

APPENDIX A

Monitoring and Data Collection Approaches

Monitoring of catch and landings provides fishery managers with vital information for science, enforcement and catch accounting and is a key component of effective fisheries management. There are a variety of data collection and monitoring approaches that have been successfully used for managing fisheries and choosing the appropriate method or methods will help ensure the effectiveness of a catch share program.

This Appendix provides a basic overview of different monitoring approaches, including a discussion of their pros and cons, as well as commonly used combinations based on different gear types. Future addenda to the Design Manual will provide more detailed information and recommendations on monitoring, and numerous companies (including Archipelago Marine Research Ltd., OLRAC, MRAG Americas and more) are available for consultation, development, testing and implementation of monitoring approaches.

To begin developing your monitoring system, you must first think about the specific goals of your catch share program and the attributes of your fishery. Your answers to the questions below will help guide you through the various monitoring options that are laid out in this Appendix.

Resource characteristics

- Is the fishery (and catch share program) multi-species or single-species?
- Are there high rates or amounts of discards and bycatch?
- Are there encounters with protected species, i.e., seabirds, mammals, turtles, etc.?
- Are there significant at-sea releases?

- Are there limits by species, stock or area that must be tracked?
- Are there any closed areas?
- What is the geography of the area?

Fleet characteristics

- What is the size/composition of the fleet?
- What are the vessel sizes?
- What type of gear is used?

Operational characteristics

- What is the value of the fishery?
- What are the characteristics of the catch?
- What is the geographic range of fishing activity?
- What are the landing characteristics of the fishery?
- How much illegal, unreported or underreported catch occurs?
- What is the trip length?
- How is the catch processed and/or stored?
- When does fishing occur? Is it year-round or seasonal?

Governance characteristics

- Is authority centralized or dispersed?
- What is the history of regulation?
- What is the culture around compliance?
- Is there strong political will for specific methods?
- What is the current management regime?

Data collection and monitoring programs can rely on self-reported data or independently collected data and can be conducted at-sea or dockside. Below is a discussion of these approaches.

HAIL PROGRAM

A hail program allows a vessel operator to communicate their fishing activity to a central clearinghouse. They may report activities such as commencement and completion of a fishing trip, fishing location, scheduled landings, and offloadings of fish.

Hail programs are often used by the enforcement agency to facilitate the logistics and planning associated with at-sea or dockside monitoring and surveillance. Departure hails, the notification of trip commencement, generally include identification of the vessel and skipper as well as the intended fishing plan, including target species, fishing location and time period. Landing hails generally include all of the details regarding landing location and time and may include information about what species are to be offloaded.

Pros – Hail programs help facilitate appropriate coverage and enforcement of fleet-wide fishing trips, monitoring processes and may help facilitate product delivery and offloading.

Cons – Hail programs require fishermen to have communications capabilities on the boat. They also require a system on the backend for collecting the data pertinent to the call.

VESSEL MONITORING SYSTEMS (VMS)

Vessel Monitoring Systems (VMS) transmit vessel identity, speed and location via satellite to a central database (Anderson and Holliday, 2007). They are commonly found on commercial fishing vessels participating in federally regulated fisheries, especially where there is a need to track vessel location. Some fisheries also use VMS to increase

safety or to provide vessel hail information. The Certified Vessel Monitoring System includes a computer, a Global Positioning System (GPS) unit attached to a vessel, and backend software that receives the data and information from the vessel transponder. The VMS program also requires centralized data management on the backend.

Pros – VMS provides independent, accurate and timely information on location and can be used effectively as an enforcement tool to monitor encroachment on areas closed to fishing. When integrated with other data collection tools, VMS could be a key piece of an effective monitoring strategy. Some VMS also incorporate email capabilities thereby providing boats with enhanced modes of communication.

Cons – VMS generally contains no detail regarding vessel activity, catch or gear and thus cannot be used to verify vessel activity, such as when the vessel is actively fishing or traveling to fishing grounds. VMS data, by itself, may be of limited value for management purposes due to the lack of information regarding catch, discard and effort data.

AT-SEA OBSERVER PROGRAM

At-sea Observer Programs have independent human observers onboard vessels to record vessel and fishing location, fishing activity, catch (retained and released) estimates, compliance with fishing rules (closed areas, mandatory retention, gear restrictions) and to collect biological samples and information.

Pros – At-sea Observer Programs are one of the most effective approaches to independently and systematically collect accurate, unbiased data on catch and effort from an active commercial fishery. Observers can ensure individual accountability given a high enough level of coverage, without which it is difficult to bring about the behavioral changes required to reduce bycatch levels and accurately account for total catch by area for each fisherman and the fishery as a whole.

Cons – At-sea Observer Programs are one of the most expensive and logistically complex monitoring solutions. Managers can determine the level of at-sea observer coverage for a fishery and each vessel, but the utility for fishery management purposes of the data collected will depend on the level chosen. In many programs, catch is sampled, rather than fully accounted for. Data obtained in this manner will not be adequate to assess individual accountability. Furthermore, when vessels are selected as part of a sampling strategy, vessel operators may modify their fishing behavior, sometimes significantly, as a result of having an observer onboard. This is commonly referred to as the “observer effect” (Babcock et al., 2003). Random fleet coverage, as opposed to 100%, limits the value of the data. The relatively high cost of at-sea observers often prevents fishery managers from being able to implement full coverage, or the high sampling levels that will lead to high data confidence. In addition, these systems may not be suitable for very small vessels.

ELECTRONIC MONITORING PROGRAM

Electronic Monitoring (EM) Programs use cameras, sensors and Global Positioning System units onboard vessels to record vessel and fishing location, fishing activity, images of catch (retained and released) and compliance with fishing rules (closed areas, mandatory retention, gear restrictions) (McElderry, 2008a). EM has been developed largely as an alternative to onboard observers, but it may also be used in conjunction with observers, particularly on large factory vessels and 24-hour operations. EM also requires onshore labor to analyze the data.

EM is a system of cameras and sensors that detect fishing activities and collect video records of fishing events. EM supports industry data collection activities by providing a tool to audit self-reported data. An audit involves comparing a sample of vessel logbook data with the EM coverage. Given proper incentive structures, an EM audit functions as a ‘radar trap’ and can improve the quality of self reported data. The audit results provide several products: a measure of logbook data quality, an independent sample of fishing activity and

an avenue for providing feedback on logbook data quality (McElderry, 2008a).

Pros – When properly employed, EM can be extremely effective. EM-based monitoring solutions are a lower cost and more convenient alternative to onboard observers. The cost of EM monitoring will vary widely by application, but experience has shown that EM technology-based monitoring programs can be expected to cost half, or less, of an equivalent At-sea Observer Program (Bonney and McGauley, 2008). Furthermore, EM can be combined with an audit approach to check the accuracy of self-reported logbooks or dealer reports. Fewer audits are required when accuracy is consistently high.

Cons – Given its fixed expenses, EM is not always viable for small-boat fishermen or for others whose landed values are low. It is possible for vessel operators to tamper with the system. However, such incidents are tamper-evident, and there are generally program rules in place to prevent or discourage tampering (McElderry, 2008a). In addition, the system requires expert installation and periodic calibration to function well.

LOGBOOKS

A logbook is a report completed by vessel personnel that provides a record of fishing activity including fishing time and location, fishing gear used and composition of catch. The logbook can be either paper or electronic. Logbooks are most useful when combined with other monitoring approaches, such as dealer reports and electronic monitoring, to increase accuracy of the data.

Pros – Logbooks can be relatively low in cost to fishermen and managers. Many fisheries are experimenting with electronic logbooks that can significantly reduce data turnaround time, recording errors, and inconvenience to fishermen.

Cons – The effectiveness of logbooks as a data-gathering tool and the reliability of the data is completely dependent on the circumstances of the fishery and the individual motivations

and abilities of the skippers completing them. Where an individual is highly motivated to record the best data possible, the results can be good. However, there may be incentives for skippers to inaccurately report catch amount and location. Timely and accurate completion of the logbook may not be among the top priorities of a skipper. In addition, discarded fish are rarely well-documented unless they become a detriment to catching the target species.

DOCKSIDE MONITORING PROGRAM

Dockside Monitoring Programs use independent observers at landing ports to monitor and report on the sorting and weighing of catch offloaded from fishing vessels (also referred to as a weigh master program).

Pros – Dockside Monitoring Programs create an independent record of the offload event, which the management authority can use with confidence. Dockside monitoring is one of the most powerful tools available to fishery managers for the collection of accurate, complete and credible records of fishery landing data. It produces verified data records that are usually available within a few days or less. When dockside monitoring is implemented with 100% coverage, every offloading event is independently witnessed and a data record is completed at the time.

Having a dockside monitor at offloading events also provides the opportunity to carry out other activities such as reviewing product quality and marketing initiatives, collecting and checking fishing logbooks, collecting biological samples and providing general outreach and communication.

Cons – Dockside Monitoring Programs require the cooperation of the buyer, vessel skipper and the offloader, which can be challenging to coordinate. In addition,

dockside monitoring activity must be carried out in a way that minimizes impact on the offloading process. In addition, it can be complicated to count live, frozen and/or pre-packed product without disturbing packaging or damaging the product.

Dockside Monitoring Programs require staff trained in standardized data collection procedures and enough monitors to cover all required offloading events. They also require coordination between fishermen, offloaders and monitors, such as through a notification system, so monitors are available at the appropriate time.

DEALER REPORTS

Landings and sales slips are reports completed by the purchaser of landed fish. They provide a record of the vessel, landing location, buyer, species, product type, product value (usually) and amount offloaded. Product type and value are two data pieces that are rarely, if ever, collected elsewhere. Experience has shown that timeliness and quality of dealer data is dependent on the level of feedback and interaction by the fisheries agency. Where little feedback is given from managers, data quality is likely to be poor. In cases where interaction is high or there are consequences for poor quality or untimely data, the resulting data quality will improve.

Pros – Electronic filing of dealer reports significantly reduces the labor requirement of the fisheries agency and the turnaround time for the data. Electronic reports are also likely to reduce data-recording errors.

Cons – Recording timely and accurate data is dependent on requiring compliance through a licensing system or other incentives for dealers to participate. An easier process will increase compliance.

TABLE B | MONITORING AND DATA COLLECTION APPROACHES - *How they accommodate fishing characteristics*

	GEAR TYPES	LANDED/ DISCARDED CATCH	VOLUME OF CATCH/ LANDINGS	FLEET AND VESSEL SIZE	EQUIPMENT NEEDED	INDUSTRY REQUIREMENTS	GEOGRAPHIC RANGE AND PROCESSING LOCATIONS	RELATIVE COST
HAIL PROGRAM	All	Does not account for catch or discards	Any	Any Larger fleets will require more coordination	Mode of communication	Report sail and landing events	Any More dispersed areas or a greater number of processing locations may increase costs and require additional coordination	Low
VESSEL MONITORING SYSTEMS (VMS)	All	Does not account for catch or discards		Any	GPS units, computers and software	Install and maintain system		Mid
AT-SEA OBSERVERS	All	All	Any	Vessel must be able to accommodate additional person	Trained observers	Coordinate and accommodate observers on vessel		High
ELECTRONIC MONITORING PROGRAM	Works best for gears that do not bring catch aboard in mass. Full retention can be used with such gears to verify species information		Any	Any	Cameras, sensors and software	Maintain system		Mid to High
LOGBOOKS	All	All Self-reported	Any Self-reported	Any	Standardized paper forms or electronic logbooks	Keep and report accounts of catch		Low
DOCKSIDE MONITORING PROGRAM	All	Landed catch only Some catch may be discarded	Any	Any	Trained monitors and a database	Notify of trips and offloads		Mid
DEALER REPORTS	All	Landed catch only Some catch may be discarded	Any	Any	Dealer slips	Dealer to regularly submit reports		Low