



Catalyzing the Growth of Electronic Monitoring in Fisheries: Summary of Updated Recommendations

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Background on Electronic Monitoring

Every day, millions of fishing vessels ply the oceans to harvest seafood that helps feed the world's almost 8 billion people. The enormous challenge of protecting the productivity of the oceans while also safeguarding the livelihoods of the millions of people who work along the seafood value chain through traditional tools of data collection can be expensive and imprecise. The result is annual losses of \$83 billion USD in global fisheries from insufficient management, accompanied by a gradual decline in the health of fish stocks and the marine environment.¹

Electronic Monitoring (EM) can provide the detailed information fishery managers need to solve their data and compliance challenges. EM uses an integrated system of on-board cameras and sensors that record fishing activity and extract data. This powerful tool can enable more targeted, cost-efficient management strategies and create opportunities for seafood industry stakeholders to drive improvements in their operations and demonstrate legality and sustainability to the seafood marketplace.²

Summary of Recommendations

In 2018, The Nature Conservancy and CEA Consulting released the report, "Catalyzing the Growth of Electronic Monitoring in Fisheries," which put forward a series of near-term recommendations for advancing EM. The following is an updated set of priority near-term investments to catalyze the growth of EM. These updated recommendations reflect the progress and lessons learned since the release of the original report. The recommendations are organized thematically in four main groups (Table 1):

1. Markets
2. Policy
3. Technology
4. On the Water

These updated recommendations aim to accelerate the growth of EM by building demand for EM, reducing the cost of EM, supporting regulators, and promoting industry leadership.

1. World Bank Group, "The Sunken Billions Revisited: Progress and Challenges in Global Marine Fisheries," 2017, <https://openknowledge.worldbank.org/bitstream/handle/10986/24056/9781464809194.pdf>

2. Philip Christiani et al., "Precision Fisheries: Navigating a Sea of Troubles with Advanced Analytics" (McKinsey & Company, 2019), <https://www.mckinsey.com/~media/McKinsey/Industries/Agriculture/Our%20Insights/Precision%20fisheries%20Navigating%20a%20sea%20of%20troubles%20with%20advanced%20analytics/Precision-fisheries-Navigating-a-sea-of-troubles-with-advanced-analytics-vF.ashx>

TABLE 1. Taxonomy of Updated Recommendations and their Primary Objectives



BUILD DEMAND



REDUCE COSTS



SUPPORT REGULATORS



PROMOTE INDUSTRY LEADERSHIP

					
		BUILD DEMAND	REDUCE COSTS	SUPPORT REGULATORS	PROMOTE INDUSTRY LEADERSHIP
Markets	<i>Amplify pressure on retailers for on-the-water monitoring</i>	✓			
	<i>Strengthen data adequacy requirements of the MSC standard</i>	✓			
	<i>Ensure traceability efforts incorporate EM</i>	✓			
	<i>Secure commitments to 100 percent on-the-water monitored seafood products</i>	✓			✓
	<i>Support pre-competitive collaboration among EM providers</i>	✓	✓		
	<i>Coordinate buyers into bulk procurements</i>	✓	✓		✓
Policy	<i>Secure EM policy commitments with credible implementation plans across a range of fishery archetypes</i>	✓			
	<i>Test and validate lower video review rates and more efficient video review methods, including risk-based approaches</i>		✓		
	<i>Develop scalable performance-based standards</i>		✓	✓	
	<i>Promote “EM as a Service” contracts</i>		✓		
	<i>Advocate for more flexible or targeted management measures enabled by EM</i>	✓			✓
	<i>Build and support EM expert working groups</i>			✓	✓
Technology	<i>Support AI development to drive more efficient video review and analysis</i>		✓		
	<i>Develop on-vessel AI for “near real-time” data</i>	✓	✓		
On the Water	<i>Demonstrate EM across a range of fishery archetypes</i>	✓	✓	✓	
	<i>Demonstrate new use cases for EM (e.g., labor and transshipment)</i>	✓			

Markets

Amplify market incentives for EM adoption.

Market incentives have been insufficient to drive EM adoption at scale. The following activities should be supported to ratchet up market demand for EM.

- **Amplify pressure on retailers for on-the-water monitoring.** Most of the largest retailers in the US and EU have made commitments to sustainable seafood, yet unsustainably harvested products and poor labor standards are still present in their supply chains. Simply put, without EM most retailers cannot have confidence that seafood products on their shelves were caught legally, sustainably, and without labor abuses. A stronger carrot and stick approach is needed to expose these practices and to demand that retailers' sustainable seafood commitments be matched by real improvements and accountability on the water.
- **Strengthen data adequacy requirements of the Marine Stewardship Council (MSC) standard.** MSC provides no data adequacy guidance to assessors. Not only does this weaken incentives for fishers to adopt EM, but, paradoxically, it may even create a disincentive to collect robust on-the-water data. Support should be provided to NGOs to engage in the MSC standard revision process that is currently underway to ensure that robust, risk-based data adequacy requirements are integrated into the standard to increase confidence that data feeding into the assessments accurately reflect fishery impacts.
- **Ensure traceability efforts incorporate EM.** There are numerous ongoing traceability efforts, but

many are just dock-to-plate systems that do not provide certainty that the product was harvested sustainably, legally, and with fair labor practices. Support is needed to bring EM experts into these dialogs and ensure that they are building true catch-to-plate solutions.

- **Secure commitments to 100 percent on-the-water monitored seafood products.** Several companies have been driving and making commitments to EM in their supply chains (e.g., Thai Union). These efforts should be supported and amplified with a goal of securing initial commitments to 100 percent on-the-water monitored seafood products from major seafood, foodservice, or retail companies.

Support pre-competitive collaboration among EM providers.

Growing the EM market will require coordinated investment to overcome the challenges of building awareness of the tool and its capabilities, and developing technologies that will improve the level of service and reduce the costs of EM programs. Due to the small EM market size and risk associated with these activities, individual EM providers are unlikely to solve these challenges on their own. Thus, support should be provided to develop an industry association to pursue pre-competitive collaboration that will lift the entire EM market, including: Government outreach and education; Coordinated technology development (e.g., AI); and Development of interoperability and performance standards

Policy

Drive improved video-review efficiency.

Improving the efficiency of video review offers the best near-term opportunity for cost-reductions. Support is needed to:

- **Test and validate lower video review rates and more efficient video review methods.** Several fully implemented programs have low video review rates (e.g., 10 percent), but many newer trials and programs are still operating with 100 percent video review as they develop baseline information. Investment is needed to test and validate methods that can allow these programs to review a lower percentage of footage while still meeting program objectives. Additionally, implementing measures that improve the efficiency

of review (e.g., high speed review, software assistance tools) can also drive near-term cost reductions.

- **Develop and test risk-based review methods.** The granular data of EM can allow for more targeted use of video review resources on the highest-risk operations. Investment is needed to develop and validate these risk-based approaches and to coordinate with other industries (e.g., casino gaming) that may have risk-based approaches to share with the fishing industry.

Confirm that new program and contract structures drive cost reductions and service improvements.

Reducing the cost and improving the efficiency of program delivery is imperative for EM growth. The following

models have the potential to drive cost reductions and level of service improvements and should be tested and validated:

- **Scalable performance-based EM standards.** Performance-based standards define a minimum set of system and service delivery standards for an EM program. Performance-based standards facilitate moving governments out of the role of EM program delivery to validating that EM providers are meeting their level-of-service requirements. While it may be desirable and efficient in some cases for governments to execute a broader set of program operations (e.g., video review and analysis), in other cases contracting with third-party providers may reduce costs, improve service, and help overcome government capacity constraints. By defining a minimum level of performance, scalable performance standards can also unlock multi-provider supply and bulk procurement bidding processes which can drive more competition among EM service providers, and also give them the flexibility and incentive to meet program requirements in the most efficient way.
- **Test “EM as a Service” contracts.** Traditional EM contracts, which pay service providers per hour of review time, do not align their incentives with driving program efficiencies. “EM as a Service” contracts, which pay service providers a fixed amount if they meet specified performance standards, create strong

incentives to improve the efficiency of program delivery. They also provide buyers with more stable and potentially lower pricing.

Advocate for more flexible or targeted management measures enabled by EM.

With 100 percent on-the-water monitoring, EM can unlock more flexible or targeted management measures such as individual quotas, rollback of time and areas closures, targeted sanctions, or uncertainty buffers. These types of measures should be supported to strengthen the link between EM and improved economic outcomes for industry.

Support existing and develop new expert working groups to provide technical assistance.

There is an abundance of information about EM, but what regulators really need are world-class experts who can provide them with curated information and consultation on program design options. Multi-stakeholder working groups consisting of regulators, fishers, NGOs, EM service providers, and scientists could provide detailed, high-quality, on-demand guidance for EM program development. The efforts of existing working groups, such as the Working Group on Technology Integration for Fishery-Dependent Data, should be amplified and could serve as a model for other regional expert working groups.

Technology

Move AI from proof of concept to a market-ready technology.

Streamlining video review is the biggest opportunity for reducing program costs and AI development is the key to unlocking much of this potential. To foster AI development, investment is needed to:

- **Continue to build and support image libraries.** Fishnet.AI, a training data library with 100,000 images, is a huge and foundational step for AI development. But many more accurately labeled images are needed to facilitate AI development across different fishery types. As more libraries come online, they should be encouraged to share tagged images to prevent balkanization.
- **Support and de-risk AI development.** EM providers may not have the resources, expertise, or risk tolerance to drive rapid AI development and integrate it into their product flow. Providing world-class AI engineers (e.g., Amazon Web Services, productOps), and resources to de-risk AI development will help speed development.

- **Support the development of on-vessel AI for “near-real-time” data.** Near-term application of AI is likely to happen in review centers after transmitting video from vessels. But the future of AI lies in on-vessel processing of video to identify relevant video clips or convert video into processed data for “near real-time” offloading. Support is needed to develop on-board AI applications and video compression that will enable more real-time analysis of fishing activity and more efficient data transfer.
- **Tie market demand to model development.** Retailer supply chains could be a powerful driver of the development of specialized models that deliver sustainability metrics at the vessel level. Smarter processing of vessel data could deliver information on various sustainability metrics like bycatch, transshipments, International Convention for the Prevention of Pollution from Ships (MARPOL), and human rights violations. Pilots with large-scale retailers are necessary to move this forward.

Demonstrate the functionality of EM for new use cases.

There is significant demand for new use cases for EM. Over the next 18 months, investments should be made to:

- **Test EM on the water for monitoring labor practices and integrate EM into a holistic fair labor platform.**
Demand is growing for on-the-water monitoring that can reduce the risk of poor labor practices in seafood supply chains, including unsafe working conditions for observers and crew. Investments should be made to test and demonstrate EM for this use case and ensure it will not have any unintended consequences for the people it is meant to safeguard. In parallel, EM needs to be integrated into a holistic fair labor platform that comprehensively addresses seafood labor issues.
- **Implement a larger-scale transshipment pilot.**
A proof of concept trial on a reefer has demonstrated EM's capability for verifying transshipments. There is increasing interest in applying EM for this function, and this has only grown with the Covid-19-induced suspension of at-sea observers. A larger-scale pilot should be supported that can test and inform the design of a fully implemented EM program to support transshipment monitoring.

Demonstrate EM on the water across a representative set of fisheries and governance archetypes.

The EM market is still in its early stages of development. For EM to transition into a growth stage, EM programs need to demonstrate success at scale across a variety of fishery archetypes (e.g., gear types, governance context, monitoring objectives). These demonstrations will provide a blueprint for other fisheries to follow that will unlock demand, decrease the friction of setting up new programs, and reduce the scale of external support required to get new EM programs up and running. Below, we present a selection of near-term on-the-water investment priorities organized by geography to prove EM's capability to improve monitoring and accountability at scale in a variety of fishery archetypes. (Table 2).

TABLE 2. Typology of Priority Regions/Fisheries for EM Development by Governance Level and Status of EM Development (Specific recommendations for the regions/fisheries in blue have been elaborated in this report.)

GOVERNANCE LEVEL:	STATUS OF EM DEVELOPMENT:		
	STUCK IN AN ACCOUNTABILITY TRAP	ON THE LEARNING CURVE	EM IS ESTABLISHED
LOW/MIXED	N/A	WCPO tuna Other tuna fisheries	N/A
MEDIUM	N/A	Chile Peru	N/A
HIGH	European Union New England groundfish	New Zealand Scotland England	United States Australia Canada

New England Groundfish

TYPE: HIGH GOVERNANCE, STUCK IN AN ACCOUNTABILITY TRAP

The New England Groundfish fishery has struggled with a lack of accountability on the water and unreported discarding of choke species. A lot of heavy lifting has been done to advocate for better accountability and to demonstrate EM's potential to meet the fishery's monitoring needs. Now is the time to push these efforts over the line. As a part of the Amendment 23 process, which will set at-sea monitoring requirements for the fishery, the New England Fishery Management Council has identified 100 percent at-sea monitoring with the option of using EM to meet a portion of this requirement as its preferred alternative. A final decision is expected soon with implementation possibly happening in May 2021. Continued effort is needed to push EM across the line, including:

- **Advocate for full accountability and the use of EM through the Amendment 23 process.** The lack of a requirement for comprehensive on-the-water

monitoring is the primary barrier to EM in the region. Stakeholders should make a final push to make sure the preferred alternative for Amendment 23 is adopted and brings full accountability to the fishery.

- **Lower video review rates to bring down program cost.** Reducing program costs will be essential for program durability, and a combination of research and on-the-water pilots should determine the minimum video review rate that can still meet program objectives of validating vessels' reported discards.
- **Develop AI concepts and integrate them into workflows.** New England has been a hub for the development of AI, and investment should continue for these efforts. Monitoring discards in a multispecies fishery presents some complex challenges for AI development, but also great opportunities to drive cost reductions.

European Union

TYPE: HIGH GOVERNANCE, STUCK IN AN ACCOUNTABILITY TRAP

The EU is in a standoff over the landing obligation. Industry sees the regulation as an existential threat to its survival and has firmly dug in its heels. At the same time, regulators are trying to find a way to enforce the landing obligation with many concluding that EM is the only way to ensure compliance. There appear to be three general scenarios for how this will play out:

- **Industry fends off implementation.** Industry continues to fend off implementation of the landings obligation which will likely have negative impacts on the health of fish stocks and the long-term economic prospects for the fishing industry. This will also increase the risk of several fisheries losing their MSC certification.
- **Government mandates EM implementation.** Government mandates the implementation of EM to enforce the landings obligation with no concessions made to industry. This causes significant near-term economic pain for industry and serious implementation and political challenges.
- **Industry and government reach a grand bargain.** Industry and government reach a grand bargain in which both sides make concessions. There will be sacrifices on both sides, but the result is a compromise that addresses the challenge of controlling unreported discards to ensure fisheries are managed sustainably while addressing the economic concerns of industry.

Completing a grand bargain will not be easy, but the following investments can help push towards a compromise that includes EM.

- **Support Northern European leadership.** In the last few months, Denmark and Sweden have made commitments to push ahead with EM. Providing on-the-water support, technical guidance, and endorsements of these efforts can make them a success and pull the EU forward.
- **Cultivate industry partners.** Bringing private-sector partners to the table to shape EM implementation will be essential to reduce political and practical friction. This is an opportunity for leading industry members to shape EM programs and incentives (e.g., quota top-ups) which will provide them benefits relative to less cooperative industry peers.
- **Create a credible MSC threat.** A large portion of MSC certified fish come from Europe, and with the lack of implementation of the landing obligation some of this supply could be at risk of losing certification. Highlighting the threat of decertification while also pushing for stronger risk-based data requirements in the MSC standard can ratchet up pressure to advance EM and to reach a broader agreement on the landing obligation

New Zealand

TYPE: HIGH GOVERNANCE, ON THE EM LEARNING CURVE

New Zealand passed legislation in 2017 to require EM for all commercial fishing vessels, which could cover up to approximately 1,000 vessels. A change of administration and fishing industry concerns put the rollout on hold, but it is now back in motion with a mandatory regulated 20-vessel program up and running. The focus has shifted from EM as an objective to EM as a tool to meet monitoring objectives, and a more collaborative dialog has developed among stakeholders.

United States

TYPE: HIGH GOVERNANCE, EM IS ESTABLISHED

The United States is the world's leader with eight fully implemented programs and 11 pilots/pre-implementation programs in process, which cover almost 600 vessels. Philanthropic efforts in the US should focus on pushing the leading edge of EM development and resolving some of the more challenging issues, including:

- **Create a model for efficient, sustainably funded EM programs.** With numerous EM programs, government budget and capacity constraints, and industry concerns about cost; a durable model for financing programs and bringing down costs needs to be established. This includes pushing performance-based standards, validating a third-party provider contracted program in the West Coast, and developing data management policies
- **Integrate EM data into science.** EM data is primarily used for compliance functions, but it has enormous potential to improve fisheries science. Research should

Support on-the-water projects and facilitate industry dialog. The next eighteen months should focus on addressing some of the main challenges to further adoption of EM in New Zealand, including cost and privacy concerns. Bringing in organizations with international EM expertise to provide on-the-water support and technical guidance can help work through design options and facilitate dialog between stakeholders to address these challenges and chart a shared pathway forward.

explore the use of EM data for fisheries science and understand how these new data streams can be integrated to reduce the cost or improve the accuracy of fishery assessments.

- **Implement more efficient management measures enabled by EM.** Some EM programs are reaching a level of maturity where data should enable more flexible management. Selectively rolling back input controls or applying more targeted sanctions (e.g., spatial closures, gear restrictions) are logical first steps, but efforts should also explore a long-term vision for how EM data can support more dynamic and flexible fisheries management, which will become even more relevant with increasing climate-induced volatility.
- **Test new use cases for EM.** EM should continue to be tested for new fisheries and use cases. For example, expanding the testing of EM in the for-hire sector would be a big step forward for bringing stronger accountability to the recreational sector.

Onboard EM system, Rhode Island.
Photo: Ayla Fox / The Nature Conservancy



Chile's Semi-industrial Fleet

TYPE: MEDIUM GOVERNANCE, ON THE EM LEARNING CURVE

Chile is already moving ahead with implementation of EM for its industrial fleet with one hundred installations completed as of early 2020. In 2022 the country is scheduled to implement EM for its semi-industrial fleet, which would bring EM to hundreds of additional fishing vessels. This could be one of the largest EM programs in the world and would demonstrate the applicability and scalability of EM in a moderate governance context. The following activities can support a successful rollout of EM for Chile's semi-industrial fleet:

- **Support on-the-water pilots.** Chile will learn a lot through the implementation of EM on its industrial fleets, but the semi-industrial fleets will present some different challenges (e.g., different fisheries, locations, boat configurations, monitoring needs). Developing on-the-water pilots in representative sectors of semi-industrial fisheries can help collect baseline data, identify challenges, and inform program

design in advance of moving towards widespread implementation.

- **Validate performance-based standards and third-party EM service provision.** The Chilean government is handling video review for its industrial vessel EM program, but a different program structure might be better suited to the semi-industrial fleet given the large number of vessels. This is an opportunity to test a third-party delivery model in which EM service providers would be responsible for hardware installation, service, video transmission, review, and the delivery of analyzed data to the government that meets minimum performance standards. The third-party contracting model could be a more scalable approach for EM program delivery, but it needs to be tested to validate whether it improves the efficiency of program development and delivery, and this model should be considered for Chile's semi-industrial fleet.

Peru Anchoveta

TYPE: MEDIUM GOVERNANCE, ON THE EM LEARNING CURVE

EM could be well-suited to monitor interactions with marine mammals, seabirds, and bycatch of juveniles, which are the primary concerns in the fishery. As of early 2020 a few large anchoveta vessels had EM systems installed, driven by the companies themselves.³ The artisanal fleet is also largely unmonitored, and EM could provide a pathway to full fleet coverage. Effort in Peru should:

- **Find industry entry-points for industrial anchoveta.** Progress on EM for the industrial anchoveta fleet is

likely to be driven from the bottom up, and investments should be made to develop on-the-water pilots in collaboration with leading companies.

- **Pilot EM in the artisanal anchoveta fleet.** The artisanal anchoveta fleet has been largely unmonitored, but a FIP is advancing human observers for a portion of the fleet. Human observers will be difficult to scale widely across the fishery and so EM should be piloted as an option for moving towards full on-the-water monitoring for the artisanal fleet.

Western and Central Pacific Ocean Tuna

TYPE: LOW/MIXED GOVERNANCE, ON THE EM LEARNING CURVE

EM has progressed markedly in the last few years in the Western and Central Pacific Ocean (WCPO). It has moved from basic trials to a point where regional bodies are pushing for EM programs and trying to influence their design and structure. The region's longline tuna fishery is set to be the first large-scale implementation of EM in a low/mixed governance region. Covid-19-induced monitoring gaps are also strengthening the case for EM for purse seine vessels and improved transshipment monitoring. The following priorities can help support successful development of EM in the region:

- **Support early adopting countries and industry partners.** A handful of countries (e.g., The Federated States of Micronesia (FSM), Solomon Islands) and industry partners (e.g., Thai Union, Bumblebee, Luen Thai Fishing Venture) are current leaders for advancing EM in the region. These groups are providing the bottom-up pressure that is driving the regional EM conversation. Investments should continue to support these groups so that their EM work can continue to drive towards broader EM adoption in the region.

3. Confidential interview

- **Advocate for a 100 percent monitoring requirement in longline fisheries.** EM is now a proven technology for monitoring tuna fisheries and with just over 2,000 longline vessels operating in the region with less than five percent observer coverage, the time is right to start pushing for 100 percent monitoring requirements for the longline fleet. Discussions are progressing at the regional level to push EM adoption to address this long-standing monitoring gap.
- **Advocate for EM as a complement to human observer coverage for purse seine fisheries.** Covid-19 has highlighted an additional weakness of human observer programs. This is creating stronger calls for EM, which should be leveraged to advocate for EM in purse seine fisheries as a complement to human observers that protects observer safety, reduces bycatch mortality and improves overall science and compliance monitoring and data collection.
- **Amplify market pressure.** Some tuna industry members are getting ahead of the EM curve to reduce risk in their supply chain. But market pressure needs to be amplified if it is going to push tuna fisheries more broadly towards EM. More pressure needs to be placed on retailers that exposes the risks and unsustainable practices in their tuna supply chains, which will create incentive for EM. At the same time, developing robust data adequacy standards of the MSC standard will push tuna fisheries to EM as a means to validate that they are meeting the requirements of the standard.
- **Test third-party service provision.** EM pilots in the region largely rely on government-run video review centers. While this structure will be the best and

preferred option for some countries, there may be efficiencies to be gained through third-party contracting of EM program delivery functions. Investment is needed to develop and test performance-based standards and third-party contracting to understand the costs and benefits of taking governments out of primary program delivery roles (e.g., system maintenance, video retrieval, video review) and into the role of auditing analyzed data to ensure its accuracy and utilizing that data to enhance the economic and environmental performance of the region's fisheries. FSM is considering performance-based standards and this effort should be supported to take them to completion and get the standards incorporated into regulations.

- **Support capacity development of national fisheries authorities to improve EM service delivery.** Many governments may want to conduct their own video review or other EM program delivery functions. These governments should be supported to help improve the efficiency and consistency of their programs and drive continuous improvements that will secure the long-term durability and quality of EM programs.
- **Implement bulk procurement.** There are numerous EM pilots in the region, many with just a handful of vessels which can be risky and costly for EM providers to service. With growing demand for EM, there is an opportunity to bring buyers together into a coordinated bidding process. This can improve supply and demand visibility and give providers sufficient scale and certainty to reduce the costs of program delivery and make the requisite investments to improve functionality.

Other Tuna Regional Fisheries Management Organizations (RFMOs)

TYPE: LOW/MIXED GOVERNANCE, ON THE EM LEARNING CURVE

While the Western and Central Pacific Fisheries Commission (WCPFC) has been out in front of the other RFMOs on EM, there is growing interest and pressure to improve monitoring in the other RFMOs. Investment should:

Provide technical support to early adopting countries. Early adoption countries, such as the Seychelles, have made strong commitments to EM. Providing these countries with technical support will help prove the EM model in tuna RFMOs beyond the WCPFC and build bottom-up pressure for a commitment to 100 percent monitoring for industrial vessels.



EM install, Seychelles.

Photo: Kydd Pollock / The Nature Conservancy