Effective and Durable Electronic Monitoring

Lessons from the West Coast Groundfish Fishery

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The Stakes Are High

Fishing contributes

$270 BILLION TO GLOBAL GDP

+

Fisheries-related jobs provide livelihoods for

260 MILLION PEOPLE

+

Seafood is a major source of protein for

3 BILLION PEOPLE

At-sea monitoring is critical to sustainability, especially with climate change

- At-sea monitoring provides reliable and high-resolution data on spatial and temporal patterns in effort and total catch, a critical component of sustainable catch limits
- It can deter IUU
- Help ensure compliance with a variety of fishery management regulations
- Account for discards
- Monitoring can also be of value to fishermen wishing to demonstrate that they are fishing sustainably in order to access certain markets and certifications

At-sea monitoring is far from ubiquitous

- Until recently relied on human observers
- Often lack of legal mandates
- High cost/perception of high cost
- Privacy concerns + lack of space on vessel
- Inertia/resistance to change
- Challenges finding human resources, especially during/post COVID

Electronic monitoring can help

Examples of types of data collected and uses:

- Catch accounting - especially important for TAC/Quota fisheries
- Endangered/rare species interactions
- Gear performance
- Gear theft avoidance
- Provenance/traceability

Potential benefits:

- Reduced cost relative to human observers
- Less space conflict on small vessels
- No challenges scheduling/finding observers
- Cameras don’t sleep
- Certification- market access/price premium
- More surgical management
- Improved climate resiliency through adaptive management
- Can be coupled with other sensors to understand oceanographic conditions

US West Coast Groundfish Case Study

- The West Coast groundfish fishery stretches from Mexico to Canada
- Fishermen catch dozens of species including varieties of rockfish, flatfish, sole, and whiting.
- Significant bycatch challenges

- There are three distinct segments of the fleet – midwater trawl, bottom trawl, and fixed gear (longlines and traps)
- After a fishery crash in the early 2000s, the Pacific Fishery Management Council imposed major new management measures
  - Closed areas
  - Catch shares/IFQ
  - **100% observer coverage**
  - **Observer and catch share regulations went into effect in 2011**

EM Drivers

- 100% human observer coverage + **industry responsibility to pay** created strong incentives to move towards a less obtrusive, more cost-effective system
- In addition to cost, fishermen were concerned about cramped space on board, safety, insurance requirements, and temperament/fit with crew
- To help address these concerns NGOs (TNC and EDF), fishermen, and tech providers working with the Pacific States Marine Fish Commission and Pacific Fishery Management Council began to pilot EM through an exempted fishing permit program

Critical design points

- Pilots/fishermen engagement
- Advisory committee formation
- Review rate and type
- Data storage
- Vessel monitoring plans
- Cost/human resource considerations

Initial pilots

- Goal – Accurate IFQ deductions and accounting for discard
- Pilots established for all three segments of the fishery
- Co-designed with fishermen, NGOs, NMFS
- Funding provided by gov. grants, NGOs
- Allowed testing of installation/service contracts, back deck procedures, review process, and overall design
- Review conducted by Pacific States Marine Fish Commission - quasi-governmental agency
- Quickly showed the potential for EM to accurately capture at-sea discards

Formation of industry and technical advisory committees

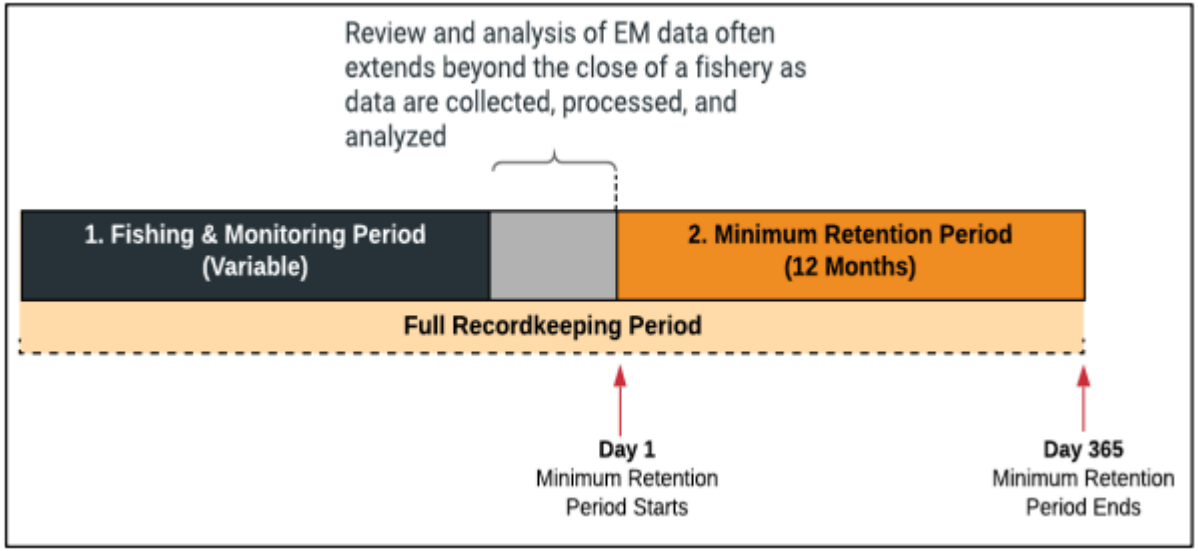
- In parallel to pilots, the Pacific Fishery Management Council (PFMC) created the Groundfish Electronic Monitoring Policy Advisory Committee and Technical Advisory Committee
- Comprised of affected stakeholders and technical experts
- Primarily responsible for making regulatory policy recommendations to PFMC
- Met regularly to explore issues including:
  - Sole source or third-party provider model
  - Appropriate level of review
  - Storage requirements
  - How to deal with discrepancies between logbook and EM review

Type of EM system + review rate

- Primary types of EM systems - census, random sample, logbook audit
  - Logbook audit selected
  - Generally, captain logbook estimates very close and often higher than EM estimates
  - Business rules describe how to treat discrepancies between logbook and EM
- 100% review selected for midwater trawl
- 25% review selected for bottom trawl and longline/pot

Data storage

- Along with review costs, data storage is a major cost driver
- Enforcement wanted indefinite storage
- PFMC wanted 5 years
- National Marine Fisheries Service ultimately developed a data storage directive establishing minimum storage requirements (12 months after fishing year + time needed for data reconciliation)



Vessel Monitoring Plan

- A VMP describes how fishing operations on the vessel will be conducted
  - Unique to each vessel
  - Describes camera placement, crew responsibilities for testing and cleaning, catch handling procedures, what to do in event of malfunction etc.
  - The VMP is developed with an approved service provider during EM system installation

Cost considerations

- Exact cost depends on program design - largely review rate/time, data transmission, data storage, program management, and system maintenance
- Start-up costs are not insignificant - $7,500 to $10,000 per vessel for equipment + installation
- After initial installation, estimates suggest EM costs roughly 10%-50% of human observers per sea day
- Some at-sea observation may still be required for biological sampling

Outcomes

- About 50 vessels are now using EM on the West Coast (about 600 nationwide)
- It is cheaper than human observers after a minimum number of fishing days (to offset initial equipment costs)
- The fishermen that use EM are generally happy with it, but have ongoing concerns around:
  - program costs
  - operational requirements for similar looking species
  - data confidentiality
- 100% accountability (EM and observers) helped rebuild severely depleted rockfish species) - quotas have now increased and catch is increasing
- Helped secure MSC certification
- Enabled access to formerly closed grounds due to improved management certainty
- New tech still under development – AI for species ID, wireless transmission, compression, activity recognition, etc. could help make EM cheaper for existing participants and new participants

Key steps in design and implementation process + lessons learned

- Set clear objectives
- Understand and articulate the EM value proposition
- Undertake on-the-water learning through pilots
- Assemble an EM working group
- Implementation, optimization, evaluation and adaptation (including exploration of emerging tech opportunities)
- Avoid mission creep
- Test assumptions

Thank you

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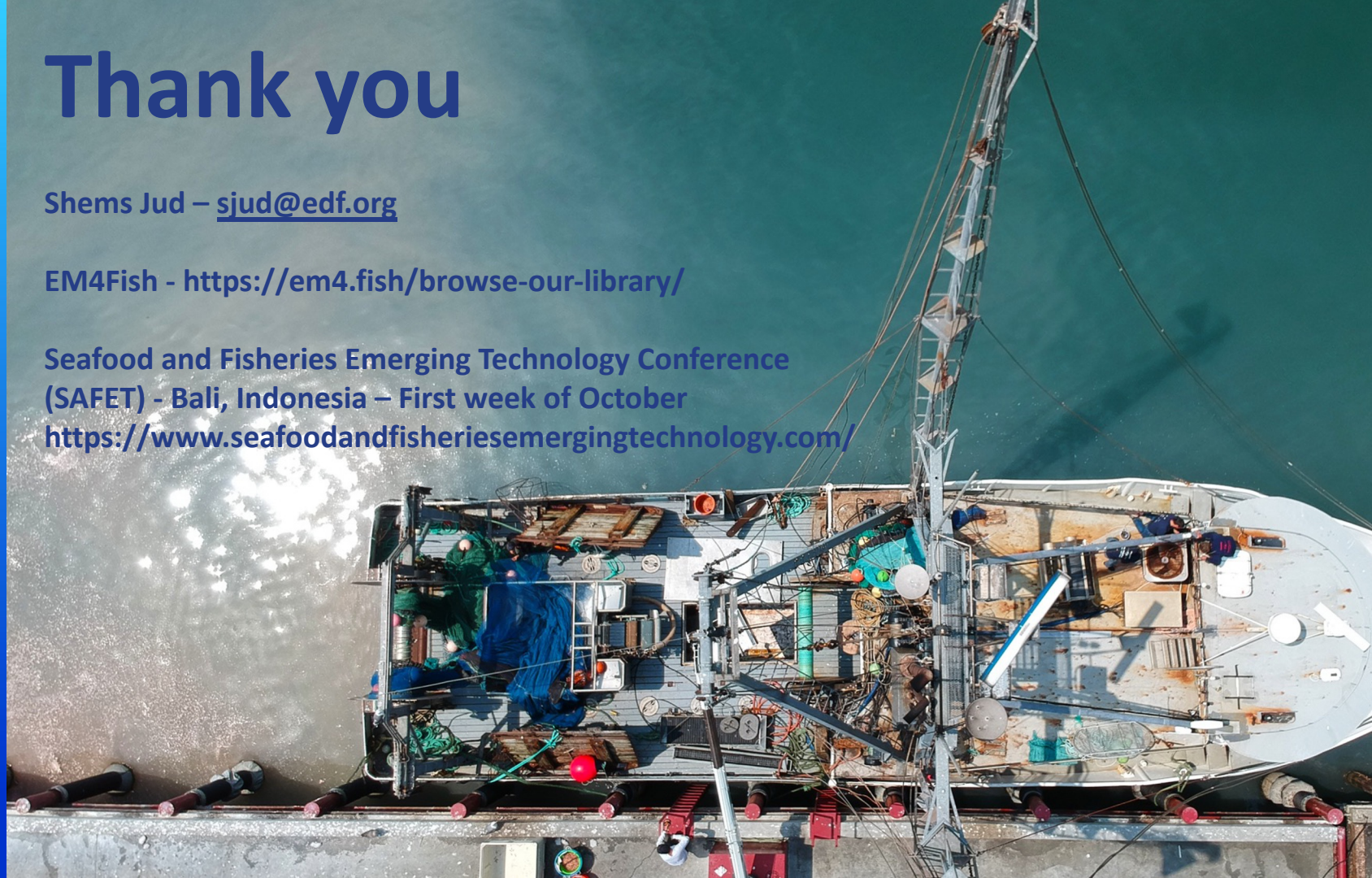
EM4Fish - https://em4.fish/browse-our-library/

Seafood and Fisheries Emerging Technology Conference (SAFET) - Bali, Indonesia – First week of October
https://www.seafoodandfisheriesemergingtechnology.com/



Iterative process to develop regulations

- Timeline
- Industry repeatedly called for delay – largely over decisions that would affect their costs
- In the interim the pilots continued to function

Final regulatory decisions

- **Vessel Monitoring Plans**
- To receive authorization for the use of EM, vessel owners will be required to prepare a Vessel Monitoring plan (VMP) as part of their application submitted for NOAA Fisheries review. VMPs detail how the vessel will configure and use EM systems, and how crew will handle catch
- **EM Service Provider Plans**
- To receive authorization to provide EM service to vessels, prospective service providers will be required to prepare Electronic Monitoring Service Plans (EMSP) that describe in detail how an EM Service Provider will provide EM services to contracted vessels.

- EM System Performance Standards, from § 660.604(j): The specifications (e.g., image resolution, frame rate, user interface) and configuration of an EM system and associated equipment (e.g., number and placement of cameras, lighting) used to meet the requirements of this section must be sufficient to: (1) Allow easy and complete viewing, identification, and quantification, of catch items discarded at sea, including during low light conditions; (2) Continuously record vessel location (latitude/longitude coordinates), velocity, course, and sensor data (i.e. hydraulic and winch activity); (3) Allow the identification of the time, date, and location of a haul/set or discard event; (4) Record and store image data from all hauls/sets and the duration that fish are onboard the vessel until offloading begins; Agenda Item H.7 Supplemental Attachment 3 November 2022 (5) Continuously record and store raw sensor data (i.e., GPS and gear sensors) for the entire fishing trip; (6) Prevent radio frequency interference (RFI) with vessel monitoring systems (VMS) and other equipment; (7) Allow the vessel operator to test and monitor the functionality of the EM system prior to and during the fishing trip to ensure it is fully functional; (8) Prevent tampering or, if tampering does occur, show evidence of tampering; and, (9) Provide image and sensor data in a format that enables their integration for analysis.
- Halibut viability – time on deck model necessitated by circumstances of the fishery – also creates incentives to get fish over alive – if no credit let them all die - cost tradeoffs – has to be reviewed
- Em can do ata fraction of the cost – depends on the specific fishery but sea day costs are roughly 1/10 to 1/3 depending on design and type of fishery

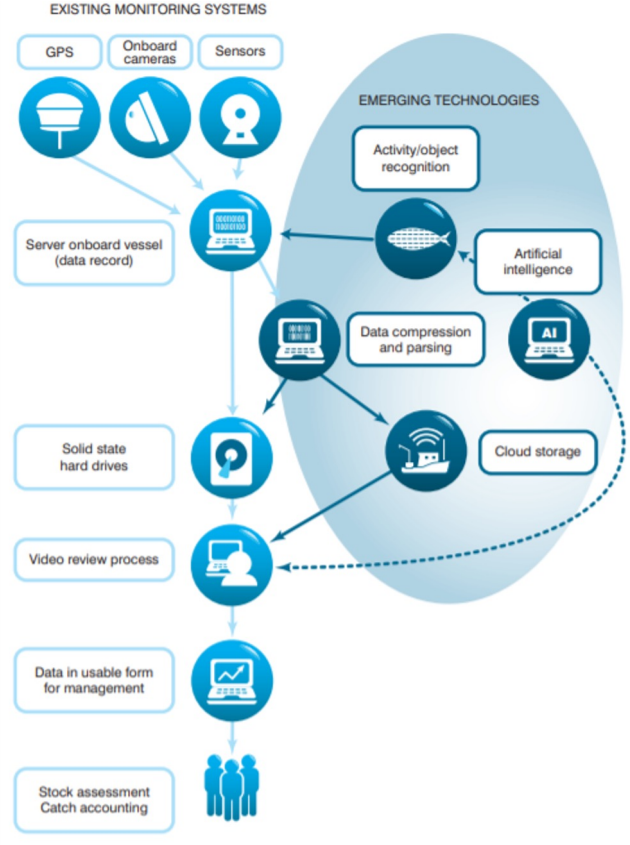
- Em doesn't work in isolation

  integrated system with logbook

  various options – census, random sample, audit model

- Gov provide services – third party provide services
- Which services – hardware/software/tech support, or data review

System overview



- Cameras and other sensors collect monitoring data which are then stored on removable hard drives *(wireless transmission is an emerging opportunity)*
- Data are typically reviewed by managers or third-party reviewers to glean scientific, management, and compliance data.
- Artificial intelligence shows great promise in reducing review costs and other aspects of EM systems

West coast details

Need to build this out

100% review for whiting

25% for trawl and longline

Audit of logbook and logbook becomes key data source

Allowed discrepancy

Cost estimates

Elements of successful programs

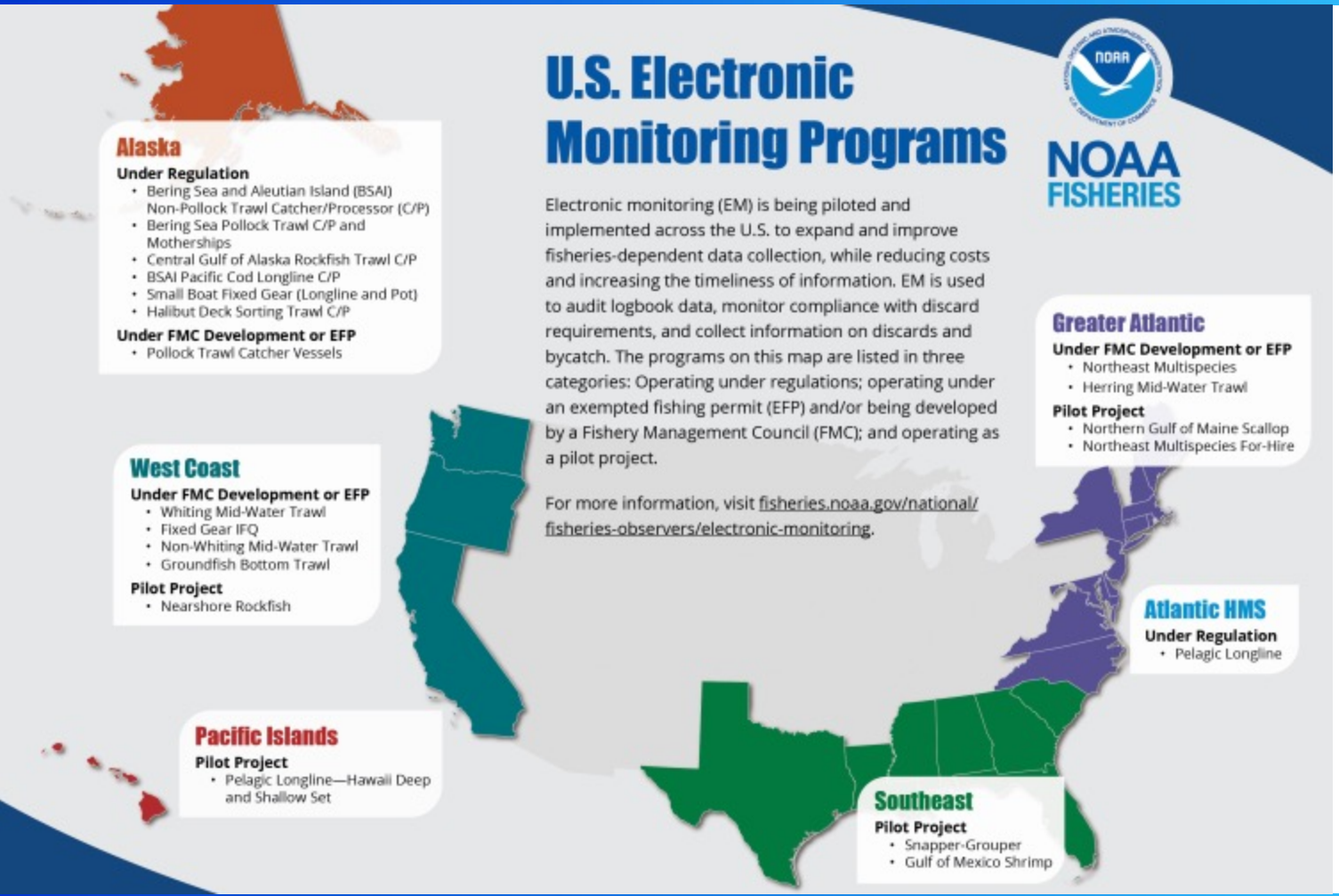
ELEMENT	SUMMARY
1. Motivate EM adoption	Mandates and other incentives are necessary to motivate the investment of time, energy and resources needed to design and implement an EM program
2. Assemble an EM working group	The EM working group is responsible for designing the EM program in a participatory way that creates industry support, which is essential for EM programs to function well
3. Set clear objectives	Fishery management goals must be connected to specific monitoring objectives that guide the development of the EM program
4. Establish governance for the EM program	Roles and responsibilities for every aspect of the EM program must be made clear and committed to by the responsible parties
5. Design and optimize the EM program	There are many options to choose from; the set of tools and processes must minimize costs and disruption to fishing operations while still achieving the monitoring objectives
6. Understand and articulate the EM value proposition	Perceptions of the costs and benefits of EM compared with those of alternative monitoring programs often vary within a fishery; a common understanding must be reached in order to decide whether or not to develop an EM program
7. Practical learning through pilots	EM tools and processes should be tested onboard vessels to prevent problems during implementation
8. Communication and outreach	Effective two-way communication is essential for engaging all stakeholders in the EM design and implementation process in order to understand and address concerns
9. Implementation, optimization, evaluation and adaptation	Much will be learned during implementation, and conditions will change over time, so evaluation of EM program performance and periodic adjustment will be required

U.S. Electronic Monitoring Programs

NOAA FISHERIES

Electronic monitoring (EM) is being piloted and implemented across the U.S. to expand and improve fisheries-dependent data collection, while reducing costs and increasing the timeliness of information. EM is used to audit logbook data, monitor compliance with discard requirements, and collect information on discards and bycatch. The programs on this map are listed in three categories: Operating under regulations; operating under an exempted fishing permit (EFP) and/or being developed by a Fishery Management Council (FMC); and operating as a pilot project.

For more information, visit fisheries.noaa.gov/national/fisheries-observers/electronic-monitoring.



Alaska

Under Regulation
- Bering Sea and Aleutian Island (BSAI) Non-Pollock Trawl Catcher/Processor (C/P)
- Bering Sea Pollock Trawl C/P and Motherships
- Central Gulf of Alaska Rockfish Trawl C/P
- BSAI Pacific Cod Longline C/P
- Small Boat Fixed Gear (Longline and Pot)
- Halibut Deck Sorting Trawl C/P

Under FMC Development or EFP
- Pollock Trawl Catcher Vessels

West Coast

Under FMC Development or EFP
- Whiting Mid-Water Trawl
- Fixed Gear IFQ
- Non-Whiting Mid-Water Trawl
- Groundfish Bottom Trawl

Pilot Project
- Nearshore Rockfish

Pacific Islands

Pilot Project
- Pelagic Longline—Hawaii Deep and Shallow Set

Greater Atlantic

Under FMC Development or EFP
- Northeast Multispecies
- Herring Mid-Water Trawl

Pilot Project
- Northern Gulf of Maine Scallop
- Northeast Multispecies For-Hire

Atlantic HMS

Under Regulation
- Pelagic Longline

Southeast

Pilot Project
- Snapper-Grouper
- Gulf of Mexico Shrimp

Key considerations

- The technology is solid and improving all the time
- Key challenges are largely oriented around costs, policy, and incentives
- Specifically:
  - Who pays
  - Program goals/mission creep
  - How long to store data/for what purposes
  - Who has access to data/how to integrate with current data systems
  - How much data to review
  - Overall program model – logbook audit, census, random sample
  - Government, sole source, or third-party model
- AI, data compression, and wireless transmission offer significant potential to bring costs down