
- Midwater whiting and fixed gear into regs (2019)
- Midwater rockfish & bottom trawl go into regs (2020)
- Full program implementation **January 1, 2021**
  - No more EFPs
  - Video review completed by 3rd party provider
  - WCGOP will audit the 3rd party provider

West Coast EM Fleet

45 Active EM vessels for 2019

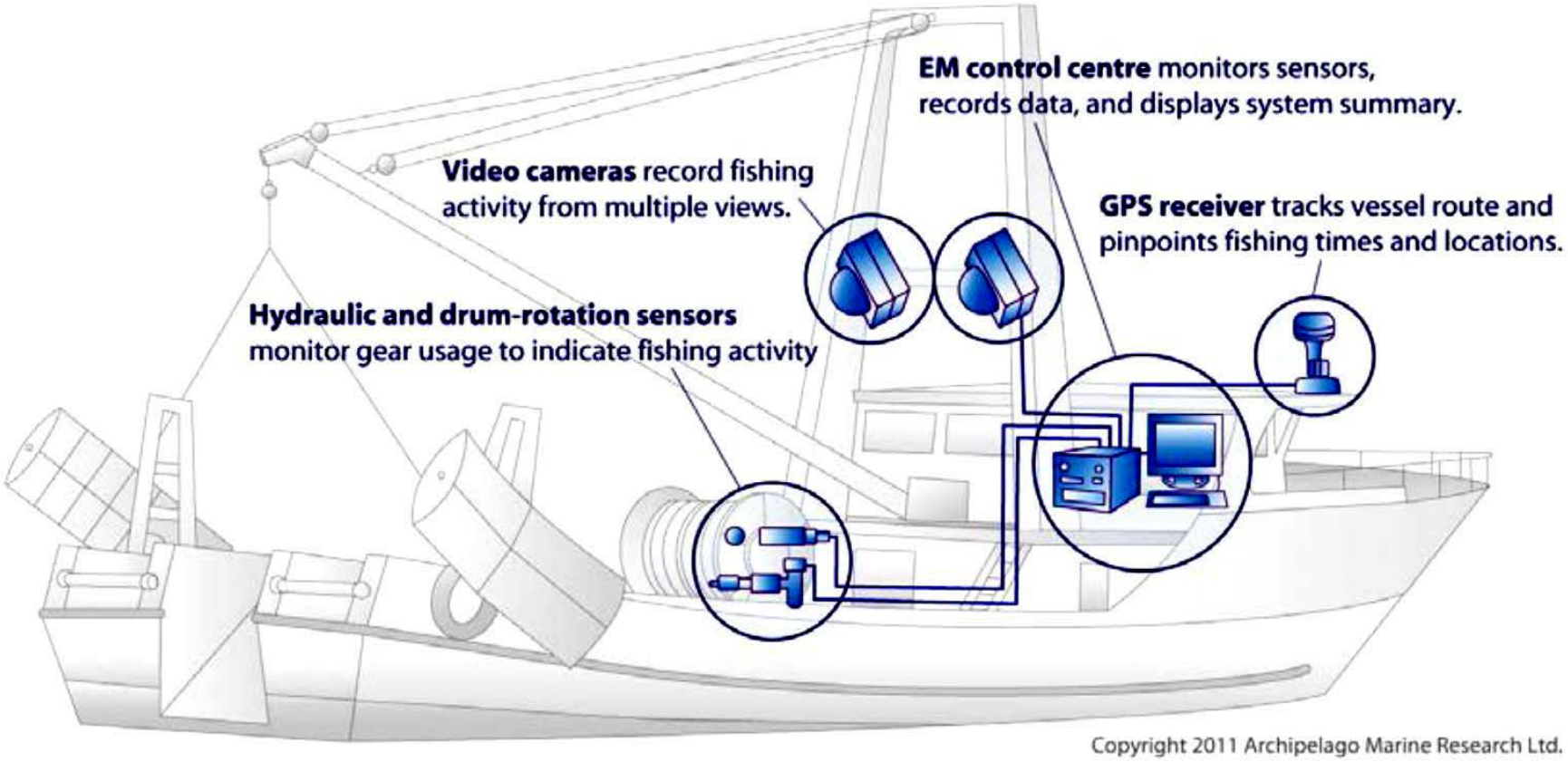
Gear Types

- Midwater
  - Whiting and Rockfish
- Bottom trawl
- Fixed gear

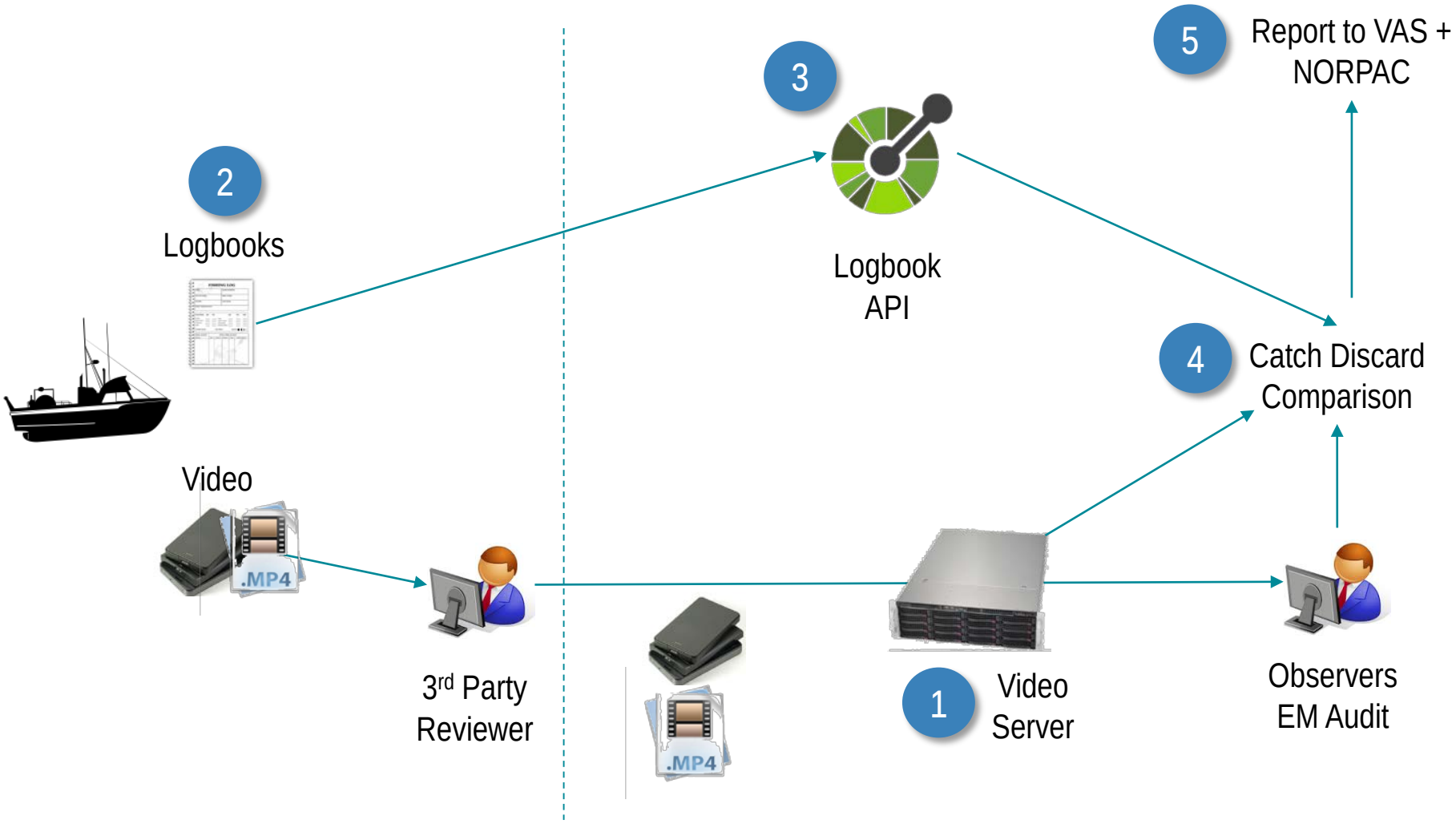
Year	Sector	Sea Days (EM)	% Sea Days (EM)
2019	BottomTrawl	369	11
2019	Midwater Rockfish	125	4
2019	MSCV	545	16
2019	Pot	154	5
2019	Shoreside Hake	2161	64

Thru Oct 15, 2019

EM Hardware


EM control centre monitors sensors, records data, and displays system summary.
Video cameras record fishing activity from multiple views.
GPS receiver tracks vessel route and pinpoints fishing times and locations.
Hydraulic and drum-rotation sensors monitor gear usage to indicate fishing activity
Copyright 2011 Archipelago Marine Research Ltd.

EM Data Flow


5
Report to VAS + NORPAC
3
2
Logbooks
Logbook API
4
Catch Discard Comparison
Video
.MP4
3rd Party Reviewer
.MP4
1
Video Server
Observers EM Audit

Data Review

- Under the EFP 100% monitoring or video review
- Under the 3rd Party structure
  - Lower review rates for some sectors
- NMFS audit of third party provider

Video Review

Provider Role

- Review video to generate discard estimates
- Sample/review rate determined by WCGOP
  - Subset of hauls for initial review
  - Review rates have not been determined yet
- Report discard to the West Coast Observer Program
- Store video

Video Review

Observer Program Role

- Accept discard estimates from 3rd party provider
- Join EM data with existing trip information from vessel logbooks
- Determine final discard estimate
  - Logbook vs EM vs Audit estimate comparisons
- Update discard estimates in Vessel Accounts

Alignment with National Policy

- Data Retention – 3 years in regulations

- Regs will be updated in 2020
- Rulemaking will change to match directive ahead of 2021 implementation

Data Review Costs

- Review currently managed by PSMFC and paid by NMFS under EFP
- Movement to third party structure, industry paid

Challenges

- Logbooks
- Data Lag
- Tracking data
- At-sea discards

Successes

- West Coast management
  - Rebuilt species ahead of schedule
  - Full accountability

- Make sure EM program is reflecting this accountability of IFQ catch

Questions?

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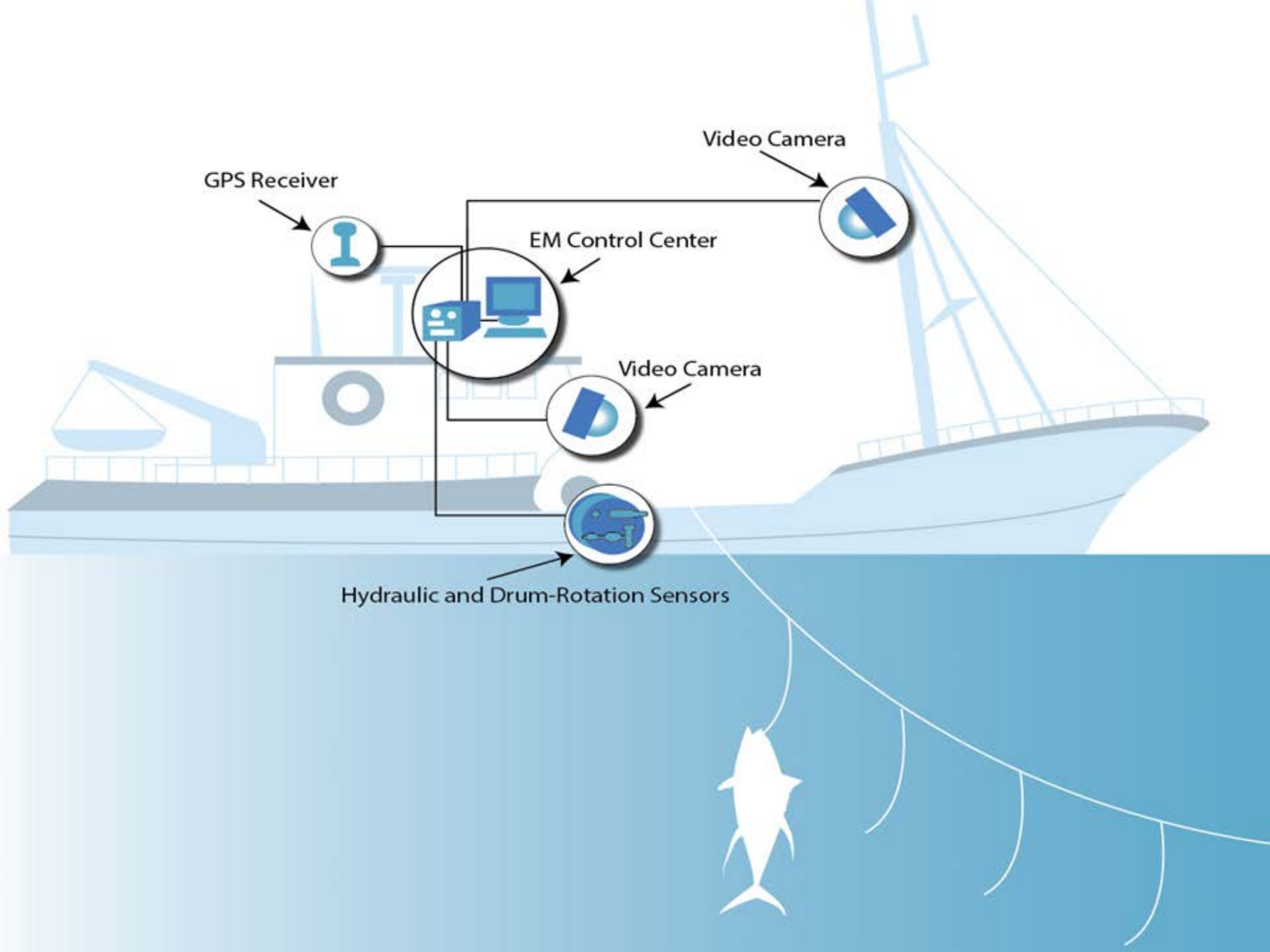
Greater Atlantic Region

Electronic Monitoring in the Northeast Region

A summary of EM programs in the Northeast

Claire Fitz-Gerald, Sustainable Fisheries Division
November 13, 2019


Video Camera
GPS Receiver
EM Control Center
Video Camera
Hydraulic and Drum-Rotation Sensors

EM in the Herring Fishery

EM pilot program (2016-2018)

- Number of vessels: 11
- Gear type: Midwater trawl
- Goal: Determine whether EM is suitable to meet monitoring requirements for fishery

Implementation of industry-funded monitoring amendment (April 2020)

- Number of vessels: 11
- Coverage target: 50%
- Goal: Use EM to verify catch retention and document slippage events at-sea; use portside sampling to collect information on catch

EM in Groundfish Sectors

At-sea monitoring requirements for sector vessels

> *"Electronic monitoring may be used in place of actual observers if the technology is deemed sufficient by NMFS for a specific trip type based on gear type and area fished, in a manner consistent with the Administrative Procedure Act."*

Regional EM programs

> **Goal:** To develop EM for use as an alternative tool to meet sector monitoring requirements
>
> Current programs:
>
> - Audit-model (discard estimation)
> - Maximized retention (compliance)

Groundfish Amendment 23

> **Goal:** To improve the reliability and accountability of catch reporting

EM in Groundfish Sectors: Audit-Model

Number of vessels: 20

Gear type: Trawl (5), Longline (3), Gillnet (5), Jig (7)

Vessel size: 31’ to 63’

Ports: RI, MA, NH, ME

Goal: Use cameras to validate discards reported by fishermen in vessel trip report

Challenges: Lack of high-volume vessels; data lags; incorporating new data sources into existing system

FISHING VESSEL TRIP REPORT

DID NOT FISH

NMFS COPY

NMFS

The Nature Conservancy

MAINE COAST FISHERMEN'S ASSOCIATION

CAPE COD COMMERCIAL FISHERMEN'S ALLIANCE

Small Boats. Big Ideas.

Gulf of Maine Research Institute

Science. Education. Community.

teem.fish MONITORING

Local focus. Global impact.

EM in Groundfish Sectors: Maximized Retention

Number of vessels: 3

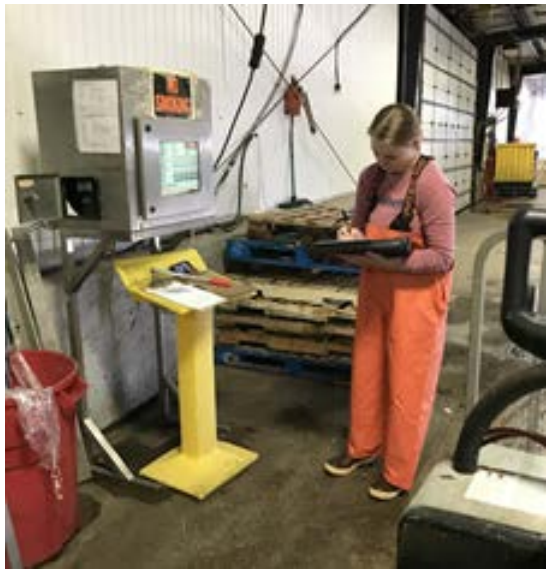
Gear type: Trawl (3)

Vessel size: 44’ to 68’

Ports: RI, MA, ME

Goal: Use cameras to verify that fishermen retain all catch, including discards, and collect catch data on shore via dockside monitoring program

Challenges: Lack of high-volume vessels; minimum size regulations; new dealer codes; dockside monitoring program



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Integrated Monitoring

Other Regional EM Programs

EM in the for-hire groundfish fishery

Goal: Pilot the use of EM to validate catch reported on the captain's eVTR

Contact: Chris McGuire, The Nature Conservancy

EM in the Northern Gulf of Maine scallop fishery

Goal: Pilot the use of EM to monitor fleet and collect fishery data; develop machine learning to increase program cost-effectiveness

Contact: Ben Martens, Maine Coast Fishermen's Association

Machine learning on the r/v Bigelow

Goal: Build a library of images during the bottom trawl survey; use these images to develop algorithms to identify fish

Contact: Nichole Rossi, Fisheries Sampling Branch

Questions?