

AT-SEA OBSERVER & ELECTRONIC MONITORING IN CANADA:

Creating a robust and reliable monitoring program to support Canada's commercial fisheries

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Effective monitoring is an essential part of a modern, sustainable, and traceable fishery.

Independently verified information is critical for producing accurate stock assessments, evaluating the effectiveness of management measures, combatting Illegal, Unregulated and Unreported (IUU) fishing, and for making sound decisions. Monitoring programs also help support jobs and the future of our fisheries economy by improving market access and improving consumer confidence.

Monitoring programs are foundational for fisheries management. Countries around the world monitor their fisheries in different ways to help steward and manage marine resources, which in turn supports thriving fisheries. In Canada, there are many species fished throughout our waters using an array of gear types and at varying scales. Designing and implementing a monitoring program that meets the needs of fishers, scientists, managers, compliance and enforcement officers, decision makers and other stakeholders in the context of these diverse fishing practices is challenging.



Canada's approach to fisheries monitoring has evolved over time, but many fisheries in Atlantic Canada remain inadequately monitored or are not monitored at sea at all. Additionally, monitoring targets in Canada are often too low to meet international standards. Even with these lower thresholds, monitoring goals in Canada are not consistently met. As a result, the fishing industry is losing money paying for programs that are not meeting their targets and missing out on marketing and trade opportunities that reward robustly monitored fisheries.

In this report, we explore the current state of Canada's fisheries monitoring program and **provide solutions for implementing a long-term, robust, affordable, and reliable at-sea catch monitoring program, with a focus on Atlantic Canadian fisheries.** We consider Atlantic Canada's current monitoring program, challenges and solutions to the recruitment and retention of at-sea observers (ASOs), the feasibility of electronic monitoring (EM) implementation, how these two tools might be used alongside one another in an effective monitoring program, and cost-sharing options for the affordable implementation and improvement of fisheries monitoring systems.

The Study

Data was collected by both independent consultants and the author organizations. This was done through desktop research and stakeholder interviews. These include:

- an analysis of the current state of Canada's ASO program across key commercial wild capture fisheries in Atlantic Canada;
- a review of monitoring programs to identify effective practices, performance benchmarks, and implementation models;
- challenges and potential enhancements to both ASO programs and EM systems to support future program development;
- a cost analysis across multiple program development scenarios.

For structured stakeholder engagement, semi-structured interviews and targeted consultations were used to capture perspectives on the design, implementation, and cost implications of ASO programs and EM systems in Canada. Engagement focused on stakeholders with direct operational, regulatory, technical, or analytical experience related to fisheries monitoring, both domestically and internationally. This includes service providers, current and former ASOs, federal and provincial regulatory bodies, relevant international regulatory and advisory organizations, fish fishers, academic researchers, and representatives from nonprofit organizations with relevant expertise. A literature review was completed for any additional research outside of structured interviews.

Recommendations

Atlantic Canada's fishing industry needs an affordable, coordinated and hybrid monitoring system that strengthens ASO capacity, expands EM, and closes persistent coverage gaps. We recommend that Fisheries and Oceans Canada (DFO):

ENABLE GOVERNMENT LEADERSHIP BASED ON INTERNATIONAL BEST PRACTICES

- Create a dedicated, adequately staffed DFO team to coordinate monitoring policy, delivery, and partnerships across regions.
- Implement a phased, risk-based roadmap that integrates ASOs and EM, with clear milestones, responsibilities, and performance measures. EM implementation should prioritize fisheries with known monitoring gaps, elevated risk, or identified needs arising from FMP assessments.
- Set mandatory timelines, corrective actions, and public reporting for fisheries that fail to meet monitoring targets.

DEVELOP NATIONAL EM STANDARDS & GUIDELINES

- Establish national EM standards, comprehensive data governance policies, and modern tools for secure data processing, storage, access, and review. National standards should include guidelines for setting appropriate goals for an EM program including the pillars of EM program use: fisheries management, science, compliance and enforcement.
- Ensure that implementation is supported by reliable internet or satellite connectivity, clear rules for data ownership, sharing, retention, and review, and qualified human reviewers to validate system performance and interpret footage.
- Provide sustained departmental capacity and funding to design, implement, evaluate, and scale EM pilot projects. Resources should be allocated first to increase monitoring coverage in high-risk fisheries that currently do not meet targets.

IMPLEMENT INNOVATIVE & AFFORDABLE FUNDING MODELS

- Adopt equitable cost-sharing tailored to fishery risk, vessel size, and compliance, using shared government-industry funding, pooled fleet levies, or differentiated rates.
- Adopt a long-term investment approach that recognizes higher initial EM implementation costs while accounting for future savings, expanded coverage, and improved program performance as systems scale.
- Work with industry to select monitoring systems that meet shared operational needs while maintaining robust, independent fisheries monitoring, and secure dedicated federal start-up funding through appropriate mechanisms, including Treasury Board allocations, the Atlantic Fisheries Fund, and Section 10 permit arrangements.

INCREASE ASO RECRUITMENT & RETENTION

- Support the recruitment and retention of ASOs through competitive compensation, stronger training and mentoring, safer working conditions, clearer career pathways, and enhanced government oversight and funding.



Canada's Fisheries Monitoring Policies, Tools and Program

Canada's Fishery Monitoring Policy (FMP) is part of the Sustainable Fisheries Framework suite of policies under the *Fisheries Act*. The policy is meant to outline how Canada should monitor its federally managed wild capture fisheries. In 2019, a modernized FMP was adopted by Fisheries and Oceans Canada (DFO) with several updates intended to strengthen monitoring. The policy lays out three objectives.

1. To have dependable, timely and accessible fishery information necessary to help ensure that Canadian fisheries are managed to support the sustainable harvest of aquatic species.[1]
2. To have dependable, timely and accessible fishery information necessary to carry out enforcement activities to ensure compliance with the Fisheries Act, the Oceans Act and the Species at Risk Act and their associated regulations.
3. To apply a common set of procedural steps to establish fishery monitoring requirements across fisheries, to ensure consistent application of the policy.

Fishery monitoring programs must have monitoring objectives tied to the specific fishery, including a procedural guide to setting and implementing objectives for fisheries and information on evaluating performance. The FMP provides tools and general guidelines including suggestions for how to prioritize the fisheries.[2] One of the main principles of the policy is that monitoring program requirements should be set out based on the risk and complexity of a fishery i.e. large-scale, multispecies fisheries using high-risk gear types or interacting with at-risk species should be more rigorously monitored than small-scale selective single species fisheries.

The creation, implementation, and evaluation of monitoring plans is largely left to fisheries managers.[3] Furthermore, although the policy states that "Where there is evidence that monitoring objectives are not being achieved in a fishery, a plan will be established in collaboration with the fishery participants to take corrective action," it does not provide concrete timelines or requirements for those corrective actions. The policy also lacks a specific budget to implement new tools or monitoring objectives when gaps are identified.

CORE FUNCTIONS OF AT-SEA OBSERVER & ELECTRONIC MONITORING PROGRAMS



[1] Fisheries and Oceans Canada. Fisheries Monitoring Policy. (2019). https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/fishery-monitoring-surveillance-des-peches-eng.htm

[2] Fisheries and Oceans Canada. Introduction to the procedural steps for implementing the Fishery Monitoring Policy. (2019). https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/fmp-implementation-psp-mise-en-oeuvre-eng.htm

[3] Fisheries and Oceans Canada. Introduction to the procedural steps for implementing the Fishery Monitoring Policy. (2019). https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/fmp-implementation-psp-mise-en-oeuvre-eng.htm

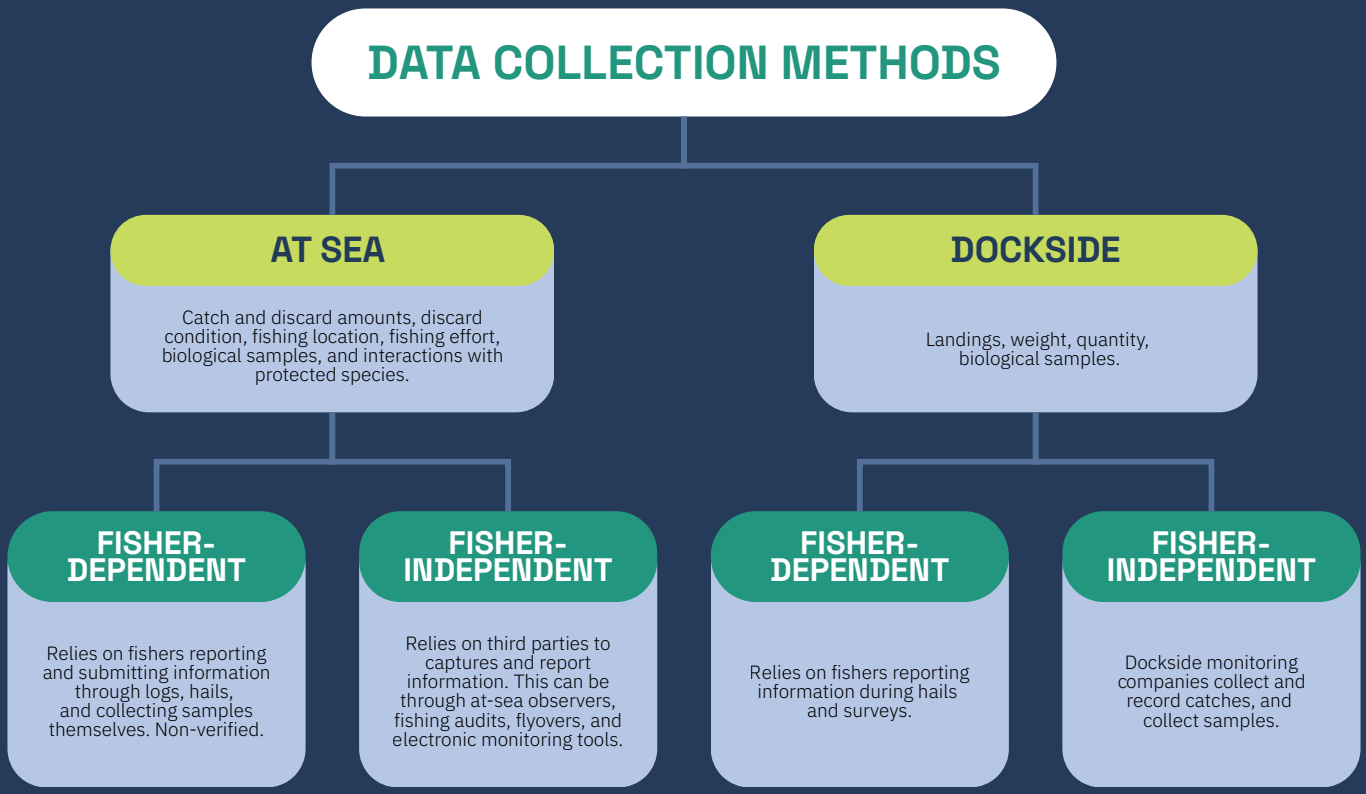


Figure 1 shows how fisheries data is collected in Canada. This data can be collected both dock side and at sea and can be fisher dependent.[4] In this report, we focus on fisher-independent tools of At-Sea Observers (ASOs) and electronic monitoring (EM).

At-Sea Observer Coverage and Electronic Monitoring

ASOs are one of several measures DFO relies on for sustainable management of fisheries. Prior to 2013, DFO was responsible for the program, making ASOs government employees. Today, ASOs are employees of independently designated companies who monitor fishing methods, fish catch, bycatch, and collect scientific information. Companies are designated according to standards, and ASO target coverage by fishery (fleet and species) is established as a percentage of vessel trips through the season. The company is then tasked with providing capacity to meet the needs of fisheries, a service which is paid for by fishers. ASO tasks include monitoring and recording fishing activities, monitoring bycatch, collecting biological samples, and reporting suspected non-compliance with fishing regulations and licence conditions. ASOs are not formal enforcement personnel.

In many jurisdictions, EM usage has grown as a way to capture fisher-independent data at sea. This can include both vessel tracking and video monitoring. Vessel tracking is widely used in Canada and abroad while video monitoring is newer to Atlantic Canada. Video monitoring can capture information on catch, discards, fishing methods, gear used, handling, and verify the data against logbook reports. It may also be used as evidence in compliance related cases.

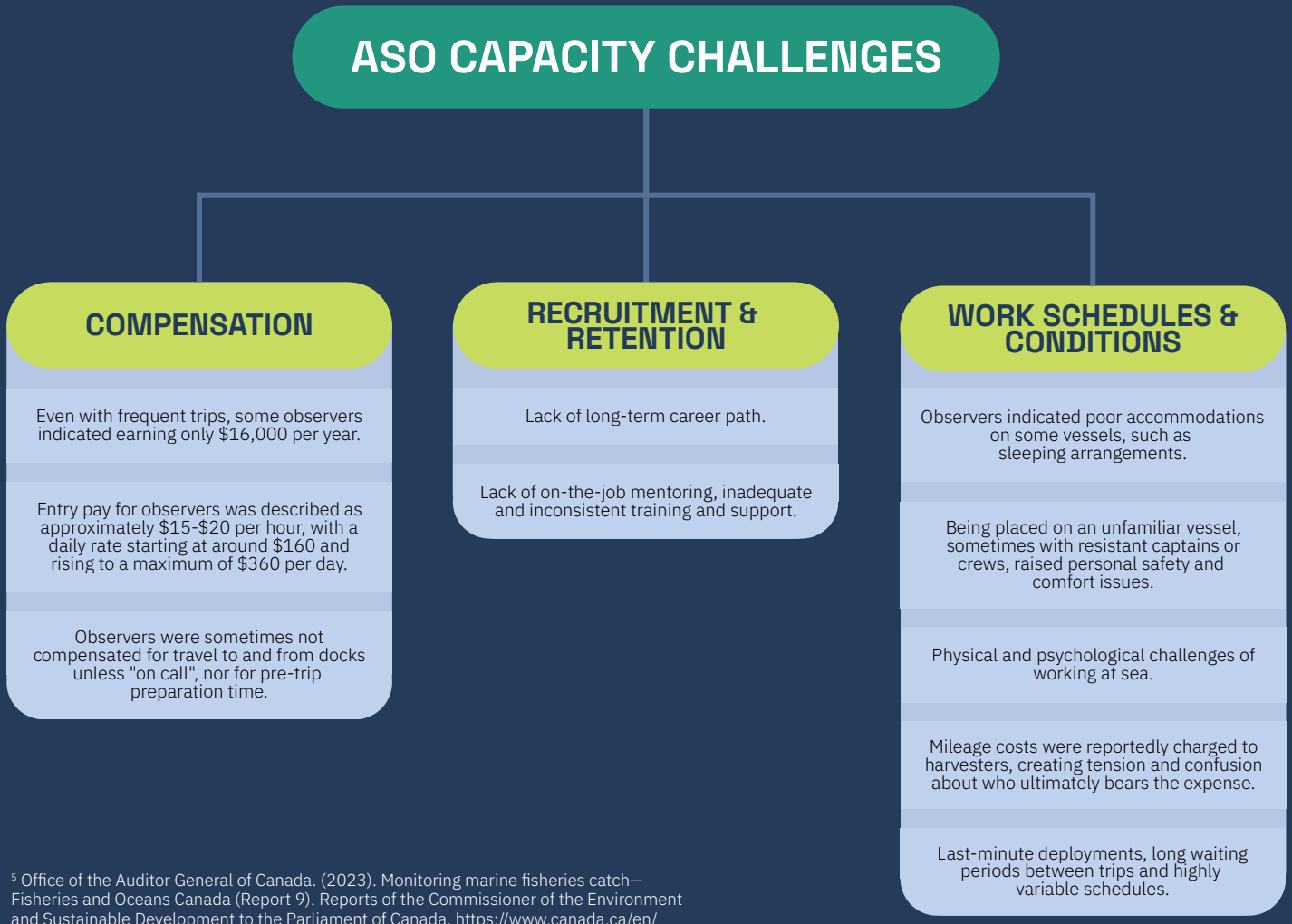
[4] Fisheries and Oceans Canada. Fisheries Monitoring Policy. (2019). https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/fishery-monitoring-surveillance-des-peches-eng.htm

Shortcomings of Canada's Monitoring Program

A 2023 assessment by the federal Commissioner of the Environment and Sustainable Development (CESD) found that DFO failed to implement the FMP and had not completed a full assessment of monitoring programs for any of the 156 key commercial marine fish stocks.[5]

This led to dedicated funding and capacity for the development of two risk assessment tools which have advanced in recent years. While these tools are helpful to identify gaps in monitoring, many of these gaps have been known for years by stakeholders and managers. Additionally, the program lacks funding to implement new programs once gaps have been identified.

Across Atlantic Canada, monitoring requirements range vastly, most fisheries have a 5% to 10% coverage requirement. Aside from a small number of cases where EM has been piloted, these requirements rely entirely on ASOs. **Capacity within the system is failing to meet the needs of fishers, scientists, enforcement personnel and managers. In many cases, industry is paying for a service they aren't receiving, losing valuable money. In 2025, ASO companies reported a need for 50% more (75 total) observers in addition to the 30-50 observers active annually just to meet the minimum requirements**. Figure 2 shows the many challenges noted by stakeholders in interviews.



[5] Office of the Auditor General of Canada. (2023). Monitoring marine fisheries catch—Fisheries and Oceans Canada (Report 9). Reports of the Commissioner of the Environment and Sustainable Development to the Parliament of Canada. https://www.canada.ca/en/auditor-general/our-work/audit-reports/parl-cesd-202311-09-e.html



A Hybrid Monitoring Future:

Combining at-sea observers and electronic monitoring for a modern monitoring system

The ASO program alone has failed to meet even the low bar for fisheries monitoring in Atlantic Canada, and discussions of how to improve these shortcomings have been prevalent across advisory committees for several years. A broad, coordinated approach to solving this system-wide issue is needed, rather than the current piecemeal approach. **Our findings support that the implementation of a combination of ASO and EM systems supported by a sustainable funding model would lead to a more robust, collaborative, and effective monitoring system.**

AT-SEA OBSERVERS IN A HYBRID MONITORING PROGRAM

During interviews, stakeholders broadly agreed that ASOs will continue to play a critical role in the fisheries monitoring system, but that their function is likely to evolve alongside the expanded use of EM. Rather than serving primarily as a mechanism for broad or universal coverage, observers may be expected to shift away from general data collection toward more specialized biological sampling and verification, while also transitioning routine administrative tasks from manual paperwork to more integrated, digital data collection systems.

In interviews, most stakeholders envisioned a future hybrid monitoring system in which EM provides broad, continuous baseline coverage across fleets and trips, while human observers are deployed strategically to perform tasks that require hands-on skills and contextual interpretation.

Under this model, coverage decisions would be risk-based rather than uniform, with higher-risk fisheries or vessels receiving more intensive human oversight. Stakeholders noted that this approach aligns with existing models in jurisdictions such as Australia and New Zealand, where EM is paired with partial human review and targeted biological sampling. In Taiwan, observers only conduct at-sea observation for scientific evidence.

There was also strong support among stakeholders for the professionalization of the ASO role.

Several participants suggested reforms to elevate the position, including the development of a formal certification program (for example, a structured six-month training pathway), improved compensation, and clearer career trajectories within fisheries science or management. Stakeholders also emphasized the need for stronger DFO oversight and accountability, as well as more consistent national standards for observer training, accreditation, and deployment across regions.

Despite advancements in EM, stakeholders consistently stressed the continued need for human judgment in fisheries monitoring. Even in jurisdictions with extensive EM adoption, such as the British Columbia groundfish fishery, participants noted that camera systems alone do not generate all the scientific data required for robust stock assessments or ecosystem management. Human observers remain essential for collecting biological samples, making nuanced observations, and interpreting complex fishing situations that cannot be fully captured by video or machine learning (artificial intelligence).



As a result, stakeholders cautioned against prioritizing cost savings over data quality, arguing instead for a balanced approach that integrates both technological and human capabilities.



ELECTRONIC VIDEO MONITORING IN A HYBRID PROGRAM

EM systems with video capabilities have already been deployed effectively in several fisheries in Canada and around the world. However, there are important considerations to meet the needs of Atlantic Canadian fisheries.

These include:

DESIGN AND INSTALLATION of camera configurations vary by vessel size and fishery, from simple game camera set-ups to complex multi-camera operations. Systems may be permanently installed or designed to be portable for smaller-scale or seasonal fisheries. Portable units can operate either from vessel power or battery. Stakeholders generally indicated permanent installations tend to be more cost-effective over time due to reduced reinstallation, maintenance, and backend updating requirements. Stakeholders noted that captains have sometimes valued EM cameras for vessel security and safety beyond regulatory purposes. The design and configuration must be customised to the specific needs and goals of the project or fishery.[6]

SERVICE CONNECTIVITY for EM systems is integral to the collection of continuous video alongside sensor data such as GPS location, winch activity, and gear deployment, creating a comprehensive digital record of fishing operations. These systems require ongoing services related to internet connectivity, data collection, storage, and data transmission, which are critical determinants of overall program effectiveness and cost. Connectivity remains a key constraint, particularly for offshore and distant-water fisheries, where reliable Wi-Fi, cellular, or satellite links are not always available. Several stakeholders suggested that improved onboard connectivity would significantly enhance data transfer efficiency.

SECURE DATA STORAGE and a clear chain of custody were repeatedly emphasized as essential, especially when equipment is moved between vessels or used in shared systems. Stakeholders recommend a shift toward third-party data storage models rather than government-held footage, partly to reduce public-sector data management costs and address industry concerns.

[6] Román, M., Lopez, J., Lennert-Cody, C., Ureña, E., & Aires-da-Silva, A. (2020). An electronic monitoring system for the tuna fisheries in the Eastern Pacific Ocean: Objectives and standards (Document SAC-11-10). Inter-American Tropical Tuna Commission (IATTC).



DATA REVIEW was identified as one of the highest ongoing costs of EM programs. There are two primary data review models: one in which the same EM service provider that installs and maintains the hardware also conducts video review, and another in which a separate specialized firm undertakes review services. Several stakeholders suggested that integrating technology and review under a single provider could improve efficiency and coordination, though independent review models are also in use.

DATA GOVERNANCE AND OWNERSHIP were also prominent issues. Fishers expressed a preference for retaining ownership of their video data, with clear rules defining who can access footage, for what purposes, and for how long it must be retained. Stakeholders indicated that transparent data policies and robust privacy protections are necessary to build industry trust and support broader EM adoption, although EM service providers mentioned that these privacy policies exist.

ARTIFICIAL INTELLIGENCE is also increasingly used to screen large volumes of footage, flag potential discards or bycatch events, and reduce the need for full human review of every trip. However, human oversight remains essential for quality control and interpretation.



A HYBRID MODEL WOULD IMPROVE:

MARKET ACCESS: This can be a powerful driver for the development of at-sea monitoring. Specifically for EM, it serves as a critical tool for providing verifiable evidence for modern markets compared to self-reported logbooks and observer coverage.

COST EFFICIENCY: A hybrid model would build the potential to deliver more monitoring at lower or more predictable cost over time, particularly compared to ASO programs. EM systems have seen substantial cost reductions, shifting from six-figure quotes to as low as $6,500 in installation costs.

BEHAVIOUR: By being operational onboard a fishing vessel, EM can create shifts in fisher behaviour. This can help to ensure that practices like handling and release of at-risk species are done in a manner that causes the least amount of harm possible.

SCIENTIFIC RESEARCH: Data collected through ASOs and EM systems both generate detailed and verifiable information, as well as providing the capacity to capture more data overall. EM allows us to gather the same information from multiple camera angles, review what has been captured and play it back multiples times where needed.

COMPLIANCE AND ENFORCEMENT: Governments face growing pressures to improve fish monitoring with the aim of stopping illegal activity and unregulated fisheries, as well as ensuring that harvest levels and bycatch are accurately reported.

Cost Sharing

A key barrier to a robust fisheries monitoring system in Atlantic Canada is cost. Previously, the government funded and housed the ASO program. Now it is delivered by private companies with fishers paying directly. With the potential expansion of EM and greater observer coverage requirements in the future, there is a need to explore sustainable financing models for future ASO systems. This could include re-internalizing some costs to government, cost sharing between government and industry, using fish quota to pay for cost, or other models.

Within the FMP, DFO states that the responsibility for costs associated with catch monitoring is shared between the department and fishers. It also shows how current costs for ASO programs are shared. Fisheries monitoring generates both private and public benefits, which means a fully fleet-funded model may not always be the most equitable or efficient approach. On the other hand, fishers make a living from the Canadian public's shared resources, and it is reasonable for costs associated with ensuring those resources are monitored and stewarded effectively to exist.

A new monitoring system would mean that industry benefits from continued access to regulated fisheries, market access, and more credible catch verification. Governments and the public also benefit because monitoring supports compliance, stock assessment, conservation, and the legitimacy of fisheries management decisions. As a result, monitoring can be treated as a shared responsibility function, rather than solely borne by industry.

A shared model between industry and government for the implementation of EM monitoring is a more equitable approach.

Equitable cost-sharing models must not exclusively rely on a single payer. In the United States, the National Oceanographic and Atmospheric Administration's (NOAA) National Observer Program is funded through a mix of congressional appropriations and industry expenditures rather than through universal full cost recovery from fleets alone. In 2022, NOAA reported total monitoring expenditures of $75.97 million, of which $55.10 million came from public funds and $20.9 million came from industry.[7] This mixed model reflects the reality that observer coverage serves public science and compliance objectives in addition to private access to fisheries.

Additionally, at-sea monitoring literature has revealed that capital costs are often treated differently from operating costs. A commonly cited transition model is for the government to fund or co-fund equipment and system rollout during early implementation, while vessel operators assume more of the ongoing costs once the program is established.

[7] National Marine Fisheries Service. (2024). National observer program FY 2022 annual report (NOAA Technical Memorandum NMFS-F/SPO-250). National Oceanic and Atmospheric Administration. https://doi.org/10.25923/mbbt-3s16





CEA Consulting's roadmap for EM notes that some jurisdictions use public funds to cover equipment costs at introduction, while vessel operators pay ongoing costs, and that programs may later move toward fuller cost recovery as fleets become more comfortable with the system. This roadmap also notes that EM cost recovery can be designed to reward good compliance, such as lower video-review charges for vessels that consistently demonstrate lower risk.[8]

The cost framework should accommodate small-scale operators.Small vessels typically have fewer trips, lower annual landed value, and less ability to spread fixed monitoring costs across revenue. As a result, a uniform vessel-level charge can be regressive. Working with small-scale fisheries, the Food and Agriculture Organization of the United Nations (FAO) emphasizes that governance frameworks should avoid placing disproportionate financial and administrative burdens on smaller producers and should be designed with relative poverty, livelihood resilience, and equity in mind.[9] For fisheries monitoring, this implies that a cost-sharing system should not assume that all fleets have the same capacity to absorb either EM or ASO costs.

In Canada a model that can be explored is the use of Section 10 permits, which have traditionally been used to fund science activities but could also be used to support pilot or on-going monitoring programs as well. Section 10 programs allow industry to request that a portion of the total allowable catch from a fishery be allocated to a specific project. In the case of a monitoring project request, funds gathered from the harvest of the fish could then support expenses such as the purchase of camera equipment, video reviews or other elements of a monitoring program.

[8] CEA Consulting. (2020). Roadmap for electronic monitoring in RFMOs. https://www.ceaconsulting.com/wpcontent/uploads/CEA.Roadmap-EM-Report-4.23.20.pdf.

[9] Food and Agriculture Organization of the United Nations. (2015). Voluntary guidelines for securing sustainable small-scalefisheries in the context of food security and poverty eradication. FAO. https://openknowledge.fao.org/server/api/core/bitstreams/edfffbfc-81e5-4208-a36f-334ff81ac10f/content

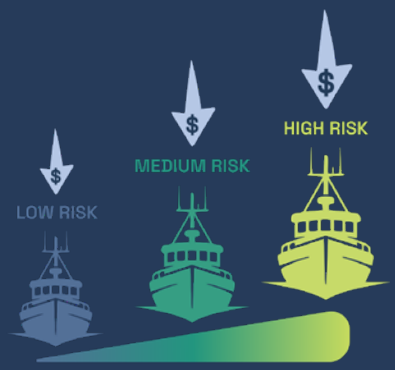
Here we provide options for cost-sharing models for region-wide implementation of EM as affordable solutions for monitoring with the commercial fishing industry. Three broad cost-sharing models are most relevant to the Canadian context. These include:



THE SHARED-COST HYBRID MODEL, in which government supports capital costs, pilot implementation, or baseline program administration, while industry pays for vessel-specific costs such as installation, routine service, and a portion of trip-level monitoring costs. This is a practical model for phased adoption because it lowers entry barriers without removing industry responsibility.



THE POOLED INDUSTRY MODEL, in which monitoring costs are spread across a fleet, sector, or fishery using a common formula, for example, a percentage of landed value, licence surcharge, or pooled association fee instead of a selected vessel assuming the full direct cost of monitoring. Alaska's partial-coverage observer fee provides an example of a pooled system in which observers and EM are funded through a percentage fee on vessel value, distributing costs across participants rather than placing them only on individual monitored trips.[10] Such pooled models can be more equitable than trip-specific billing because they minimize cost volatility and reduce the financial shock for vessels that are selected for monitoring more often than others.



THE RISK-BASED MODEL, in which cost responsibility and monitoring intensity vary by fishery risk, vessel size, and compliance. Review costs for EM systems can be reduced by reviewing only a subset of footage, by targeting higher-risk trips, or by lowering review rates for vessels with strong compliance performance. NOAA's Northeast groundfish program and other EM literature show that coverage targets and funding levels can be adjusted based on available public support and management objectives, rather than on a rigid, fully industry funded standard. This means higher-risk fleets may warrant more intensive oversight, while low-risk and small-scale fleets may benefit from lower-cost review rates.[11]

[10] National Oceanic and Atmospheric Administration. (2020, February). Adjust the partial coverage observer fee. NOAA Fisheries. https://www.fisheries.noaa.gov/s3//dam-migration/observer-fee-adjustment-earir0220.pdf

[11] Cap Log Group, LLC. (2019). Projected costs of providing electronic monitoring to 100 vessels in New England's groundfish fishery. The Nature Conservancy.



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