



NOAA
FISHERIES

National Observer Program

Second National Electronic Monitoring Workshop

**Transcripts, Video Links, and Program
Summaries**

November 30–December 1, 2016 | Seattle, WA

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Introduction

The Second National Electronic Monitoring (EM) Workshop was held from 30 November to 1 December, 2016, in Seatac, WA. The workshop objectives were to:

- Facilitate a better understanding of the range of EM applications.
- Determine solutions to current challenges impeding the integration of EM.
- Share lessons learned from pilot studies and early EM program design and integration efforts across regions.
- Identify key program design elements and processes.
- Understand cost considerations and implications of EM.

The workshop was designed to bring people together who have been working on EM program design and implementation. The workshop also allowed participants to share their experiences building and implementing an EM program, particularly which aspects of their respective programs were successful and which aspects present challenges.

Day One (Nov 30, 2016) Objectives:

- Evaluate the successes and challenges of each region's progress on EM implementation.
- Explore those successes and challenges in the context of EM programs under development or planned for the future.
- Identify remaining issues and challenges that are common across regions for discussion on Day Two.
- Identify best practices for issues listed on Day Two.

Opening Remarks, Workshop Purpose, and Logistics

George Lapointe welcomed participants to the Second National EM Workshop. He noted that the workshop was organized and planned by a steering committee of fishermen, fishery non-governmental organizations, managers, and scientists, who assisted with all aspects of workshop planning.

George said that this workshop builds on the success and energy from the First National EM Workshop, which was held in January 2014. The first workshop was foundational and aspirational, pulling together people and information to assist those interested in using EM as a monitoring option for their respective fisheries. This workshop gave people a direction to pursue with EM, buoyed by the information from the workshop and a readiness to consider EM to solve monitoring issues in fisheries around the nation.

In the three years since the first workshop, EM programs have been implemented or are in the pre-implementation

phase in five fisheries in the United States. There have also been advances in technologies for EM programs. This second workshop would provide a forum for EM practitioners to discuss the successes and challenges of individual EM programs. The workshop was organized to describe regional EM programs that are implemented or in development and emerging EM programs and technologies on Day One and cross-regional issues on Day Two. The Day Two discussion would also be informed by issues that arose in the regional panel discussions.

Alaska Regional Panel Discussion

Moderator:

Kelly Denit, NOAA Fisheries, Office of Sustainable Fisheries, Silver Spring, MD

Panelists:

- Chris Rilling, NOAA Fisheries, Alaska Fisheries Science Center
- Dan Falvey, Alaska Longline Fishermen's Association
- Diana Evans, North Pacific Fishery Management Council
- Howard McElderry, Archipelago Marine Research
- Nancy Munro, Saltwater Inc.

The Alaska Regional EM Program Summary section (page 38) provides information on the four ongoing and two developing EM programs in Alaska. The panel discussion can be viewed online at: <https://bcove.video/2q14Jsg>.

Chris Rilling

Chris provided background on the developing EM programs that will be used for catch accounting in the longline and pot fisheries. He said that the North Pacific Fishery Management Council decided in 2013 to put observers on small vessels (between 40 and 57 feet), and began collecting landing fees to fund the program. These smaller vessels have logistical constraints that made placing observers on vessels difficult, including limited bunk space, conditional releases from observer coverage, and the distances between and isolation of many Alaska ports with longline vessels. Interest in EM as an alternative to human observers grew from these limitations and from a desire to find a less costly alternative to human observers.

Chris said that factors contributing to success in the Alaska EM programs include the following:

- The North Pacific Fishery Management Council appointed a fixed gear EM workgroup with broad stakeholder representation; the workgroup embodies the concept of having all views represented at the discussion table.
- There has been sustained NOAA and National Fish and Wildlife Foundation (NFWF) funding for field support, video review, and purchase of equipment.

- The Magnuson-Stevens Act (Section 313) allows fee collection to cover observer costs; these fees can be used to support EM deployment.

There is increasing interest and participation in EM representing a mix of equipment across pot and longline gear.

Challenges to EM programs in the Alaska region include:

- Developing a pathway for integration of new technologies. EM programs need the flexibility to incorporate new technologies in a timely way.

Dan Falvey

Dan said that a major contributor to the success of EM in Alaska was the switch from a top-down to an all-hands approach with all stakeholders at the table developing the details. Other contributors to this success include the following:

- The program provided accountability, encouraging both detailed questions and strong defenses of proposals to everyone in the room.
- The process was consensus-based so people worked toward solutions instead of counting votes.
- The North Pacific Fishery Management Council defers to committee consensus. Originally the council deferred to NOAA Fisheries, but now it concedes to the EM Working Group.
- NOAA Fisheries has bought into the process by committing time and resources from all relevant offices including sustainable fisheries, General Counsel, and the Office of Law Enforcement.

Dan said an important lesson that does not fit neatly into the success or challenges category is that the federal management process works slowly; patience with the system is essential as it moves forward.

Dan noted the following challenges to the EM program in Alaska:

- Developing an EM program that meets stakeholder expectations. He noted that there was not a lot of buy-in in 2013.
- Making EM cost-effective. One example is the 30% partial coverage observer rate, which can make EM revenue-neutral; however, it is more difficult to make revenue-neutral with lower coverage rates.
- Determining the value of making EM cost-effective.
- Remembering that EM is voluntary and must work for the boats. If the EM system does not work well, then boats can revert to using human observers.

Diana Evans

Diana discussed the following successes with EM in Alaska:

- The EM Workgroup is a success because it brings all perspectives to the table and allows an understanding of all perspectives and how everyone's needs must mesh. Another success factor of the EM Workgroup is that people come to work; they are prepared and participate in the meetings.
- Another success factor is significant buy-in by stakeholders. Industry members continue to volunteer for EM due to trust building, a seat at the table for all, voices being heard, and constituencies receiving positive reports. At the workgroup, the agency perspective includes staff from OLE and GC, not just Sustainable Fisheries staff. This approach frontloads the agency's work into the committee's workload.

Diana mentioned the following challenges for the EM programs:

- The program is voluntary; some vessels in the program are not ideal for EM but there is no way to choose who opts in. For example, the program may end up with vessels that take only 1 to 2 trips per year, and getting good data on the first few trips is challenging.
- Another challenge with the voluntary nature of the program is that a vessel may opt out in future years, wasting the time and resources used to train the vessel's crew.
- When the EM programs are implemented through regulations and are using the single pool of funding for observers and EM, it will be a challenge to develop the metrics to balance the needs of human observers and EM programs.

Howard McElderry

Howard said that factors contributing to the success of the Alaska EM program include the following:

- Agency commitment to the process.
- Working group members took their work seriously.
- Strong industry participation in developing and evaluating program design choices. The industry representatives created a strong connection between the workgroup and industry.
- The working group developed material to support the council process, which was folded into all the meetings.
- The working group also aided with the design of operational procedures and development of program capacity.

Among the challenges of the Alaska EM program are the following:

- Addressing and incorporating new technology choices, including features, functional capabilities, and the strengths and weaknesses of technologies under consideration.

- Not having enough time to meaningfully work through these technology choices.

Nancy Munro

Nancy said that the EM work in Alaska has been growing and evolving during the last 7 years. She viewed the following success factors as part of this growth and support:

- Strong industry leadership and interest in electronic monitoring.
- Establishment of the EM working group which allowed an inclusive process that has really taken into account fishermen's concerns.
- NFWF funding that encouraged testing of different service delivery models including third-party data review and storage.

She also identified the following challenges:

- Determining the data fields and structure to incorporate a new EM data stream into NOAA Fisheries' existing catch accounting system.
- Shaping a cost-effective service delivery model for the overall monitoring program - both EM and human observers.
- Understanding the legal, policy, and cost issues presented by the review and storage of EM data.
- Defining catch handling procedures that allow for the collection of EM data with minimal disruption of fishing practices.

Questions and Responses

Adopting EM is optional; so is catch accounting also optional? And, if so, how are you determining the ideal level of adoption and how to set the sampling level?

Chris Rilling said that EM is not currently part of the catch accounting system; it is a prototype that is not being used for catch accounting. Determining how to incorporate EM into the Alaska catch accounting system will be tested in 2017 for implementation in 2018. The current approach is to select vessels for the 30% partial coverage and review 100% of the video from these selected trips. These data will be used to estimate catch for the longline fishery.

He added that there are other models being considered, such as having the EM system running whenever a vessel is at sea and selecting the trip on the video post-trip. This approach may reduce bias and is an evolving discussion.

Dan Falvey added that because all boats will conduct the same type of at-sea monitoring, giving the vessels a choice of EM or an observer will reduce observer bias, such as taking a short trip solely to limit the amount of time that a captain and crew have to share the boat with an observer.

Giving operators a choice is critical to monitoring programs. To make this technology work, there must be clear expectations of monitoring systems that do not depend on whether EM or human observers are used. Is the Alaska EM program at the point where this choice can be made?

Dan Falvey said that whether EM or human observers are chosen for monitoring, system requirements will be clearly defined and the selection model will have gone through the EM working group and council process to ensure that the methods are sufficient to meet monitoring objectives. The expectation is that good, usable data will result from either method. In terms of testing at-sea monitoring for catch accounting and statistical confidence, this comparison is in the near future. An upcoming challenge will be how to allocate observer fees between EM and human observers.

Howard McElderry said that the EM program has thus far been funded externally and has not included information to allow program cost allocation; there is not enough information about how to adjust the allocation of funds between EM and human observers. This information allows us to determine a vessel's eligibility to enter the EM program if it takes only one or two trips a year. This topic is for future consideration but must be addressed to determine whether the program is getting the best value for funding monitoring activities.

Has anyone considered industry cooperatives (co-ops) for EM monitoring programs? Is there value in considering coops and in what direction might this take the monitoring programs?

Dan Falvey said that the use of co-ops for EM has been discussed. An attribute of Alaska fishery programs is that they are fee-funded. In the context of co-ops, the question to ask is whether there can be incentives to reward operators for good practices. Industry has used co-ops, which can operate efficiently and quickly; co-ops can provide internal incentives to individual boats to provide the data needed in the most efficient and cost-effective way. The idea of using co-ops for EM has been discussed with people who are considering that this approach might benefit monitoring programs, but this concept hasn't advanced yet.

The Alaska EM program has a value proposition to fisherman in choosing between EM or observers. Please discuss what factors you attribute to the growth in the EM program and what challenges remain?

Nancy Munro said that in the first year of pre-implementation for EM in the pot cod fleet, vessels volunteered for EM despite the fact that 30% of their trips would be monitored by EM. If they had chosen to be monitored by onboard observers, only 3% of their trips were slated to be monitored. There are three reasons for these results. First, the pot cod fleet was intimately involved in

the development of the EM program from the beginning and is convinced that it can provide a more cost-effective monitoring strategy. Second, EM is not seen as a threat in this fishery because of its low bycatch rates. Lastly, some captains favor EM because the EM cameras allow them to closely monitor activity on the back deck from the wheelhouse.

Dan Falvey said that operational compatibility is a big motivator, providing a tool for managing the back deck. Low coverage in the trawl fishery is another factor. This low coverage rate is a concern to the longline fleet, and people think that more cost-effective EM can free observer funding for higher coverage rates in the trawl fishery. Industry members are also concerned about the effects of 3% or 11% coverage and how a lightning strike (i.e., rare events) could be expanded and have catastrophic impacts on the fishery, such as in-season closures or crashing a stock. There is buy-in to achieve target coverage levels to get the data needed to accurately reflect conditions in the fishery.

The Council EM Workgroup seems fundamental to the success of the EM program. What made the workgroup effective in engaging the affected communities?

Chris Rilling replied that there has been a multifaceted approach to outreach. The agency held outreach meetings to discuss EM broadly and to make people aware of the observer coverage level in the next fishing year. He added that outreach is about relationships and building trust and confidence; the workgroup has built confidence over time. He said that people have seen the progress toward a regulated, operational program in 2018, and knowing that EM is an option has encouraged experimentation in this technology.

Many program partners have participated in outreach efforts, including NOAA Fisheries, industry members, the council, and stakeholders. These efforts have included “dock talk” where people discuss what is working and who is working on it, resulting in relationships that have greatly aided the EM program.

Howard McElderry said that the EM Workgroup has provided a known, regular forum for talking about the issues that come up with program development and implementation. The workgroup has designed the program in an open, consultative way and provides a feedback mechanism for issues that arise and lessons learned, which allows positive program development.

What challenges might hinder progress toward implementation in 2018?

Chris Rilling said that incorporating new data streams is a challenge for the agency, including infrastructure

development and setting up data-sharing processes. Getting EM data from the vessel to the regional office requires several steps, including: 1) Send the hard drive to the Pacific States Marine Fisheries Commission (PSMFC); 2) Send analyzed data to the Alaska Fisheries Science Center (AFSC); and 3) Send data to the regional office for final catch estimation across the fleet. Dan Falvey said that the regulatory process is underway, and methods to divide the funding provided by observer fees between human observers and EM boats to get the best data output possible also need to be developed. There will be a few years to develop EM and human observer boats with operator responsibilities that are compatible with boats and get the data needed to monitor the fishery. This effort involves a very detailed process to reduce costs and deliver quality data.

What is needed most to overcome the data challenges that have been discussed? Is it computing time, hardware, staff, or some other factor?

Chris Rilling said that the primary need is more staff, which is impacted by budgets and the federal hiring process. The agency does not lack hardware; they currently take in an enormous amount of data from the observer program, which has about 450 observers. Approximately 200–250 observers are at sea on a given day collecting data electronically and sending the data to the AFSC, which then sends it to the Alaska regional office for catch estimation.

Dan Falvey said that there is a list of analyses that need to be completed (about three pages of tasks and 2 years to complete them). It would be helpful for the industry to have a person with technical skills in fisheries and good people skills to help industry members understand how to structure the monitoring program to get the data needed for management.

With respect to observer bias, does industry believe that the stock assessments used for Alaska fisheries are accurate? Is reducing observer bias a reason for increasing industry participation? People in the northeast are thinking about similar issues with cameras running 100% of the time with a certain percentage of the video being reviewed after a trip. In Alaska, 30% of trips are selected, leaving 70% unobserved. Was observer bias a factor in choosing this selection model?

Dan Falvey said that no single factor was used when considering these issues, because 100 fishermen will give you 100 different views. With respect to assessments, fishermen respect the data when the stock is increasing, but when it is decreasing they are skeptical about the data. In general, there is good buy-in for the science in Alaska. There are healthy stocks and, in the case of halibut and sablefish, there is a dedicated longline survey. Stock assessment scientists are good at outreach with industry, which also results in a lot of buy-in.

With respect to observer bias, Dan Falvey said that the motivation to use EM for many fishermen is operational compatibility and increasing coverage in other fishery sectors.

Howard McElderry said that EM provides different avenues for investigating the potential for observer bias. The EM Workgroup discussed trip selection prior to a trip. If you use a human observer, you need to make arrangements for the observer. If you use EM, you simply turn the system on. To get at observer bias, you could reverse the arrangement to have the camera operating all the time and make the 30% selection after the trip is completed. That way, the fishermen would not know which part of the trip would be viewed. This approach could be used without much additional cost and is used in the Australian surface longline fishery where 100% of trips are recorded, and 6–7% coverage is achieved at the video analysis stage. Therefore, there is some flexibility for addressing the observer bias question.

Dan Falvey added that an important factor in turning the video on only when a trip is selected is to save data storage costs. Why pay for extra storage costs associated with having the camera on all the time if won't view 70% of the video? Additionally, from a fishermen's perspective, there is a cost of keeping a system up 100% of the time and fishing time can be lost if the system breaks down. He said that other data are gathered through logbooks. For halibut, there's a paper logbook for vessels more than 26 feet long. For Pacific cod and sablefish, vessels more than 60 feet long have a federal reporting requirement. There is also a voluntary logbook in sablefish fisheries for vessels less than 60 feet long, which is used by about 90% of participants in the fishery because of industry buy-in to improve the stock assessments. Some work with electronic logbooks has been completed, but there is still work to be done to make them functional.

Chris Rilling said that with selection rates and bias, the more selection rates are increased, the less likely it is that fishermen will try to bias the data. If every fishing trip is observed, then there is no motivation to alter fishing behavior because the data are collected during each trip. He added that the EM Workgroup has discussed the appropriate method for sampling vessels with EM. From an agency perspective, some additional cost is associated with data storage at higher recording rates but this method gives the option of post-trip deployment. He thought that this approach could be made more cost-effective and is one of the issues being looked at in 2017. A challenge with observer coverage is that rates are going down because of reduced funding. With pot cod observer levels at 4%, there is a greater chance of significant observer bias.

Are there concerns among stock assessment scientists about whether getting monitoring data from two sources (e.g., human observers and EM) is compatible and whether it will

affect stock assessments? Particularly because the same boats may not be in the EM program year to year compared with human observer coverage.

Chris Rilling replied from the observer perspective that EM data are going to be integrated into the observer program data stream. These data may be kept separate through the catch estimation process. Functionally, the data are the same and scientists should have confidence in them. Additionally, there is a feedback loop through the plan development team (PDT) and annual reporting process to correct errors.

The number of boats using EM in the European Union (EU) is very low and the EU has put in place a discard ban for 2019. Fishermen there want to know how to be compliant with the law. Were there discard issues with Alaska fisheries that were addressed in the beginning of the program? For example, does selectivity work come before EM or do you start with EM and work out the selectivity issues as the program develops?

Howard McElderry said that it is an iterative process; work on monitoring programs builds awareness of actual catch retention practices and this awareness leads to creative solutions. The technological approach also leads to detailed discussions of catch handling protocols; e.g., camera arrays in areas of catch handling. He added that using EM to monitor full retention requirements is one of the easiest EM applications.

Dan Falvey said that the first step is determining what performance standards are achievable by the fleet. From an enforcement perspective, EM is like a red light camera; it is there for everyone to see if a fish is dropped over the side of the boat. It is also important to realize that the EM systems will not achieve 100% compliance; the result is a confidence range similar to that found in other data streams. The key is to achieve a threshold that allows monitoring at an acceptable level. Another factor to consider is the importance of defining terms in the EM program. For example, with West Coast whiting, fishermen said that they did not discard fish but that they escaped the nets in what is called "slippage" rather than discards. Really understanding what is going on in a fishery is critical, and EM cameras can increase this understanding. Getting buy-in from fishermen and determining what is achievable are both critical needs.

With programs that are underway, do people talk about reviewing regulations and requirements after fishermen and managers see what is happening on the water?

Diana Evans said that the Alaska planning process has a feedback loop for addressing issues that arise. For example, the partial coverage program has been in place since 2013 and there have been four or five amendments to adjust the program in 4 years. Aspects of the EM program, such as operator requirements, are in regulation, other aspects are in

vessel monitoring plans, and other aspects can be adjusted annually through the annual monitoring plan. The method chosen depends on the type of change and where it fits in the infrastructure process; however, there is a process for ongoing improvement. Equally important in Alaska is that industry members are active in meetings to learn about and recommend changes, and the program design tries to accommodate requests without going through the regulatory process.

Kelly Denit added that the pre-implementation process is designed to work out program issues prior to being set in regulations.

Please discuss the logistical challenges associated with moving EM equipment among vessels.

Howard McElderry said that from a program design perspective, about half the cost of an EM installation is the cost of the control box and the majority of the labor is in installing wiring and peripherals. Therefore, with large fleets that contain vessels that do not take that many trips, it makes good sense to pre-install EM on as many vessels as possible and move control boxes before fishing trips. Until this year, the selection method meant that fishermen did not know that they would be carrying EM until right before the trip started, which caused challenges to get everything in place and make sure the technology worked before a trip. Therefore, it makes sense to pre-install EM on all the vessels in the program and move the control boxes when needed.

Nancy Munro said that the pot cod fleet is different, taking many trips that were clustered in the first and last quarters of the year. This fleet decided to install the equipment and leave it on the boats. From a program perspective, this demonstrates that the decision about how to deploy equipment is fishery-specific.

What are the policies and practices for video data retention, such as time period and who owns the data?

Chris Rilling said that these questions are still being worked on nationally. In the Alaska region, the data are sent from the vessels to the Pacific States Marine Fisheries Commission, and the agency never takes possession. This is important because if the agency does take possession, the video becomes a federal record with specific record retention requirements as well as the applicability of the Freedom of Information Act (FOIA), which allows public access to many types of federal records. The data that are derived from the video (metadata and text files) are federal records.

In the Alaska catcher/processor fleet, EM is used to supplement observer coverage to allow visual access to bins that are used to store any salmon bycatch. This EM data is

available for inspection for enforcement or compliance for 120 days after the end of a trip. However, this is a unique EM program compared to the programs that have been discussed because there is always an observer on board the vessel.

Alaska has had success with voluntary EM programs going to catch accounting. How have you worked out catch accounting and deck handling so it is not operationally prohibitive?

Dan Falvey said that there has been much discussion about this and they are currently using average fish weights. To get lengths, a large discard chute system would be needed that won't work on longline vessels where the catch is sorted at the roller. There is ongoing work on a discard chute that might work on vessels that use a sorting table. What works is really all about the details of the boat's back deck.

Nancy Munro said that on pot vessels, which are small boats with limited space, the practice had been to throw over all discards overboard quickly followed by bleeding the pacific cod and putting them in the hold. These vessels have changed their handling practices to first bleed and store the cod and then sort through the discards in front of the camera.

West Coast Regional Panel Discussion

Moderator:

Chris McGuire, The Nature Conservancy, Massachusetts

Panelists:

- Melissa Hooper, NOAA Fisheries West Coast Regional Office
- Brent Paine, United Catcher Boats of America
- Lisa Damrosch, Half Moon Bay Groundfish Marketing Association
- David Colpo, Pacific States Marine Fisheries Commission

The West Coast Regional EM Program Summary Document is on page 40. The panel discussion can be viewed online at: <https://bcove.video/2rOgWzj>.

Melissa Hooper

Melissa said that NOAA Fisheries, the council, industry members, and others have been working on EM in the groundfish trawl fishery. This is a multispecies fishery managed under a catch share program implemented in 2011. The catch share program divided the fishery into three sectors: whiting catcher/processor sector, whiting mothership and catcher vessel sector, and whiting/groundfish shore-based individual fishing quota (IFQ). To ensure accountability with quotas, the amendment implemented 100% observer coverage at sea and shoreside, funded by industry. Observers are accustomed to documenting all landings and discards for IFQ species, to

debiting from IFQs of individual vessels, and to monitoring compliance with requirements of the catch share program. Monitoring programs were originally funded by NOAA Fisheries through a subsidy program that began in 2011 and transitioned to full industry funding in 2015.

For several years, managers and industry had been experimenting with EM and there was renewed interest with industry taking on full monitoring costs. This experimentation led to exploring EM as a more cost-effective alternative to human observers. To pursue this interest, the council began a regulatory amendment to operationalize an EM alternative to meet the 100% at-sea monitoring requirement. In 2015, a collaborative project began to test EM and to develop the regulatory program needed to implement EM as a monitoring alternative. The EM Exempted Fishery Permit (EFP) program began in 2015, deploying EM on 34 vessels. There were 46 vessels in the EFP program in 2016, representing about two-thirds of the active fleet for the shore-based sector and at-sea mothership sector with vessels using midwater trawl, bottom trawl, and pots. EM can be used in place of observers if the vessel has functioning EM, submits logbooks, submits data after each trip, and complies with EM rules. Additionally, scientific observers are deployed to collect biological samples, gather protected species information, and record data on non-IFQ species. EM video and logbooks are used in place of human observers to account for discards. The PSMFC reviews the video data and transmits discard estimates, which are compared with logbooks, and then NOAA Fisheries uses either EM or logbook data to debit IFQ accounts. Video review will transition from PSMFC to a third-party reviewer in 2020.

To develop the EM EFP program, all parties worked together to define catch handling protocols and weight estimation methods, how to use EM data or the logbooks to debit IFQ for discards, and what to do if the EM system was not functioning. This collaboration allowed the council to move two programs to proposed rule in September for whiting catcher vessels, shore-based and mothership vessels, and fixed gear vessels in the shore-based sector. Currently, work is underway on a second phase for bottom trawl and non-whiting midwater trawl. The challenge for the phase two fisheries is a combination of higher catch volume and a larger mix of species, which will require more catch handling.

The region is also interested in EM for the swordfish drift gillnet fishery in California. The Council approved hard bycatch caps of marine mammals and turtles in this fishery with requirements for 100% observer coverage or EM to monitor the hard caps. NOAA Fisheries and the council are working through program requirements. They also tried to establish an EFP but were unsuccessful because of lack of industry interest.

Brent Paine

The United Catcher Boats and Midwater Trawlers Cooperative requested an EFP from the council 3 years ago to allow EM use for two sectors, mothership and shoreside delivery mode in the whiting fishery. There were 22 boats in the EM EFP in the first year of the program and 27 in the second year. Brent stressed the importance of monitoring costs and collaboration, saying that the reason the fleet was interested in EM was the 100% observer requirement in the catch share program. With industry funding observer coverage, the costs were significant with one vessel spending more than \$70,000 for observer coverage in 1 year. In contrast, EM cost was in the \$10,000 to \$15,000 range. This cost difference is really what the industry was interested in.

Fortunately, both NOAA Fisheries and the council were receptive to the industry EFPs and the EFPs went through the council process in a timely way. Industry collaboration was also very important with the Council, Sustainable Fisheries staff, Office of Law Enforcement, and General Counsel all being involved early and consistently.

It is also about cost control: EM is used to monitor for discards and to estimate the weight of discarded fish. To date, EM has proven to be a cost-effective substitute for observers. About 75% of the fishery is now using EM and this percentage will likely increase in the future.

Lisa Damrosch

Lisa said she comes from a fishing family and got involved in the family business when the fishery switched to IFQs because it now requires more shoreside and technical support.

To assist with the transition, the California Groundfish Cooperative (CGC) was formed. It is a group of seven boats from three ports using three gear types (fixed gear, bottom trawl, and Scottish seine). It is also important to note that West Coast fisheries are significantly different below 40°10' (near Cape Mendocino) compared with other West Coast fisheries. When the fishery transitioned to catch shares, there was concern about consolidation within the fishery. This concern persists because there are 11 vessels that remain in the CGC and are trying to make EM work.

They created an EFP for the CGC and now five of the 11 vessels use EM. For fixed gear, EM works well because pots do not catch many non-target species. For sablefish, which does not have much discarding, catch handling procedures allow every fish to be monitored. Trawl vessels are more challenging because of larger catch and more species but the logistics of EM for the trawl fishery are still being worked out. There is a strong incentive to make EM work because of the 100% observer requirement. The vessels are incentivized to use efficient on-water techniques and to change behavior as little as possible, in addition to having limited space for another body onboard the vessel. For fixed gear, 100% of the

vessels use EM. With trawls, program development is still underway.

David Colpo

Dave said that he would focus on the PSMFC role in the West Coast and Alaska EM programs, noting that PSMFC seems to be the only interstate fisheries commission actively engaged in the EM process. The West Coast benefits from PSMFC involvement because all the data needed for monitoring goes to the commission, including landings data, logbooks from fishermen, and EM video data. This approach is important because there are no data handoffs to another entity, which expedites the timeliness of data flow and gets data from vessels and docks into the management system. Dave said that EM video review can take up to 48 hours after receiving the hard drive in the whiting fishery, and take a bit longer in the fixed gear and trawl fleet.

The results are that the three data streams needed for compliance monitoring, landings, logbook, and video summaries are generally available to managers within a couple of days of landing. What slows down EM interpretation is physically getting the hard drive but overall the data flows pretty well. Also important is that PSMFC staff have a good working relationship with industry to cooperatively determine what is working and how to improve areas that need help. The commission uses a hands-on approach to get buy-in and participation from industry and to solve problems. This approach has proven beneficial in the West Coast EM program, mainly because PSMFC staff are not managers or members of law enforcement, and are able to talk to people from a neutral position.

Questions and Responses

How many people at PSMFC work on EM?

Dave Colpo said that PSMFC has four EM video reviewers who review video from both the West Coast and Alaska. Another data analyst works part time on EM and two contract developers work on database questions, such as how to get the data to flow to NOAA Fisheries and the states. Dave oversees the overall program.

Please discuss the top success and challenges critical to getting the West Coast EM program on a path to implementation.

Melissa Hooper said the biggest success factor is the working EFP resulting from collaboration and working through issues as they emerge. She said the biggest challenge is incorporating bottom trawl vessels and the tradeoffs associated with the diverse mix of species and a desire to estimate discards, along with the burden of getting that information from fishermen.

Brent Paine said that collaboration and timely action on the EFPs were the biggest success factors. The biggest challenges are how long EM data need to be stored and who pays for video interpretation. Another challenge is determining what happens if EM fails during a trip. If an observer gets sick on a trip, the vessel is still allowed to fish. Should the same model be used for EM or should the trip be terminated; this is a decision with significant implications for fishermen.

Lisa Damrosch said that the biggest success factors were collaboration and industry's ability to sit at the table when discussions about EM took place. Also important is the use of collective enforcement agreements with all vessels under one plan. The most significant challenges are cost and coordination of dockside monitoring in the area where the CGC works. Also critical are program costs as they are transitioned to industry members. For the CGC, the costs are too high and will likely put many industry members out of business.

David Colpo said that the biggest success factor is 100% observer coverage, which brings industry to the discussion table in a way that does not occur in other regions. Also important is collaboration with the NOAA Fisheries regional office, and the Office of Law Enforcement stepping back and allowing industry to come up with solutions. The biggest challenge is people who are reluctant to change and to collaborate, which causes loss of trust.

Describe the industry cooperative (co-op) model used for the California Groundfish Collective and what the benefits of the model are? Additionally, how will the co-op model be maintained?

Lisa Damrosch said that the co-op model was their plan from the beginning to work together as a risk pool, so there was already a structure in place for EM. When it came time to work on the EFP, it made sense to use this same model because it allows the CGC to resolve its own issues first, using the group to solve problems internally rather than having the council or NOAA Fisheries dictate a solution. Also important is the ability to move vessels in and out of the agreement. This approach allows the collective to address problems internally with individual fishermen as needed.

Melissa Hooper said that the collective agreement has been a benefit by not having to work with vessels individually; the agreement provides a central contact with one person to address issues. She added that this is similar to sector managers in the New England groundfish fishery. Another benefit is that the collective agreement allows people to work together and self-enforce, filling a role analogous to the observer management and training program for human observers.

What process is in place to allow enforcement in the West Coast EM program? PSMFC does not get involved in

enforcement, so how do you set up filters and thresholds that trigger additional review to look for violations? How do you distinguish between substantive violations or issues and minor issues, such as one fish going over the side of a vessel?

Dave Colpo replied that every hard drive that is reviewed results in a drive report after the video review is completed. The report includes video gaps, camera issues such as dirty lens, and good outcomes. This confidential report goes to the boat captain, so the captain can see what was written about the trip, as well as to appropriate stakeholders for review. If OLE has a question about the trip, they receive video clips for their review but data are not routinely sent to OLE. Managers and video reviewers are not interested in minor issues; they have other things to worry about such as looking for fishing events for discard compliance review.

With the West Coast EM program, 100% of the video is reviewed, but this review percentage will likely decrease over time as experience is gained with the EM program. As the percentage gets lower, there will be a focus on looking at bad actors to keep the program effective compared with looking at minor issues on the video.

With the fixed gear EM program moving through the regulatory process, how do you see the EM program changing when the regulatory process is finalized, particularly in terms of the cooperative enforcement agreement?

Lisa Damrosch replied for the CGC, stating that they are still working out the details but the current thinking is that very little will change for vessels.

Brent Paine said that United Catcher Boats and the Midwater Trawl Collaborative are operating under an EFP and a cooperative agreement with NOAA Fisheries, which outlines roles and responsibilities of the parties. When it moves to regulations, they anticipate that the associations may step back a bit and the vessels will take a larger role.

Are there tasks now given to human observers that might be done better with automation? In the long term, what does this mean for fisheries data collection compliance, and how do you think allocation of jobs between humans and computers will take place? Additionally, what could this mean for funding requests and staffing needs?

Dave Colpo said that the short answer is that it is unknown because we do not know what technologies will be available to better allocate funding and staffing. There will be adaptation and usage of new technologies as they become available for testing and operational use.

Brent Paine said that United Catcher Boats contracts with SeaState to help manage data needed for management, and human observers are needed at the processor level.

These observers collect important biological data needed to manage fisheries to determine when a boat should stop fishing, what bycatch rates are, or when vessels need to move to avoid choke species. This effort requires human intervention but EM is needed on catcher vessels. In the future, there might be new information to help with data turnaround. If technology can help with this, that's where he sees future changes.

Lisa Damrosch said that, long-term, she'd like to see cameras do catch accounting and not need dockside monitoring, which is an additional cost and logistical challenge. So, an optimal outcome would be advancing to the point where cameras can be used to account for discarded and retained catch.

The EFP process is like a training program; what is the ideal duration of an EFP program in terms of getting the fleet ready and to allow the Council and NOAA Fisheries processes to advance simultaneously?

Brent Paine said that the Council jump-started the regulatory amendment process. He said that he was hoping for a longer EFP process to answer questions about the relative cost of the audit model and program.

Dave Colpo replied that 100% review of the whiting fishery costs \$12 per day so it is unlikely that additional EFP time will change this cost. It would take longer and cost more to determine how to subsample video data for a lower percentage with the audit model. For EFP length, it's really a case-by-case decision based on readiness by the industry and managers.

Melissa Hooper said that the EFP process allows the flexibility to change things as you learn and to work on what you did not know when you started. EFPs also come with uncertainty and are designed to be temporary. So long term, they don't provide certainty for industry or service providers.

When the transition from EFP to regulations occurs depends on all parties involved because it is an iterative process. If the switch occurs too soon, there might not have been the opportunity for learning, correcting, and stakeholder involvement.

Are there new uses for discarded fish that may offset the additional catch handling and sorting that come with EM programs? Another way of asking is are there uses of fish that were formerly discarded and are now being retained by the boats, and how is this perceived by processors and dealers?

Lisa Damrosch replied that the CGC operates under an optimal retention model because maximized retention is a non-starter for trawl vessels. Optimal retention starts

with a list of allowable discards based on a prioritization of discard species. What the EFP offers, and what needs to be retained in regulations, is the ability to change this list as more is learned about how the program works. From a catch handling perspective, the change is in sorting procedures, particularly what needs to be sorted.

There may be opportunities for marketing what is now discarded but there are not currently any secondary markets for unmarketable fish. Unmarketable fish are now disposed of and fishermen are charged a fee for all offloaded fish from the boats. So the unmarketable fish are currently a financial liability.

Greater Atlantic Regional Panel Discussion

Moderator:

Dorothy Lowman, Pacific Fishery Management Council

Panelists:

- Nichole Rossi, NOAA Fisheries, Northeast Fisheries Science Center
- Geoff Smith, The Nature Conservancy, Maine
- Ben Martens, Maine Coastal Community Sector
- Mike Russo, Cape Cod fisherman
- Amanda Barney, Ecotrust Canada
- Mary Beth Tooley, New England Fishery Management Council

The Greater Atlantic EM Program Summary Document is on page 41. The panel discussion can be viewed online at: <https://bcove.video/2s2MEcB>.

Nichole Rossi

People in the New England region have been investigating EM in the groundfish fishery since 2010. Specifically, they have been looking at EM for bycatch monitoring as part of quota allocation. They conducted a 4-year project with Archipelago Marine Research to determine the feasibility of EM, understand EM capabilities, and determine how EM could fit in the groundfish fishery. They also developed performance standards for data and equipment, simulated an operational EM program, and investigated cost drivers for EM. When the project ended, the Gulf of Maine Research Institute (GMRI) and The Nature Conservancy (TNC) continued where the pilot project left off. Through this process, a partnership developed that allowed NOAA Fisheries to continue developing an operational EM program. Currently, an EFP has been issued that allows up to 12 vessels to use EM in place of at-sea monitors; now six to eight vessels use EM.

The EFP uses an audit model for quota monitoring and video review to validate the captain's catch log. EM is used by six to eight vessels of the approximately 200 vessels in the groundfish fishery. EM is accustomed to auditing 14%

of trips, the same coverage percentage that is used with at-sea monitors. In addition, vessels carry human observers to collect biological samples. Human observers also allow comparison of data generated from EM and at-sea monitors.

The groundfish fishery has another EM project targeting larger vessels that fish farther offshore. This project, which is a collaboration between GMRI and the Environmental Defense Fund (EDF), will use a maximized retention model and dockside monitoring. This project will begin in spring 2017 and will include three to four vessels.

EM partners can use these two projects to develop the best EM program to meet the monitoring needs in the New England groundfish fishery.

Some of the challenges that confront the groundfish fishery include integrating EM data into the current data infrastructure, developing performance standards and business practices for EM, and defining appropriate levels of data alignment and video review levels needed to validate logbooks. Another challenge is implementing EM in a fishery with less than 100% observer coverage. Varying coverage levels have had a direct impact on participation levels in the EM program in New England and subsequently the amount of data the program generates to improve program effectiveness.

One advantage of the EFP process is that it allows program partners to move past the pilot program stage and continue development on working EM programs, as well as strengthen collaboration among program partners.

Geoff Smith

TNC was a project partner in the pilot program to test an audit-based EM program where cameras were left on continuously, and then a portion of the video data were reviewed and compared with the vessel's catch log. The current EFP runs slightly differently. Instead of running the camera on all trips and reviewing some portion of the trip's video data, the EFP program runs the camera on a percentage of the trip and then all the video data from the selected trips is reviewed. EM program partners are still interested in the audit-based approach for cost savings and to give fishermen control of the information that is being collected. However, this year is a variation of the audit-based model.

From the 3 or 4 years of EM work in New England, there have been important successes. These include determining that EM systems can collect data of sufficient quality to identify species and estimate lengths, of which both parameters are needed for catch accounting. There have been challenges with identifying a few species, such as silver hake and red hake, but program partners have developed ways of addressing these limited exceptions. Another

success is improvement in the EM system by fishermen and service providers. Vessel management plans (VMPs) and a timely feedback loop between captains and reviewers are an important part of program improvement. A final success has been the approval of the EFP, which has allowed fishermen to run camera systems compared with having camera systems and an at-sea monitor on board at the same time. EFP approval has been a significant hurdle to overcome, and the success in getting the EFP approved is due to the persistence and insights of program partners.

There are two primary challenges in the EM program. First, there are not strong incentives for fishermen to participate in the EM program. At the same time, there are strong incentives for fishermen to mis-report discards when on an unobserved trip to avoid constraining stocks and individual catch caps. There are also relatively low observer coverage levels, about 14%, and the cost for at-sea monitors is covered by NOAA Fisheries. The groundfish fishery is transitioning out of the subsidized observer costs, which have negatively impacted the EM program. The consequence of this dynamic is that there is no incentive structure to encourage participation in the EM program. This result contrasts with the strong incentives provided by the 100% model in the West Coast groundfish fishery.

A final point is that the New England groundfish EM program needs to develop operating rules on issues such as audit review percentages, pass/fail criteria for the audit, and the consequences of failing an audit review. Finalizing these performance standards is a challenge, but is a necessary step to implement an audit-based EM program in the groundfish fishery.

Ben Martens

An important factor in the New England groundfish EM program is that it was identified as a need by groundfish fishermen. These fishermen met with himself, Geoff Smith, and GMRI staff and acknowledged EM as a viable solution to an ongoing problem: the need for accountability in the fishery. In doing this, the fishermen expressed some uncomfortable facts to themselves and others. These included that the cost of at-sea monitors would eventually be shouldered by the fishermen, in spite of the ongoing situation where money is found to keep paying for the at-sea monitors. Others in the industry continue to believe that the funding to provide at-sea monitors will continue into the foreseeable future.

Equally important to these fishermen is getting new and better data streams for use in stock assessments. Fishermen from the Maine Coast Community Sector and Cape Cod Fishermen's Alliance bought into EM as an alternative and they have been willing to experiment to make sure that this new process works, even with all the problems that arise

with a new system. Implementing EM with Ecotrust Canada has been a fantastic experience for many fishermen who felt that they have been heard in the EM program development process. This result shows that fishermen must be given a voice in creating this type of system.

There are mostly external challenges to EM program success. For example, many vessels cannot afford to be operational. Additionally, many non-EM program vessels have built businesses that rely on not being accountable for a significant number of trips (i.e., those that are not observed). With this status quo, it is hard to build support for EM with the inherent accountability that comes with EM programs.

Mike Russo

Mike noted there are a few things that have incentivized him to participate in the EM program. When the groundfish fishery transitioned from days-at-sea to catch share management, the rate of observed trips increased and the quality of observers decreased. He fishes on a 40-foot vessel where space is limited. One thing that he did not anticipate was the stress that comes with carrying an observer onboard, such as worrying about another person in bad weather. Also, 4 to 5 day trips make the vessel seem very cramped by the end of a trip, and an extra person onboard makes this worse.

Another thing that he likes about EM is that without the camera, his information is viewed as anecdotal to managers but a camera makes the observations more substantive. This gives fishermen power that they did not have before. From his perspective, EM provides a tool that is advantageous to all parties in fishery management. It is good at promoting partnerships and cooperation between industry and managers.

One thing that would be a useful addition is developing a volumetric system of measuring fish because sometimes being inundated with a big catch makes placing each fish before the camera problematic. Given how fishing works, this is not feasible long-term. There does not seem to be a difference between an observer taking a subsample of a large catch and then extrapolating to the entire catch with what he has proposed. On long days, this would make a big difference when any added tasks become burdensome.

There are few incentives but this year he didn't have to pay for an at-sea monitor out of pocket, which in itself is a significant incentive. One incentive he would like to see is the elimination of unnecessary management lines with 100% EM coverage. When New England management moved from input to output controls, a lot of input controls were left in place and he believes that this is the wrong way to manage. He would like to see some of these changes in place before he quits fishing, and EM for fixed gear vessels will help restore some efficiencies to the fishermen.

Amanda Barney

From a service provider's perspective, one thing that has been useful is developing a common language for species identification, which helps to agree on how to compare data from different people and processes, e.g., logbook or EM. In the last year, these issues have been discussed among fishermen, managers, and service providers, to speak with NOAA Fisheries with one voice. This is important for fishermen, service providers, and managers in each sector but also between sectors with everyone working toward creating the same standards which, in the end, is a time and money saver.

One big challenge is around data delivery standards: not just what the technical specifications look like but also what the service provider sends to the agency, whether the agency is getting the data, and whether a feedback loop exists to report problems. For the Fish Sampling Branch, an important issue is how they access data if they want to audit some video data.

For different types of analyses, there are different technologies and data delivery challenges. These issues need to be discussed; the more they are discussed, the more that can be solved.

Lastly, she echoed a comment from earlier in the day about logbooks, specifically having EM and logbook services through the same entity. They provide logbook services for the people that they work with, and having the logbooks available for feedback and comparison with EM data is an important efficiency to consider for feedback and rapid turnaround times.

Mary Beth Tooley

The Atlantic herring EM test program is for midwater trawl vessels and they hope to bring a couple of purse seine vessels in the project. Monitoring the herring fleet has been a priority for the council because these are large vessels for the New England region that participate in a high-volume fishery. Because of high catch volume and the way the fishery operates, there is concern that the fishery could have significant bycatch events. Currently, the fleet has at-sea monitoring coverage provided by NOAA Fisheries. There are variable observer coverage rates in the fishery, which can cause problems with the observation of rare events when an observer is on board. The most critical issues are the two bycatch caps that the fishery has for haddock and river herring. Because of low coverage levels, a rare event can shut down the entire fishery for extended periods, as occurred in 2015. The alternative to an adequate monitoring program can be whether vessels can go fishing at all.

For these reasons, the industry is motivated to develop a monitoring program for this fishery. The EM project is

designed to determine whether fish in the net are brought on board or are discarded; e.g., is slippage occurring. Vessels in the fleet typically pair trawl and one vessel drops off the net when they haul back. The net then comes along the side of the vessel and fish are pumped into the hold. So, there are cod ends that do not come on board with fish in them, which is an example of how EM needs to be tailored to each fishery.

The New England Council has a monitoring amendment that is scheduled for final action in January 2017. One analysis in the amendment clearly indicates that a high level of observer coverage in this fishery is cost prohibitive. An alternative in the amendment would allow vessels to use EM as a substitute for at-sea monitors. This approach will be attractive to industry members if the project shows that EM can be used to monitor the fishery. The amendment would require that EM be paired with a shoreside sampling program. If EM can document that a high percentage of the catch ends up in the hold, the shoreside sampling program can provide catch composition for the vessel and trip.

It is not clear that EM will reduce costs. Some initial estimates in the amendment suggest that EM and shoreside sampling may cost more than at-sea monitors. The EM program has been adjusted and has changed how people view the data EM can provide, and this iterative process will provide a viable monitoring option.

The project is just starting and there is not much to report yet. EM systems are just being installed and there is 100% participation in this voluntary program. There is much interest in the project with many people waiting to see how the project progresses. While the project is ongoing, vessels are monitored by at-sea monitors as well as shoreside sampling programs run by Maine and Massachusetts; this shoreside monitoring accounts for 50% of landings.

Nichole Rossi added that this is a new project that builds on the experience of previous EM work, applying information and resources from previous EM projects. The herring/mackerel fleet is also small and they are very interested in maintaining the integrity of the fishery, including using EM.

Questions and Responses

What has been the role of the council in the groundfish and herring EM projects; why did they develop differently and where do you see them going in the future?

Mary Beth Tooley said that the council's approach to monitoring has been Fishery Management Plan (FMP) by FMP. Groundfish has been the topic of a long conversation with the transition from days-at-sea to catch shares being very significant, followed by sharply declining quotas and monitoring costs that seem untenable. The omnibus monitoring amendment now in development is meant to

address monitoring issues consistently across FMPs, and is a joint effort with the Mid-Atlantic Fishery Management Council. This amendment also allows EM to be used in the herring and mackerel fisheries as a monitoring option.

Geoff Smith said that another action by the council was to establish an EM Working Group a number of years ago to explore two types of EM programs, audit-based versus maximized or optimized retention, as well as other EM issues. This effort stalled because of competing priorities but demonstrated the council's interest in EM. Although this EM Working Group has not met, there has been a group of fishermen, NGOs, service providers, and agency staff who have been working through EM implementation issues in the groundfish fishery.

On the West Coast, PSMFC conducts the video review. In New England, video review is being handled by a third-party provider. How do you see the respective roles of third-party reviewers and NOAA Fisheries evolving in the future?

Nichole Rossi said the Northeast Fisheries Science Center conducted a 4-year study in which all video data was reviewed, giving a good basis for considering the use of third-party providers. The study found that using a third-party provider works but requires attention to data standards and quality control to ensure that data is monitored adequately. Also, the agency audits the reviewers, which is a process to verify the work of the video reviewers, providing another quality control check in the program.

Amanda Barney said that the third-party process has been beneficial because it has allowed the development of data and performance standards needed for the program. To help with quality control, they make sure that their video reviewers are past or current observers; this is important because they have spent time on boats and have seen the species and operations of a particular fishery. Species identification has been useful because the video reviewers understand the identification standards used by the observer program, maximizing consistency between EM and human observers.

Ben Martens said that using the third-party reviewers was important to fishermen because of concerns about who can access the data. The third-party review process also had an important cost component because cost rates can be negotiated directly with the third-party company. The third-party relationship also allowed for the completion of other reviews and analysis on the video. For example, one Maine fisherman has the camera on 100% of the time and all the video is reviewed with the goal of providing a better data stream for science. This enhanced review also allows improvement of the EM program by looking at overall

system performance. Using the third-party provider allows flexibility that does not occur with the federal process

Participation in the groundfish EM program is lower than expected for a variety of reasons. How do you view participation levels increasing to provide some economies of scale in this EM program?

Ben Martens said that there are certain sunk costs that go into an EM program and it becomes more cost-effective with increased participation. This effect will not be evident in the groundfish EM program until the fishery has accountability and adequate coverage levels. The current choice of having a camera and accountability or relying on the 14% coverage level is an easy choice for most fishermen to make.

When fishermen become accustomed to an EM system, they generally like using it. Increased operational flexibility and fewer people onboard are some of the benefits of using a camera system. The sector system was supposed to allow flexibility in business planning but has not provided this benefit. Therefore, EM systems would ideally provide innovation and business flexibility to allow some restrictions to be removed, such as access to closed areas.

Mike Russo said that he needs to complete five separate tasks before leaving the dock, including a 48-hour declaration, VMS declaration, starting an electronic logbook that in turn generates a vessel trip report (VTR) number, a trip start hail system, and then turning on the camera. These tasks involve a lot of redundancy, which discourages additional people from signing on to another requirement. An improved, integrated system would encourage participation in the EM program. Mike agreed with Ben Martens that there are not sufficient incentives to enter the EM program given low observer coverage and current fee structures.

Mary Beth Tooley said that the council expected groundfish sectors to grow and that fishermen would support higher observer levels. This did not occur because of high costs; it is cheaper to lease-fish than to pay for an observer. So, if observer or EM costs can be reduced, she thinks that participation levels will increase.

Geoff Smith said that many external factors determine whether people participate in EM programs. For example, this year in Maine the price for lobster is high and they are plentiful, and cod quota was expensive to lease. Consequently, a number of fishermen who had planned to use EM chose not to go groundfishing this year. Geoff added that he did not think that this dynamic was unique to Maine.

There needs to be some incentive for fishermen to participate. Otherwise, there is no benefit to the fishermen

to install cameras, changing fish-handling practices, etc., and EM will not be used. Some of these incentives have been discussed, including getting an individual discard rate, being able to validate at-sea observations, being exempt from certain regulations, and lowering uncertainty buffers for vessels using cameras. Progress on this type of incentive needs to continue because there needs to be a benefit for the fishermen to achieve higher participation levels in the EM program.

What are some of the main cost drivers in the New England groundfish EM program? It is equipment, field services, maintenance, or data review? And what are your thoughts about reducing these costs?

Amanda Barney said that video review is one of the big costs because high-speed review cannot be conducted for the catch accounting needed in this EM program. Additionally, with a new EM program, there are significant costs around software development and maintenance so that the data works for fishermen, service providers, and NOAA Fisheries. Working out procedures and bugs takes significant time and resources. However, these start-up costs will not result in long-term program costs.

Mike Russo said that he was not too concerned about costs as long as EM costs are comparable to those for at-sea monitors. He added that technology costs should decrease where human costs will increase over time. He thought that initial program costs are high, but the program will see cost savings and efficiencies over time.

Ben Martens said that the highest cost driver is data review, but the EM program gives control to fishermen in terms of what they can do on deck to reduce review costs. Fishermen who practice careful fish-handling in front of the camera to make video review easier have been able to reduce review costs by half. When costs and accountability are shifted to the fishermen, good handling procedures will produce significant cost savings.

Amanda Barney said that a significant cost initially was for data retrieval. With fishermen now mailing in hard drives, there has been a huge cost reduction. EM program partners still need to go to the boats for field servicing and relationship maintenance. However, not having to go to the boat for every trip has saved time and money.

Are costs higher for EM in New England, and are the high costs due to boat size or lack of profitability in the fishery? Is it something that other regional programs have done, such as higher coverage levels, because the cost factor does not seem to be as much of an issue in other regions?

Mary Beth Tooley said that a recent analysis showed comparable rates among the regions. Factors that influence costs in the northeast include the geographic range of the fishery, vessels operating from remote ports, and time at sea for observers. She added that she did not know why EM costs would vary regionally.

Ben Martens said that he did not think that EM was much more expensive in New England than in other regions because the costs of an implemented program are not yet known. The most important cost factor is a negative comparison, which is the relative low cost of at-sea monitoring coverage because of low coverage levels and subsidized costs.

Amanda Barney said that costs for EM review in this program are not much more expensive than in other areas. Start-up and sunk costs have been high, and the EM program is disadvantaged relative to at-sea monitoring. Developing an EM program for a small number of vessels is a legitimate concern that needs further work.

Nichole Rossi said that program costs are directly related to program goals, which vary widely by program and region. The fact that the New England program is being used for catch accounting means that species identification and lengths for all regulated species must be recorded, which makes video review more costly in this program.

From the audience, Gerry O'Neil said that data review costs could be reduced by targeting events critical to program objectives such as haul-back and pumping in the herring fishery. High-speed review of other parts of the video should result in significant cost savings.

Geoff Smith agreed, saying that a cost and time saver in the groundfish EM program, with the camera on all the time, is variable review speed based on what is happening on camera, e.g. haul-back, catch sorting, or steaming. Fast review of events that are easy to see will save costs for the fishermen and EM program.

Mary Beth Tooley said that the herring/mackerel EM program is not expensive by itself, but pairing with dockside monitoring makes the overall program more costly.

After data are reviewed and validated, how long before the trip reports are available to fishermen?

Nichole Rossi said that for the herring EM program, fishermen will receive a summary report from a trip as well as have access to the video itself.

Atlantic Highly Migratory Species Panel Discussion

Moderator:

Chris Rilling, NOAA Fisheries, Alaska Fisheries Science Center

Panelists:

- Brad McHale, NOAA Fisheries, Highly Migratory Species Division
- Terri Beideman, Highly Migratory Species Advisory Panel
- Morgan Wealti, Saltwater, Inc.

The Atlantic Highly Migratory Species EM Program Summary document is on page 43. The panel discussion can be viewed online at: <https://bcove.video/2qJmlEj>.

Chris Rilling briefly summarized the Atlantic HMS fishery, which is managed by NOAA Fisheries with multiple jurisdictions over international borders. There is no direct council involvement in HMS management, but the fishery occurs in the New England, Mid-Atlantic, South Atlantic, Gulf of Mexico, and Caribbean council areas. There are 136 vessels in the fleet with 112 active vessels. All vessels must use EM to verify the accuracy of counts and identification of bluefin tuna received through VMS reports, logbooks, and dealer reports in the pelagic longline fishery. This EM program is funded by NOAA Fisheries.

Brad McHale

One of the main differences between the Atlantic HMS EM program and other EM programs is that the HMS program experienced a number of management changes with implementation of the EM program. First, in managing the pelagic longline fleet, they essentially implemented a catch share program for bycatch of Atlantic bluefin tuna. With this new vessel accountability, they explored using EM to verify existing data reporting streams.

Some people have asked how the HMS EM program was implemented so quickly. One important factor is that HMS is not managed through a council. Rather, HMS is managed under secretarial authority, which means that things can be done more quickly. The timing of EM implementation was also important. How to account for bluefin tuna bycatch was a struggle, and the evolution of EM positioned the program to meet current management needs. Another factor influencing the pace of program implementation was the extremely focused objective; verifying pre-existing data collection streams to account for bluefin tuna bycatch.

The fishery has about 110 vessels that operate from Maine to Texas and in the Caribbean. The fishery also has a number of vessels that offload in foreign ports. This broad geographic range was challenging in terms of tracking down vessels for system installation and testing. To address this challenge, they worked with Saltwater Inc. and industry representatives to determine dates and locations for centralized installations

rather than going to over 100 ports in this large geographic area.

One important benefit of the EM program is that it allows a retrospective analysis of past management tools, e.g., closed areas, and whether they are still needed. As confidence in the EM program grows, this type of analysis can still be conducted.

An important note is that making something mandatory is not an incentive—it is a compliance method. Incentives from the program will come from discussions with fishermen about how EM can be used to provide them with benefits, not because they are required to use it.

The mandatory EM requirement allowed the HMS program to avoid some of the difficult decisions facing other EM programs. For example, all the fishermen in the fishery participate, not just the better fishermen or innovators that are seen in other EM programs. As a result, there is no need to determine what a subsample of fishermen, who probably do not represent the average fisherman, means to the fishery overall.

Terri Beideman

Terri has been a boat owner and fishery advocate since 1978—before permits were needed for the fishery—and is a member of several fishery management advisory panels including the HMS Advisory Panel and MAFAC.

When the requirement for EM on all pelagic longline vessels came about, there was initial trepidation about how the program would work. However, the issue with bluefin tuna quota brought fishermen to the table to help determine how to verify bluefin tuna bycatch. The industry has led in testing innovations in the fishery, such as circle hooks and line cutters, so they knew how to work on this issue. Even so, the idea of EM took some convincing but was ultimately accepted because of the high costs of observers. EM also allowed some management options that included individual accountability.

A confounding factor was that the individual bluefin quota was being implemented at the same time as cameras, which presented various situations for fishermen to adjust to. Most of the boats are now okay with the EM system and can see the benefits of the program. Overall, the system works well and allows fishermen to continue fishing because the agency has confidence in the reported bluefin tuna data.

There are some things to consider incorporating into the EM program to improve it from a fishermen's perspective. The EM system should be adapted to eliminate duplicate requirements or reporting. This fleet has mandatory reporting, observer requirements, VMS requirements, and now EM requirements and it would be beneficial to reduce some of these redundancies. EM could also be used to

validate what is now viewed as anecdotal information to improve the assessment and management in this fishery. The elimination of time and area closures because of EM monitoring would also be a big improvement. EM brings the potential for dynamic management if the agency is willing to look for flexibility and reduce burdens on fishermen. This type of dynamic management would require near real-time data to be effective.

Last, Terri noted that quota set-asides could be used to pay for ongoing EM program costs.

Morgan Wealti

From Saltwater Inc.'s perspective, the most important components of success of the HMS EM program are communication and relationships. The HMS EM program began with no pilot projects and a short timeframe. Therefore, talking to fishermen and making sure that they understood the program was very important. Early discussions about the EM program were variable but, in the end, not a single installation was missed. One of the program's biggest successes was installation of EM systems on 112 vessels in a short time period with accompanying training.

Communication was critical in this EM program. If a problem arose, they called people and discussed how to resolve the problem. Flexibility was also important; they worked each issue with NOAA Fisheries and the industry to see which were critical and how to address them so that vessels did not have to return to port. This approach resulted in no loss of fishing time because of EM system problems.

Due to the wide geographic range of the fishery, some efficiency measures were implemented right away, such as mailing hard drives. This approach required a learning curve about sending the hard drives to ERT (the review company) and not to Saltwater Inc., and to send the hard drives on time (i.e., right after the trip). Mailing hard drives late resulted in "non-reviewable" designations, which impacted program data quality. Another efficiency measure was installing system updates via flash drives that were mailed to captains and would make the needed changes when the system was turned on. Saltwater Inc. also had reviewers look at all the data and made changes to the system, based on system feedback, before the issues were reported by ERT.

The HMS EM program used technicians and reviewers who all had observer experience. This meant that they knew which types and formats of data were needed, how fishing vessels work, where to place cameras, and how to talk to fishermen.

Some of the challenges of this EM program are enforcement; determining when and how to enforce to maintain the program without being too overbearing. Another challenge

was getting hard drives mailed on time, and this issue is something that has greatly improved.

A unique challenge to this fishery was that a significant portion of the fishery is from a Vietnamese community in Louisiana, many of whom do not speak English and some of whom are illiterate. These factors made installation and training very difficult. This challenge was addressed by translating training and informational materials and by finding bilingual people in the community to assist with communication.

Questions and Responses

With the HMS model of going directly to regulations, if there was something that you could change, what would it be? Additionally, what do you think are the lessons of the quick implementation of EM in the HMS fishery?

Brad McHale said that the HMS fishery experienced benefits from the rapid implementation. They accomplished this implementation by learning from other EM programs. They thought they would learn more by becoming operational and refining as the program evolved. The downside of the process was that HMS was not empowered through learning about what really can be monitored with the video data. More build-up time would have allowed a broader implementation which, in turn, would impact how you can use the information, such as information for stock assessments, replacing at-sea observers, or conducting catch estimation.

Brad added that the HMS EM program would have future discussions about what else the EM system could be used for and how regulations will need to be adjusted to incorporate program and technology changes.

Terri Beideman said that the rapid implementation was difficult because of simultaneous implementation of individual bluefin quotas and EM. The EM installations were all customized, and conversations with fishermen were useful during the program installations. It would have been useful to have a few boats, both big and small, to test the equipment before doing a broader implementation.

Morgan Wealti thought that the rapid implementation did not allow for the degree of industry buy-in that has occurred in other EM programs. A pre-implementation process would have allowed fishermen to better understand how the equipment works, how it is installed, and what was being expected of them. A break-in period would have allowed fishermen to better know what EM systems looked like and how they functioned. Another downside of rapid implementation is that adjustments are hard to make as the EM program evolves. A pre-implementation period would have allowed stakeholders to adjust to the program better.

One example of this is mailing hard drives. For long trips, mail-in after each trip makes sense because the hard drive will be substantially filled at the end of a trip. However, for shorter trips, sending in a hard drive and the associated costs when the hard drive might be 10% full is a burden for some fishermen. Some fishermen would like to see adjustments to the required mail-in time for hard drives; however, this is difficult to accomplish because the requirement is already in regulations.

With 136 vessels in the fleet but 112 installations does not make sense; what happened to the other vessels?

Morgan Wealti said that there are 136 active permits in the fleet but only 112 vessels are fishing. The other vessels are permitted but either are not fishing or are engaged in other fisheries.

Brad McHale added that the permitted vessels do not need EM until they put longline gear on their boats. The 24 vessels without EM are likely participating in other fisheries.

Regarding program costs, what will happen in 5 to 6 years of system service life when the control boxes need to be replaced? When this switch is made, do have you a process in mind to test other available technologies?

Brad McHale said that the HMS program is struggling with this question because everyone recognizes that agency funding is not likely sustainable in the long term. They also know that some fisheries do not have the economic health to pay for all EM costs. The HMS program is preparing for a 3-year review of the EM program, which will include deciding how to pay for the long-term program and how to incorporate new technologies.

In terms of technology evolution, this is expected and there is nothing to preclude the HMS program from changing program hardware and function. Events such as this workshop will help HMS, and other EM programs, to learn about improvements to consider in technologies and program changes. Brad said that these questions are an integral part of all EM programs in that there will be ongoing discussions to determine how to incorporate needed changes.

Has the EM program discussed vessels participating in two fisheries that use EM and how to ensure compatibility between the systems? It would be inefficient and cost prohibitive to have two EM systems at once.

Brad McHale said that multiple EM requirements on one vessel have been discussed but there has been no progress beyond these initial discussions. This delay occurs because it reflects how management system works (i.e., people do not talk to other people doing similar work because everyone is busy). One example of making technologies work in multiple

fisheries is vessel monitoring systems where performance specifications were established and people could use whatever gear was available.

Brad McHale continued to say he thought that this model will gain traction with EM implementation and some national direction. It could also apply to logbook requirements where fishermen have multiple logbooks; one logbook could be used for multiple fisheries. The question is how to consolidate the various logbooks to get required data, reduce burden on fishermen, and distribute the right information to the right management agencies. There is a long way to go on this coordination and interoperability challenge.

In the Alaska, West Coast, and New England discussions, there was a strong role discussed for cooperatives and self-governance in aiding with program implementation. Are HMS fishermen organizing similar self-governance arrangements to take on some program responsibilities and assist with solving problems?

Terri Beideman thought that risk pools and other cooperative tools often occur as the result of individual quotas or choke species situations. In the HMS fishery, all the management changes were made at once so they had the opportunity to consider other issues. It is likely the fishery will eventually transition to some cooperative arrangements, but it will take some time and significant changes in the fishery, such as the bluefin quota being exceeded.

Brad McHale said that, from the agency perspective, the broad geographic range of the fishery probably makes it less amenable to cooperative arrangements in other fisheries. It is possible that this may evolve over time to adapt to challenges such as rare events that could shut down the fishery.

NOAA Fisheries is paying for the entire HMS EM program. Are there discussions about shifting some of costs to the industry?

Brad McHale said that the HMS EM program capitalized on internal funding that was available to start the program. This worked well for all aspects of Amendment 7 that were being developed. They are aware that EM funding sources are generally used to start programs rather than to maintain them long-term. The HMS program will need to discuss a funding transition but these discussions have not yet taken place.

The HMS program uses two providers, one for hardware installation and servicing and one for video review. Do you think that this model could be applied to other EM programs?

Morgan Wealti said that the two-provider process has worked well thus far. A ticket system was instituted to identify, track, and solve issues; this ticket system has

worked well. The two-provider system did result in some delays in the feedback loop for issues that come up.

Brad McHale said that the two-provider model was the result of a number of factors, including contract limitations within the agency that restrict how much funding can be applied to one contract based on the time of year the contract is awarded. Good communication and knowing the tasking boundaries between the two providers can make this process work smoothly.

Do you have a sense of what proportion of a trip's video is unusable? This question comes from the last EM workshop, where people discussed unusable video and that they had developed standards for when video was usable.

Brad McHale said they have not developed standards to account for this but they do have issues with unusable data. They track the causes of the unusable data such as inadequate system maintenance, technological failure, or light levels that impair video images. The majority of EM video is viewable. They have a quality control review process that identifies problems, which are then relayed to the captain to correct when possible. The HMS program has used this education and collaboration role to improve the EM program in the first year. This process has shown when there are systemic or individual problems.

In the Northeast panel, they had discussed a break-in period when crew had to get used to working with the EM systems for issues, such as where to stand and catch-handling procedures. Did the HMS program have similar experiences and how long did this dynamic last before crew were comfortable operating in a way that optimized EM system performance?

Brad McHale said that initial implementation did not specify catch-handling procedures, in part because of the diversity of vessels in the fishery. A lesson from this is that the consistency of video review across platforms can vary significantly, which then leads to variation in the time needed for video review. Brad thought this issue will be a focus of the HMS program in the future: to develop consistent catch-handling procedures that do not overburden the deck flow of individual operations. This will be a balance between the efficiency of crew catch-handling procedures and the ease of reviewing EM video.

Morgan Wealti said that another factor that varied among vessels is the need to adjust camera placement and angles after reviewing initial video data. This process allows iterative improvement of the system's ability to capture data needed while minimizing impacts on crew operations. Initial installations are based on discussions with crew, and the early EM review shows where adjustments should be made.

Brad McHale said that this fishery deals with relatively large fish that are coming over the rail one at a time. Much of

the catch sorting is easy when distinguishing among tuna, swordfish, sharks, and mahi. The program objective is to focus on which tuna are bluefin, which probably makes deck-handling procedures easier than in other fisheries.

The HMS EM program allows fishermen to access their video data. How many fishermen use this option and do you think it helps with acceptance of the EM program?

Brad McHale said that access to an individual's video is allowed; the HMS program views these data as similar to logbook data. This means that access to data is limited to the submitter. The volume of requests for data has been low thus far, likely because the video is not the primary monitoring tool for the fishery. Requests for access to video data come more from issues outside the monitoring function, such as injury on a vessel. This is challenging because of the different interests of various parties. Therefore, the HMS program provides access only to the data submitter; access by other parties is arranged among the various non-governmental entities and the data submitter.

New Kids on the Block: Emerging EM Programs and Technologies

Moderator:

Ben Martens, Maine Coast Fisherman's Association

Panelists:

- David Gloeckner, NOAA Fisheries, Southeast Fisheries Science Center
- John Wang, NOAA Fisheries, Pacific Islands Fisheries Science Center
- Todd Phillips, The Ocean Conservancy
- Josh Wiersma, Environmental Defense Fund
- Farron Wallace, NOAA Fisheries, Alaska Fisheries Science Center

The panel discussion can be viewed online at: <https://bcove.video/2snCRuE>.

Ben Martens said that this "New Kids on the Block" session would be aimed at emerging electronic technology programs that can learn from other EM programs how to start their respective efforts more efficiently. During this session, speakers would give an overview of their programs and then discuss some questions including: (1) why you are involved in the project, (2) what makes your program unique, (3) project timeline, and (4) the biggest challenge that your program faces.

David Gloeckner

David talked about an EM project in the southeast region to monitor shrimp trawls for protected species interactions. The fishery has 0 to 5% observer coverage; this is important because a protected species interaction could shut down this fishery due to low observer rates and extrapolation of

observer data. He thought that EM looked promising as a tool to better manage the fishery. In 2016, there was one vessel that spent 62 days at sea and had 109 hauls and no protected species interactions. In 2017, they are going to try to increase sample size and the effort has been moved to west Florida; these changes will hopefully provide additional data. The timeline is to use 2017 to look at protected species interactions and catch by volumetric measurement using EM video. The project is in its early stages. Coverage levels are an ongoing issue in the southeast region. For example, there is no observer coverage in the South Atlantic snapper/grouper fishery. A consequence of low coverage rates is that all of the discard estimates come from self-reported data, and these estimates are slowly approaching zero because of trends in reporting. The hope is that EM will result in more valid discard estimates.

John Wang

John Wang said that their EM project is now in its second year; the objective of the program is to monitor for protected species interactions in small-scale or artisanal fisheries, efforts that stem from Pacific Islands Fisheries Science Center efforts in bycatch reduction. These bycatch reduction efforts have occurred in small-scale fisheries in the eastern Pacific, Mexico, Peru, and El Salvador, and in the western Pacific, Indonesia, and the Philippines. Within U.S. waters, the Hawaii longline fishery has a small turtle bycatch and a hard bycatch cap. The small-scale, artisanal fisheries drive population declines in turtles, resulting in a huge number of turtles being caught in the Eastern Tropical Pacific and Indonesia. It is incumbent on this process to help international partners assess what is occurring in their fisheries and then testing different gear technologies to reduce the bycatch. EM works nicely as a tool to help with this assessment and fishing gear changes. The problem encountered with EM systems is that systems available at the time were too expensive for newly developed countries and small-scale fisheries. They looked for a cost-efficient EM solution, working with the World Wildlife Fund and Flywire to develop a substantial EM system that cost around \$750.00, has an independent energy source, and GPS. They put these units on small vessels to capture information in these fisheries to augment the nascent observer programs for a more robust data set. This approach has allowed a much better idea of the bycatch issues in these fisheries. They also use the EM systems to help run gear trials, which results in larger sample sizes and faster data acquisition.

These systems have been deployed in Peru, Mexico, and Indonesia for 2 years, and they have gone through a few evolutions of the Flywire system. The hardware has worked well and they are now working with Flywire to improve the software. They are also comparing the data streams from observers and EM to make sure that they are comparable, and that the EM system is efficient.

What makes this system unique is that EM will be important throughout the world. Indonesia and Mexico are very interested in engaging in the EM system because they see the potential to get data from small-scale or artisanal fisheries for which there is almost no data.

Todd Phillips

Todd Phillips discussed an electronic reporting (ER) program for the party/charter fleet in the Gulf of Mexico. EM is almost non-existent in the Gulf of Mexico but there is some progress on ER. The ER project was originally designed to research different ways to validate catch and effort to determine which system resulted in the best data. The program shifted to direct stakeholder engagement, working on the communication and collaboration that has been discussed today to encourage buy-in and outreach. They are working with industry leaders and NOAA Fisheries staff to encourage compliance and to get better management data. The unique part of their effort is conducting the early stakeholder work to improve information exchange, communication, and stakeholder buy-in.

The project's timeline is not fixed; however, a party/charter ER amendment is due for final action at the January 2017 Gulf of Mexico Fishery Management Council meeting. If the amendment passes, they will have 2 years to implement the program.

Josh Weirsma

Josh Weirsma described the maximized retention EM project that is being developed for New England groundfish. The proposal will allow fishermen to keep all the groundfish that they have previously been required to discard. The project is focused on the offshore, large vessel trawl fishery that have large discard amounts because of larger catches, and the amount of discards precludes putting every discarded fish in front of a camera.

The project was seen as a way to use EM in a part of the groundfish fishery that has not been covered by the early EM work in New England. They believe that EM can be used to observe the 60 to 80 larger, offshore vessels that land about 80% of allocated groundfish species in New England. The idea was that there could be a good return on developing EM for this segment of the groundfish fleet.

Another issue in New England is who pays for monitoring. This has been an ongoing debate that has been pushed back but the expectation is that monitoring costs will come back to the industry, whether using EM or human observers. There is also a move to use a model that stresses accountability and more accurate monitoring; these factors have reinforced interest in this EM program.

The timeline for the project is that they received a NFWF grant in fall 2016, they are currently developing an EFP application, and they expect to test the system through 2017.

Farron Wallace

Farron Wallace said that the goal of the EM innovation project is to develop tools to efficiently collect monitoring data for fisheries management. Another objective is to further the goal of the NOAA Fisheries Policy Directive on Electronic Technologies to collect fishery-dependent data more efficiently and cost effectively with electronic technologies.

Farron said that EM and smartphones have both been around for approximately 20 years. His goal with EM is to develop smartphone-like EM so that apps can be added to the device to do specific tasks that are desired in an EM program. He noted a major difference between smartphones and EM is the size of the market for the two technologies; smartphone apps are sometimes in the millions and EM in the low thousands.

Farron said that the Alaska Fishery Science Center (AFSC) is developing four main tools for EM: (1) a stereo camera system, (2) a camera chute system, (3) multispectral camera systems, and (4) an EM “lite” system, part of the control box that gathers sensor data for information such as location and hydraulic sensors.

The unique thing about the EM innovation effort is a focus on machine learning systems to conduct catch estimates, monitor catch events, and so on. This effort is analogous to automated industrial inspection systems used for fast, efficient product grading and testing of a particular product. The AFSC is trying to do the same thing with EM, developing systems that are fast, durable, and less expensive than current EM systems. Having an EM system that automatically reviews video data to meet monitoring objectives will significantly reduce video review costs and may speed up review times.

The timeline for this work is that they are in the early development of the stereo camera system and will need a few years to be ready for broad deployment. The chute camera system is ready to test on vessels, and they have developed algorithms for species identification that are 90% accurate in a trawl fishery. The EM “lite” system will be ready for field testing in 2017.

Project Challenges

Ben Martens asked panel members to discuss challenges of their projects.

Farron Wallace said that the biggest challenge is finding volunteer vessels to collect data and refine the EM systems that are being developed. For example, computer identification of species requires large photo libraries to train the system on fish identification. To do this, industry buy-in and support is needed.

Josh Weirsma said that the biggest challenge facing their program is competing with the low observer coverage levels in the groundfish fishery. They also have a large choke stock component; people can modify their behavior on observed trips to achieve low catches of choke stocks. Fishermen are comfortable with accountability if it applies to everybody, not just boats carrying EM. Another challenge that the EM program faces is a dedicated and active part of the fleet lobbying against adequate coverage levels.

Todd Phillips said that a significant issue for the Gulf of Mexico party/charter ER program is funding. Another issue is who will run the program. In the Gulf of Mexico, there are currently four recreational surveys and it is a challenge to figure out where to locate the ER program for optimal performance.

John Wang said that the biggest challenge facing his work is developing the capacities for effective monitoring in the countries that they are partnering with, including building the back-end capacity to receive and analyze the data.

David Gloeckner said that the biggest challenge to the Gulf of Mexico shrimp trawl EM project was getting industry buy-in. The Southeast observer program is entirely funded by the government; however, getting fishermen to buy into a system that they must partially fund is a huge challenge.

Key Takeaways

Ben Martens asked panel members about one takeaway from the other EM panels that they thought was helpful to their projects.

Dave Gloeckner said that his takeaway was the need for 100% observer coverage, or some higher coverage levels to produce accurate monitoring information.

John Wang replied that what resonated with him was that technology costs are going down and human costs are going up. This scenario reminds him that they will make EM systems less costly, but attention still needs to be paid to developing human capacity in monitoring programs.

Todd Phillips said that he sees the need for strong leadership and vision by managers and fishermen to make meaningful changes.

Josh Weirsma said that his biggest takeaway are the similarities between the New England maximized retention EM program and some aspects of the West Coast EM program, and the potential of applying the West Coast experience to their developing EM program with respect to sorting and handling currently unsold fish.

Farron Wallace said his most important take-away is the critical need for a good working relationship with the

industry. Without industry support, there can be no EM program. He also mentioned the potential for broadband satellite communications, which could make many EM storage and transmission challenges easier to address.

Questions and Responses

Please describe the stereo camera system that is being developed at the AFSC.

Farron Wallace said that the stereo camera system allows more accurate measurement of length to get the weight estimates needed for catch accounting.

Are there domestic applications to the Flywire EM system?

John Wang thinks that the low-cost EM system that they are developing could be used in domestic fisheries where boat size, operational constraints, and cost are important considerations. They are testing a couple of bycatch monitoring systems in North Carolina, and there is also interest in the Gulf of Mexico.

To incentivize fishermen to join the project is the New England maximized retention program considering incentives such as quota adjustments or relaxation of some regulations?

Josh Weirisma said that they have given much thought to incentives because their program is competing with the status quo of low coverage and costs being covered by the federal government. He sees two primary ways to provide incentives in this project. The first is to allow dealers to develop a market for the currently unsalable fish; this approach would provide an incentive for the extra fish. Another possible incentive is the groundfish monitoring amendment that is currently being considered by the New England Fishery Management Council that has the potential to incorporate ideas such as quota adjustments, converting uncertainty to catch, and access to closed areas for vessels with full accountability. An interesting example of an incentive-based system is the scallop fishery where vessels get additional scallop catch when they carry an observer to offset observer costs for that trip. He added that for this project, one incentive is that they are paying fishermen to participate, although they are still having problems getting participants.

What drives the high cost of some of the options in the Gulf of Mexico party/charter ER program?

Todd Phillips replied that this was largely the result of choices that will be made at the programmatic level, such as 100% coverage with 100% VMS, using archived GPS, or not collecting spatial data at all. The costs are driven by program design choices. Additionally, a large number of vessels in the fishery and a long coastline add costs that impact the dockside validation of catch and effort information.

How does the data processing and video review work with the Flywire system? Who looks at the data produced by the system?

John Wang said that there are already basic observer programs in place in the countries where the Flywire system is being tested. In addition, these programs are already generating data streams that are being managed. The EM program uses a subset of the observers to score the video data as it comes off the vessels; the EM data then goes into existing data management systems. They are scoring fish and bycatch species that come on board, including catch rates, soak time, and location. When they think of expanding this work, they try to find the right program partners by conducting a rapid assessment of villages or ports that have high impacts on protected resources. This approach allows them to choose between using observers or EM as part of the overall monitoring program.

With respect to the Flywire system, can you provide an overview of the system's capabilities and constraints compared to the more traditional EM systems?

John Wang replied that the goal is getting high-quality video for monitoring that is linked to time and location. All the EM systems provide these functions at some level. Their project involves buying the systems, and post-processing is completed by staff in the project areas. They wanted a movable, self-contained system that is not tied to an onboard wiring system. The Flywire system is a self-contained unit that can be easily moved among boats in the program as needed.

Is there an interagency working group that is keeping track of the research and development of these various technologies and projects with EM? If not, do you think it is needed?

George Lapointe said that the agency has an Electronic Technologies Work Group made up of staff from regional offices, centers, and Silver Spring to address technology and policy questions regarding electronic technologies. This working group addresses a wide array of issues, and there have been discussions about a targeted EM technology group with a narrower focus.

Jane DiCosimo added that the Office of Science and Technology has an Advanced Science Technical Group that deals primarily with underwater technology. However, this group provides a model for coordination within the agency and with stakeholders.

She thought that we probably will not see the rapid change in EM technology as with other technology applications because of economies of scale. Will we ever be in the position with turnover of technology every couple of years like with cellphones? Given this dynamic, how do we plan for EM equipment upgrades?

Farron Wallace said he thought that there is a major change in EM technology that is just beginning based on current technologies to learn and borrow from, and with machine learning coding from smart applications. With these changes, he thinks EM will change more quickly than in the past. He added that determining how to plan for these changes is a big challenge for managers that will need to be addressed.

George Lapointe said that one of the goals of early EM work was performance standards that would allow programs to be developed to meet these requirements. However, EM was in its early development phase, making it difficult to determine what standards are needed to meet various program objectives. With ER in the northeast, the agency has been able to post system standards and let service providers be certified as providers when they meet performance standards. This approach allows fishermen to choose the provider that best serves their individual or sector needs. He said that EM performance standards should aid in adapting to emerging technologies.

Josh Weirisma said that a big step in technology advancement is the current development of broadband internet technology. The evolution of satellite technology is not like cellphone technology with steady, incremental advances. Rather, it moves in rapid, big steps similar to what is happening with broadband. This evolution will allow vessels to use satellite technology to stream data and use cloud-based technologies that will allow rapid evolution of EM for fisheries management.

John Wang agreed that rapid change is part of EM development. The Flywire system is now in its third generation in 2 years, adapting to changing technology and how it works. As funds become available and more fisheries use EM, he thinks that EM will change rapidly and the technology will look very different in a few years compared to the current systems.

Howard McElderry said that fishermen in the BC groundfish EM program installed EM on 300 hook and line vessels. These systems were designed to be replaced in 5 years, but after 10 years the fishermen do not want to change because the systems still work well. Technology is rapidly changing; however, unless there is a significant change in the market, it is unlikely to result in a rapid change to the EM market. EM is a small, niche market, which makes it difficult for people in the product development business to get excited about it.

In discussing how to integrate new technologies, are there models from other industries about how to filter the many technology choices that come along so that we narrow the search for technologies that add value to monitoring programs? Additionally, how do we test and integrate new technologies?

Farron Wallace replied that there are many models to learn from, including industrial inspection technologies. This process is a bit self-fulfilling, with useful applications moving forward and less useful technologies being moved to the side.

John Wang thinks that all fisheries have different sets of requirements and that EM technologies will evolve to serve EM niches that develop in these various fisheries.

Day Two (Dec 1, 2016) Objectives

- Identify potential solutions to cross-regional issues listed below from the best practices identified on Day One.

At the end of Day One, the workshop steering committee developed the following questions to help guide Day Two discussions:

- What best practices have you seen or heard about?
- What are the key challenges facing EM programs?
- What issues should be decided nationally compared with regionally?

Data Quality, Storage, and Retention Session

Moderator:

Bill Karp, NOAA Fisheries, retired

Panel Members:

- Ben Martens, Mid-Coast Fishermen's Association
- Brett Wiedoff, Pacific Fisheries Management Council
- Tom Warren, NOAA Fisheries HMS Division
- Jennifer Mondragon, NOAA Fisheries Alaska Regional Office
- David Colpo, Pacific States Marine Fisheries Commission

The panel discussion can be viewed online at: <https://bcove.video/2snEnwU>.

Bill Karp asked panel members to address three questions based on their experience and the first day of the workshop. First, what are the best practices for data that you have heard? Second, what are your key data challenges? Third, what data issues should be decided nationally or regionally? Bill said that the last question is challenging in the data arena. The successes that have been realized are due to a lack of national direction and guidance; development and problem solving at the regional or program level is a key factor in program success. This is an important point, but there is likely national guidance or requirements that are needed as well. Exploring this balance will provide a foundation for the day's discussions.

Ben Martens

Ben Martens said that data issues were some of the biggest challenges of the New England groundfish EM projects, both from the industry and agency perspectives. Access to EM data is critical to EM programs; giving boat captains control of data access is how the discussions have tended in their EM program. They always try to protect the fishermen and incentivize them to participate in the program.

He added that key challenges in the groundfish EM program include cost, data quality, and how long data needs to be retained. Another challenge is comparing at-sea monitoring data to EM data, the first being a log and the second a digital record, which are completely different data formats.

Ben stressed that a data-quality issue is what data types are available for access. The fishermen do not mind derived data being used, but these fishermen are concerned about how video or pictures might be used. They are concerned about non-fishing images of the video because the vessel is their home when they are at sea.

On a national level, clarity is needed on data ownership, how data can be accessed, and costs associated with storage. Fishermen have dropped out of the EM program because of who can access the data; this shows how important this issue is for EM programs.

Brett Wiedoff

Brett Wiedoff said that using exempted fishery permits (EFPs) were helpful in the West Coast EM program, including data issues. The EFPs allowed us to work out best practices, vessel monitoring plans, and operating rules. The proposed rule for the West Coast EM program addresses many of the data issues being discussed today. For data retention, the agency proposed a 5-year plan, but industry countered with no data retention requirement because the video data are not needed after the catch and bycatch debiting of individual quota accounts. The agency then compromised at 3 years in the proposed rule and will solicit comments on the data retention requirement. The agency announced the proposed rule to advance discussions which, in turn, will inform the final rule.

The balance between national and regional issues is important. The void of national guidance allowed the regional program to develop to meet regional needs; having people isolated from these local conversations can be problematic.

Best practices developed through EFPs, which provide the agency flexibility to adapt the program as it addresses challenges that arise during early implementation.

Tom Warren

Tom Warren said that the HMS EM program uses an audit-based model, sampling 10% of trips to verify logbook

or observer data sources for bluefin tuna bycatch. A key challenge has been linking data sets from various sources such as logbooks, VMS, observer data, and video data. The details really matter in this conversation.

Best practices for this EM program include using contractors with technical expertise in EM, access to data by authorized parties, and finding efficiencies through software development, flexibility, and an iterative development process.

Tom thought that record retention and confidentiality were important issues to work on nationally, while other program issues can best be addressed regionally or locally.

Jennifer Mondragon

Jennifer said that the Alaska EM program is using a catch estimation approach. In addition, the region is authorized under the MSA to collect fees that can be used for observers and, in the future, for the EM program. The use of federal funds will result in some data challenges not seen in other programs.

For data quality, integration, and review, challenges include conducting catch estimation in terms of what data are needed to achieve correct estimates and how to estimate catch using video with different gears. Determining how to use EM data for catch estimation has taken some time to work through issues as they arise.

Data quality is an ongoing discussion as the EM program moves ahead. Setting up a data-quality standard up front is problematic; it requires adjustment as the program advances. This iterative process has been mentioned many times in this workshop.

With respect to regional direction compared with national direction, it seems most issues need to be addressed locally because these issues need to be addressed based on program design and implementation challenges.

Storage and retention issues can be addressed nationally because EM data is essentially observer data. For Alaska, EM data will be categorized as federal records so they need to know which data retention standard applies to these data.

David Colpo

Dave thinks that EFPs are the way to start an EM program; they allow for getting things going, making mistakes, learning from and correcting these mistakes, and moving on. These mistakes will be made by all parties: fishermen, managers, and service providers. Pilot programs result in programs that cannot easily be changed and should not be used in EM programs. Another successful model is the Alaska EM Workgroup, which promotes communication, collaboration, and working through issues that come up in EM programs. Both processes promote trust building.

His list of best practices includes trust building, working with industry, not using pilot programs, listening to all parties, and working through issues rather than setting up cumbersome processes without an endpoint.

Challenges include storage costs because these costs could end EM programs; information needs must be balanced with costs. Another challenge is who has access to the data; data confidentiality should be strictly maintained with access by fishermen, law enforcement, and managers.

With respect to third-party reviewers, there is a worry about the nimbleness of having data split among different parties. At the commission, all the data are housed in one place so integration is easy, at most taking the time needed to walk from one office to another.

In thinking about new software tools for EM review, those tools will be utilized when they are available. If workable technologies make EM programs more efficient and less costly, they will be integrated quickly.

Like others, Dave also expressed concern about national requirements because all regions and programs are different and need solutions based on the development of individual program needs.

Questions and Responses

Should there be a national data retention policy to provide consistency among regions and programs?

Tom Warren thought that national guidance would be useful but added that cost is tied to the length of the data retention requirement. High program costs may lead to a shorter retention period.

Jennifer Mondragon said that an important distinction is the difference between EM video data and derived data. Also important in this discussion is program objective and whether the data are federal records. For the Alaska compliance EM program, the EM is essentially another set of eyes for the observer so these data do not need to be retained. For the catch accounting EM program, another standard may be more appropriate.

EM is being implemented in a number of fisheries. How will Alaska use EM and ER for catch accounting? How will these data be incorporated in management data sets?

Jennifer Mondragon said that all data are integrated and used in catch accounting. It has taken a bit of time to figure out which data are needed for catch accounting and how to technically incorporate these data into the data infrastructure. A significant challenge with data integration is resources, having the staff and time to do this important work.

Bill Karp added that a challenge is connecting data integration with program design; different approaches will be needed based on program objectives.

David Colpo said that he does not understand why data integration is a problem. Simply, there are boats making landings with a fish ticket, logbook, and EM data. It is just data so he thinks we may be over-thinking the data integration issue.

Brett Wiedoff said that the West Coast Regional Office was specific about the objective of the EM program; this is compliance with discard monitoring. So, what's needed is the data to debit individual quota accounts. The council discussed other questions such as will the data be used for stock assessment, calculating total mortality rates, and so on. The answer was that EM was not about science, but was about compliance monitoring. Other questions are outside the EM program and should be addressed separately.

Ben Martens said that the data flow in the New England EM program has not been smooth. He asked Amanda Barney to elaborate on this. Amanda Barney said that the data needs to be looked at in two forms, raw video data and derived data. They allowed the NEFSC to access video data so they could audit species and length determinations by the reviewer. The summary or derived data is compared with logbooks and observer data. Thus far, the correlation between EM data with other data sources has been pretty good.

David Colpo said that the Fisheries Information Networks (FINs) have the data integration capacity that is being discussed. EM problems need to be separated from data integration problems and treated accordingly. The important point is getting the respective data houses in order overall.

Should these data details be addressed up front to place the camera where it is needed to collect required information, and aren't there some boats for which the cameras can't be placed to collect needed data?

Jennifer Mondragon said that determining the purpose of the EM program and data quality drives the information standards that are needed in the program. These standards are program-specific based on program objectives.

Brett Wiedoff said that the West Coast EM program includes these specifications in vessel management plans. Changes to camera type, camera placement, and data handling can be changed easily through these plans to get the images needed to debit individual quota accounts.

How data are collected matters when trying to understand variability in these data. Is progress being made in examining the variability of EM data? For example, knowing whether to do 25% or 75% video review should be partially based on data variability.

Jennifer Mondragon said there are a few aspects to this question. One is: are you subsampling data, which is similar to all data-sampling regimes. The other aspect is the quality of the information and what kind of bias you are importing into the data.

Brett Wiedoff said that the West Coast EM program looked at EM data from trips that also had an observer and compared the resulting data. The results were variable: Sometimes the observer data are better and sometimes the EM data are better. In the future, quality assurance checks could be conducted by placing observers on some EM trips to answer this question.

Tom Warren said the HMS program has compared observer and EM data, and compared machine vision analysis with human review of video. The challenge that they have experienced is the relative rarity of bluefin tuna interactions, so more data are needed to advance this discussion.

Tom Nies said that these discussions highlight why data integration is an important issue. If data are not comparable, there needs to be some way of reconciling the differences between the data sources.

Melissa Hooper replied that the West Coast program has been assessing variability in the EM program relative to human observers. Uncertainty can be introduced at many points in the data collection process, from data collection, camera placement and operation, to video review. They are systematically working through these issues but it is a slow process.

With respect to video review rates, the West Coast wants to start at 100% review and look at reducing review rates based on an evaluation process. What criteria do you suggest to reduce the video review rate from 100%?

Dave Colpo said the review percentage will vary among fishermen based on knowledge of their ability and past record; less dependable operators will be reviewed more carefully. He added that this is not a science but will be based on where problems are known to occur.

Tom Warren said that the Atlantic HMS EM program stratifies their review percentage based on location where interactions are more likely to occur.

Brett Wiedoff said that the Pacific Fishery Management Council had early discussions about what review levels should be used. They started at 100% based on obtaining data sufficient to meet management objectives. Also, because fishermen pay for the video review, the onus is on them to be careful enough to reduce review levels and their EM program costs.

Dan Falvey said that the data integration question is important so that EM programs can use the data for its stated purpose. Attention also needs to be paid to minimizing duplication among various management programs.

With respect to data retention, he thought that the West Coast EM program data are of limited use after an individual's quota account has been debited. The purpose of longer retention is for law enforcement to review after the fact. He suggested that tools be developed for law enforcement to sample the data in a timely way and then the video data be discarded, allowing EM programs to minimize data storage costs. An alternative is to let law enforcement pay for the longer data storage.

EM data still results in data gaps and information about these gaps is not shared. What are the implications of having information gaps? If you are looking for rare events, then data gaps could be very important.

Ben Martens said that they have talked about data being used for issues other than compliance monitoring or catch accounting, such as getting better information for science. Scientists need to be included to advance this discussion. There should also be creativity in thinking about how EM data can be used, such as comparing catch and discard trends on vessels with and without EM to examine trends in the overall fleet.

Greg Hammann cautioned that imagery is not fishery data, and data by itself does not reflect information content. He suggested that terminology should be more specific to have the most productive conversations about data uses and quality.

Should third-party providers be discussed nationally or regionally? Do we need a certification process with respect to data access, storage, retrieval and ties to science? This type of arrangement could open up new markets in the EM field. Additionally, in the larger system design realm, the best way to enforce compliance may not be EM, and we might benefit from approaching social scientists and law enforcement specialists to see if there other ways of addressing the compliance issue.

Brett Wiedoff said that third-party arrangements may be the best way of moving an EM program ahead but he did not think this should be a government requirement. Rather, it should be something that works best for an individual monitoring program.

Howard McElderry said that what is being asked of service providers with respect to EM programs has not been adequately defined. This makes it difficult to evaluate the utility of third-party arrangements.

Ben Martens said the utility of third-party arrangements varies among fisheries and regions. Some national guidance may be helpful in evaluating what works best in each EM program. The right way to proceed is to design a system to meet monitoring objectives. However, there is a tendency to add other things to the program. They always come back to what data they are trying to collect and whether the cameras are the right way to get the information. But other uses of EM should also be considered. In New England, a secondary benefit of EM cameras is in trust building.

Bill Karp asked each panelist for an issue they believe should be prioritized with respect to data quality, integration, and retention.

Dave Colpo said that there is no single issue that is most important. That being said, he thinks that maintaining a regional focus to EM program design and implementation is a key to program success.

Jennifer Mondragon replied that collaboration is a critical element of developing an EM program and solving the issues that arise as the program advances.

Tom Warren said that program flexibility to adapt to changing conditions is a key consideration.

Brett Wiedoff also mentioned flexibility and the use of vessel management plans to allow flexibility and rapid adjustment to issues that come up.

Ben Martens suggested a stronger national approach is needed to some EM issues, including communication. He said that biannual workshops are not sufficient to provide timely communication of what is working and what needs to be fixed.

Walking the Walk: Exploring EM Program Enforcement and Compliance

Moderator:

Bill Tweit, WDFW, NPFMC

Panel Members:

- Joe Sullivan, Sullivan and Richards
- Mariam McCall, NOAA General Counsel, Enforcement Section
- Mike Russo, New England Groundfish Fisherman
- Dayna Matthews, NOAA Office of Law Enforcement
- Bob Hogan, NOAA General Counsel, West Coast Regional Section

The panel discussion can be viewed online at: <https://bcove.video/2snjfqD>.

Bill Tweit said that enforcement and confidentiality issues have been mentioned frequently in the workshop and they are both important to EM programs. The developing EM program in Alaska is not yet ready for rulemaking, and enforcement is a major issue that needs to be addressed. Bill added that he thinks there are a number of misconceptions about the role of enforcement in EM programs. Some of the misconceptions hold EM back because of deep-seated concerns about enforcement, and there will be more buy-in of EM if these misconceptions are understood and addressed. Identifying these issues, finding means to resolve them, and getting this information to fishermen in dockside conversations and other means of outreach is critical. Another important discussion topic is balanced enforcement to achieve compliance but still be workable for fishermen.

Joe Sullivan

Joe discussed two enforcement issues. One is using EM to enforce program requirements and the other is enforcing compliance with the EM regulations themselves. West Coast EM is used for program enforcement. The West Coast groundfish observer program will continue to collect fishery-dependent data for other reasons, so there will be EM and observers at the same time. Another key factor is that the proposed rule outlines NOAA Fisheries' intent to make the fleet responsible for obtaining private, third-party data procurement, review, and storage services. The intent is to shift the agency's role to setting performance standards and auditing the process for adequate performance. Critical to this shift are the performance standards and how specific they are. Programs need flexibility to adapt to changing conditions and incorporate lessons learned. However, programs also require enough structure to conduct the needed analysis to comply with the Regulatory Flexibility Act, and determine the cost impacts of this shift on industry.

A key program result should be adequate deterrence against program violations, which does not automatically mean 100% review of the video data. This entails using a risk of loss equation with the likelihood of non-compliance and the magnitude of penalty for non-compliance. If the penalty for non-compliance is high enough, then the review rate can be proportionately lower.

Mariam McCall

Mariam discussed confidentiality issues, saying that she relies on the statute (MSA) and would relay the agency's position on confidentiality based on discussions with lawyers. She said that she was a bit concerned when she heard workshop participants say that confidentiality issues were not resolved. Lawyers and program staff have coordinated on many of these issues but there is not a formal, written document or regulations. However, they have spent much time on the confidentiality issue. This has been at the "big picture" level but not with the specific issues and questions where lawyers work best because legal interpretations depend on the facts in question.

She said that she sees other confidentiality issues that need to be addressed as an agency, such as needing to determine how to have these conversations in a transparent way that is accessible to the public.

Mike Russo

Mike said that he was a participant in the first New England EM pilot project and that he had stopped participating because of lack of clarity about the confidentiality of EM data. He questions whether the MSA language on observer/EM data is sufficient to address video imagery. By this, he meant that numerical data is hard to manipulate but video images and pictures can be altered and misinterpreted. He said that one image taken out of context could negatively impact a fisherman or the entire industry. He ended by saying that buy-in from fishermen will continue to be very difficult if there is any indication that the data will be used for anything other than observing trips.

Dayna Matthews

Dayna said that when a compliance program is put together, programs objectives must be considered, including compliance, science, or both. Design of the compliance model should result in a particular behavior from the regulated community. On the West Coast, his experience began in 2003 with the IFQ program with a committee consisting of him and 20 industry members. The Office of Law Enforcement was involved to properly incentivize the desired behavioral outcome in EM programs.

One of the problems they have had to address with the camera program, in lieu of 100% observer coverage, is what to do when someone abuses the provisions of the camera program. Under usual due process, it could take months or years to remove the camera option, resulting in a loss of accountability and compliance. The program needed an administrative process for timely response to program violations. Under the EFP, the use of the camera system is an exception to the 100% observer coverage requirement. This allows the withdrawal of the exception, meaning the vessel then needs to carry an observer. This exception has been maintained in the draft regulation, which also includes an appeal process. Under this system, the ability to fish has not been affected; only the option to use EM has been removed.

Bob Hogan

Bob said that he had adopted a “wait and see” approach to see how EM develops, because there are different regional EM programs with differing objectives and it remains to be seen how these programs change over time. He said that he had advised from an enforceability perspective on issues such as vulnerability of hardware to hacking and chain of custody. These are issues that may not be able to be overcome but must be considered in program development and enforcement.

He added that data retention is important from an enforcement perspective. The goal of retaining video data

is not trolling for violations; rather, it is the ability to look at the video record for significant violations. He added that the statute of limitations for enforcement is 5 years under the MSA and he does not see the need to keep the data any longer than that.

Questions and Responses

Are performance standards a good tool for enforcement and compliance? Or should we be looking for other means of achieving compliance?

Joe Sullivan thought that two points were relevant to this question. First, there is an effort to shift costs to industry. Second, they are trying to capture advantages of a non-regulatory approach to compliance, with an important goal of maintaining flexibility and setting costs to achieve a cost-effective program. At the same time, the cost impact analysis of the transition is critical. Performance standards for program efficiency and the Regulatory Flexibility Act analysis are needed.

Mariam McCall said that the agency needs to draft performance standards for video review. After 2020, the agency will certify reviewers for the West Coast EM program who will need to comply with these performance standards. The eventual performance standards will go through the council and public review processes to ensure transparency and the ability to engage in these discussions. The challenge for performance standards is to be specific but allow enough flexibility to change as needed.

Dayna Matthews said that type approval processes, by which a product meets a minimum set of regulatory or technical requirements, could be used in addition to performance standards. This process has been used by OLE for more than 20 years through regulations. Under the EM program, performance standards should be structured to allow adapting to changing technologies.

Bob Hogan added that the type approval process might be a good fit for the third-party review options. Type approval notices could be used for updating units and changing requirements.

For confidentiality, there was discussion of threshold issues being resolved but there are other issues to address. What are some of these other issues?

Mariam McCall said that prior to 2006, the enforcement issue was not resolved because there was no specific, informative statutory language. The 2006 language stated that observer data is confidential and shall not be disclosed with some exceptions. This language included EM data as observer data, which meant that EM data is also confidential. This is what Mariam meant when she said that a confidentiality threshold had been reached. But as she listened to workshop participants, she realized that

some questions remain, including imagery and what data aggregation means.

Another important distinction is the difference between retention requirements for federal records and retention requirements of the EM program. Federal retention requirements exist for observer data, which now require indefinite retention. However, the long list of federal retention requirements does not address video or EM data. Discussions about adding a retention schedule specifically for EM data have begun at NOAA Fisheries but are in the early development process.

We heard that a vessel is a business operation and a fishermen's home while they are at sea, and this raises privacy issues. Are we on a collision course between access and privacy, or are we resolving the privacy issues sufficiently to make fishermen comfortable?

Mike Russo said that data is covered by confidentiality but that the non-fishing aspect of video is an ongoing concern because of the potential for being held responsible for events outside the captain's control. He added that he is comfortable with what he had heard today and that the issue is going to be further developed. This is very important because he thinks that there will be challenges to accessing the data. It will be important for each fisherman to consider these issues and come to their own conclusions. He believes that the better fishermen understand these issues, the more they will accept EM.

Dayna Matthews added that confidentiality is a serious issue that everybody needs to pay attention to. Basically, the issue is who has access to the data and for what purpose. There are many rules and procedures to protect confidentiality and ongoing discussions to further refine these requirements. So, the idea of limiting video strictly to fishery management is not appropriate. The door should be open for other legitimate purposes such as investigations of onboard assaults or suits against boat owners.

Bob Hogan said that the EM aspects of confidentiality are settled. How it is handled moving forward is another issue for topics such as aggregation—areas that the agency needs to work on. Bob did not feel that photos could be released because they cannot be aggregated. EM data can be used in other legal proceedings through subpoena in federal court but this is no different than any other information. It is also important to note that the captain or vessel owner can use the data for whatever purposes that they want. Overall, he is comfortable about confidentiality but there are a number of follow-up issues that remain unresolved.

Monica Medina commented that the difference between data and imagery is important, and that data aggregation deserves more attention because it is a standalone issue that does not fit neatly into one category.

Joe Sullivan agreed that the confidentiality of observer data is settled but a distinction should be drawn between observer data, which is confidential, and the availability of agency records, which are accessible through the exceptions that have been discussed and through Freedom of Information Act (FOIA) requests. The key point with third-party review is that the agency may never receive the data; in this case it is not an agency record and is not subject to FOIA access. This is a very important point because these data may become valuable over time for other licensable uses, potentially becoming a valuable commodity. Fishermen should be able to capture this value from the data if they are paying for its collection. A data futurist that Joe has talked to said that fishermen should “mind their rights” because the data may ultimately be worth more than the fish.

He added that it is hard to make an argument for retaining data for a period shorter than the MSA statute of limitations, and that there is always a susceptibility of data to subpoena in federal court. At the same time, the courts look closely at applicable statutes and the sensitivity of information in making this type of determination.

With respect to a vessel being a fishermen's home, typically there are strong restrictions put on this type of access and it is important to remember that the video data might be your strongest defense in a fishery violation or spurious injury claim.

Mariam McCall said that the West Coast groundfish fishery is distinct because, most of the time, the information goes to the agency, is confidential, and is a federal record. When the West Coast groundfish EM transitions to third-party review in 2020, the agency view is that these data are still protected by MSA confidentiality provisions. The data submitter can waive confidentiality to give access to other parties. This is a new issue that came about as development of the EM program included discussions of third-party review.

Melissa Hooper commented about the difference between confidentiality of data compared with imagery. The agency is discussing distinguishing among data, imagery, and GPS location information. Some people have argued that the video by itself is a medium which does not necessarily have inherent value after program data are extracted through the review process. This distinction could be used to establish different retention schedules for video imagery and derived data.

There seems to be three reasons to store EM video: first, that a person is violating the operating requirements of the EM program regulations; second, to look for ongoing violations on the boat; third, to allow testing if someone is a repeat offender. If we focus on program objectives, could we design EM programs to meet monitoring needs without storing the data for such a long period?

Dayna Matthews said that the Office of Law Enforcement is concerned about storage costs, which is a factor in program success. From the West Coast perspective, initial estimates of storage cost were very high, but they quickly found that data costs were decreasing from these initial estimates. Acknowledging that data storage costs are not free or inconsequential, he thought that the 5-year statute of limitations under the MSA is the appropriate retention period for EM video. Dayna believes that the video data has value after the derived data are extracted from it.

Bob Hogan said that they are not looking to impose penalties on someone by having the ability to go back 5 years. Rather, he said he is interested to see what types of schemes or patterns are being used that might have been missed so that improvement can be made in the long term. There is value in figuring out how the bad actors get away with something for a period of time. Understanding these patterns is important so they can be corrected in the future. If there is not have a body of data to look at, these situations will never be discovered.

Joe Sullivan said that this discussion is the beginning of the third-party review discussion; it is the right conversation to have and then follow up on the costs associated with performance-based standards.

Gregg Hammann said that imagery is not data; it simply allows remote observation. He said that imagery that is stored must be encrypted to protect it from illegal access.

As machine learning advances, the EM unit will perform real-time processing of imagery onboard the vessel, and will produce the summary data that we need to meet monitoring program objectives. Under this scenario, the video imagery could be dumped as soon as the machine analysis occurs. Does this scenario alleviate fishermen's concerns about data retention?

Mike Russo said he likes this concept but it seems a long way in the future because of needed development. So, he felt he could not comment based on currently available technology. However, he thought that no video data retention would be helpful.

Bob Hogan said that this idea concerns him from a law enforcement perspective. He does not understand how this approach would work for enforcement questions. He added that you could process compliance data the same way as video data.

Yesterday, there were discussions about outreach, and different regions conduct outreach differently. Most people agree that more outreach is needed and that it needs to be well organized. There needs to be a NOAA Fisheries-wide effort on the current state of data confidentiality. Is the West Coast EM program

setting a precedent on confidentiality? Also, what types of outreach can we do to better promote EM?

Dayna Matthew replied that it is not easy to promote EM because it is not a panacea that works in all scenarios. It may not be cheaper or easier than observers in all cases. The outreach process starts with providing good education about monitoring program objectives and then determining whether EM is the right tool to meet those objectives.

Joe Sullivan said that one of the best things that can be done is to give innovative programs and technologies some time to develop and be mindful that we are learning as we go. It's important that EM should not be over-represented as a fishery science tool. There is a steep learning curve, particularly with respect to third-party review. There are tradeoffs and opportunities that should be discussed and worked on together.

Two major costs of EM are video review and data storage. Technologies that allow machine analysis of the data have tremendous potential to grant much more control to fishermen about what data are submitted and to see what their discards or catch profile look like trip by trip.

Joe Sullivan said that he is concerned about the machine analysis and the result of having no video data retention. From a legal perspective, there should be concern about the accuracy of machine review of video. If the machine processing is not absolutely accurate, you may be destroying evidence in a situation where it is needed most. If the system sends a false violation or inaccurate discard report, fishermen would have strict liability with no means to defend themselves.

George Lapointe added that the machine learning could be used to process the data but the video could be retained to save processing time and cost while retaining the video as evidence for the reasons discussed.

The point has been made about the need for regular communication to work through the issues that we have been discussing. How many of these issues are being discussed across the regions?

Mariam McCall said that cross-regional discussions are taking place among lawyers, managers, and others. It allows focused collaboration among NOAA Fisheries staff to determine internal communications on these issues.

Kelly Denit said that the agency is doing this to allow internal staff to talk through these and other issues. But there may be a need for a broader discussion that includes NOAA Fisheries staff and outside stakeholders.

Bill Tweit said that the final question would be to ask panelists about priority next steps, and whether next steps should be regionally or nationally focused. Some examples of these issues include confidentiality, guidance for performance standards, outreach, third-party review, and data security.

Bob Hogan replied that the aggregation issue needs national guidance. Managing the data internally is difficult if there is not clarity about how the data may be released.

Dayna Matthews said that keeping a regional focus is important because of maintaining flexibility but there is a need for national guidance on some policies. Another issue is whether an individual wants to participate in EM. Living in a camera-centric world, every time camera technology is used, an expectation of privacy is eroded.

Mariam McCall thinks that national guidance is needed on a few issues, including confidentiality, image vs. data, and records retention. She added that performance standards need to be defined in the context of an individual program.

Joe Sullivan agreed that national work is needed on areas where there may be inconsistency among regions, such as access to records and what is open to FOIA. With performance standards, an appropriate sequence for this discussion is crucial, with enough frameworks to know what costs and responsibilities the fleet will bear.

Program Design and Implementation

Moderator:

Kate Wing, Kate Wing Inc.

Panel Members:

- Nichole Rossi, NOAA Fisheries Northeast Fisheries Science Center
- Mark Hager, Gulf of Maine Research Institute
- Melissa Hooper, NOAA Fisheries West Coast Regional Office
- Dan Falvey, Alaska Longline Fishermen's Association
- Kelly Denit, NOAA Fisheries Office of Sustainable Fisheries

The panel discussion can be viewed online at: <https://bcove.video/2qJutV9>.

Kate Wing said that the panel would discuss program design from the perspective of what has been discussed thus far at the workshop and the panelist's experience with challenges, best practices, and the appropriate place for national and regional efforts. By program design, she meant how goals and objectives are set and how the EM program is developed and implemented.

Nichole Rossi

Nichole Rossi focused on EM in the groundfish fishery in New England. She said that Amendment 16 to the groundfish fishery management plan switched from days-at-sea to sector management; this change in approach provided the impetus for EM. Amendment 16 also implemented at-sea monitoring and allowed EM. The expectation of the at-sea monitoring program was that program costs would shift to fishermen over time. Pilot projects were conducted to determine whether EM was a tool for bycatch monitoring as part of quota monitoring. In the groundfish fishery, logbooks and dealer reports are used to document catch, and EM is used for bycatch monitoring. The ASM program was established for bycatch monitoring, focusing on data to support bycatch allocation.

The New England EM program originally focused on the feasibility of EM for bycatch monitoring but it was expanded to collaboration and co-management. Collaborative development of the EM program reinforced the need for focused, well-defined objectives, and how program design and cost were impacted as the program became more complicated. Collaboration was an important part of program development, including vessels in the study, service providers, and the regional office.

Three things come to mind with respect to study design and data needs. First, data needs to meet program objectives. Second, which performance standards are achievable for EM programs? Third, to what extent are catch-handling practices feasible to support meeting program data needs?

With 7 years of pilot programs and 1 year under an EFP, Nichole thought that it was time to reevaluate program goals and data needs. As the program has matured, there are unresolved issues, and some fishermen have come up with objectives such as using EM for stock assessments. A renewed look at objectives and data needs would allow an open discussion about whether program elements need to be adjusted to meet current program needs and expectations.

Using the EFP allows program partners some flexibility in program development to learn as the program advances, and full participation by all program partners is critical to the EM program advancing to meet objectives.

Participation in the program has been limited by catch-handling procedures that do not work for all participants, an issue that has limited the scalability of the project.

Program challenges include inconsistent participation by fishermen, Office of Law Enforcement staff, General Counsel staff, and the New England Fishery Management Council. Another challenge is issues that require national guidance including data retention, confidentiality, and ownership.

Mark Hager

Mark Hager said that program design requires clear goals and objectives, which should be revisited to help keep sight of the goals and objectives. Additionally, it is easy to add extra objectives and functions in EM programs, which can result in a program that is too expensive and cumbersome.

One best practice is the need for cross-regional communication. For example, with catch-handling procedures, some regions are using average fish weights rather than weighing each fish. This one change could help the New England groundfish EM program significantly by reducing catch-handling time. Considering this type of change could improve participation levels in the EM program as well as control program costs.

He agreed that using EFPs allows the program to get started and learn as the program advances. The EFP also allows data to be used, which forces data collectors to maintain data quality and the agency to assimilate the data into their systems.

Mark said that vessel management plans are critical; they provide the backbone to the New England EM program and include strict protocols to make sure that the program is getting data to achieve program objectives.

Challenges with the program include not losing sight of program goals, allowing new ideas to be considered, and maintaining a reasonable balance between getting needed data and maintaining program flexibility. Communication is another big challenge; a national communications plan or information-sharing process is needed because national workshops every 2 years do not fulfill communication needs.

Melissa Hooper

The West Coast EM goals are to support the goals and objectives of the 100% observer coverage; to ensure accountability of discards of IFQ species; and to monitor compliance with requirements of the catch share program. The clear, defined objectives helped maintain focus and minimized scope creep. One objective of the EM program was to find a more cost-effective way to meet the 100% observer requirement. They looked at other data needs and requirements of the MSA. At the same time, the council reviewed and overhauled the data collection system for the groundfish fishery. Data collected by at-sea observers has multiple purposes, including accounting for discards and compliance of IFQ species, discard of non-IFQ species, protected resources monitoring, and collecting biological samples. This information is needed for stock assessments and standard bycatch reporting methodology so an EM program could not replace all these functions. For these reasons, changes in the monitoring and EM program had to be evaluated for impacts on various data streams needed for different management functions. This overall data

review showed the need for maintaining observers to collect information that cannot be obtained using EM.

They designed their program to meet these goals; what to collect, what to sort, what to report, and what not to report. They also wanted the program to be flexible to required changes, new technologies, varying business models from different service providers, and different fishing operations. This evaluation resulted in using a performance standard approach, and the EFP has enough flexibility for the program to consider emerging issues. The draft regulations are tiered for overarching requirements and performance standards for equipment, providers, and vessels. They are working on program guidelines for best practices and the best way to meet these needs in vessel management plans (VMPs) and service provider plans.

The EFP process is designed to adapt as they learn and to change as needed by evaluating how to make changes through VMPs, policies and procedures, council action, or regulation. The intent is to keep the program as an adaptive, flexible learning process.

Dan Falvey

Dan Falvey said that one of the best program design elements in Alaska was establishing the EM working group, a process that gets everybody to the table and uses consensus to identify solutions to ongoing issues. After the workgroup was established, it focused on management objectives but also discussed fleet demographic issues such as vessel size, back deck layout, fishing-handling procedures, and other operational factors.

Another very helpful idea is sharing cross-regional experiences through direct meetings. This recently occurred with EM staff from the West Coast and New England coming to the Alaska EM working group; the resulting discussions were very helpful for sharing ideas and challenges. There is huge value in bringing folks from different regions together in this way.

In Alaska, they did get distracted by “the shiny bauble” in thinking that new technologies could solve all of their problems. They took about a year and a half arguing about these issues. A valuable lesson from this is that EM programs have to consider hardware, software, and operational issues and how they fit together into a viable program. They struggled with how to consider and incorporate new technologies so that they get value for investments made. An important issue when discussing new technologies is whether they are developed generically for all programs or are developed to meet the needs of one EM program.

As other panelists have mentioned, after the program design is articulated, EM programs need to get started using flexibility and “learning to learn” as the system is implemented.

Some of the challenges in program design and implementation include end stage tradeoffs (i.e., how much review needs to be done and the cost associated with that level of review), sharing between observers and EM, and identifying program design elements for an effective enforcement program.

Kelly Denit

Kelly focused on the national issues relative to program design. She said that the agency is working on many national issues such as data retention and confidentiality.

She said that an important element of program design is tradeoff analysis, balancing confidentiality, enforceability, program costs, and flexibility. She said we need to think about what evaluation tools can help with this analysis, or develop them if they are not currently available. Flexibility is beneficial but it's also important to be realistic about resource limitations; therefore, doing nearly identical work in multiple regions or programs should be avoided. There needs to be a better way to leverage investments across regions. An example of this is automatic species recognition. Should there be multiple, independent projects or a core program that can be tailored to meet the needs of individual programs?

Another important consideration is what information goes into regulations, what goes into other documents, or what gets deferred for subsequent work. There should be more discussion about how various programs balance what is stipulated in regulations with what needs flexibility to adapt to specific program challenges.

The last question relates to communication; what are the suggestions for sharing relevant information better and in a timely way? This could include people attending meetings in different regions, EM information in the weekly Fisheries Updates, emails, updates at council meetings, and so on. It is very important to know how to share EM program information effectively.

Questions and Responses

How can EM data be used to assist stock assessment efforts?

Melissa Hooper said that the West Coast EM program is not designed to collect stock assessment information, but the potential to use EM information was discussed and is feasible. For stock assessments, the West Coast region makes sure that they still have enough human observer coverage to gather biological samples and other information that does contribute to stock assessments. They also explain to program partners how EM can be used in stock assessments; this is a step-by-step learning process.

Nichole Rossi said that initial goals of the New England EM program were narrowly focused on cost effectiveness

for bycatch monitoring. The stock assessment need is real but requires redefining goals and objectives, and potentially modifying the EM program to meet these needs.

Mark Hager said that using EM data to inform science is one of the barriers to participation in New England. The next year will include discussions on how to use EM data for science and assessment. As others have mentioned, this could impact data requirements, catch-handling procedures, and cost, meaning that there should be a robust discussion of costs and benefits of adding assessment data goals to EM programs.

Using EM systems for multiple fisheries or objectives is a good question but current technology does not allow “plug and play” among different technologies. How could program design elements be modified to allow an EM system to be used in more than one fishery or program?

Melissa Hooper said that it is beneficial to discuss the multiple system issue and thought that the performance standard approach is the best way to advance this discussion. In the VMS program, a national process was used to develop uniform system standards. This approach is very different than the bottoms-up approach used in EM program development. She added that service providers are trying to work in different regions or programs that have different design criteria. Some coordination among EM units would help with interoperability, which would also be useful in the one unit/multiple fishery issue.

Amanda Barney said that some British Columbia fisheries worked with Archipelago Marine Research and Ecotrust Canada in two fisheries and they developed common sensors. Therefore, extending this to interoperable units would be more efficient than two redundant EM systems.

Howard McElderry added that most EM units are designed similarly so probably there are not huge hurdles to using one unit in two fisheries. Other program elements such as operating procedures, technicians who are trained on one unit, and data set up and handling would be important considerations in adapting EM to multiple fisheries on one vessel.

Dan Falvey said that this is a good example of a program design issue. The shared EM system concept will likely increase as EM use broadens over time. The equipment requirements should be in a service contract or VMP, which makes adapting an EM system to two or more fisheries easier. This is a real issue in Alaska where there are two providers in the pot and longline fisheries, and some vessels that participate in both fisheries. It makes no sense to require vessels to switch EM systems when they switch fisheries. In Alaska, they are also considering an exception that allows vessels with West Coast EM systems to fish in the longline fishery.

Tom Warren said that there is a role for regulation writers in developing programs so that the programs meet the regulatory requirements of multiple fisheries.

In New England, you have completed many stages of development but are considering refining program goals. Is there room to do this or is the management and regulatory system too rigid for this to happen?

Mark Hager replied that the New England groundfish EM program had room to consider refining program goals; operating under an EFP gives the flexibility for this to take place.

In terms of the Flywire system, how did you get them to build the system that you needed and are you able to change the system as you learn from it?

John Wang replied that the monitoring program had a particular set of goals for their project. There was a system to move monitoring data through the analysis process but they needed to increase the number of vessels providing data and they thought EM could help increase sample size.

Consequently, adapting EM to their program needs was not that difficult. He thought that adding EM to monitoring programs is possible because the hardware is a small part of the overall monitoring program.

Kate Wing commented that this example demonstrates the value of maintaining a strong focus on core values and goals.

Program Costs and Stakeholder Buy-In

Moderator:

Randy Fisher, Pacific States Marine Fisheries Commission

Panel Members:

- Jane DiCosimo, NOAA Fisheries National Observer Program
- Lisa Damrosch, California Groundfish Collaborative
- Chris McGuire, The Nature Conservancy, Massachusetts
- Claire Fitz-Gerald, Cape Cod Fishermen's Alliance

The panel discussion can be viewed online at: <https://bcove.video/2rOpXsM>.

Randy said that program cost and stakeholder buy-in are closely related issues. A number of years ago, a group of people on the West Coast met with the whiting fleet about monitoring and they had two goals: providing flexibility and saving the fleet money. Since then, PSMFC has been involved with a number of issues that have been discussed at the workshop. First, is it policy or technology? An example of this is data storage, which is not a technology issue but a policy issue. Second, is EM for science or compliance? This is one of the bigger issues because using EM for science is

going to be expensive. If the goal is compliance, it is likely to be less costly. Third, is the focus regional or national? This issue has been talked about a lot and the consensus is that most issues should be regionally focused. The last major issue that comes to mind is "Is it me or is it we?" This is the issue of who pays for what in the EM program, which clearly has significant cost and participation implications.

The interesting thing about these questions is who decides them, and there has not been a lot of discussion about this. However, it is an important part of the system design and build-out discussion.

At PSMFC, here is what has been learned about EM program costs. Cameras cost from \$10,000 to \$12,000 installed on boats; hard drives cost around \$75 and are reusable; camera reviewers cost \$85,000 to \$90,000 annually; review equipment is about \$3,000; camera review interface software is a one-time cost of about \$4,000; and camera review and storage is about \$15,000 annually. This totals about \$130,000, all of which has been paid for federally. The changes in Washington suggest that who pays for what is likely to change drastically, and all need to plan accordingly.

With respect to EM review, PSMFC review costs are about \$50 per hour. If they had to charge back the daily costs to the fleets, it would work out to \$106/day for Alaska longliners, \$72/day for West Coast pot fisheries, \$163/day for the West Coast trawl fishery, and \$12/day for the whiting fleet.

Jane DiCosimo

Jane said that EM and ER have been central issues for the agency. In listening to workshop participants and ongoing discussions elsewhere, she has identified four themes from a science perspective. First, EM program design should be part of an integrated framework that includes other technologies such as ER and VMS to be most useful to management as part of a fishery-dependent data collection program. This includes bycatch monitoring for compliance, catch estimation, quota monitoring, and input for stock assessments. Challenges to integration are institutional roadblocks, lack of transparency in data collection, how the data enter data streams, staffing, and expertise.

The next theme is that improvements in technology—including cameras, electronics, optics, computers, and machine learning—are expected to lower costs, but these changes may result in market disruptions that threaten established business practices. At the same time, improvements in catch estimation technologies resulting from improved data streams, including observer effects, may threaten fishing sectors by restricting or closing fisheries sooner because of better catch and bycatch data.

The third theme is finding cost-effectiveness through the marketplace as technologies change. The key challenge from

a science perspective is that data quality should not be a tradeoff to lower costs.

Jane's fourth point is that EM may cost between 50% and 150% of observer costs depending on how the program is designed. If catch and revenue are low in a fishery, observers are relatively less costly than EM. As fishing catch or revenues increase, EM is relatively more attractive, especially with lower levels of video review, geographically dispersed fisheries, and higher levels of observer coverage.

Jane said that it is important to pay attention to EM program costs. Nationally, about \$35 million has gone into EM pilots, programs, and research and development. Also, a significant amount of matching funds has been applied to EM. The current funding focus is on program implementation but there should be consideration of the tradeoffs of getting programs started with funding for innovations that will help EM programs become more efficient in the long term. For some EM efforts such as small EM programs, artificial intelligence, and automatic species recognition, progress is not limited by available funding as much as staffing limits and lack of industry buy-in to help develop innovations. NOAA Fisheries has received \$7 million in base funding for EM and ER. Of this total, \$3 million goes to the National Fish and Wildlife Foundation for partnerships in advancing EM and ER. In addition, internal NOAA Fisheries funding is also used to advance EM and ER.

Another key challenge is that the agency charge is not just management; it also includes science. The agency partners with external stakeholders to address issues such as big data and artificial intelligence, or developing stereo cameras for use in EM systems. The Office of Science and Technology has numerous efforts underway to coordinate these and other issues, both internally and externally. These efforts are aimed at moving forward issues, such as EM, at the best pace possible.

Lisa Damrosch

Lisa said that when she thinks about costs, she hears how the industry will be paying more. In the West Coast groundfish fishery, there is a deadline when the costs will shift to industry, which is scary when also discussing changing things as the program evolves, meaning that industry does not know how much it will be paying. Industry has been lucky to get support from many sources, and with these resources, a lot of progress has been made. Looking ahead, fishermen want to know exactly what they are being asked to pay for, and that cannot be determined currently. Without clear costs, fishermen cannot make an informed business decision about whether to use EM.

Lisa stated that she has seen some information about what fishermen will pay as a percentage of total costs being allocated to different functions such as program service, system licensing, actual service, video review, and data

storage. If these costs are shifted to industry, it is important to understand which costs are fixed and which can be looked at for efficiency. For example, video review can be made more cost-efficient by better catch-handling procedures, as others have discussed. But for cost centers like program services, more information is needed to better understand what goes into this cost center and where efficiencies can be found. Fishermen are adaptable but they need to understand what goes into these cost categories and how they can help make the programs more efficient and cost-effective.

Chris McGuire

Chris said that costs are difficult to discuss as long as EM is largely in the research and development phase, since most research and development is supported by outside funding sources. Similar to other technologies, subsidies are often used to make technologies operational. One thing that is becoming clear is how long it takes to make a program operational.

Also important are cost drivers to EM programs. Program requirements can impact costs as can fish-handling procedures by fishermen. Some cost drivers can be impacted by fishermen and others cannot. In the northeast, there is also using a third-party arrangement where the service provider installs and maintains equipment, reviews the video, and submits summary reports to NOAA Fisheries. In this process, providing some competition among service providers has been a priority.

Going forward, there is sensitivity to the points raised about how money is spent and how these costs are controlled. In terms of incentives to participate, there is a difficult situation in the northeast because fishermen do not have to pay for observers. For this reason, different ways to incentivize fishermen need to be examined.

Claire Fitz-Gerald

Claire said that she would limit her comments to new concerns to not be redundant. She said that it is important to stress how EM can empower fishermen by allowing them to control costs. She thought that the observer program can make fishermen feel helpless, but EM gives them a way to regain control of some issues.

She said that it is also important to reiterate how EM allows fishermen to control costs. One example of this is a Maine fisherman who found that careful fish handling cut video review time by half which, in turn, reduced costs considerably. Another approach was taken by a Cape Cod fisherman who came across a substantial haul of undersized haddock. Rather than put fish on the measuring table one at a time, he put many on at once. He got to decide that cost and safety factors were important. Since then, their EM program has changed to a volumetric estimation method to save time and costs.

Questions and Responses

How can we get fishermen more involved in EM?

Lisa Damrosch said that for California fishermen, it is either cameras or an observer, and having both as options allows fishermen to make a choice. The 100% coverage in the West Coast groundfish fishery creates a lot of data that can be used to make other arguments in fishery management such as access to restricted areas. This creative incentive is what will get more fishermen involved.

If we could use EM to take care of other tasks such as multiple reporting functions, would this provide an incentive for fishermen to participate? Can you think of other incentives to encourage participation?

Lisa Damrosch said that for her members, getting the flexibility to fish where they want would be a big incentive to use cameras. Another incentive is not having another body onboard a vessel.

Claire Fitz-Gerald said that there are many tangible benefits that have been discussed that would make EM more attractive. Also important are intangible benefits, such as turning on the cameras all the time because they think a long-term data stream that is verifiable by managers could provide information to strengthen stock assessments. New England fishermen have also discussed spatial access that could be granted with EM use. Another idea is that uncertainty buffers could be converted to catch for vessels using EM because of use of location, catch, and bycatch information available with the EM systems.

Howard McElderry said that the cost discussion is interesting because nobody has mentioned not using the private sector, which is an after-the-fact part of the EM discussion. From a buyer's perspective, people are trying to figure out what type of environment is created to encourage businesses to provide the EM service and how you get the best value for this arrangement. A problem with U.S. EM programs to date is that the scale of the EM programs is small so that you do not achieve economies of scale. Discussions often focus on hardware, which is a minor cost in EM programs. A direct cost to sea days is video review, so these are large costs relative to equipment costs. He added that costs need to be looked at holistically and early in the planning and development process to discover drivers that can be adjusted to achieve cost efficiencies.

Gerry O'Neil said that for the herring fleet, an incentive would be to relieve other regulatory restrictions such as closed areas; this could also be achieved by having 100% observer coverage for closed-area trips. He also hopes that

the maximized retention requirement, which now mandates that fish be dumped at sea after dockside verification, could be adjusted to count and discard haddock at sea at the time of the fishing event.

Chris McGuire said that it would be useful to have a shared vocabulary about the words used in EM discussions, such as open source or data. A glossary of terms would help with EM discussions, including costs.

Amanda Barney said that with respect to some software and costs, it is hard to have somebody invest in software changes if they cannot be assured that they own the software. She added that just as open source software is not free, proprietary software is not inherently expensive. With respect to service provision costs, this includes costs such as office space, having staff on call, training, and so on. These costs are associated with any business and they vary significantly by scale. She added that to get the true cost of different monitoring options, people should compare similar costs among different monitoring programs such as EM and human observers.

Lisa Damrosch said that the scale issue does not work in all fisheries, such as the California groundfish collaborative, which has only 12 vessels. A difficulty for the fleet is that their only choice is EM or human observers. Additionally, having industry pay is difficult for low-volume fisheries such as the California groundfish fishery, which cannot pay for extra services. Taken too far, this will result in small boats leaving the fishery.

Bob Dooley said that incentives should really be a focus when looking at program costs. To do that with EM is difficult because it seems like it is all costs and no incentives. He thought that the uncertainty buffer is a potential area for incentives. With the accountability of EM systems, converting uncertainty to individual catch would be a valuable incentive. Uncertainty buffers create difficulties for fishermen, so if this could be turned into an asset through accountability, it would be a huge benefit for vessels to use EM.

Kate Wing said that clarity of purpose will help make costs more transparent and predictable. With respect to open source software, it is important to know that using open source software is U.S. federal policy. A good reason for this is that open source software can be used as a base for proprietary software. The market advantage of service providers is that they know their users and can provide unique services. Then other companies can figure out how to provide a service to the fishing industry. She said that we do fisheries a disservice when we say that EM is so unique that only a few providers can know how to build a useful product for the fishing industry.

When fishermen have asked to pay for additional services, they have been told no because some functions are the responsibility of the federal government. Has the federal government decided on who is responsible for what function in EM programs?

Jane DiCosimo said that this cost allocation question is being discussed internally, and will hopefully be a public discussion in the near future.

National EM Workshop Wrap-Up

The meeting wrap-up session was moderated by Erika Feller, National Fish and Wildlife Foundation. The session can be viewed online at: <https://bcove.video/2qJuAajx>.

Erika said that the workshop was very useful in engaging EM participants, including fishermen, community organizations, service providers, NGOs, scientists, and managers, in identifying problems and challenges in EM programs and, where possible, finding ways to address these problems. She added that this is important because a problem well defined is a problem half solved.

Erika said that the meeting wrap-up would consist of asking the four Day Two moderators to share their key take-away messages for their respective sessions, with the understanding that this would be the initial thoughts of the moderators and would, therefore, not be comprehensive reviews of the sessions earlier in the day.

Bill Karp, moderator of the Data Quality, Storage, and Retention panel

Bill said the issues that he would mention are not unique to data; they are considerations that overlap many of the topics discussed during the workshop. Bill said that his first overarching issue is that communication and collaboration are keys to success; EM programs must build on the effective communication that has been discussed at the workshop. Second, most data problems can be solved if there is clarity in both policies and program design elements. EM programs must be clear about program goals, needs, and requirements from the policy and program perspectives. Third, there needs to be a balance between national requirements and local flexibility. He said that there is a need for national guidelines and clarification of legal requirements, which must be balanced with local flexibility to meet specific program objectives. Lastly, with respect to data integration, there is the capacity to deal with integration challenges but it must be noted that the solutions are not all simple.

Bill Tweit, moderator of the EM Program Enforcement and Compliance panel

Bill said that his top take-away issues are also not specific to enforcement and compliance. First, for EM programs to succeed and expand, implementation of an EM confidentiality rule is needed. This is something that must be consistent nationally. He added that this is needed soon because EM program participants need to clearly understand the rules of an EM program. Second, EM programs need a balance between enforceability and individualized programs. This is important because EM programs need buy-in from participants, and that can vary among EM programs. Third, EM programs need to consider security issues to protect participants and to protect data that can have use and value beyond the compliance monitoring and catch accounting of current EM program goals. Attention must be paid to how to make EM data secure during required retention periods. Lastly, EM programs need a well-designed outreach component to explain how the program is designed and implemented. Explaining terms of an EM program is critical for all program stakeholders.

Kate Wing, moderator of the Program Design and Implementation panel

Kate said that she thought that best practices are crucial to EM program success. First, use human-centered design. This approach includes having everybody in the room: fishermen, scientists, managers, and service providers. As mentioned by others, collaboration among stakeholders is critical. Second, EM programs need clear goals that show what success looks like. Goals should be a program's guiding principle and should be revisited and tracked to keep the program focused. Third, program terms need to be defined. People define terms differently, and this will cause confusion unless the terms are defined and understood by all program stakeholders. Fourth, EM programs need flexibility to be tailored to individual program needs. This is similar to the flexibility among regions that is built into the MSA.

Randy Fisher, moderator of the EM Program Cost and Buy-In panel

Randy agreed with other moderators that collaboration, terms, and flexibility are important for EM programs. Second, EM program size matters in terms of cost, logistics, and efficiency. Third, funding is a critical issue for the future and needs to be addressed quickly; particularly what fishermen will have to pay for in EM programs. Lastly, he said that clarity is needed about the funding, development, and use of open source software in EM programs.

Alaska Regional EM Program Summary

Current/Ongoing EM Programs

Alaska EM programs are divided into two categories: 1) programs that are already in regulation and are designed for compliance monitoring purposes; and 2) ongoing EM development in the small boat fixed gear and pot fisheries primarily for catch accounting purposes with some compliance monitoring aspects.

The ongoing EM programs were implemented from 2008 to 2013 in the following fisheries:

- Amendment 80 to the Bering Sea/Aleutian Islands non-pollock trawl fishery requires video recording of sorting activity in bins (or an alternative measure) to prevent pre-sorting of the catch before the observer has an opportunity to sample the catch (also referred to as bin monitoring, implemented in 2008).
- Amendment 91 to the Bering Sea/Aleutian Islands pollock trawl fishery requires video monitoring of all locations where salmon bycatch is sorted by the crew and the location where the salmon are stored until sampling by an observer (implemented in 2011).
- Gulf of Alaska Rockfish Program requires bin monitoring similar to Amendment 80 (implemented in 2012).
- Bering Sea/Aleutian Islands Pacific cod freezer/longline vessels using flow scales are required to monitor sorting and flow of fish over the scale (implemented in 2013).

New EM Programs Under Development

The developing EM program is in the small boat fixed gear (longline and pot) fisheries to collect data for catch accounting purposes. Program development has been guided by the EM working group of the North Pacific Fishery Management Council. This EM program is scheduled for implementation through regulations in 2018.

Program Objectives

The overall goal of the 2017 EM Pre-Implementation Plan and the cooperative research plan is to develop the use of EM, in combination with other tools, for catch accounting of retained and discarded catch, and to identify key decision points related to operationalizing and integrating EM systems into the Observer Program for fixed gear vessels in a strategic manner. The experience and results from the data collected during this pre-implementation and research phase will inform the implementation of EM as an integrated part of the Observer Program.

Vessels in Fleet

Small boat fixed gear: 523 vessels in fishery. Up to 90 vessels \geq 40 feet will be allowed to participate in the EM selection pool; 70 have opted in to the 2017 EM program. Average vessels take 3–5 trips/year.

Pot cod fishery: 109 vessels in the fishery. Up to 30 pot vessels \geq 40 feet will be allowed to participate in the EM selection pool; 18 have opted in to the 2017 EM program. Average vessels take 10–15 trips/year.

Type of Program

- Partial coverage.

Percent Coverage of EM Program

Small boat/fixed gear fishery: 30% of trips will be randomly selected for EM coverage through the Observer Declare and Deploy System (ODDS), which is the same system used to select vessels for observer coverage. The current approach as described in the 2017 EM Pre-Implementation Plan is for all participating vessels to be pre-wired with EM systems prior to their first fishing trip, with systems to be turned on whenever a vessel is selected for an EM coverage trip (currently set at 30% for 2016–2017). A total of 60 control boxes will be moved among vessels.

Pot cod fishery: 30% of trips will be randomly selected for EM coverage using ODDS. The current approach is identical to the small boat/fixed gear fishery. Vessels in the EM selection pool will not be required to carry an observer for the duration of the fishing season (i.e., all of 2017) unless they opt out of the EM pool.

Financial Information

Compliance monitoring cameras in the groundfish fishery (A80, A91, rockfish, and freezer longline vessels) are 100% funded by individual vessels. Video is stored on board the vessel for 120 days and retrieved when necessary for compliance monitoring purposes.

Start-up costs for the small boat/fixed gear EM catch estimation program have been funded by NOAA Fisheries and NFWF grants. EM has an estimated cost in 2017 of \$1,007,000, of which \$750,000 is NOAA Fisheries funds and \$257,000 is from NFWF funds. Hardware costs are \$480,700, of which 83% is government funded and the remainder is funded through an NFWF grant to industry. Field support and data analysis costs are \$523,309, of which 67% is government funded and the remainder is funded through an NFWF grant to industry.

The pot cod fishery EM program has an estimated cost in 2017 of \$1,132,047, of which \$537,000 is NOAA Fisheries funds and \$595,047 is NFWF funds. NFWF funds will support up to 15 pot vessels, and NOAA Fisheries funds will be used to support an additional 15 vessels.

Upon implementation by regulations, the small boat/fixed gear EM program will be primarily funded by 1.25% fee on partial-coverage boats. The fee will be divided between EM and human observed boats on an annual basis.

EM Equipment and Field Service Logistics

- Longline vessels have rail cameras for species identification, deck cameras for catch dispositions, and a rear facing sea bird camera to validate deployment of seabird streamer lines when setting.
- Pot gear vessels have deck cameras to monitor sorting tables for species identification and disposition.
- Archipelago Marine Research and Saltwater Inc. provide separate field services through contract staff in Alaska.
- NOAA Fisheries provides field services to support R&D work.
- No special dockside monitoring is currently envisioned.

EM Video Review Services

- PSMFC provides video review and data storage services.
- 100% of longline hauls is reviewed.
- TBD% of pot lifts is reviewed.
- PSMFC transmits data to NOAA Fisheries for management purposes.

Enforcement Considerations

- Under development.

Success Factors of EM Program

- Establishment of a Council EM working group—transition to a bottom-up approach.
- Funding support from NOAA Fisheries and NFWF.
- Growing list of EM participants.
- Good cooperation between NOAA Fisheries, industry, EM service providers, PSMFC.
- PSMFC involvement from the start.
- Process of pre-implementation leading to implementation.
- Light at the end of the tunnel—implemented program and observer fees.

Challenges of EM Program

- Making EM cost effective in a partial coverage environment.
- Developing incentives within a single fee-based program.
- Developing appropriate enforcement filters.
- Developing tools to evaluate sampling design trade-offs and cost models.
- Integration/acceptance of new technologies.
- Using data for catch accounting.
- Incorporating different data streams (from multiple reviewers and/or technologies).
- Continued support for EM with decreasing observer coverage.
- Reducing EM bias (i.e., 100% EM coverage with random selection of trips for review post-deployment).

West Coast Regional EM Program Summary

Electronic monitoring is being proposed for two West Coast fisheries—the limited entry groundfish trawl fishery and the California-based swordfish drift gillnet fishery.

Groundfish Fishery

EM is being proposed as an alternative to human observers to meet the requirements for 100% at-sea observer coverage in the catch share program. The catch share program requires 100% industry-funded observer coverage at sea and shoreside to ensure accountability for catch of allocated species. Due to the costs of observer coverage (approximately \$500 per day), EM is being explored as a potentially more affordable alternative. Catcher vessels targeting whiting in the at-sea mothership sector, and shore-based vessels targeting whiting and other species in the individual fishing quota (IFQ) fishery, would be able to apply for an exemption to use EM instead of an observer. Vessel operators and crew would need to comply with new catch-handling requirements, species retention and discard requirements, reporting requirements, and other conditions. Logbooks and EM data would be used to account for IFQ and mothership catcher vessel discards at sea in lieu of human observer discard estimates. The proposed program would be voluntary and includes eligibility requirements to use EM and a process for vessels to declare their intention to use EM prior to fishing. Other components would include individual vessel monitoring plans, equipment and installation requirements for a video monitoring system, video data processing protocols, and compliance measures. After an initial transition period, vessel owners would be responsible for funding the costs of reviewing and storing the EM data beginning in 2020.

The proposed EM program is not intended to meet the needs for collecting biological data or monitoring for other scientific information. Human observers would still be necessary to collect this information at an appropriate level to support scientific needs; therefore, on EM trips the vessel could be randomly selected by NOAA Fisheries to carry an observer for the purpose of collecting scientific information. Vessel operators would continue to make arrangements with third-party observer providers to secure an observer if required to do so. However, NOAA Fisheries would revert to pre-catch share program levels of 20% to 25% coverage. NOAA Fisheries would bear the cost of the scientific observers.

A proposed rule published in September 2016 proposed EM regulations for two components of the trawl fishery—the Pacific whiting fishery and fixed gear vessels in the shorebased IFQ fishery (http://www.westcoast.fisheries.noaa.gov/fisheries/groundfish_catch_shares/electronic_monitoring.html). The Pacific Council will be taking final action on EM regulations for the remaining components of the trawl fishery in 2017.

Swordfish Drift Gillnet Fishery

The NOAA Fisheries West Coast Region and Pacific Council are also developing an EM program for the swordfish drift gillnet fishery. In 2015, the Council approved requirements for hard caps of bycatch of protected species and 100% observer coverage or EM to monitor the new caps beginning in 2018. NOAA Fisheries is developing the proposed regulations for the EM program, but the EM program is suffering from a lack of interest by vessel owners.

Greater Atlantic Regional EM Summary

Regional EM Overview

EM is expanding as an alternative to existing at-sea monitoring tools to increase catch monitoring, accountability, and compliance.

The Nature Conservancy (TNC), an EM program partner, has received an exempted fishing permit (EFP); participants from groundfish sectors use EM instead of human at-sea monitors to account for quota-managed groundfish discards. On a subset of EM trips, vessels also carry federally funded fisheries observers for data comparison.

The Gulf of Maine Research Institute and Environmental Defense Fund intends to test the “maximized retention” model under an EFP in the groundfish fishery beginning May 1, 2017. Participants would retain 100% of certain species, discard others, and EM would be used for monitoring compliance with catch retention rules.

In the Atlantic herring and Atlantic mackerel fisheries, NOAA Fisheries is evaluating EM to increase monitoring to address concerns about the incidental catch of river herring, shad, and haddock, as well as the amount of discarding at sea. NOAA Fisheries has implemented a voluntary EM study to verify catch retention and identify discard events on 12 midwater trawl vessels in 2016 and 2017.

Program Objectives

Groundfish Audit Model:

1) Evaluate third-party video review for discard monitoring; 2) Develop audit methodology by comparing discards from EM and fishermen’s reports; and 3) Refine catch handling and video review protocols.

Groundfish Maximized Retention Model:

1) Examine discard compliance monitoring in a mixed-species fishery; and 2) Develop a pilot dockside monitoring program to verify catch retention and monitor potential changes in fishing behavior.

Herring and Mackerel Midwater Trawl Project:

1) Examine the utility of EM in an operational setting and develop program requirements; 2) Evaluate the information that can be gathered with EM systems; and 3) Refine EM cost estimates.

Vessels in Fleet

Groundfish: ~200 active vessels; 12 vessels under the current EFP. Next year, we will add more vessels and add three to four vessels for the maximum retention project.

Herring/Mackerel Midwater Trawl: ~13 active vessels; 12 vessels in the EM project.

Percent Coverage of EM Program

Groundfish Audit Model: EM is running on 14% of all trips (observer coverage target for the year) and 100% of the video is reviewed from each EM trip.

Groundfish Maximized Retention Model: EM would run on 100% of all trips and 100% of the video would be reviewed from each EM trip.

Herring and Mackerel Midwater Trawl Project: EM is running on 100% of all trips and 100% of the video is being reviewed from each EM trip.

EM Program Financial Information

Groundfish Audit Model: Funded by the National Fisheries and Wildlife Foundation (NFWF), non-governmental organizations (NGOs), and groundfish sectors.

Groundfish Maximized Retention Model: Funded by the NFWF with additional financial support from NOAA Fisheries for dockside monitoring.

Herring and Mackerel Midwater Trawl Project: Funded by NOAA Fisheries.

Success Factors of EM Program

Groundfish Audit Model

- Strong support for EM from NGOs, some fishing industry groups, public and private funding sources, Congress, and NOAA Fisheries. Some fishermen in the fishery are committed to EM and motivated to have their observations on the water verified/used in the management and science processes.
- The EFP creates incentives for fishermen to use EM by removing the logistical challenges associated with carrying at-sea monitors.
- Some consistency in species identification, weight estimation, and piece counts by EM service provider and NOAA Fisheries video reviewers.
- Communication/coordination among project partners, EM providers, and NOAA Fisheries.

Herring and Mackerel Midwater Trawl Project

- Moderate support for EM from the New England and Mid-Atlantic Councils, the herring and mackerel fishing industry, some NGOs, the public, and NOAA Fisheries.
- The vast majority of the fishery is participating in the EM project.
- The project will inform New England and Mid-Atlantic Fishery Management Council EM and portside monitoring alternatives for the herring and mackerel fisheries in the Industry-Funded Monitoring (IFM) Omnibus Amendment.

Challenges of EM Program

Groundfish Audit Model

- Minimal participation due to low monitoring coverage in the fishery and continued NOAA Fisheries funding of the monitoring program. The EM program remains voluntary, resulting in a lack of regulatory or economic incentives to participate.
- The fishing industry does not trust NOAA Fisheries; reduces the willingness to collaborate.
- There is a need to further develop EM specifications, data analysis protocols, and design for the audit model (i.e., what percentage of video to review and the appropriate pass/fail criteria).
- Limited NOAA Fisheries resources for EM development and subsequent approval.
- Identifying all species and developing consistent video and data quality.

Herring and Mackerel Midwater Trawl Project

- The fishery is currently active, making EM installation difficult (2–3 days needed).
- Fishing industry is concerned about the economic impacts associated with EM.
- The results of the EM project may be produced too late to inform the councils' selections of preferred alternatives for the IFM Amendment.

Atlantic Highly Migratory Species EM Program Summary

Program Overview

The Atlantic Highly Migratory Species (HMS) pelagic longline fishery is managed under several U.S. laws and treaties, including the Atlantic Tunas Convention Act (ATCA), which implements the U.S. treaty obligations of the International Commission for the Conservation of Atlantic Tunas (ICCAT). Due to the international nature of these fish stocks, the MSA provides management authority for Atlantic HMS species to be implemented by the Secretary of Commerce (Secretary), who has delegated it to the Atlantic HMS Management Division of NOAA Fisheries. Although this fishery is managed by the Secretary, it does occur in the geographic areas managed by a number of Fishery Management Councils (exclusive economic zone; EEZ), such as New England, Mid-Atlantic, South Atlantic, Gulf of Mexico, and Caribbean. Fishing also takes place beyond the EEZ in international waters of the Atlantic Ocean. The pelagic longline fishery harvests swordfish; several species of tunas including bigeye, albacore, and yellowfin; pelagic sharks and dolphin fish (mahi-mahi); and also has an incidental catch of bluefin tuna. The EM program for this fishery is intended to verify preexisting reports of bluefin tuna bycatch as part of an Individual Bluefin Quota (IBQ) program that was introduced under an amendment to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (Consolidated HMS FMP).

The Amendment process was finalized in December 2014, and the EM portion of that amendment was implemented on June 1, 2015. For months prior to the implementation date, EM system installations were conducted at more than a dozen specific ports throughout the range of the fishery to balance efficiency for the EM service provider (Saltwater Inc.) and minimize the distance vessels in the fleet had to travel.

The service provision in this EM program is divided between two contacts. EM systems, installation, and maintenance is currently performed by Saltwater Inc. Audits, analyses, and custody of the EM video footage is conducted and maintained by Earth Resources Technology (ERT).

Program Objective

The objective of the Atlantic HMS EM program is to verify the accuracy of counts and identification of bluefin tuna recorded through other means; for example, VMS reports, fishery-dependent logbooks, dealer reports, and Pelagic Observer reports.

Vessels in Fleet

136

Percent Coverage of EM Program

- 100% of active vessels, currently 112 vessels.
- Some vessels do not have EM systems on board because the permit holders are not active participants in the fishery.

EM Program Financial Information

The EM program in the Atlantic HMS pelagic longline fishery is currently funded by NOAA Fisheries, including EM system acquisition and installation, ongoing maintenance, interpretation of EM video, and data storage costs.

FY 2016 summary costs:

- Equipment installation and support: ~\$410,000
- Data storage: ~\$194,000
- Data processing and review: ~\$322,000

Success Factors of EM Program

- Government funding of program development and implementation.
- Industry acceptance of program.
- Mandatory program as part of FMP requirements.
- Flexibility in implementation date.
- Trial period before mandatory program to work with selected volunteer vessels to resolve problems that could have hampered the system's efficacy.
- Development of EM interpretation software by ERT is finding computer vision solutions for searching EM video for fish catch events.

Challenges of EM Program

- Custom installation required for each unique vessel.
- Species-specific identification of similar-looking fish (e.g., tunas).
- Data storage costs.

WORKSHOP AGENDA

DAY 1, 30 NOVEMBER 2016

Objectives:

- Evaluate the successes and challenges of each region's progress on EM implementation.
- Explore those successes and challenges in the context of developing future EM programs.
- Identify remaining issues and challenges that are common across regions for discussion on Day Two.
- Identify best practices for issues listed on Day Two.

8:00–8:45	Breakfast and networking
9:00–9:30	Introduction, workshop purpose, and logistics
9:30–10:45	Alaska Regional Panel Discussion (Video at: https://bcove.video/2qJ4Jsg)
10:45–11:00	Break
11:00–12:15	West Coast Regional Panel Discussion (Video at: https://bcove.video/2rOgWzI)
12:15–1:15	Lunch
1:15–2:30	Greater Atlantic Regional Panel Discussion (Video at: https://bcove.video/2s2MEcB)
2:30–2:45	Break
2:45–4:00	Atlantic Highly Migratory Species Panel Discussion (Video at: https://bcove.video/2qJmlEj)
4:00–5:00	New Kids on the Block: Emerging EM Programs and Technologies (Video at: https://bcove.video/2snCRuE)
5:00–5:30	Day One Wrap-Up
6:00–7:30	Reception

DAY 2, 1 DECEMBER 2016

Objective:

- Identify potential solutions to cross-regional issues listed below from the best practices identified in Day One.

8:00–8:45	Breakfast and networking
8:45–9:00	Recap of Day One
9:00–10:30	Best Practices for Addressing Data Quality, Storage, and Retention (Video at: https://bcove.video/2snEnwU)
10:30–10:45	Break
10:45–12:30	Walking the Walk: Exploring EM Program Enforcement and Compliance (Video at: https://bcove.video/2snjqfD)
12:30–1:30	Lunch
1:30–2:45	Dealing with the Details: Program Design and Implementation (Video at: https://bcove.video/2qJutV9)
2:45–3:00	Break
3:00–4:30	Considering Costs: Understanding EM Program Costs and Facilitating Stakeholder Buy-in (Video at: https://bcove.video/2rOpXsM)
4:30–5:00	Meeting Wrap-Up (Video at: https://bcove.video/2qJuAjd)

Workshop Participants

Alessi, Sarah, Flywire Cameras, Hawaii

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Barney, Amanda, Ecotrust Canada

Beideman, Terri, HMS Advisory Panel

Belay, Bryan, MRAG Americas

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Ferdinand, Antonio, Flywire Cameras

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Hammann, Greg, Marine Instruments

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Wing, Kate, KW Consulting