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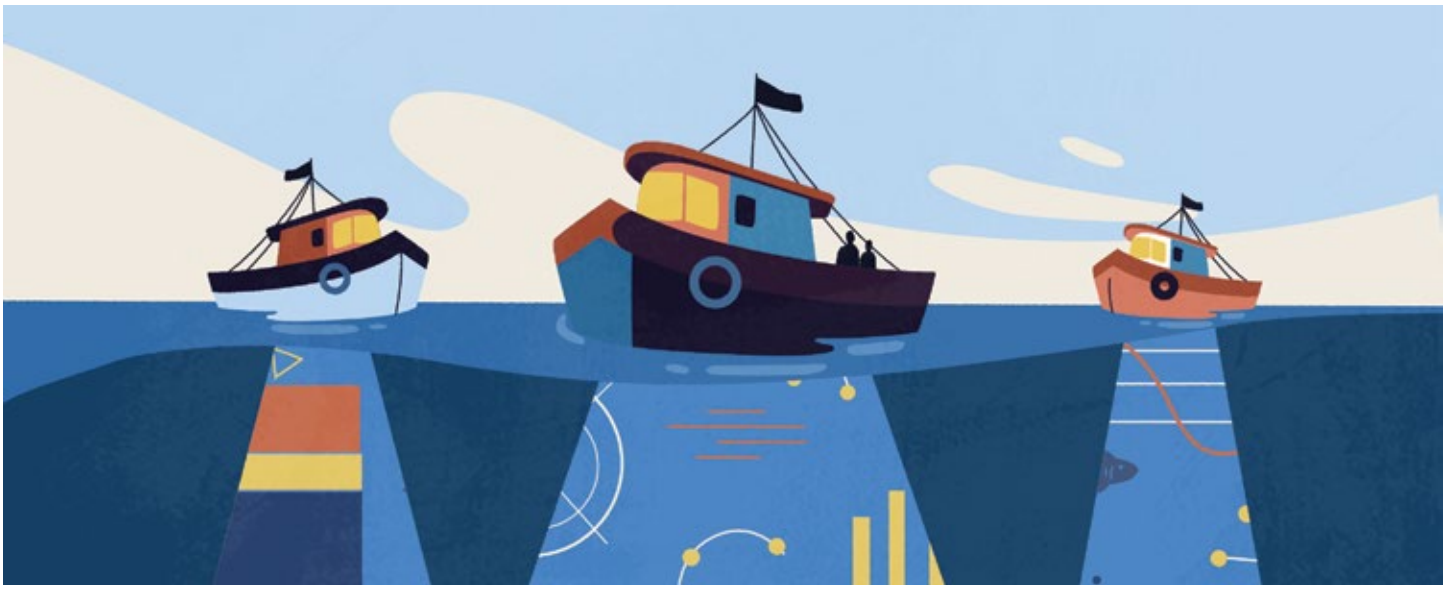

5 Key Elements for Designing an Electronic Monitoring Program

A guide to improve oversight by regional fisheries management organizations

Overview

Across the globe, regional fisheries management organizations (RFMOs) are responsible for overseeing the catch of highly migratory fishes that traverse the waters of many nations. To ensure that these fisheries are sustainable, RFMOs need reliable data on what, how, and where fish are caught, and whether rules and regulations are being followed. Although many RFMOs have mandated that observers be on board purse seine vessels to gather such data, it can be challenging to collect it from other types of vessels, which in turn can make scientific and compliance processes less effective. As RFMOs seek to improve oversight of their fishing fleets, electronic monitoring (EM) can be an effective way to meet their goals.

EM systems—a combination of cameras, computers, GPS, and gear sensors on a vessel—can complement coverage by human observers. EM can also be used to collect data on fleets that have not been independently monitored. Many entities using these systems have created an EM program and set standards for how the information is collected, transferred, analysed, and stored. Managers, scientists, and vessel owners can then use this data to effectively manage the fisheries.

Many trials have shown that EM is a powerful driver of compliance and improved reporting. A recent study in Australia, for example, found that reports of discarded catch and interactions with protected species—including safe handling and release—significantly increased on vessels that had adopted the systems.[1]

EM programs are usually limited to a local or national fleet. RFMOs face challenges when designing and implementing the programs, including needing to incorporate a wide variety of fishing vessels, many nations, and large geographical areas. This fact sheet includes elements RFMOs should consider when creating an EM program and several examples of design options. It can serve as a resource for stakeholders, including political leaders, RFMO staff, national fishery managers, industry members, and non-governmental organizations.

Designing an EM program

RFMOs should consider five elements when creating an EM program. More details can be found in "Roadmap for Electronic Monitoring in RFMOs," a 2020 report by CEA Consulting that was commissioned by The Pew Charitable Trusts.[2]

1. Stakeholder engagement, outreach, and communication

A transparent participatory process is vital when designing and implementing an EM program. Several studies show that programs that lack buy-in from stakeholders are not as successful as those that do.[3] Since groups will have different concerns, it is critical to give each a platform to ask questions, pass along lessons they have learned, and jointly develop solutions. It is also important to establish feedback mechanisms that continue after the program is put in place.

2. Program objectives and coverage levels

Because an EM system can have a variety of uses, clear objectives are essential. The objectives inform every aspect of the program, from equipment and costs to levels of coverage and analysis of data. When identifying objectives, fisheries managers should consider what challenges they have with monitoring and what additional data can be collected economically, efficiently, and accurately by using an EM system.

Based on their objectives, managers will need to decide what percentage of the fleet will require EM systems and which activities will be recorded. Ideally, all vessels should be required to have an EM system, with all on-board activities captured electronically. Full coverage ensures proper oversight and data that represents the entire fishery.

3. Program structure and review

EM programs for RFMOs can fall into two categories: an RFMO-wide program, or a decentralized system made up of national or regional EM programs. Which type is implemented should be guided by the program's objectives, the RFMO's history, and geography. These elements will also inform contracting of vendors, sharing of costs, standards for hardware and data, and development of national legislation.

Programs should include regular evaluations to ensure that they remain effective as fishery conditions change. The evaluations will help RFMOs tackle unexpected challenges, improve the program's adoption of new technology, and refine data analysis protocols. A review process can also secure additional industry support because it allows managers to demonstrate the program's success.

4. Data collection, transmission, and storage

After deciding on objectives and the program's structure, fishery managers should agree on how to collect, transmit, and store data. An effective EM program includes robust standards that ensure uniformity across member nations and fleets. These standards set a clear direction for the life cycle of EM footage, giving stakeholders more transparency and successful interoperability.

5. Data review and privacy

Extracting data and reviewing video footage are potentially the costliest elements of an EM program. RFMOs must carefully balance the need to meet minimum data standards and include relevant data fields against not overburdening the program with additional costs. An EM program will also need to determine how video is reviewed, what percentage of footage is analysed, and who does the reviews. Finally, fisheries managers should develop a data access chart that determines how to handle video footage and which entities can access this data, while considering potential privacy issues, including crew and data confidentiality.

While many elements of designing an EM program may seem operational or technical, stakeholders should be engaged throughout the design process. By exploring each element above, fisheries managers will help ensure that their EM program succeeds.

Endnotes

1 T. Emery et al., "Changes in Logbook Reporting by Commercial Fishers Following the Implementation of Electronic Monitoring in Australian Commonwealth Fisheries," *Marine Policy* 104 (2019): 135-45, https://www.sciencedirect.com/science/article/pii/S0308597X18307218.

2 M. Michelin, N. Sarto, and R. Gillett, "Roadmap for Electronic Monitoring in RFMOs," (CEA Consulting, 2020), https://www.ceaconsulting.com/casestudies/the-pew-charitable-trusts/.

3 R. Fujita et al., "Designing and Implementing Electronic Monitoring Systems for Fisheries: A Supplement to the Catch Share Design Manual," Environmental Defense Fund, San Francisco (2018), http://fisherysolutionscenter.edf.org/sites/catchshares.edf.org/files/EM_DesignManual_Final_0.pdf.

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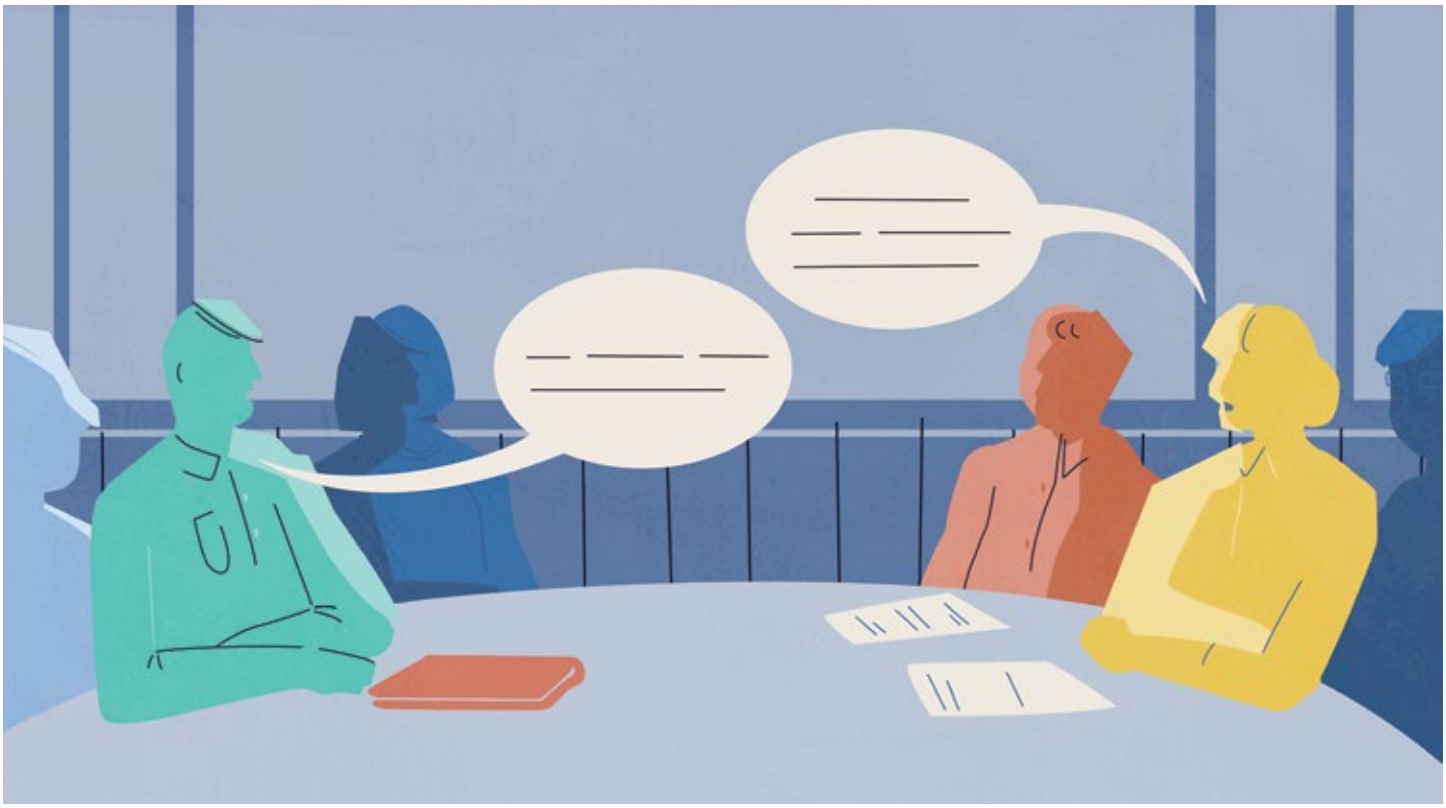

Stakeholder Outreach and Communication

Transparency by decision makers can ease adoption of electronic monitoring

Overview

When regional fisheries management organizations (RFMOs) design and implement an electronic monitoring (EM) program, it is vital that the process be transparent and include all stakeholders. Frequent engagement with stakeholders as the program is developed is necessary to garner broad support for its adoption. Several studies show that a lack of buy-in by relevant entities can hinder a program's success.[1] Because an RFMO's EM program can cover many countries and a wide range of vessel sizes, gear types, fishing locations, and catch compositions, a representative group of stakeholders should be consulted to address concerns before they become intractable.

Table 1 provides an overview of common stakeholders, their key interests, and relevant discussion topics related to electronic monitoring.

Table 1

Stakeholder Interest in EM and Discussion Topics

Stakeholder	Possible interests in electronic monitoring (EM)	EM discussion topics
RFMO secretariat and science agency staff	• Improve compliance with conservation management measures (e.g., bycatch mitigation) • Increase data collection (e.g., for stock assessments) • Verify human observer data • Adapt and scale up for various gear/vessel types	• Development of standards • Implementation logistics (labour and costs) • Reasons some stakeholders are reluctant to use an EM system • Inability to collect biological data
Vessel flag State officials and coastal State officials	• Improve transparency of vessel activities (e.g., catch quotas and protected areas) • Ensure sustainability of catch to boost market access • Ensure a legal and verifiable supply chain • Meet the 20% observer coverage requirement recommended by some RFMOs	• Operational costs of an EM system • Potential loss of revenue for coastal States if vessels move to the high seas to avoid EM requirements • Adherence to or need for national legislation or regulations
Vessel owners	• Meet observer coverage requirements • Verify fishing operations • Ensure quality control of products • Improve communication and tracking devices • Increase oversight of crew • Ensure sustainability of catch to boost market access	• Initial costs of EM equipment and analysis • Concerns that infractions may be misconstrued • Additional requirements for EM compliance
Major tuna companies	• Ensure legality of vessel operations • Ensure sustainability of catch	• Concerns that confidential data could become public
Vessel crew	• Save space: More room for crew instead of observer • Eliminate logistical problems involving observers, including loss of fishing time • Protection from frivolous claims by observers	• Privacy concerns • Additional tasks to ensure the EM system is operational/effective (e.g., camera maintenance)
Observers	• Increase observer safety • Possibility of onshore employment as EM reviewer	• Audits of observer reports • Loss of on-vessel employment
Non-governmental organizations	• Increase observer coverage and improve transparency of vessel activities • Ensure sustainability and legality of vessel operations	• Formulation of standards and effective implementation
Markets	• Ensure a legal and verifiable supply chain for the public	• Additional costs

Collaboration opportunities

The first steps of the collaboration process are to identify the relevant stakeholders and then create engagement opportunities. They can be in the form of an RFMO EM working group, stakeholder workshops, EM pilot showcases, or other gatherings. To allow for both top-down and bottom-up communication, the events could be hosted in collaboration with RFMOs, NGOs, or United Nations bodies. Regardless of the forum, the gatherings would provide a platform for industry, government agencies, and secretariats to ask questions, offer lessons learned, and develop solutions.

While engaging stakeholders is a clear starting point for designing an EM program, feedback mechanisms must also be established to ensure that such engagement continues once a program has been put in place.

Industry Engagement

Collaboration with vessel owners, captains, and crew must occur in the early phases of designing an EM program to help ease industry uncertainty about how the systems would affect fishing operations. Pilot partnerships between industry and governments could help inform decisions on scaling up EM programs.

Conclusion

To ensure the long-term success of an EM program, fisheries managers must create opportunities to collaborate with, and incorporate feedback from, a variety of stakeholders. Formal processes for stakeholder engagement should continue for the duration of the program.

Endnote

1 R. Fujita et al., "Designing and Implementing Electronic Monitoring Systems for Fisheries: A Supplement to the Catch Share Design Manual," Environmental Defense Fund, San Francisco (2018), http://fisherysolutionscenter.edf.org/sites/catchshares.edf.org/files/EM_DesignManual_Final_0.pdf.

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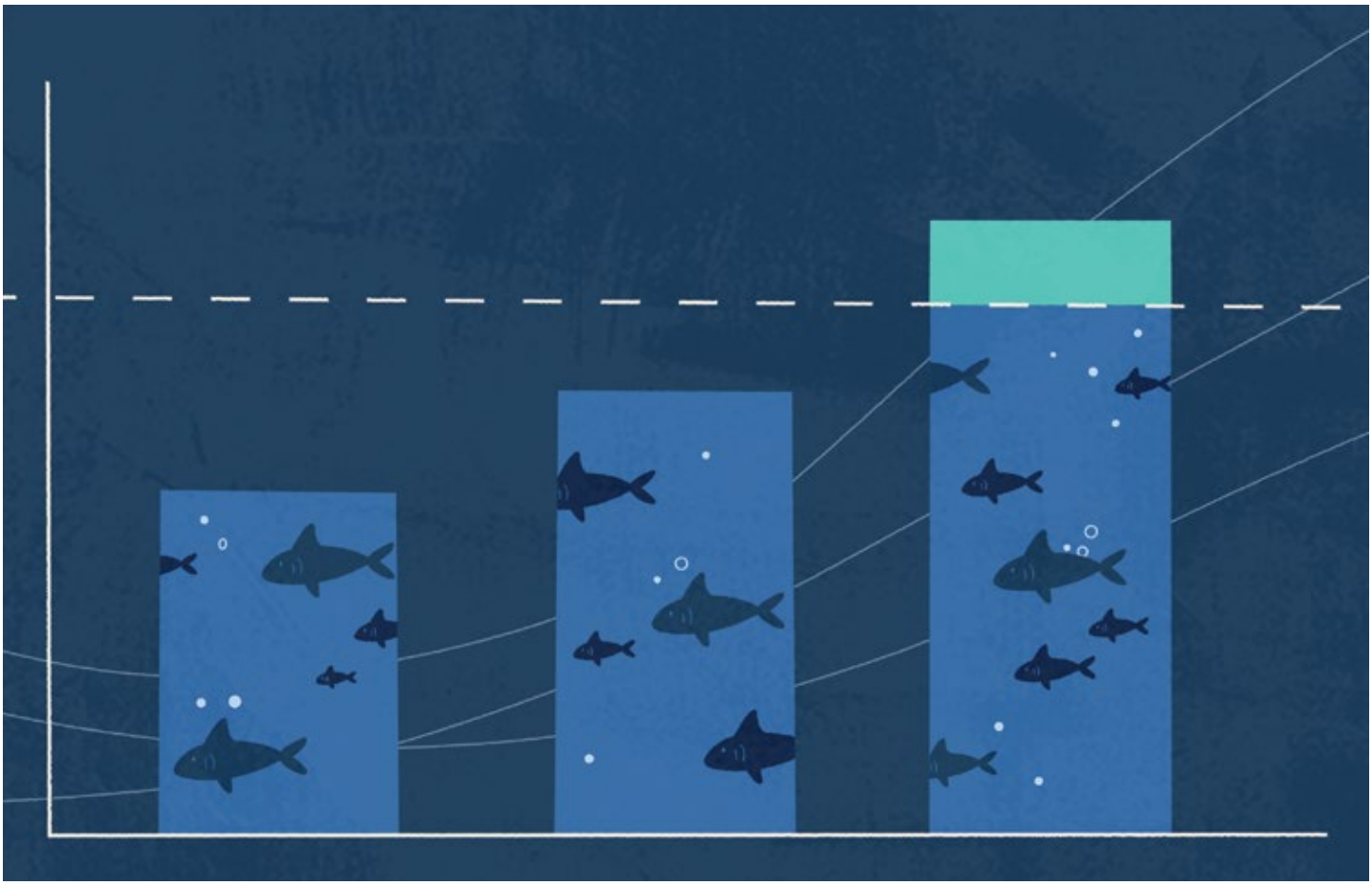


Program Objectives and Coverage Levels

Successful implementation of electronic monitoring depends on reaching agreement on clear objectives

Overview

An electronic monitoring (EM) program can help regional fisheries management organizations (RFMOs) improve their oversight of vessels' catch and other on-board activities. To ensure that the program is effective, RFMOs, in consultation with stakeholders, should determine clear objectives for it. The stated goals will also help define the necessary level of monitoring and how EM systems will complement human observers.

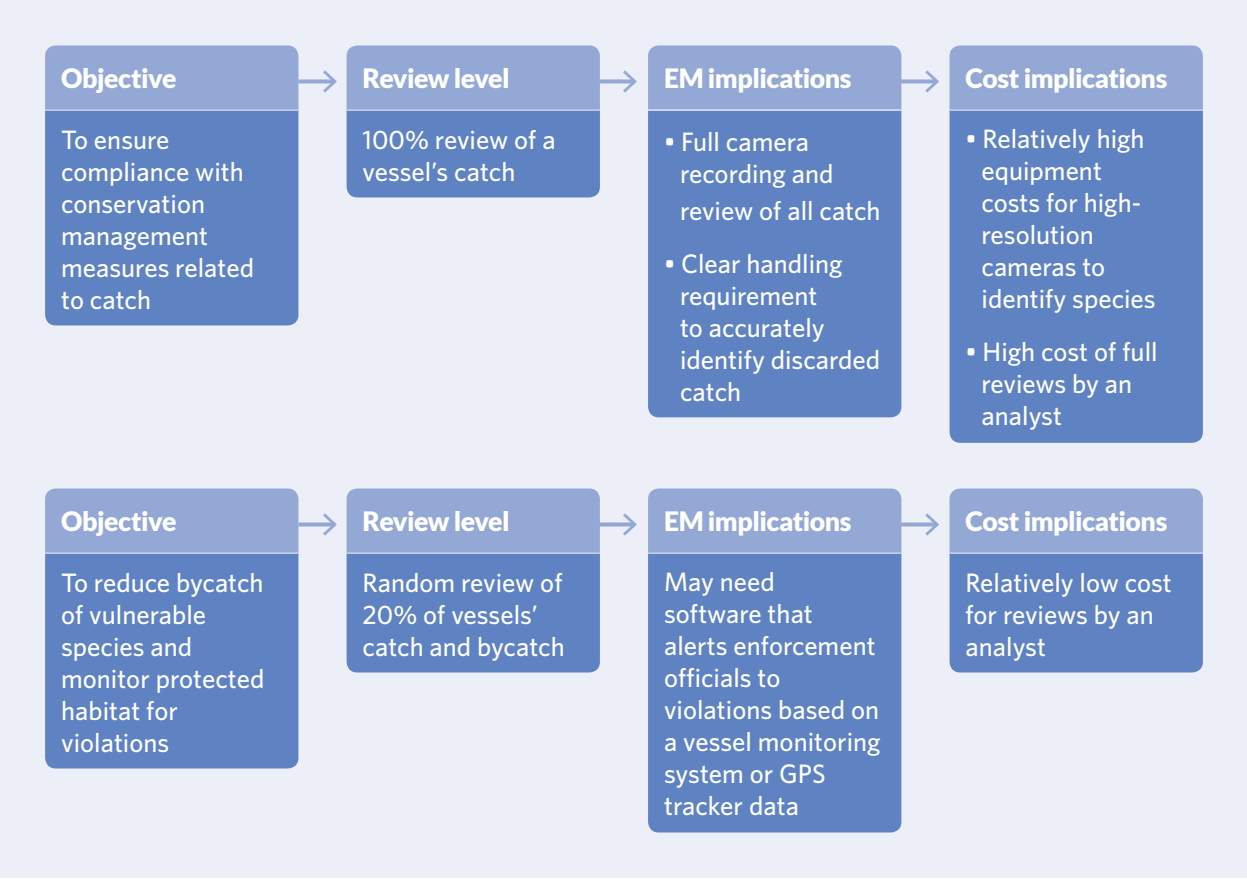
Setting EM program objectives

An EM program's objectives inform every aspect of it, from determining what equipment is needed and related costs to the amount of desired coverage and how data will be analy2ed. Clear objectives also make it easier to communicate decisions to, and receive buy-in from, stakeholders.

Those objectives could include verifying target catch levels or complying with bycatch limits and other regulations. Fisheries managers should consider what challenges they have with monitoring, how EM systems can complement their current information collection system, and what additional data points can be collected economically, efficiently, and accurately with the systems.

Figure 1

Typical Fisheries Management Objectives and Their Implications



Objectives define coverage levels

Once objectives have been agreed upon, managers should decide the appropriate level of EM coverage—what percentage of the fleet would need to have EM systems installed and what activities would need to be recorded. Ideally, all vessels should be required to capture all activities electronically. If an EM system is not required on all vessels, operators who must participate might become frustrated by the lack of full accountability across the entire fishery. Full coverage would ensure proper oversight, and the data collected would represent all fisheries—and reduce the chance that vessel operators change their fishing practices when an observer is present.

Having 100 percent coverage does not mean that all video footage must, or should, be reviewed. EM programs usually review a random sample of the data, a practice that studies have found to be effective.[1]

If full coverage is not feasible, a program should decide what portion of the fleet must install an EM system. In such cases, fishery managers and RFMO staff should:

- **Agree on the EM program's management and monitoring objectives**. An EM working group, for example, could be set up to allow stakeholders to discuss trade-offs, share information, and negotiate EM objectives.
- **Evaluate gear types to determine what information an EM system should collect**. Managers should consider vessels' fishing activity. For example, it may not be feasible for smaller vessels with limited fishing activity to have EM coverage.
- **Identify monitoring priorities tied to the program's objectives**. For example, longline fisheries may be interested in monitoring bycatch. Managers should assess the risks that unmonitored activities or fleets could present. Fisheries with minimal compliance problems could be rewarded with lower observer coverage requirements.
- **Discuss areas where EM may replace or complement human observers**. Most purse seine fleets require 100 percent observer coverage, so EM would probably complement this coverage. Because longline vessels have a high incidence of bycatch and extremely low observer coverage (about 5 percent), EM may be prioritized as a tool to improve monitoring.

Conclusion

Clear objectives, developed with input from stakeholders, form the basis for a well-designed and effective EM program. By taking the time to agree on the program's goals at the beginning of the design process, RFMOs can ensure that participants are on the same page about why and how the technology will be used, and managers can use the objectives to guide decision making throughout the process.

Endnote

1 The Pew Charitable Trusts, "How to Review Electronic Monitoring Data While Safeguarding Privacy," (2020), pewtrusts.org/ElectronicMonitoring.

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Program Structure and Review

Programs should have clearly defined roles and responsibilities

Overview

Electronic monitoring (EM) programs for regional fisheries management organizations (RFMOs) can be structured in two ways: an RFMO-wide design or a decentralized system made up of national or regional programs. Which type is implemented should be guided by the program's objectives, the RFMO's history, and geography. Along with the structure, these elements will inform how vendors are contracted, what standards for hardware and data should be developed, and what changes, if any, are necessary to national legislation.

Once an EM program is implemented, its progress should be reviewed at regular intervals and improvements should be made to its effectiveness.

Program structure

Human observers play a critical role at sea by collecting fisheries data that managers can use to improve monitoring. Most RFMOs have either a centralized observer program, or individual national or subregional programs. Their current model may strongly influence how they decide to structure future EM programs. Table 1 gives an overview of the advantages and disadvantages of three program models.

Table 1

Electronic Monitoring Program Structure

Structure	Advantages	Disadvantages
RFMO-wide program	• Uniform across regions • Scalable • Consistent data • Preferable for small countries and countries with little access-fee revenue • Easily modelled after centralized transshipment programs at RFMOs • Cost-effective (e.g., bulk equipment pricing)	• RFMOs can be slow to implement new programs • Political influences drive objectives • Need to increase capacity and finances • Concern about data ownership and use
National programs for exclusive economic zones (EEZs) and RFMO program for the high seas **Or** **National programs for EEZs and flag State coverage of high seas**	• Coastal States control their own data • Local job creation • Customizable to fit in zone fishing fleets	• Programs' effectiveness may vary • Concerns regarding inter-operability of EM software systems • Confusion over data handing procedures for multi-zone trips • Higher start-up costs since each country will need to develop its own program • May require support from regional institutions (e.g., Pacific Islands Forum Fisheries Agency)

Access and inter-operability

Once an RFMO has decided the structure of its EM program, it needs to determine how to handle video footage and which entities can access this data. Because the system may be complex, given that vessel trips span multiple exclusive economic zones (EEZs) and the high seas, RFMOs should create and distribute a detailed chart that clearly identifies these roles.[1]

To ensure that relevant reviewers and authorities can access EM data, transmitted video should be standardized so all file formats are compatible with all reviewers' software. This will reduce any necessary "cleaning" of the data once it is centralized and will make reviewing it more efficient.[2]

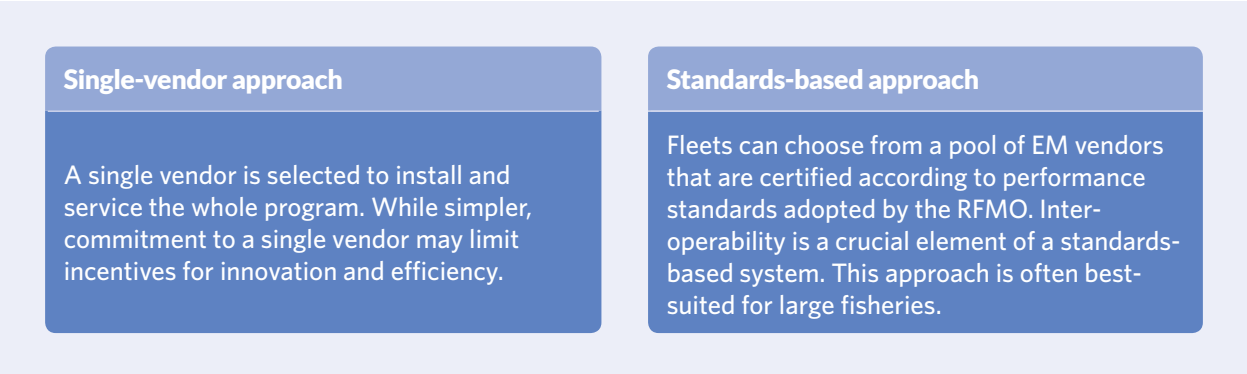
Vendor contracting and maintenance

Agreeing on a structure for the program will also help the RFMO determine whether to use a single EM vendor or multiple vendors that would operate based on agreed-to standards. (See Figure 1.)

When considering EM vendors, fisheries managers must also include an appropriate servicing plan that clearly articulates responsibilities of vendors and crew to ensure that maintenance issues are promptly addressed. Vessel operators may be required to perform basic EM maintenance, such as lens cleaning and keeping camera views unobstructed. RFMOs should also implement procedures for EM system repairs to ensure that vessels are not left unmonitored for long periods.

Figure 1

Single Vendor vs. Standards-Based Approach



Costs and cost recovery

When considering approaches to vendor contracting, stakeholders should also discuss costs and potential ways to cover them. Since fisheries are a public resource, stakeholders, including RFMOs and consumers, often expect that flag States will be responsible for expenses related to ensuring that their operations are legal and verifiable. While some RFMOs have hesitated to deploy EM systems because of concerns over their cost, many reports on EM have found that they are less expensive than employing observers.[3]

Although not all costs can be recovered over time, those relating to EM can be divided into the following categories:

- **On-vessel costs:** EM hardware, installation, and operation.
- **Program administration costs:** Personnel expenditures for a regional or national program. This is usually a major focus for distributing costs.
- **Policy and regulatory development costs:** Establishment of relevant regulatory and policy arrangements. This expense may be borne by fisheries managers.
- **Analytical costs:** Review and analysis of EM data to produce reports. Reviewing videos can be the most expensive part of an EM program, depending on the amount or percentage of review needed.

Measures to potentially reduce those costs include:

- Incentivizing competition among vendors.
- Limiting how long EM data is stored.
- Reducing the percentage of EM data that is reviewed.
- Incorporating artificial-intelligence technology that flags key events, reduces file size or image rates based on activity, and truncates video footage for review.
- Scheduling stakeholder working groups during key meetings.
- Leveraging scientific staff to help develop policy text.

Program evolution

Once an EM program is in place, RFMOs should establish mechanisms to incorporate feedback after stakeholders have acquired experience with the system. Evaluating a program at regular intervals is critical to ensure that it remains effective as fishery conditions change. A review process may also secure additional industry support because it allows managers to demonstrate the program's success. The evaluations can help RFMOs tackle unexpected challenges, improve how efficiently new technology is adopted, and refine data analysis protocols.

Domestic legislation

For programs to be successful, governments may have to modify or adopt domestic fisheries regulations to allow them to implement EM systems across their national fleets.[4] Ideally, such measures should be approved in parallel with RFMOs' work to design and put EM programs in place.

Conclusion

The decisions about how to structure an EM program will affect almost every other element of the design process. Determining who has oversight of the program, how the EM systems will be installed and maintained, and who will bear the costs are important considerations that will help determine the roles and responsibilities of various stakeholder groups. National legislation must be in place so that RFMO regulations can be implemented domestically. Finally, the program should be reviewed often to ensure that it is operating efficiently and meeting its objectives.

Endnotes

1 The Pew Charitable Trusts, "How to Review Electronic Monitoring Data While Safeguarding Privacy," (2020), pewtrusts.org/ElectronicMonitoring.

2 The Pew Charitable Trusts, "Options for Collecting, Transmitting, and Storing Electronic Data," (2020), pewtrusts.org/ElectronicMonitoring.

3 M. Michelin, N.M. Sarto, and R. Gillett, "Roadmap for Electronic Monitoring in RFMOs," CEA Consulting (2020), https://www.ceaconsulting.com/casestudies/the-pew-charitable-trusts.

4 Ibid.

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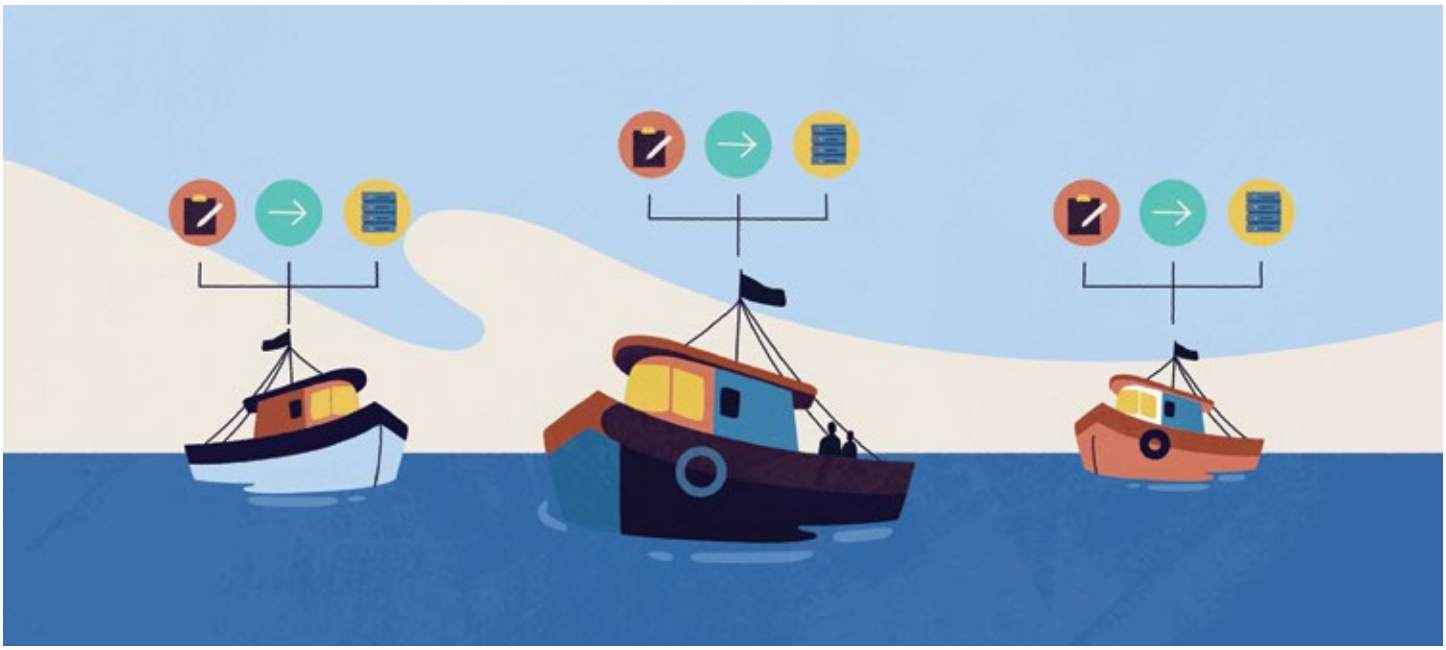


Data Collection, Transmission, and Storage

Robust standards help ensure accurate, consistent monitoring

Overview

After determining an electronic monitoring (EM) program's objectives and structure, fishery managers will need to decide how to collect, transmit, and store the resulting data. Different combinations of monitoring technology can be used to meet a program's needs and make the best use of available resources. (See Figure 1.) An effective EM program will include robust standards that ensure uniform data collection and review practices across member nations and fleets.

Data collection standards

Technology standards should be aligned with a program's objectives to ensure that all vessels are accurately and consistently recording the required data and that information is shared, reviewed, and audited in a uniform way. Working with vendors early on can provide much-needed flexibility to meet the standards and to allow for the use of new technologies when they become available. Regional fisheries management organizations (RFMOs) should also periodically review minimum standards and adopt innovations.

Figure 1

Minimum Hardware Components for an Electronic Monitoring System Typically Include:

- **Digital cameras:** Cameras that record and store digital images. *Consider the minimum resolution, frame rate, low-light capabilities, etc.*
- **Sensors:** Devices that detect an object's movement. *For example, a drum-rotation sensor to trigger video recording or tag fishing activity.*
- **GPS:** A satellite-based navigation system to determine a vessel's exact location.
- **Hard drives:** High-capacity, self-contained data storage devices.
- **Control box:** A collection of instruments and physical interfaces that allow operators to control a piece of equipment and monitor its performance.
- **Satellite modem:** A device used to establish data transfers to report a system's status.
- **Video monitor:** A device with a screen to display a system's status and camera views. *These are usually located in the wheelhouse.*

Video retrieval and transmission

Once data is collected by EM systems on-board vessels, it will need to be transferred for review and analysis. Three options exist to transfer the data to the appropriate agency, and they vary widely in cost, reliability, and turnaround time. (See Table 1). RFMOs can lower the cost of video retrieval and transmission by requiring videos to be in a standardized format.

Figure 2 provides an example of how the data-retrieval methods fit in the EM data pathway.

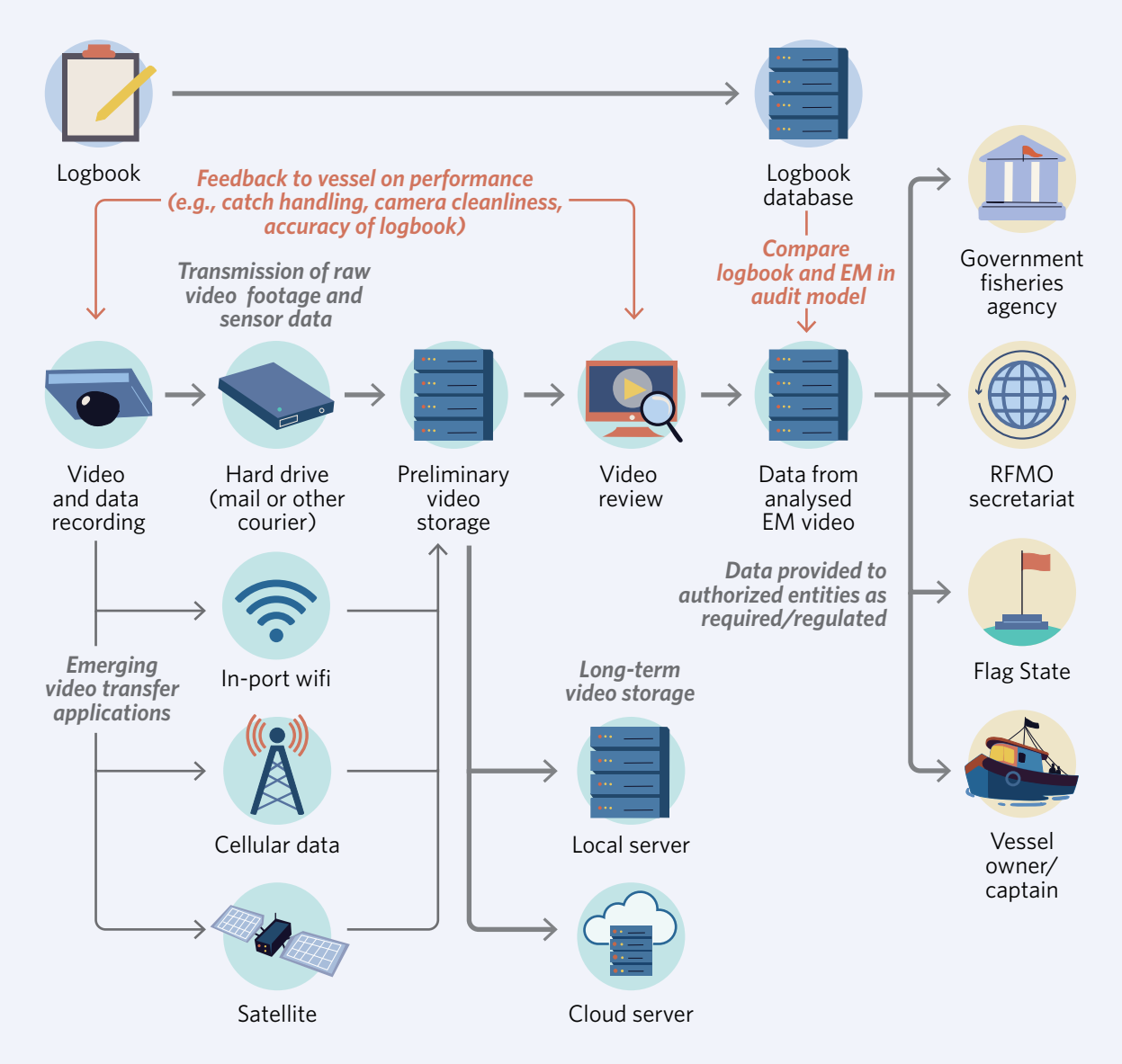
Table 1

Operational Video Retrieval Methods

Hard drive exchange	Hard drive exchange is the most popular approach and best-suited for fisheries operating for long periods across vast distances. Several options exist: • Mailing companies are used by vessel operators to send hard drives to fisheries managers. • Couriers periodically exchange used hard drives for new ones. To ensure a reliable chain of custody, fisheries managers could consider data encryption. • Collector stations at major ports with trained staff are used to transmit videos to the appropriate centralized review office.
Wi-Fi transmission	Wi-Fi transmission, including via mobile data networks, is possible when vessels are in range of shore. This is the cheapest system, but it requires network connectivity in all ports of entry.
Satellite	Satellite transmission is the most-expensive option. However, it could become more cost-effective with the use of emerging technologies such as sensors or artificial intelligence. This would allow the most near-real-time transmission of data.

Figure 2

EM System Data Flows



Source: M. Michelin, N.M. Sarto, and R. Gillett, "Roadmap for Electronic Monitoring in RFMOs," CEA Consulting (2020), https://www.ceaconsulting.com/casestudies/the-pew-charitable-trusts

Data storage

RFMOs should create standards for where, how, and how long video footage will be stored after it has been reviewed. Storage decisions should be based on the EM program's goals and the personnel who will need to access monitoring records, at what frequency, and for what purpose. The storage system's design will also depend on whether the EM program is national or RFMO-wide and if fishing companies will receive copies of the EM records for their own use.

Depending on the program's objectives and standards, footage can range from video of an entire fishing trip to video stills from key fishing events (e.g., transshipment). Once footage is reviewed, it may be deleted or stored, indefinitely or for a finite period. Figure 3 lists some guiding questions and data storage considerations for EM program designers.

Figure 3
Storage Decision Considerations and Examples

Conclusion

Setting standards for data collection, retrieval, and storage gives a clear direction for the life cycle of footage and ensures that systems will be inter-operable and monitoring more transparent. These considerations help ensure that RFMOs have the data to support improvements in the management of important fisheries and thus to ensure their long-term sustainability.

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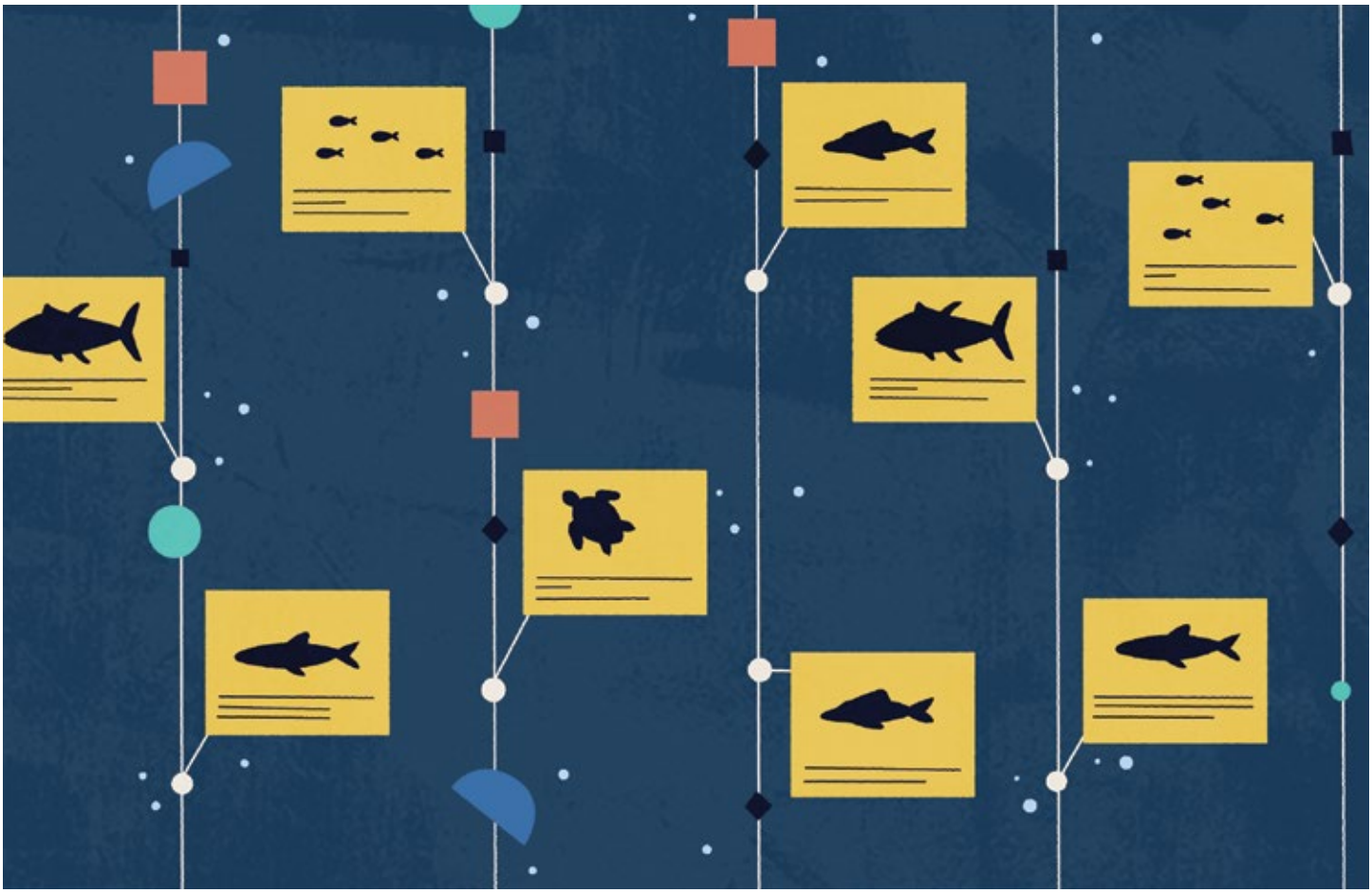

Data Review and Privacy

Managers must balance strong data standards with protections for crew, fishing industry

Overview

Managing data collected by thousands of vessels using electronic monitoring (EM) systems can be more complex for a regional fisheries management organization (RFMO) than for a national program. Through engagements with stakeholders, RFMOs must determine what data they should collect using EM systems to meet their program's objectives, how much of that data will be reviewed, and by whom. During this phase of developing an EM program, RFMOs should also consider stakeholder access to data and privacy concerns.

Video review method and standardization

Extracting data and reviewing video footage is a key element of an EM program—and potentially the costliest. The more footage is reviewed, and the more detailed the data, the more expensive the process will be. RFMOs should carefully balance the need to meet minimum data standards with not overburdening the program with additional costs. They should also consider which data fields are best collected by an electronic system and which by an observer. For example, EM may be able to identify the number of sharks a vessel hauls in as bycatch, but identifying each species may be more time-consuming. Artificial intelligence may eventually make the reviewing process more efficient, but these emerging technologies are not ready to be deployed yet. Table 1 outlines three video review approaches that should be considered.

Transmitted video could be standardized across the entire EM system to ensure that all the file formats are compatible for review by all the necessary reviewers' software. This will reduce the data "cleaning" that should occur once all the EM data is centralized and enable it to be efficiently reviewed, as necessary.

Table 1
Potential Approaches for Reviewing Video Footage

Review method	Primary data source	Advantages	Disadvantages
Census: Review of all, or a subsample of, fishing activity that is scaled up to create fishery-wide estimates (e.g., fishing effort, times, locations, and target and non-target catch data)	EM video data	• High data quality	• Higher review time/cost • May require specific catch handling practices
Logbook audit: Review of a random fishing activity sample, which is compared to vessel-reported logbook data	Logbook	• Lower review time/cost • Use of fisher-provided data • Good-quality data	• May require specific catch-handling practices • Can be used only for logbook-reported data
Compliance: Basic review of video for a non-compliance event	EM video data	• Very low review costs • No specific catch-handling procedures	• Limited to most basic functions (e.g., did a discard happen?)

Additional Logbook Audit Considerations

Logbook audits are the most commonly used video review approach in most EM programs. Of the methods outlined in Table 1, this approach will also have the most significant impact on costs. The audit approach will dramatically reduce review expenses, but a less-appreciated benefit is that it also helps build industry buy-in to the program, since its self-reported data is used to inform management decisions.

Video reviewers

EM program structures will influence who will review video footage. Program designers have three options when deciding who will review it: national fisheries agencies, third parties, or RFMO staffs. (See Table 2.)

Table 2
Review Structures

Review model	Considerations
National fisheries agency review: Review completed by member governments	• Members will need to build their own capacity • Potential for complications of data ownership between member States, along with variability across national observers • May raise privacy concerns from the fishing industry • Cost barriers can exist due to start-up costs (e.g., hiring and training staff, purchasing review stations)
Third-party review: Third-party service contract (e.g., with a commercial EM vendor or quasi-governmental agency) to review footage and deliver processed data that meets specified standards	• Government can act solely as a contract manager, rather than building internal capacity to review EM video from scratch • If local jobs are a concern, contracts can require in-country reviews
RFMO staff review: Using RFMO staff to analyse EM video	• Start-up costs (e.g., building a review centre) can be high, but having a centralized review centre may be more beneficial than setting up review centres in multiple member States • Potential resistance may arise from member States that want to maintain control of the review process; States may be reluctant to share data taken from within their exclusive economic zones or on their flagged vessels

Post-review access

Fisheries managers should also develop an EM data-access chart that details agreements on how to handle video footage and which entities can access raw footage and processed data. This system may be complicated for a national fisheries agency review structure when vessel trips span multiple countries' exclusive economic zones and the high seas. How data access is structured varies across EM programs, but there are many advantages if vessels have access to the video and data from their trips. This information can be valuable for industry (e.g., evaluating on-vessel operations and monitoring for safety) and is an important incentive for building industry support. Creating a map of EM data flow can help clarify who is responsible, who pays, and how data will be used.

Privacy

Privacy is among the top concerns that stakeholders have about EM systems. RFMOs must consider issues ranging from the crew's privacy to data confidentiality. Regardless of the concerns, data collection must remain the top priority if an EM program is to be effective.

> "Cameras should primarily be focused on fish and fishing gear, not people."
>
> "Roadmap for Electronic Monitoring in RFMOs," *CEA Consulting (2020)*

Privacy concerns should be addressed when RFMOs develop their objectives for EM programs. Creating an EM system should be transparent and participatory so that stakeholders agree on how EM data will be used to improve the fishery. In addition, RFMOs should put mechanisms in place to ensure that records are not shared with unapproved parties. Fishery managers should consider the following privacy components:

- **Workplace privacy**. These steps can ensure that cameras are trained on fish and fishing gear, not people:
    - During installation, give the crew a chance to view what the cameras are recording to help address any concerns.
    - Install sensors that trigger recording only when fishing activity occurs. Sensors have the added benefit of maximizing storage capacity.
- **Ex-vessel data confidentiality**. Beyond workplace privacy and general concerns about being monitored, industry members may be concerned about the possible misuse of confidential data. Data privacy standards used for observer programs and RFMO logbook catch data confidentiality arrangements can be a model for an EM program. One option would be to require an independent third party to review EM records under strict contractual obligations—for example, to analyse data only for specific purposes and delete raw images once they have been examined. Fisheries agencies or other stakeholders would receive raw imagery only if the third party observes a non-compliance event or other incident the RFMO agrees must be reviewed.

Conclusion

Comprehensive data and review standards are essential to ensure that an EM program collects and analyses the information necessary for the scientific and management processes, while still making sure that strong privacy protections remain for crews and vessel operators. Managers should seek out and incorporate input from vendors, fishers, and industry members when designing these elements to make certain that these requirements meet the program's objectives while also addressing stakeholder concerns.

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This fact sheet is one in a series outlining key elements for regional fisheries management organizations to consider as they develop electronic monitoring programs. More information is available at pewtrusts.org/ElectronicMonitoring.

Electronic Monitoring Benefits Every Link in Seafood Supply Chain

Widespread use of the technology can improve sustainability, traceability, and compliance in the fishing industry

Overview

In 2018, 67 million metric tons of fish, valued at over $164 billion, were traded internationally.[1] And as global demand for responsibly sourced fish products grows, so does the call for more sustainability and transparency within the seafood supply chain.

Regional fishery management organizations (RFMOs), which oversee some of the most valuable marine species around the globe, have long relied on human observer programs to collect data to inform management decisions. Although these programs are a critical tool for effective fisheries management, 100% coverage of fishing activities is often difficult—and sometimes impossible—to attain using just human observers.

Comprehensive electronic monitoring (EM) programs (those that include clear objectives and standards for data collection and review[2]) will enable RFMOs to build upon existing observer programs, expand monitoring coverage, and support sustainable management solutions. Producers, distributors, and retailers along the supply chain that are involved in catching, sourcing, and selling seafood have a direct interest and an important role to play in encouraging the implementation of EM at RFMOs.

Electronic monitoring can improve vessel operations and strengthen transparency

EM programs provide up to 100% continuous coverage of all fishing and vessel activity. Vessel owners and captains can use this technology to accurately track and report catch, bycatch, and fishing effort and demonstrate compliance with RFMO rules, fishing company regulations, and seafood sourcing policies. EM may also reduce the occurrence of illicit activities onboard vessels and help deter illegal, unreported, and unregulated (IUU) products from entering the supply chain.

EM programs can also increase monitoring of transshipment, the transfer of catch between vessels. Without adequate oversight, transshipment can facilitate illicit activities, such as laundering illegally caught fish. EM can help fishery managers—and other industry members whose products are transshipped—to verify the legality of this important link in the seafood supply chain.

EM programs can help demonstrate regulatory and ecolabel certification compliance

Comprehensive EM programs can help seafood buyers confirm their adherence to international import and/or domestic regulations and show that their products are sourced sustainably.

For fisheries seeking ecolabel certification (e.g., Marine Stewardship Council or fishery improvement projects), EM programs can help demonstrate sustainability through compliance with RFMO conservation management measures, data collection requirements, and other obligations that are necessary to receive certification.

Table 1

Examples of Domestic Regulations and Where EM Can Help

Domestic or import regulation	How it works	How EM can help
U.S. Seafood Import Monitoring Program (SIMP)	This program requires importers to provide reports that ensure seafood entering the U.S. market is not IUU caught.	Importers can more easily validate information on fishing activity, such as gear type, protected area compliance, and chain of custody to help meet reporting requirements.
U.S. Marine Mammal Protection Act	This act mandates an ecosystem-based approach to marine management and includes a moratorium on the catching and importing of marine mammals.	Companies can demonstrate the effectiveness of marine mammal bycatch mitigation measures such as proper on-board handling and release procedures.
European Union (EU) IUU Regulation's "Carding Scheme"	This scheme assesses whether non-EU countries comply with international and regional rules to combat IUU fishing. Failing to do so may result in a fishery import ban.	Countries can use EM to improve fisheries oversight by capturing data needed to verify legality of catch and demonstrate effective governance of their fishing fleets.
EU Common Fisheries Policy (CFP)	The CFP provides rules for fisheries in EU member states. This includes the landing obligation (LO) that requires all species with quotas to be landed and documented.	EM can help enforce catch retention regulations and compliance with the LO. EM can also provide the robust and verifiable catch data needed for fish stock assessments and efforts to mitigate the bycatch of protected species and can inform management decisions that successfully encourage stock recovery and sustainable practices within the EU fleet.

Supply chain actors should encourage adoption of EM programs by RFMOs

Members of the seafood supply chain can play an important role in accelerating the adoption and implementation of EM technology. Seafood companies should advocate for countries and RFMOs to adopt and implement EM programs that include standards and pathways for improving and increasing observer coverage. They should also actively participate in national RFMO advisory bodies to encourage governments to support EM programs and use the data provided to help ensure compliance with management measures. Additionally, market partners have the power to help drive EM implementation by committing to sustainable sourcing policies, supporting non-governmental organization collaborations and educational efforts, and amplifying EM messaging through statements and RFMO letters.

Conclusion

Supporting the implementation of comprehensive EM programs at RFMOs can help the fishing industry meet the growing market demand for sustainability and transparency. The entire supply chain can benefit from this technology from ship to shelf—including seafood processors, buyers, and retailers. By advocating the development, adoption, and implementation of robust EM programs, industry can help guarantee a consistent supply of sustainable seafood for the global market.

Endnotes

1 Food and Agriculture Organization of the United Nations, "The State of World Fisheries and Aquaculture 2020" (2020), http://www.fao.org/documents/card/en/c/ca9229en.

2 The Pew Charitable Trusts, "5 Key Elements for Designing an Electronic Monitoring Program" (2020), https://www.pewtrusts.org/-/media/assets/2020/10/em-toolkit/toolkit_1_final_oct.pdf.

For further information, please visit:
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