

Catalyzing the Growth of Electronic Monitoring in Fisheries: Global EM Developments

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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

EM Developments Around the World Since 2018

In 2018, The Nature Conservancy and CEA Consulting released the report, "Catalyzing the Growth of Electronic Monitoring in Fisheries." The 2018 report presented several country or regional targets for EM, and there has been significant progress against these targets in the last 18 months (Table 1). Many of the regions are on track to meet these targets—although some will get there after 2021—and there have been EM developments in all the priority regions identified except North Asia. The following section discusses EM progress across different geographies. There is no global database of EM pilots or programs, and this paper is not intended to be comprehensive. Instead, it provides a picture of how adoption of EM is progressing in different regions (Figure 1) and synthesizes key trends.

To help structure the progress of EM, we have grouped countries into the following archetypes:

- EM is established
- On the learning curve
- Caught in an accountability trap

The types of interventions required in these different archetypes will vary.

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>

EM is Established

In places where EM is established, investment should be focused on pushing the boundaries of EM, developing supportive policies and directives, and resolving some of the more persistent challenges (e.g., data management, program financing). More specifically, work should be focused on:

- Identifying new fisheries or use cases for EM
- Refining regulations, directives, and implementation to make program delivery more efficient
- Integrating data from EM into science
- Using EM data to improve management

On the Learning Curve

In places that are on the EM learning curve, efforts will need to focus on building confidence that EM can efficiently meet monitoring objectives without breaking budgets or politics. This will include:

- Providing technical support for regulators
- Facilitating dialog and providing information to stakeholders
- Executing EM pilots on the water, iterating on designs, and proving that EM can cost-effectively meet monitoring objectives.
- Building bottom-up support for EM (e.g., through industry partners, or leading countries)

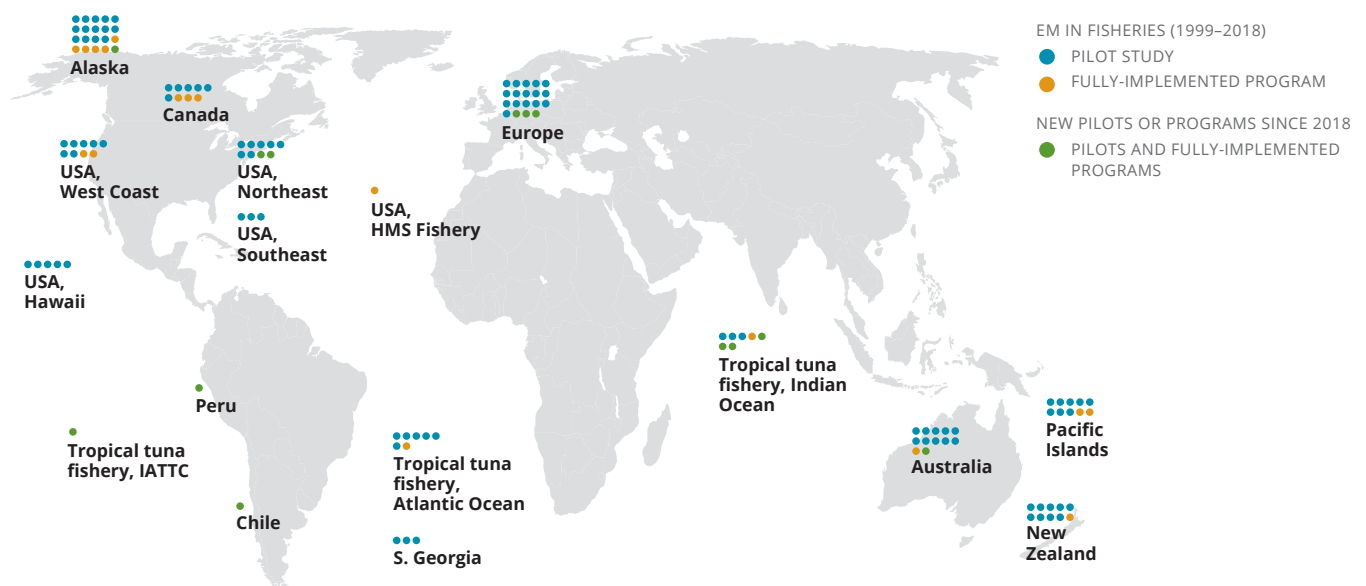
Caught in an Accountability Trap

In these fisheries, the management system paired with insufficient monitoring has fully embedded non-compliance in fishery operations. Although industry resistance to better accountability is a barrier to EM in almost all fisheries, in these fisheries the resistance has become especially acute and has ground progress to a halt. These fisheries have experience with EM pilots, the capacity to implement EM programs, and recognize that EM can drive compliance with regulations. But portions of industry see full implementation and compliance with existing regulations as an existential threat to their viability and are vehemently opposed.

For fisheries/regions caught in an accountability trap, interventions need to find a way to break the gridlock and create agreements that balance economic, social, and ecological objectives. In these cases, progress may be slow as some actors dig in their heels. But there are signs of progress in some of these challenging contexts, such as the New England groundfish fishery and the EU. Interventions should include:

- Building public pressure for better accountability, highlighting the current lack of compliance, or even litigating
- Creating a coalition of the willing to take the first step forward
- Providing incentives to and working with early adopters to demonstrate the benefits of EM
- Supporting pilots to work through any unresolved questions about EM

FIGURE 1. Number of EM pilots and programs from 1999–2018 and a selection of new pilots and programs since the end of 2018¹



1. Adapted from Aloysius T. M. van Helmond et al., "Electronic Monitoring in Fisheries: Lessons from Global Experiences and Future Opportunities," *Fish and Fisheries* 21, no. 1 (2020): 162–89, <https://doi.org/10.1111/faf.12425>.

TABLE 1. Three-year EM Development Targets by Geography from the 2018 Report

2018 THREE-YEAR TARGET	PROGRESS STATUS	UPDATES
<p>United States: <i>Continued rollout of EM in priority federally managed commercial fisheries (e.g., HMS, trawl, pelagics), and development of stronger national guidelines to streamline implementation</i></p>	<p>On track ●●●</p>	<p>Some bumps in the road, but there are several fully implemented programs and EM trials operating under exempted fishing permits moving toward full implementation (e.g., West Coast groundfish, New England groundfish). There are now almost 600 vessels participating in federally managed fisheries with EM systems. EM is also being tested in new fisheries (e.g., recreational sector) and new EM policy directives are providing clearer guidance for the regions.</p>
<p>Australia: <i>Adoption of EM in the majority of Commonwealth fisheries</i></p>	<p>More effort needed ●●●</p>	<p>Progress is slower than anticipated but expansion of EM to additional Commonwealth fisheries was still planned as of the beginning of 2020. Development is underway for EM at the state level, including Queensland's inshore vessels.</p>
<p>New Zealand: <i>Full implementation of EM mandate</i></p>	<p>More effort needed ●●●</p>	<p>EM development appears to be back on track with the first mandated EM program in place to monitor dolphin interaction and bycatch. A more collaborative approach between government and industry has developed with a shift from EM as the objective to achieving objectives with EM. Scoping is underway for the next fisheries, but program cost, funding, and privacy are still a concern.</p>
<p>Western and Central Pacific Fisheries Commission (WCPFC): <i>Regulatory mandate for longline permits and implementation in the majority of Forum Fisheries Agency nations. Initial piloting of EM for purse seine vessels</i></p>	<p>More effort needed ●●●</p>	<p>Several island nations appear to be on the path to requiring EM as a licensing requirement. FFA has drafted longline EM policy, the Data Coordinating Committee has developed draft EM Data Standards, and industry leaders are pushing EM forward. With 100 percent observer coverage on purse seiners, EM can play a complementary role, especially for compliance and observer safety functions. As highlighted by Covid-19, EM can also provide a backstop if observers cannot be deployed.</p>
<p>Europe: <i>Adoption of EM for high-risk vessels in select EU nations (e.g., Denmark, UK, Netherlands).</i></p>	<p>More effort needed ●●●</p>	<p>Continued discussion about the failure to enforce the landings obligation and that EM is the only tool capable of monitoring the regulation. Several N. European countries (Denmark, Sweden, Netherlands) are taking initial, unilateral steps forward on EM, but more effort is needed to break the gridlock. For Brexit countries no longer in the EU, there may be significant fisheries management changes and opportunities for EM. Scotland is moving forward on a plan to implement EM in multiple fisheries. Early discussions are also underway in Norway and Iceland.</p>
<p>North Asia: <i>Pilot EM trials for domestic fisheries at scale in China, Japan, and Korea, tied to fisheries reform goals that demand comprehensive monitoring</i></p>	<p>Not on track ●●●</p>	<p>There was some early dialogue about EM in Japan, but focus now is on digital data collection. Limited insight into China and Korea, but there is some anecdotal evidence of interest in China's distant water squid fishery.</p>
<p>Newly Industrialized Countries: <i>Pilot EM trials at scale for industrial-scale fisheries in major middle-income countries: Peru, Chile, Argentina, Mexico, and Brazil. Further develop proof points of low-cost EM systems in small-scale fisheries (e.g., Indonesia and Mexico).</i></p>	<p>On track ●●●</p>	<p>EM is being rolled out for Chile's industrial fleet, and semi-industrial fleet deployment is slated for 2022. A few vessels in Peru are now testing EM. Testing of low-cost EM cameras is continuing in Indonesia.</p>

Progress in Regions Where EM is Established

Canada

Canada was the home of the world's first EM trial in the British Columbia (BC) Area "A" crab fishery, which started in 1999. Canada now has several fully implemented EM programs, including the BC Area "A" crab fishery, the BC Groundfish Hook and Line/Trap Catch Monitoring Program, and the BC Hake Fishery. In total there are just under 300 vessels participating in fully-implemented EM programs.³ Although Canada was an early adopter of EM, there have been no new fully adopted programs

since 2006. A 2019 analysis of Canada's Pacific Region Fisheries found that for the most part, catch reporting tools have been applied in fisheries where they are feasible.⁴ In other words, the absence of additional EM programs in Canada's Pacific region over the last decade is likely due to the lack of suitable fisheries for the tool. In the Atlantic region, several groups are testing an electronic whale interaction mitigation system, but the effort has so far been focused on non-video solutions.

The United States

The United States has more vessels with EM systems than any other country. There are eight fully implemented programs and 11 pilots/pre-implementation programs in process. In total, nearly 600 vessels are part of an EM program. The US continues to explore additional opportunities for EM and is also making changes to policies to try and improve the efficiency of its EM programs. While there have been some bumps in the road, the US has largely embraced EM and the benefits it can provide fisheries management.

On the policy side, the National Marine Fisheries Service (NMFS) updated its Policy on Electronic Technologies and Fishery-Dependent Data Collection in May 2019.⁵ While the policy does not mandate anything, it encourages the consideration of electronic technologies including EM. The Policy also states that no electronic technology program will be approved by NOAA if it creates an unfunded or unsustainable cost of implementation.⁶ The language recognizes the long-term funding challenges for the government and indicates that they are looking to move program costs to industry as the technology has matured and their experience with EM programs has grown.

NMFS also put forward a proposal to reduce the required retention time for EM video and data that have been

collected in programs funded by industry to 12 months.⁷ While the cost of data storage has declined over time, requirements to store video for extended periods (sometimes indefinitely) create an unnecessary cost burden for EM programs. This directive applies a common-sense approach to reducing the video and data retention requirements and their associated cost.

There have been some notable EM program developments in the United States in the last 18 months.

On the West Coast, the groundfish fishery is in the process of trying to move to a fully industry-funded third-party provider model, and this transition has been challenging. The fishery has 100 percent accountability requirements in place that can be met with human observers or EM. The fishery has been using the Pacific States Marine Fisheries (PSMFC) as its EM video reviewer during the pilot phase, and they have provided this service at a price that makes EM a cost-effective alternative to human observers for a portion of the groundfish fleet. This has also been subsidized for the fleet. But, at last check, PSMFC will not be bidding as a 3rd party provider for EM video review for the fully implemented program because they are concerned about receiving payments directly from industry. The bids from other

3. Aloysius T. M. van Helmond et al., "Electronic Monitoring in Fisheries: Lessons from Global Experiences and Future Opportunities," *Fish and Fisheries* 21, no. 1 (2020): 162–89, <https://doi.org/10.1111/faf.12425>

4. Howard McElderry and Phillip Meintzer, "Design Considerations to Optimize Monitoring for Canada's Pacific Region Fisheries" (Archipelago Marine Research Ltd., March 2019), <https://em4.fish/wp-content/uploads/2019/03/McElderry-Meintzer-2019-FisheryMonitoringDesignConsiderations-1.pdf>

5. Brett Alger, "Policy on Electronic Technologies and Fishery-Dependent Data Collection" (National Marine Fisheries Service Office of Science and Technology, May 2019), <https://www.fisheries.noaa.gov/national/laws-and-policies/science-and-technology-policy-directives>

6. Ibid.

7. Brett Alger, "Third-Party Minimum Data Retention Period in Electronic Monitoring Programs for Federally Managed U.S. Fisheries" (National Marine Fisheries Service Office of Science and Technology, April 3, 2020), <https://www.fisheries.noaa.gov/national/laws-and-policies/science-and-technology-policy-directives>

providers have been coming in at significantly higher cost than what PSMFC charges, likely because PSMFC already performs video review for the groundfish and other fisheries on the West Coast (e.g., Alaska) and already has all of the required infrastructure in place. PSMFC is also a quasi-governmental organization that does not require the same return on investment as private-sector EM providers.

On top of the higher priced bids coming in from EM providers, the West Coast Groundfish Observer Program is also proposing to audit 10 percent of the EM video footage as part of a debrief/audit of the third-party reviewer. This additional review-of-the-reviewer step is anticipated to cost approximately \$450,000 USD each year and would be a cost recovered from industry. The higher cost of EM video review with a new third-party provider paired with the additional \$450,000 USD annual cost to audit the provider has the potential to tip the economics back in favor of human observers and stall EM development. The debate is ongoing, and stakeholders are in a tricky spot of trying to steer the program to a fully cost-recovered third-party model that NMFS is encouraging, while not undermining what has been a successful EM program.⁸ This debate also highlights the path dependence of EM piloting and program development.

In Alaska, EM continues to move ahead with five fully implemented EM programs and two pilots. The small boat fixed gear program, which was just getting underway when we released our 2018 paper, is running well. The midwater trawl fishery is now exploring EM and will be operating a pilot under an exempted fishing permit in 2020, with a target of being under regulation in 2022.

Hawaii recently completed a review of its longline EM pilot and found that EM could substitute for human

observers. EM could be used to accurately identify almost all species of importance for management with just a couple exceptions. For the deep-set longline fishery, EM is expected to be a cost-effective alternative to human observers as vessels take trips that average 22 days in length, but fish for only 13 days. Work will continue to improve the ability to use EM to identify the species that it could not match observers on in the year-long trial (e.g., bigeye and turtle identification to the species level). But with observers only covering 20 percent of the deep-set trips, a viable model appears to be expanding EM to cover all trips and scaling observer coverage back to 10 percent. According to one person interviewed for this report, this could be done at a similar cost to the existing observer program.

On the East Coast, after a successful pilot, the herring and mackerel fishery is moving ahead with an exempted fishing permit (EFP) that will allow the use of EM as a replacement for human observers. Enrollment in the EFP ended at the end of April 2020 with EM trips expected to begin in June. The expectation is that this will move to full implementation in the future.

The Northeast scallop fishery recently began piloting EM to improve the timeliness of the collection of vessel data, which is used to open and close the fishery. The first stage of the pilot was successful and is now moving to deploy EM on more boats.

EM has also been tested as a way of validating captains' required catch reports on two for-hire recreational fishing boats in the region: one party boat and one charter boat. The recreational sector is a major source of fishing mortality and catch uncertainty, with very limited monitoring, and these trials are an exciting first step in assessing the applicability of EM in that context.

Australia

Australia has 75 vessels operating with EM in their Eastern and Western Tuna and Billfish Fisheries and their Gillnet Hook and Trap Fisheries. The next likely candidate for adoption of EM is the trawl fishery, which has piloted EM on a couple of vessels. The process for rolling out EM in this fishery has slowed, but at last check the intention is to have full program implementation in 2022. Following the trawl fishery, the Northern Prawn fishery would be one of the likely next candidates. Together these fisheries would bring an additional

estimated 80 to 90 vessels into EM programs and would mean that over half of Australia's federally managed vessels would be in an EM program.

At the state level, EM is being explored for roughly 200 inshore trawl, gillnet, and line vessels in Queensland. If this moves ahead in full, the program would have almost three times the number of vessels as Australia's federal EM programs.

Australia Fisheries Management Authority (AFMA) is also

8. Melissa Mahoney, "West Coast Groundfish EM Program at a Crossroads," December 6, 2019, <https://em4.fish/west-coast-groundfish-em-program-at-a-crossroads/>

working to expand its use of EM data. EM is already used for logbook compliance, and they are using the data to apply targeted sanctions (e.g., sanctioning vessels with high levels of seabird bycatch). The agency is now exploring how they can better integrate the EM data stream into stock assessments. Under the EM program, validated logbook data is accepted as the data from

fishing trips, but this data would be an entirely new data stream for stock assessments and there is still some skepticism that fisher reported data can be used. Work is underway to understand how to integrate this new data stream into the models and build confidence that with EM, logbooks can be a trusted source of data for science.

Progress in Regions On the Learning Curve

New Zealand

Legislation was approved in 2017 to require EM for all commercial fishing vessels, which could cover up to approximately 1,000 vessels. A change in administration and concerns from the fishing industry put the rollout of EM on hold, but it is now back in motion. New Zealand now has a regulated mandatory EM program for 20 vessels with the primary objective to assess and minimize Māui dolphin interactions, but also to verify catch reporting. The government paid for the cost of the equipment and is also reviewing the video for this program. Initial reports are that the trial is working well.

Looking forward, four key issues are likely to influence the continued rollout of EM in New Zealand's fisheries. First, there is a low level of observer coverage in the inshore fleet and strong incentives for misreporting catch data. Second, a revised Hector's and Māui Dolphins Threat Management Plan is under development. A draft plan was put out for public consultation and garnered over 13,000 submissions, indicating the importance of both fisher livelihoods and dolphin conservation. While

fishers say dolphin interactions are very rare, there is limited evidence to prove this. EM provides a potential path forward to validate the absence of dolphin bycatch and to verify self-reported catch data. Third, costs of managing New Zealand commercial fisheries are recovered from the fishing industry and the industry is concerned the current high costs of EM could make sectors of the industry uneconomic. Fourth, data privacy concerns are an ongoing point of contention for industry.

Significant challenges remain but EM appears likely to be cautiously rolled out in more fisheries in the coming years. Initial opposition from parts of the fishing industry, which is common in almost all regions at the beginning of an EM rollout process, has lessened as the government adopts a more collaborative approach, including supporting additional EM trials managed jointly by industry groups and conservation NGOs. These trials are designed to explore how privacy and cost concerns might be addressed by different approaches to EM.

Scotland

Scotland is an emerging leader for EM. The country has completed trials of EM on demersal vessels, as well as a large pelagic vessel. While these trials did not make it to full implementation, Marine Scotland is now moving ahead with the Inshore Fleet Modernisation Program. As a part of this program, there are three fisheries in queue for EM: scallops, inshore trawl, and inshore pot and creel.

There are now 13 scallop vessels with EM systems, with an aim to eventually cover 114 vessels. Illegal fishing within MPAs created the momentum for EM in this fishery, but there are other factors that have led to camera-based systems as opposed to just location tracking. Fishery regulations only allow vessels to fish with eight dredges in inshore waters, but they can fish with

10 dredges offshore. With cameras, vessels can fish inshore and demonstrate that they are abiding by the eight-dredge limit and still fish with 10 dredges in offshore waters. The fleet is also interested in pursuing MSC certification and an EM program could provide data to support the assessment process.

The next fishery slated for EM is the inshore trawl fleet that fishes primarily for langoustines and nephrops. This fishery is believed to have a lot of bycatch and discard issues, but the agency cannot put observers on these boats due to safety concerns. This inshore trawl project is still in the scoping phase but would cover 118 vessels if fully implemented.

Finally, the third phase of the program is looking to implement EM on the inshore pot and creel fishery, which has 1,440 vessels, but this is on the distant horizon right now.

Chile

Chile adopted legislation that required the installation of EM systems on all industrial vessels by the end of 2018 and on artisanal boats longer than 15 meters by 2020. Implementation is behind schedule, but installations on the industrial fleet were well under way by the beginning of 2020. By the end of January there were more than 100 industrial vessels newly equipped with EM systems and beginning to record video. Rollout for artisanal fleet is now expected in 2022.

A driver for the EM program in Chile has been the United States' import provisions of its Marine Mammal Protection Act, which requires nations exporting fish products to the US to be held to the same standards as US commercial fishing operations. Chile has numerous fisheries that export to the United States and by January 2022, they must apply and receive a comparability finding for each of these fisheries to continue to export to the United States. Industry says that mammal bycatch is limited, but there is little data to support this claim. EM

In addition to these EM projects and plans, Scotland is also partnering with the University of East Anglia on AI development.

is being deployed to help fill this data gap, with the intent of demonstrating that Chilean fisheries meet the necessary standards to continue exporting to US markets.

Uncertainty about the level of discards is also driving EM adoption. The scale of the issue is not well understood in many Chilean fisheries, and it can be a source of conflict between industrial and artisanal vessels. A study of the demersal crustacean fishery found that observer reported discards in the fishery were 65 to 125 percent higher than those reported in captain logbooks. The study concluded that absent conditions that drive accurate self-reported data, logbooks cannot be used to make administrative and quota decisions.⁹

Looking ahead to 2022, the rollout of EM for the artisanal fleet (vessels longer than 15 meters) could bring a large number of vessels into the EM program. If this moves ahead, it could become one of the largest EM programs in the world.

Tuna Regional Fisheries Management Organizations (RFMOs)

WCPFC

The WCPFC continues its steady progression to broader adoption of EM with a goal of adopting an EM conservation and management measure at its 2020 Annual Session. The region is home to numerous pilots, including the recently completed 50-vessel pilot for longline vessels in Fiji run by the Food and Agriculture Organization (FAO) of the United Nations. There have also been pilots in several longline fleets of the island states, including the Federated States of Micronesia, Marshall Islands, Palau, Cook Islands, and the Solomon Islands. Not to be left out, the distant water fishing nations of Japan and Taiwan have also trialed EM for their tuna fleets. As of the end of 2018, there were approximately 80 longline vessels in the WCPFC equipped with EM (excluding Australia and New Zealand).

The WCPFC has a target for human observers to cover five percent of longline trips, but many countries struggle

to meet even this modest level of coverage. There is growing consensus that current observer coverage is insufficient and that EM can fill this monitoring gap. Market demands for sustainability are also driving EM forward in the region. Thai Union has a target that at least 75 percent, with a goal of 100 percent, of its branded tuna will come from fisheries that are MSC certified or in a fisheries improvement project. Other tuna companies, such as Luen Thai and Tunago, are also integrating EM into their supply chains.

Island nations have been driving EM from the bottom up and FSM leadership has been particularly influential. The country has moved all the way from EM pilots to a commitment to having 100 percent of longline vessels fishing in its exclusive economic zone (EEZ) with EM by 2023. Through the Technology for Tuna Transparency (T3) Challenge, FSM is encouraging others in the region to match their commitment to on-the-water monitoring. With the encouragement of FSM, the

9. Marcelo San Martín et al., "Are Self-Report Fishing Log-Books a Solution for Measuring Catch, Bycatch and Discards?: The Case of Crustacean Demersal Fishery in Chile." (9th International Fisheries Observer and Monitoring Conference, Vigo, Spain, June 2018), <https://ifomcvigo.com/wp-content/uploads/2018/08/proceedings-9th-ifomc.pdf>

Marshall Islands, and other members, the Parties to the Narau Agreement (PNA) has also been out in front of EM.

At the end of 2019, the Forum Fisheries Agency put forward their Draft Regional Longline Electronic Monitoring Policy. In this document, they propose developing a set of minimum EM standards at the RFMO level but leaving EM program design and implementation to the member states. The end goal would be a set of harmonized EM programs across the region. The Pacific Community (SPC) has also continued to explore EM, including research on the capability of EM to provide the data required in the longline WCPFC regional observer program minimum standard data fields.

There is still much work to be done, but the WCPFC appears to be well on its way to widely adopting EM.

IOTC

Within the territory of the IOTC, Spanish purse seine vessels that are part of the National Association of Tuna Freezer Vessel Shipowners (ANABAC) and Organización de Productores de Atún Congelado (OPAGAC) are voluntarily using EM for their trips. French purse seine vessels that are part of Orthongel have also adopted EM voluntarily. Between these two groups there are about 27 vessels operating with EM in the IOTC region.¹⁰ The voluntary EM programs of these producer groups are the only large-scale programs that are not managed by national or subnational governments.¹¹ All of the data analysis is handled independently, and these vessels only submit the processed data required by governments or the RFMO.

Countries in the IOTC are also beginning to explore EM in the region. As a part of a World Bank project, the Maldives is beginning to install EM systems on its pole and line fleet. According to one person involved in the project, the plan is to roll out EM on all of the approximately 700 pole and line vessels by the end of 2020. The program is also exploring placing systems on collector vessels. One of the drivers of EM adoption for the pole and line fleet is to stay ahead of the European Union's illegal, unreported, and unregulated (IUU) carding system. There is also an important human element as well, as the systems will have 2G capabilities which will allow for crewmembers to use communication apps and make emergency voice calls.

Although the IOTC has a limited role in the voluntary French and Spanish programs and the Maldives work,

they are also beginning to explore EM. A key driver for the RFMO is the limited observer coverage and the significant safety concerns for observers in the region, both from piracy and from unsafe vessels. The RFMO is moving ahead with a pilot in Sri Lanka, which is just getting underway. According to one person involved in the trial, the EU's yellow and red-carding of Sri Lanka is driving efforts in the country to improve accountability and was a key factor in Sri Lanka volunteering for the trial.

The recent scandal of the Spanish fleet under-reporting yellowfin catches in the IOTC is opening more opportunities for EM. The Seychelles is taking the lead and has made a commitment to 100 percent EM coverage for all vessels fishing in its territorial waters. Pilot projects are getting underway for both longline and purse seine vessels in that country and TNC is providing on-the-water support for these trials.

ICCAT

There are several vessels with EM systems in ICCAT. Orthongel, OPAGAC, and ANABAC are operating purse seine vessels with EM systems. As in the IOTC, this is a voluntary EM program run completely by industry. At the end of 2018, the FAO completed its trial of EM on 14 purse seine vessels that operate in the Ghanaian EEZ. The pilot was successful on many counts, but at the end of 2018 the vessels had discontinued the use of the EM systems. The EM systems, however, may soon be put back into service as a part of FIPs.

Although EM is currently voluntary in ICCAT, some recent changes may start a stronger movement to EM. ICCAT recently agreed to require 100 percent observer coverage on purse seine vessels year-round, and to expand longline observer coverage to 10 percent in 2022 for vessels greater than 20 meters.¹² They have also agreed to develop EM minimum standards by 2021.

IATTC

IATTC is in the early stages of exploring EM, particularly to collect data from purse seine vessels. There is an EM pilot underway with two small vessels and two larger Ecuadorian-flagged vessels. One of the objectives of the IATTC EM program on purse seine vessels is to determine the effectiveness of EM compared to human observers. While small in scale, this pilot is an important first step in IATTC's exploration of EM.

Early progress is also being made in the longline fleet.

10. Van Helmond, Aloysius T.M., et al., 2019 "Electronic monitoring in fisheries: Lessons from global experiences and future opportunities." Fish and Fisheries, Volume 21, Issue 1, 162-189.

11. Ibid.

12. Victor Restrepo and Holly Koehler, "ICCAT Moves to Protect Atlantic Bigeye and Close Gaps in Monitoring and Data Collection," December 4, 2019, <https://iss-foundation.org/iccat-moves-to-protect-atlantic-bigeye-and-close-gaps-in-monitoring-and-data-collection/>

IATTC scientific staff and the IATTC Working Group on Bycatch have recommended at least 20 percent observer coverage on longline vessels fishing for tunas in the Convention Area, and the Working Group on Bycatch has suggested that human observer coverage could be supplemented by EM in order to achieve that goal. It is

likely that IATTC staff will present preliminary EM standards at the Scientific Advisory Committee in May 2020. One early opportunity for EM may be on smaller purse seine vessels that do not currently have human observers.

Progress in Regions Caught in an Accountability Trap

The European Union

In some regions, fisheries regulations paired with limited on-the-water monitoring have created fisheries in which non-compliance is firmly embedded in their operations. This is the current situation in the EU. The landing obligation requires that all fish caught be landed, but with limited quota for some species and little or no market value for small size classes, there are strong incentives in many EU fisheries to discard. Although quotas were increased to compensate for the impact of the landing obligation, all indications are that discarding continues unabated, undermining the objective of the Common Fisheries Policy to achieve maximum sustainable yield.

This has created an environment in which it is difficult to take any steps forward to implementing EM. For some parts of the fishing industry, the prospects of full accountability are an existential threat, as discarding is fully embedded in their current business model. Member states are likewise reluctant to lead on this issue, since implementing EM for their vessels will disadvantage their fishing industry if other member states do not follow suit. Despite these challenges, it is widely recognized that EM is the only way to ensure compliance with the landing obligation and some countries are taking a leadership role.

Denmark has been one of the strongest supporters of EM in the EU and ran the longest running EM trial in the EU. The country has long supported EM, and at the end of March 2020 shared plans to move forward. The country announced that it will move ahead with an EM requirement for vessels that have over 20 sea days a year in the Kattegat Sea. It is estimated that 15 vessels will be equipped this year with EM and that 100 vessels currently meet these criteria and will be required to install EM systems under this decision.¹³

Sweden has instructed its Agency for Marine and Water Management (HaV) to investigate the use of EM to

ensure compliance with the landing obligation. In January 2019, HaV proposed piloting EM in three different fisheries: bottom trawl for fish and nephrops, bottom trawl for shrimp, and a pelagic trawl fishery. The proposal is for EM to be tested on five vessels in each fishery over a period of three years.

The Netherlands is taking a different approach to EM and the landings obligation. Industry is fiercely opposed to the landings obligation and is working on an EM pilot with 12 vessels to fully document what they are catching with the intent of still being able to discard.

In addition to this progress at the national level, the European Fisheries Control Agency released its guiding document, “Technical guidelines and specifications for the implementation of Remote Electronic Monitoring (REM) in EU fisheries.” The document puts forth a set of minimum technical requirements and standards for EM, which could be used to help control of the landing obligation.

There appears to be three general scenarios for how things will play out in the EU:

- **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.
- **Top-down implementation.** Government mandates the implementation of EM to enforce the landing obligation with no concessions made to industry. This causes significant near-term economic pain for the industry and serious implementation and political challenges.
- **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

13. Mogens Jensen and Nanna Møller, March 30, 2020, <https://www.ft.dk/samling/20191/almindel/mof/spm/698/svar/1647184/2171422.pdf>

is a compromise that addresses the challenge of controlling unreported discards while addressing the economic concerns of the industry.

The third option appears to be the only stable and durable solution to the conflict over the landing obligation.

United States: New England Groundfish

The New England groundfish fishery has been, perhaps, the most problematic test case for EM in the United States. The multispecies fishery is managed with strict quotas, and choke species prevent the fishery from landing larger amounts of other species that are not overfished. This structure provides a strong incentive to discard landings of choke species. The fishery has human observer coverage for 40 percent of the trips in 2020, but because of the strong incentive to discard there is consensus that data from observed trips cannot be extrapolated to provide fleetwide estimates. Gulf of Maine cod is one of the key constraining stocks in the fishery and despite continued ratcheting down of catch entitlements for this stock, its status has continued to decline. An analysis by the Groundfish Plan Development Team found that unreported cod discards could mean that cod catch is 2.3 times higher than reported. Observer requirements in the fishery have increased in the last couple of years, growing from 15 percent in 2018 to 40 percent in 2020.^{14,15} But even at this higher level of observation, discarding may just be further concentrated in unobserved trips.

Several EM pilots are ongoing in the fishery, and these pilots are answering some of the remaining questions

about how EM will work in the fishery. In our estimation, ultimately the argument now is less on the technical feasibility of EM, and more on the need for a regulatory requirement. As one person working on EM in the region said, “We have all of the volunteers that we are going to get, we are working with these boats, and they are doing okay.”

There are, however, signs that things are moving. According to another person who has been involved, “It is actually going okay. It is such a large decision and inflection point for the fishery, and there are actors trying to slow things down. But there is more and more interest by the month to move forward.”

A key breakthrough may have been made in January 2020, as the Fishery Council released its draft decision document on Amendment 23 and made 100 percent at-sea monitoring its preferred alternative for the fishery. While this does not mean that the final ruling will require this level of coverage, it indicates that pressure is mounting to bring full accountability to the fishery. If this preferred alternative is adopted, many in the fleet will likely move to EM to meet this monitoring coverage requirement.

14. NOAA Greater Atlantic Regional Fisheries Office, “Northeast Multispecies (Groundfish) Fishing Year 2019 Regulations (Sector Measures),” April 25, 2019, New England/Mid-Atlantic, <https://www.fisheries.noaa.gov/bulletin/northeast-multispecies-groundfish-fishing-year-2019-regulations-sector-measures>

15. Chris Chase, “New England Fishery Management Council Examining 100 Percent At-Sea Monitoring for Groundfish,” SeafoodSource, February 6, 2020, <https://www.seafoodsource.com/news/supply-trade/new-england-fishery-management-council-examining-100-percent-at-sea-monitoring-for-groundfish>