Northeast Electronic Monitoring Workshop

Summary Report

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Hosted by The Nature Conservancy and NOAA Fisheries
Report prepared by Laura Taylor Singer, SAMBAS Consulting LLC

Table of Contents

Executive Summary 1

About the Workshop 3

Recommendations from the Workshop 4

Group Discussion Summaries 9

Establishing Goals 9
Groundfish Fishery *9*
Herring and Highly Migratory Species *14*
Scallops and Surf Clams *17*

Cost Drivers 19

Technical and Performance Standards 28

Data Issues 32

Other Keys Issues Raised at the Workshop 39

Appendices 41

Presentations 41
Opening Remarks 41
Panel: Setting the Context for Electronic Monitoring in the Northeast *42*
Panel: Perspectives on Electronic Monitoring – Potential Goals & Implementation Strategies *45*
Panel: Lessons and Observations from Pilot Electronic Monitoring Projects *49*
Panel: Issues & Implications for EM Implementation *52*
Closing Remarks and Next Steps *55*

Agenda 57

Participant List 59

Strawman EM Goals for Northeast Fisheries 61

Executive Summary

Electronic monitoring (EM), specifically video cameras and associated systems, is one of several tools that can be integrated to monitor catch and bycatch of some fisheries or to monitor compliance with regulations at sea. EM has been used successfully to support compliance monitoring in fisheries outside the United States and in a more limited capacity in U.S. fisheries in the North Pacific. EM has been pilot tested in many other U.S. fisheries, including the Northeast multispecies (groundfish) fishery in New England, but has yet to be approved for use in day-to-day operations in the region.

In early May 2014, The Nature Conservancy (TNC) and the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries), with support from the New England Fishery Management Council (NEFMC), hosted a two-day workshop to further regional efforts to implement EM in candidate fisheries. Approximately 90 fishermen, fishery managers, scientists, conservation organizations, and other stakeholders from New England, the West Coast, British Columbia and South Africa participated in the workshop. The workshop goals included: 1) Identifying clear goals for EM as a component of modernizing data collection and monitoring; and 2) Identifying key implementation challenges with specific recommendations for addressing them to share with the New England Fishery Management Council and NOAA Fisheries.

During the first day, participants gained a better understanding of national efforts to move EM from pilot studies to operational programs in the U.S. fisheries (see www.eminformation.com). Participants learned about work in the Northeast to better understand fishery dependent monitoring needs across fisheries, implement pilot projects for EM in groundfish, and identify barriers to EM implementation by the New England Council. Workshop participants also learned about the experiences of implementing EM in British Columbia and efforts underway on the West Coast of the U.S. Presentations and audio from Day One of the workshop can be found at www.nero.noaa.gov/mediacenter/publicevents/upcomingevents/em/info/index.html.

Day Two provided an opportunity for workshop participants to explore issues in more depth in four general categories identified and prioritized by the attendees. These included: Cost Drivers, Establishing Goals/Objectives, Technical & Performance Standards, and Data Issues. The breakout groups made a series of recommendations. While there was not enough time to refine or prioritize the list of recommendations, they serve as a starting point for further conversation regarding implementation of EM in the northeast.

Recommendations for Next Steps

- **Develop acceptable standards for an EM program to be used in the fixed gear segment of the groundfish fleet as a working example to build from.**
- **Develop a pilot study for use of EM in the Atlantic herring fishery using herring RSA funds.**
- **Consider whether EM could be used to meet some monitoring objectives for the Atlantic herring fishery, such as for monitoring compliance with slippage regulations.**
- **Establish clear goals/objectives for monitoring in fishery management plans that are achievable and the potential role EM could play in meeting those objectives.**
- **Clarify the goals and scope of the proposed EM program, as well as the governance structure and roles and responsibilities for parties in the system.**
- **Bring lessons learned from EM Workshop to Northeast Federal Fishery Dependent Data Visioning Workshop June 30-July 1, 2014 (see www.gmri.org/mini/index.asp?ID=60&p=189)**
- **Identify roles and responsibilities and accountability in the standard setting process.**
- **Draft performance standards from NOAA Fisheries for implementing EM within larger set of data streams.**
- **Assess quality of the existing fishery dependent data system and current performance standards for fisheries dependent data.**
- **Review technological options available for implementing EM.**
- **Prepare a draft paper of basic cost estimates comparing EM and At-Sea Monitoring (ASM) in groundfish and EM and Northeast Fisheries Observer Program (NEFOP) in Atlantic herring fisheries.**
- **Discuss costs for EM specifically and early on during the EM discussion process.**

The above recommendations may not reflect the opinion and/or approval of all workshop participants. The EM Workshop Steering Committee intends to continue convening throughout the summer of 2014 in order to further refine these recommendations to the Council and NOAA Fisheries. These efforts will be coordinated with the Council's EM Working Group, which is developing a white paper on barriers to implementing EM that will be finalized in September 2014.

About the Workshop

The Nature Conservancy and NOAA Fisheries, with support from the New England Fishery Management Council, convened a two-day workshop to identify the goals and key implementation strategies for use of electronic monitoring (EM) in the northeast. This workshop was developed by a diverse Steering Committee (see back page) over a six-month period and was facilitated by Laura Taylor Singer of SAMBAS Consulting LLC.

The workshop brought together approximately 90 participants including fishermen, fishery managers, scientists, conservation organizations, and other stakeholders from New England, the West Coast, British Columbia and South Africa. The workshop was participatory in nature with a focus on the following goals.

Goals:

1. Building off lessons learned at the national EM workshop to explore how EM can be implemented in New England fisheries;
2. Building broader awareness of EM technologies among New England stakeholders, including regulators, managers, industry and the public;
3. Identifying clear goals for EM as a component of modernizing data collection and monitoring in candidate fisheries, including groundfish, scallops, and herring; and
4. Identifying key implementation challenges and developing specific recommendations for the Council and NOAA Fisheries.

The workshop format provided several opportunities to break into smaller working groups to discuss specific topics in more detail. Workshop attendees brought a variety of expertise and knowledge about EM to the discussions. The discussions on the first day focused primarily on goals for electronic monitoring and generating a list of topics that need to be addressed in order to move forward with implementation of EM. Four of these topics: Cost Drivers, Establishing Goals/Objectives, Technical & Performance Standards, and Data Issues were selected by participants for consideration in more detail on Day Two.

The objective of the workshop was to work toward addressing three key questions:

a. *What are the goals for Electronic Monitoring in the Northeast?*
b. *What are the key implementation challenges for Electronic Monitoring that need to be addressed?*
c. *What Action Steps can be taken to address these challenges? Who should take the lead responsibility (i.e. a Council action? Regulatory? Industry-driven?) and when is progress realistic (i.e. by what date)?*

Recommendations from the Workshop

Several ideas and recommendations were generated during the process of the workshop. Although these ideas and recommendations were developed collectively, the workshop participants did not have time to refine them beyond the initial brainstorming work or to come to full consensus. Therefore, the following recommendations may not reflect the opinion and/or approval of all participants. They are presented here to document the workshop and provide a basis to inform future conversations and decisions regarding EM implementation in the Northeast.

Overarching Themes

Throughout the workshop, there were several consistent messages put forward by the presenters and by participants within the breakout group discussions. Collectively, they represent some of the key elements that should be considered as implementation of EM moves forward.

- Electronic monitoring is *one component* of a comprehensive fishery dependent monitoring system.
- Drivers for implementing EM vary by fishery and by gear type. *Compliance monitoring* and *reducing cost of At-Sea Monitoring* were consistently raised as primary objectives.
- Electronic monitoring implementation must *balance among many factors* including: cost – speed – data quality.
- Future EM efforts should continue with a *collaborative approach* to planning and implementation with a broad array of stakeholders.
- It is essential to prioritize establishing *deadlines and timelines* to help galvanize efforts.
- Industry involved in pilot EM projects see *promise in technology* to:
    - Reduce safety risks and address logistical challenges associated with carrying at-sea monitors
    - Provide more accurate bycatch and discard reporting
    - Supply vessel specific catch and discard data so that discards deducted from allocations are based upon the vessel's actual performance rather than an estimated rate
    - Eliminate "observer effect"[1] by enabling more comprehensive (100%) monitoring coverage.
    - Validate sustainability of fishing practices and traceability of product
- Implementation of EM should be *scaled to the size and financial capacity* of the specific fishery.
- The Northeast can *learn from others* such as the west coast and highly migratory species and use these as models to advance implementation.

[1] The "observer effect" refers to modifications in fishing behavior that may take place as a result of an at-sea monitor or fisheries observer being present on a fishing trip.

- Consider using a *phased approach to implementation* with specific fisheries, gear types, target species and vessel sizes that are more conducive to EM on a volunteer basis. Build off a tangible monitoring objective and working example.

Suggested Next Steps

The breakout groups on Day Two provided an opportunity to focus more specifically on action items and resulted in a series of recommendations with tentative timelines and potential responsible groups identified to address some of these next steps. Again, due to time constraints, the preliminary ideas were not refined nor were they a consensus opinion of all the participants in the workshop. These recommendations serve as a starting point for further work.

- **Develop acceptable standards for an EM program to be used in the fixed gear segment of the groundfish fleet as a working example to build from.**
  There was considerable discussion regarding goals and objectives for EM in the groundfish fishery and how to move from pilot projects to more broad-scale implementation. Some members of the fixed gear sector of the fishery are ready to implement EM as part of their sector operation plans. This would be part of a phased approach with the next phase applying this model to other segments of the fishery. The standards should be accurate, timely, verifiable, and ensure they are "measuring the right thing".

  Who: Council EM Working Group
  Want/need: Individual catch accounting/accountability; focus on discard-audit model (EM electronic vessel tip report (eVTR)) for groundfish regulated species (including non-allocated species).
  When: September 2014 to be used in sector operation plans (implemented in FY15). [Implementing EM through an Exempted Fishing Permit (EFP) may be an alternative approach.]

- **Develop a pilot study for use of EM in the Atlantic herring fishery using herring RSA funds.**
  The potential use of EM in the Atlantic herring industry was discussed and several questions were raised. The monitoring requirements for the Atlantic herring fishery may benefit from exploring how EM could be implemented as part of the monitoring technology used on the vessels. Although EM has been used in the Pacific whiting fishery, the need for a pilot project in the Northeast was identified. The results from this work could be compared with current groundfish pilot projects and Pacific whiting fishery.

  Who: unspecified
  Want/need: Slippage regulations in effect in January 2015; want to identify operational discards and slippage and ensure compliance; observer shortage limits flexibility to go fishing when desirable; accountability may allow access to closed areas; (dockside monitoring will likely be required)
  When: unspecified

- **Consider whether EM could be used to meet some monitoring objectives for the Atlantic herring fishery, such as for monitoring compliance with slippage regulations.**
  It was noted that Council members are concerned with different issues (e.g., bycatch, compliance, etc.). There is currently an Omnibus Amendment creating a framework for industry-funded monitoring programs for all New England and Mid-Atlantic fishery management plans, to include At-Sea Monitoring, portside monitoring, and maybe electronic monitoring. The Observer Advisory Committee will be providing input on this amendment for the New England Council. This may be a potential avenue to address the potential for EM in the Atlantic herring fishery.

  Who: Council's pending Observer Advisory Committee
  When: unspecified – add to preliminary agenda of Observer Advisory Committee

- **Establish clear goals/objectives for monitoring in fishery management plans that are achievable and the potential role EM could play in meeting those objectives.**
  Although the primary focus of the workshop was on electronic monitoring, it is a potential component of the larger monitoring system for a fishery. There was a clear need identified for fishery management plans to be more specific about the goals of the monitoring program so implementation could be designed to realistically achieve these goals.

  Who: New England Fishery Management Council
  When: as plans are developed

- **Clarify the goals and scope of the proposed EM program, as well as the governance structure and roles and responsibilities for parties in the system.**
  In discussing standards for a proposed EM program in the groundfish fishery, participants identified the need to clarify the scope of the desired EM program. The participants raised specific questions:
  - *What are the goals of the EM program as part of sector At-Sea Monitoring programs?*
  - *What is the scope of participation in EM as is currently being proposed (i.e., voluntary vs. mandatory participation, EM on all trip vs. a subsample, expected number of participants)?*
  - *What is the desired governance structure of the EM program? What are the roles and responsibilities of the parties in the proposed system?*
  - *Should the EM program improve on the current system and, if yes, how so? Collect more data and/or better data?*

  Who: New England Fishery Management Council
  When: Summer 2014

- **Bring lessons learned from EM Workshop to Northeast Federal Fishery Dependent Data Visioning Workshop June 30-July 1, 2014 (see www.gmri.org/mini/index.asp?ID=60&p=189).**
  Several workshop participants are also involved in the fisheries dependent data review process being conducted by Greater Atlantic Regional Fisheries Office (GARFO), Northeast Fisheries Science Center (NEFSC), and Gulf of Maine Research Institute (GMRI). The upcoming visioning workshop may provide an opportunity to produce a schematic of data uses, sources, connections etc. perhaps on a fishery-by-fishery or sector level. This could provide the assessment of the current system and how EM can be incorporated and could motivate clearly defined goals.

  Who: EM Workshop Steering Committee and members of the workshop who are working on the Visioning Project
  When: Prior to Visioning Project workshop in June, 2014

- **Identify roles and responsibilities and accountability in the standard setting process.**
  Workshop participants were unsure about the pathway to implementation of EM, especially with regard to the performance and technical standards that the system must meet. There is uncertainty about the technological specifications that boats will need to meet and the industry is looking for direction from NOAA.

  Who: EM Workshop Steering Committee to request that NRCC (and GARFO?) identify a person or group within the Northeast Regional Coordinating Council (NRCC) that has the responsibility for working on this, possibly with the Council's EM Working Group
  When: Spring, 2014

- **Draft performance standards from NOAA Fisheries for implementing EM within larger set of data streams.**
  There was considerable discussion about performance standards and crafting a draft document was recommended as a first step. The draft standards document should be made as a proposal to get feedback from stakeholders (i.e., engage in development of a mutually acceptable set-up). The use of a specific, targeted example that is a good candidate for success was also suggested (e.g.. work with one groundfish sector.) Specific consideration should be given to clarify what information we are asking EM technology to provide, potential trade-offs that must be made, and what are non-negotiable requirements.

  Who: NOAA/GARFO
  When: unspecified
  [This request is in accordance with 2010 commitment to provide guidelines for EM.]

- **Assess quality of the existing fishery dependent data system and current performance standards for fisheries dependent data.**
  The utility of the current fishery dependent data being collected through At-Sea Monitoring for groundfish sectors was raised throughout the workshop. Several participants noted that the current data collection may be sufficient for specific objectives, but not for others and this should be clarified and evaluated.

  Who: NOAA
  When: unspecified

- **Review technological options available for implementing EM.**
  The technology for video monitoring on vessels and analyzing video footage is continually evolving. EM systems are being used in Europe and Canada, as well as the U.S. The suggestion was made to continually share 'tools in the toolbox' to ensure that the best and most appropriate technologies available are used effectively.

  Who: unspecified, but Sea Grant Extension Network is a possibility
  When: unspecified

- **Prepare a draft paper of basic cost estimates comparing EM and At-Sea Monitoring (ASM) in groundfish and EM and Northeast Fisheries Observer Program (NEFOP) in Atlantic herring fisheries.**
  The discussion on cost drivers for EM acknowledged that they relate to the full monitoring program and the monitoring goals. However, it was suggested that documenting some of the primary drivers that can impact cost of implementing EM and ASM/NEFOP would be a useful exercise to create a framework for future conversations.

  Who: George Lapointe and GARFO
  When: June 2014 (outline of paper)

- **Discuss costs for EM specifically and early on during the EM discussion process.**

  The potential to reduce the cost of fishery dependent monitoring is one of the primary motivating factors to explore EM in the groundfish fishery. The cost of EM was raised repeatedly throughout the workshop. An important consideration is the scope of the EM program in relation to the value of the fishery. Several questions and concerns were raised which should continue to be part of the ongoing dialog about the utility of EM.

  Who: Council EM Working Group
  When: early and often

Group Discussion Summaries

Establishing Goals

Several discussions throughout the workshop addressed the issue of defining goals and objectives for the use of EM. Prior to the workshop, the Steering Committee developed a set of potential goals for EM in the groundfish, herring, and scallop fisheries that were reviewed by the Council Advisory Panels for these fisheries as well as the Council's EM Working Group. These strawman goals were used as a starting point during some of the workshop discussions (see Appendix).

Overall, goals for EM varied by fishery, but participants generally expressed interest in using EM to reduce the cost of monitoring, to provide more accountability, and to collect more accurate and timely discard information. Participants were interested in using EM to monitor compliance with full retention and codend slippage restrictions in the Atlantic herring fishery. Fishermen from the groundfish industry were interested in using EM to generate vessel-specific catch and discard data so that discards deducted from allocations could be based upon the vessel's actual performance rather than their sector's aggregated discard rates by gear/area or assumed discard rates. Other benefits of EM cited included: eliminating safety risks and logistical challenges associated with carrying at-sea monitors, and validating the sustainability of fishing practices and traceability of product.

Groundfish Fishery

Electronic monitoring in the groundfish fishery has been under discussion in New England for a number of years. Yet, there is no common understanding of the goals for using EM in the fishery. The workshop provided three specific breakout sessions for workshop participants to articulate what specific goals EM could address. During these discussions, many participants stressed that EM needs to be looked at within the context of the entire monitoring system because the broader monitoring goals for the groundfish fishery need to be articulated before defining how EM may help achieve those goals. The monitoring goals established in Framework 48 were used as the starting point for EM goals. The Framework 48 goals are listed below in italics and the range of initial comments regarding how EM fits within these goals are included below.

1. *Improve the documentation of catch*
2. *Reduce the cost of monitoring*
   - Cost effective monitoring should be an emphasis of EM.
   - Do not want EM to increase costs. Cost should be acceptable and cost efficient.
3. *Incentivize reducing discards*
   - It is unclear that EM will incentivize reduction of discards, but it will capture actual discards rather than relying on assumed discards
   - This may be considered redundant with number 1 (above).
4. *Provide additional data streams for stock assessments*

- Revise to read improved data, not necessarily additional data

5. *Enhance safety of monitoring system*
6. *Perform periodic review of monitoring program for effectiveness*
   - Program evaluation needs to consider cost/benefit and return on investment in program. Fishermen fish for money and will eventually be paying for the monitoring. There needs to be some return on that investment.
   - This is an activity rather than a goal.

Additional suggestions for goals and objectives for implementing EM included:

- *Instilling trust in the management system*
  - EM will allow fishermen to validate their fishing activities and counter negative public perceptions.
  - EM will level the playing field among fishermen and improve trust.
- *Create streamlined experience of monitoring for vessels.*
- *Compliance - To provide reliable estimates of at-sea discards*
  - Need a broad level objective such as compliance. Then, if other groups want to take their EM plan a step further, they can, and they will absorb the additional costs.
  - EM doesn't weigh fish out at the dock, but it certainly allows you to have more confidence in the fish being weighed out (knowing what has been discarded).
  - Reliable estimates of At-Sea discards
- *To have a monitoring system that supports the management goals.*
  - The attributes are timeliness, safety, and accuracy.
- *For EM to complement human at-sea observers to collect data to achieve broader monitoring goals of the industry.*
  - Develop infrastructure to allow EM as a part of a sector's monitoring plan.

It was mentioned by some workshop participants that there have been previous conversations around monitoring goals that should be considered. For example, during 2011-2012, the Gulf of Maine Research Institute facilitated a Monitoring Working Group to discuss monitoring for groundfish sectors around the Council's development of Framework 48. The focus of one of these meetings was to establish goals for groundfish monitoring and the following two goals were identified:

1. *For the monitoring program to collect the most robust data possible*
2. *Create a monitoring program to account for groundfish catch (by area fished/gear type) for the purpose of* annual catch entitlements (*ACE) monitoring at optimized levels of accuracy and precision and in the most cost effective approach.*

Workshop participants debated whether the current At-Sea Monitoring (ASM) system for groundfish sectors meets the monitoring goals developed in FW 48 and asked what can EM do to better to achieve the overall ASM goals. The ASM regulations require a 30% Coefficient of Variation (CV) for catch estimates, which is achieved by a combination of NEFOP observers and at-sea monitors. The target annual coverage level is determined by NOAA Fisheries, but has been between 22-38% since 2010, leaving ~70% unmonitored. It has been documented that fishermen behave differently when an observer is onboard the vessel and this "observer effect" may increase the potential for inaccuracy of discards.

Under an individual or sector quota system, there is a strong incentive to discard choke species and some advocate for 100% monitoring through the use of EM to increase incentives for compliance. Fishermen are required to report their catch and discard estimates using the vessel trip report (VTR). Some participants feel that the current VTR system does not meet all needs and is unrealistic to comply with for many fishermen. The data fields are too course and discards are an estimate that can vary widely in accuracy. There needs to be a different system other than VTR, that would combine VTR and ASM/EM, that is coherent with data that has value to the fishing industry. The Study Fleet model does record tow-by-tow discard data on eVTRs of all species, not just ACE-managed groundfish species. Study Fleet will be phased in slowly, as not the entire industry will adopt wholesale right away.

It was recognized that EM isn't going to address all of the monitoring goals, such as biological sampling, and must be used in combination with other monitoring. Its application also varies from fishery to fishery. However, EM can be used as a method to validate discards from the groundfish industry (verify piece counts or weights of species) reported in the logbook.

The groundfish sector quota system creates more pressure for accurate catch-by-catch data that is timely. The fishing industry wants individual vessel-level catch accounting and individual catch accountability, with standards that incorporate accurate, timely and verifiable data. NOAA Fisheries wants accurate catch accounting for precise catch estimates, which could be achieved with 100% ASM, but that is cost prohibitive. A combination of using eVTR linked with EM may provide more accurate data. The desire is for better coverage rates than the current ASM system for limited costs. The concept of verifying fishermen's data, and giving them the tools to ensure data are tabulated in a standard, verifiable way, is an incentive for fishermen. The fishermen want catch accounting/discards, the scientists want data for stock assessments and the managers want compliance and catch accounting.

Standard Guidelines for Sectors

Workshop participants discussed what role NOAA Fisheries should take with regard to setting goals and standards for At-Sea Monitoring and use of EM by sectors. Some advocated for GARFO to set at-sea monitoring goals and then allow the fishing industry to determine if they want to use EM to achieve these goals.

Each sector is required to submit an annual operation plan. GARFO is required to publish a rule that has performance standards for EM in order for a sector to propose EM in their operation plan. However, it is still unclear what sectors want EM to be used for so it has been difficult to write the standards. NOAA Fisheries also needs to build the data infrastructure to integrate the data into the current system. It was noted that the amended standardized bycatch recording methodology (SBRM) will be implemented soon and may be used as a basis for standards.

GARFO would prefer to have one overarching set of goals for using EM rather than having each operations plan have something different. Although the concept behind sectors was to

have the flexibility to work with different sectors, the agency hasn't always been able to treat each sector separately and in some cases is legally restricted from treating fishermen differently. The agency needs to be fair and equitable among sectors, which makes it more difficult to be flexible by sector. The trick will be finding a balance between flexibility and general standards. Although flexibility from sector to sector is limited, GARFO can differentiate from gear type to gear type.

Again, emphasis was placed on the idea that EM is a part of the entire monitoring system. EM data is not a direct replacement of the discard rate that goes into the Sector Information Management Module (SIMM) because the quality and scale of the data may not be as accurate. If use of EM results in data that is less accurate or precise (i.e., more uncertainty) this would result in more quota being taken out of a sector's ACE and lower the available annual catch limits (ACL) for sector vessels.

Data standards also need to be addressed. Typically, the government develops a scope-of-work with data standards and publishes it and then the service providers submit proposals that meet those standards. The industry is required to use the provider or providers that have been selected. NOAA Fisheries is not prepared yet to define data standards for EM and then solicit and select provider(s).

Cost-effective

While discussing goals of implementing an EM system, the costs of the system were raised several times. It was noted that the goals and objectives might vary depending on who pays (i.e., industry funded goals may be different than agency-funded goals). A monitoring system to provide accurate, timely, and verifiable catch information can be designed, but who pays for it and how much it costs are critical factors. Equitable distribution of costs and value to different segments of the fleet was suggested as an important objective.

The lessons from British Columbia (BC) provided participants with some information. It was emphasized that there is no "off-the-shelf" EM system to purchase but rather the system needs to be designed to fit the goals within your available budget. In BC, the objective for EM within the crab fishery was to bring costs down to deal with "cheaters" in industry by monitoring the vessels. Monitoring all fishermen was a tactical choice, not a goal. In BC, they wanted yellow-eye rockfish catch accounting, and not all ancillary goals. It may be frustrating and cost prohibitive to try to solve everything at once.

In the BC groundfish fishery 100% monitoring was required by DFO and the industry needed to design a program to meet DMF's objectives. Electronic monitoring is still evolving in Canada. The primary costs are for the onboard equipment and for the validation of the video captured. This can vary significantly depending on the percentage of video being reviewed. You can have 100% EM on vessels, but the cost driver is how much you validate/review data (e.g. 10% or 100%). The BC model uses a third party to review the data and certify it prior to giving it to the agency.

The BC groundfish fishermen are accountable for a sub-set of species (quota-managed species), the system is built around those they are accountable for, not those they are

responsible for (e.g., basking sharks). If the video matches what the fishermen says, the conservation goals are being met. However, if you only interact with 6 sharks a year you can document to the public that these are being recorded and the fishery is being responsible.

Study Fleet was raised as a potential complementary system to implementation of EM. Study Fleet generates accurate haul-by-haul data and the fishermen are paid to report at this level. Electronic monitoring isn't for everyone, so NOAA Fisheries wouldn't require this level of reporting for those not involved in EM.

Phased Approach with Set Deadlines

Workshop participants were encouraged to think about a phased in approach by concentrating on one thing (e.g., groundfish and individual vessel-level accounting) to implement a basic EM system and then build from there. If individual catch accounting is an incentive, then it would make sense in a phased implementation to start with using EM to generate discard estimates for folks fishing under that scenario. Electronic monitoring has never been implemented in a fishery that didn't set dates for action steps and implementation. It was suggested that one segment of the fleet (i.e. fixed gear) be targeted for implementation from which to learn from.

Based on the conversation surrounding goals for implementing EM in the groundfish fishery, the following preliminary recommendation was drafted:

- **Develop acceptable standards for an EM program to be used in the fixed gear segment of the groundfish fleet as a working example to build from.**
  Some members of the fixed gear sector of the fishery are ready to implement EM as part of their sector operation plans. This would be part of a phased approach with the next phase applying this model to other segments of the fishery. The standards should be accurate, timely, verifiable, and ensure they are "measuring the right thing".

  Who: Council EM Working Group
  Want/need: Individual catch accounting/accountability; focus on discard-audit model (EM electronic vessel tip report (eVTR)) for groundfish regulated species (including non-allocated species).
  When: September 2014 to be used in sector operation plans (implemented in FY15). [Implementing EM through an Exempted Fishing Permit (EFP) may be an alternative approach

  Other considerations: Who pays? How are providers approved/selected? Do standards need to come first? Maybe look at EMP approach. Not necessary to focus on fixed gear, just to focus somewhere to inform larger guidelines.

Herring and Highly Migratory Species

There were two breakout sessions where goals regarding use of EM in the herring fishery and the highly migratory species (i.e. tuna) fishery were discussed. Participants in these fisheries have spent less time considering how EM could be utilized, but shared some common goals such as documenting catch compliance with regulations.

Participants in the herring fishery were most interested in monitoring to:

- Document catch and bycatch of river herring and other species in conjunction with portside sampling
- Record compliance with slippage restrictions

The Massachusetts Division of Marine Fisheries (DMF) has developed EM and ER (Electronic Reporting) as part of an improvement to the River Herring Bycatch Avoidance Program. With funding from the National Fish and Wildlife Foundation and The Nature Conservancy, DMF has the ability to port sample small-mesh bottom trawl and mid-water trawl landings in the Atlantic herring and Atlantic mackerel fisheries. Staff samples the entire offload and calculates the bycatch amounts of river herring. The bycatch amounts from the sampled trip are reported back to the sampled vessels, as well as, advisories are sent to the entire fleet on areas to avoid due to the potential of high river herring bycatch. While participation in the program is voluntary, all active vessels communicate with DMF and receive alerts, and two thirds of vessels are reporting electronically via Boatracs technologies. Electronic reporting is helpful in speeding up the reporting to and from the fleet. Electronic reporting allows immediate transmission of observer data, which can also be incorporated with DMF portside sampling data, increasing the data available to inform the vessels with. The EM and ER costs for the project are relatively inexpensive because of its small scale (6-8 vessels) and the goal of the study, which was not to develop a full-fledged EM system, rather, use EM/ER to modernize the existing monitoring and bycatch avoidance system. Using Boatracs products provides EM and ER capabilities that have modernized the River Herring Bycatch Avoidance Program.

It was noted that EM would not be useful in identification of river herring because the quality of the images are not detailed enough for that purpose and sometimes fish have to be cut open to make a positive identity. It could document the occurrence of bycatch but not necessarily identification or quantification.

Electronic moniroting could be helpful in getting data on “unobserved” trips. However, the number of baskets that need to be sampled at sea to get accurate estimates would not be manageable in a high volume fishery like the herring fishery. Participants remarked that EM will never replace observers.

Electronic monitoring is helpful if viewed as part of a total “electronic technology package” to document herring fishing activities (in addition to portside monitoring). Net sensors can be used to determine the weight of the net before and after it is released to identify when slippage is occurring or has occurred based on weight differences. A slippage event can be

documented and a video camera on board the vessel can verify whether the operator complied with reporting the event and other restrictions. Currently, slippage is only prohibited on observed trips. This equates to 100% of trips into the closed areas, because midwater trawlers get 100% observer coverage in the closed areas. However, the trips outside the closed areas have no slippage prohibitions. These is interest in having the slippage prohibitions and 100% observer coverage apply to all midwater trawl trips, but that would be cost prohibitive. EM might offer a solution by providing 100% video monitoring for all trips at less expense.

The amount of video reviewed would depend upon what information is needed. Some participants viewed EM more as an enforcement and compliance mechanisms. Others felt it could enhance the observer program and be part of an effective catch monitoring program.

The group concluded that purpose of using EM in the herring fishery would be mainly to document slippage events, but not for bycatch identification because verification is needed. The current technology not good enough as a stand alone tool, but may be useful as part of a package. Members of the fishing industry view EM as useful to address negative perceptions of the herring industry and provide individual vessel-level accountability. For herring, 100% coverage may be the right level, though this is not realistic for all fisheries and EM levels should be tailored to the fishery. Specific objectives for implementing EM in the herring fishery include: compliance, slippage, cost reduction, reducing the burden on observers, validation (video photo can corroborate operators), and verification of discard logs.

Beyond monitoring slippage, members of the herring industry are concerned that there is an observer shortage problem and they won't be able to go fishing if an observer isn't available. This is especially relevant in closed areas where there is a 100% coverage requirement.

Costs and Benefits

There may be financial benefits to the use of EM if it can reduce the number of observers. It was also mentioned that documenting fishing operations would likely decrease "fighting" at the council level. There was concern, however, about who reviews and managed the video data and whether there is infrastructure present to support this.

Participants identified barriers to utilizing EM in the herring fishery. They included the costs and the current lack of infrastructure (regulatory and data systems). Concerns were raised about NOAA Fisheries ability to support the current portside sampling program and whether the government would have the financial resources to support both portside sampling and EM.

Council staff clarified that NEFOP will always be a component of the monitoring system for herring, and observers will supplement that up to 100%. This level of monitoring is above the level needed for stock assessment, but is for compliance purposes (i.e., documenting a slippage event).

It was suggested that lessons learned from the groundfish pilot EM work may be useful for the herring fishery as well as the Pacific Whiting studies, which might be more applicable. One suggestion was for a pilot herring EM program funded through the herring research set-aside.

It was noted that Council members are concerned with different issues (e.g., bycatch, compliance, etc.). There is currently an Omnibus Amendment creating a framework for industry-funded monitoring programs for all New England and Mid-Atlantic fishery management plans, to include at-sea monitoring, portside monitoring, and maybe electronic monitoring. The Observer Advisory Committee will be providing input on this amendment for the New England Council. This may be a potential avenue to address the potential for EM in the Atlantic herring fishery.

Quota Monitoring for Pelagic Longline Fishery

The pelagic longline fishery is interested in using EM for quota monitoring.
The current regulations scheduled to take effect in 2015 for highly migratory species require 100% monitoring and the cost and availability of human observers will prohibit vessels from leaving the dock.

Members of the tuna industry suggested that if herring fishermen have EM onboard (without an observer) and the system is tamper proof and captures everything an observer can capture, then herring boats should be allowed to go into closed areas. Herring fishermen will behave as if there is an "observer" onboard (i.e. observer effect) and fewer observers will be needed in the herring fishery to free up observers for the tuna fishery.

NOAA Fisheries described the EM program that will be implemented in the pelagic longline fishery for Highly Migratory Species from the Gulf of Mexico to New England in 2015. The goal is to verify the accuracy of counts and identification of bluefin tuna bycatch reported by the vessel operator, and potentially augment data used to estimate bluefin dead discards. The monitoring system includes EM combined with logbooks, at-sea observers, and Enhanced Mobile Transmitting Unit (E–MTU) Vessel Monitoring System 'real-time' reporting of bluefin catch. The EM program will be implemented, if finalized, among the approximate 137 long-line vessels. Vendors are currently being sought and the plans are under development. NOAA's Highly Migratory Species Division is collaborating with Southeast Fisheries Science Center and the Northeast Fisheries Science Center to implement the program. Funding may cover deployment, data storage, etc. The government will own the data.

Although the primary focus of the workshop was on electronic monitoring, it is a potential component of the larger monitoring system for a fishery. There was a clear need identified for fishery management plans to be more specific about the goals and objectives of the monitoring and they should be achievable.

Several recommendations were generated from the discussions:

- **Develop a pilot study for use of EM in the Atlantic herring fishery using herring RSA funds.**
  Although EM has been used in the Pacific whiting fishery, the need for a pilot project in the Northeast was identified. The results from this work could be compared with current groundfish pilot projects and Pacific whiting fishery.

  Who: unspecified
  Want/need: Slippage regulations in effect in January 2015; want to identify operational discards and slippage and ensure compliance; observer shortage limits flexibility to go fishing when desirable; accountability may allow access to closed areas; (dockside monitoring will likely be required)
  When: unspecified

- **Consider whether EM could be used to meet some monitoring objectives for the Atlantic herring fishery, such as for monitoring compliance with slippage regulations.**
  There is currently an Omnibus Amendment creating a framework for industry-funded monitoring programs for all New England and Mid-Atlantic fishery management plans, to include At-Sea Monitoring, portside monitoring, and maybe electronic monitoring. This may be a possible avenue to address the potential for EM in the Atlantic herring fishery.

  Who: Council's pending Observer Advisory Committee
  When: unspecified – add to preliminary agenda of Observer Advisory Committee

- **Establish clear goals/objectives for monitoring in fishery management plans that are achievable and the potential role EM could play in meeting those objectives.**
  There was a clear need identified for fishery management plans to be more specific about the goals of the monitoring program so implementation could be designed to realistically achieve these goals.

  Who: New England Fishery Management Council
  When: as plans are developed

  Other considerations: Is current data system ready for data from EM? Monitoring goals and use of EM are fishery specific. Be aware of lots of questions/unknowns, but don't use that as an excuse not to move forward on small projects.

Scallops and Surf Clams

While discussing the potential use of EM on scallop vessels, some participants felt the current 3 to 10% of observer coverage is adequate for monitoring bycatch of flatfish and therefore EM is not needed for this purpose. Scallop vessels have not documented catch of protected species (e.g., turtles) since 2006 so there was no perceived need for EM for this purpose. However, there is some potential use for dockside cameras to compare scallop landings with dealer reports. The potential use of video cameras on scallop vessels to monitor compliance was also suggested. By placing a camera on the winch and comparing

this with VTR data, the location and time of fishing could be determined. Electronic monitoring could also be used on scallop vessels for research purposes and to document catch [for consumers] throughout the supply chain.

Workshop participants from British Columbia emphasized that all electronic technology should be discussed together as all have strengths and weaknesses. These could include video cameras, electronic logbooks, identification tags inside of buoys, etc. A lot of technologies are considered part of an electronic monitoring system in BC, not just cameras. It is important to continuously explore and investigate new technologies as needed.

For example, Ecotrust deploys radio frequency identification tags (or RFID tags/chips) in the buoys used for crab trap fishery. Each time a trap is hauled, the buoy is scanned and that data goes into the EM system. The tag information is linked to GPS data with date, time and location of where that trap was last scanned. This information provides data on how many traps are being hauled (since each trap has a unique tag), how often they are being hauled (since most trap fisheries have soak time regulations) and where they are setting their traps (to make sure they are fishing in the regulated areas). The Ecotrust software automatically analyzes the data for certain flags (like the ones listed above), which are then reviewed by the analyst. A random selection of video is also reviewed for general compliance.

There may be marketing benefit to electronically monitoring the product, but some are skeptical about the true value of this for the fisherman.

The surf clam industry will be implementing electronic logbooks in the near future with 100% compliance as the target for 2014. Participants felt there is no need for EM in the surf clam fishery.

Program management of EM was raised as a concern, especially with regard to data systems and data ownership. There need to be centralized control of a vessel monitoring system. Does the federal government need to be the first place and central place for data to go? Who is responsible for data accuracy? Issues of cost sharing were also raised.

Reporting standards that must be met by outside venders who want to design the new systems need to be developed and published. It would be useful for the fishing industry to bring very high tech folks into the discussion.

Cost Drivers

The costs associated with EM systems was one of the most pressing issues for participants at the conference. During the afternoon of Day 2, two sequential breakout groups discussed cost drivers for EM. During both of these discussions, it was acknowledged that it is hard to talk about cost drivers before having clear monitoring objectives. For example, cost could vary significantly if the program is for enforcement or for research purposes and if it is voluntary or required by all vessels.

Participants felt that it is important to define the scope of work to identify costs as costs can change with changing expectations. For example, the BC crab fishery has experienced changing expectations regarding what is being monitored through EM. Program objectives and expectations need to be clear by all parties from the start. Some workshop participants expressed concerns that EM may start small, but then have increased expectations over time.

Despite the lack of clarity on goals and objectives, the breakout groups saw some value in having a general discussion on cost drivers. The conversations focused primarily on identifying various aspects of factors that can impact cost and also creating a list of potential benefits to EM.

Factors to Consider

- *Roles and Responsibilities of NOAA Fisheries, NEFMC, Industry, and Third Party Providers*

  Specific costs and responsibilities need to be defined and agreed to by all parties. Several ideas on how the roles and responsibilities for EM may be allocated and who should bear which costs for an EM program were discussed. Many participants had questions about which costs the fishing vessels will bear (i.e. video equipment, etc.) and which will be paid for by NOAA Fisheries. The fishing industry's interest in EM is driven, in part, by the cost and the inconvenience of having a human observer on the vessel. It is important to better understand which costs for EM will be borne by the fishing industry so fishermen can better evaluate the cost/benefit of an EM system on their vessel. There was also a discussion regarding the current internal data handling practices by NOAA Fisheries, especially with regard to monitoring groundfish sector quotas, and how that may be impacted if some vessels in the fishery use EM and some do not.

  The NEFMC does not have direct responsibility for implementing an EM program, but their role in setting goals and objectives for the program can have profound impact on the potential costs. Amendment 16 provided for EM as a potential alternative but the ability for GARFO to approve an EM system for sectors is limited to the framework that was established for the sector operations plans.

Third party service providers could be used for EM and may have a role in video review, leasing of equipment, and equipment maintenance. Most participants in the workshop believe that a third party provider is more cost effective than NOAA Fisheries.

- *Video Review and Analysis*

Understanding the amount of video review, who will review the video, and who pays for video review are important cost considerations. In Alaska, they developed in-house expertise within NOAA Fisheries to review video instead of using a third party. There are different costs associated with different reviewers. One suggestion made was to look at Gulf of Alaska observer program analysis to compare in-house to third party costs. The question was raised whether it is permissible for a third party to conduct the video review if the purpose of the EM program is for compliance monitoring. Perhaps protocols could be developed to clarify if certain enforcement issues are observed during video review they are passed along for further agency review. It is important to maintain a secure chain of custody for the video review.

- *Cost of EM vs. Value of Fishery*

Workshop participants suggested that it might be useful to evaluate the scope of the EM program in relation to the value of the fishery. Rather than determining objectives for the program and building EM to meet objectives, one can also start with a certain budget number and then see what EM program fits into that budget. A practical approach might be to build the EM program for the appropriate scope and scale of the fishery. For example, the groundfish industry is valued at only $60M annually; a big EM program may not be cost effective. If the scope is for compliance purposes then it is assumed the EM program would be much less costly compared to a program to include species identification.

- *Start-up versus Maintenance Costs*

Start-up costs for EM include both data infrastructure and system hardware. Capital costs and on-going operational costs need to be considered. Previous EM experience shows that maintenance and video review are more significant cost drivers than start-up costs. Setting up the data system and flow and getting infrastructure together is a significant commitment and expense and there were several questions about who is responsible for start-up costs and how they can be recovered over time. Questions remain for many workshop participants if EM can really reduce the cost of monitoring and if it is cost effective.

- *Dockside Monitoring in Groundfish in Relation to EM*

There were several questions about how EM would fit with the current dockside monitoring program. Concerns were raised about the long-term viability of an EM program (i.e., Is EM a “flash in the pan”?). It was suggested that dockside monitoring is a

cost driver if it is considered part of the EM system. Dockside monitoring validates the transaction to show fish were caught and to get weights and it not considered as costly as At-Sea Monitoring. Some participants believe the cost of monitoring would increase if EM is used as the primary means of data gathering.

- *Competing Costs for Monitoring Needs*

Workshop participants noted that there would need to be a transition from the old monitoring system to a new monitoring system. Questions were raised about how costs would be shared to pay for a new monitoring system in addition to the old monitoring system and whether fishermen would have a choice between two parallel systems.

Participants were reminded that EM is one tool in the whole monitoring program and it is valuable to think about the monitoring program and associated costs holistically. Workshop participants noted that it is important to understand monitoring needs before defining the tools. NOAA Fisheries is currently collecting information to develop a data modernization process. The first step is to identify needs through the stakeholder interview process before proposing an overhaul of fishery dependent data monitoring. There are "bigger picture questions" to be discussed before getting into a discussion about specific EM tools. Results from the interviews will inform the process moving forward.

There is a need for a robust monitoring program with EM as one component of an overall monitoring program. The costs of the entire monitoring program need to be considered. For example, if NOAA Fisheries requires maximum retention with dockside monitoring, an observer will still be necessary to conduct the biological component. There are tradeoffs and workshop participants questioned whether EM would relieve other sampling costs.

Industry participants in the workshop suggested that NOAA Fisheries make an institutional investment prior to implementing industry funded monitoring. The industry will be reluctant to put resources toward monitoring unless there is a clear commitment from NOAA. Support and cooperation will help EM move forward. The perception by some industry participants is that fishery dependent monitoring costs continue to increase and EM could add more expense. There was concern that implementing EM would simply be a shift in resources instead of new investment in monitoring.

- *Role of At-sea Monitors*

Fishermen continued to express concern about the cost of At-Sea Monitoring and are seeking clarification from NOAA Fisheries as to the utility and methods for approving EM as a substitute for ASM. If ASM were required for 30% of the vessel trips, would EM coverage be the same? It was noted that EM would replace only some of what observers do but not everything.

During the April 2014 Council meeting, there was a discussion of observer costs, including the number of observer days and the ability of the groundfish fishery to handle additional observer days. If NOAA Fisheries has fixed costs distributed over fewer observed days, does the cost per day increases? NOAA Fisheries staff responded during the workshop that there is not a direct ratio such that fixed costs decline with a decline in observer days.

- *Indirect Costs of Adopting EM*

Workshop participants also raised several concerns about the indirect costs of adopting EM. They noted that it is important to measure what other valuable data may be lost, if the data is improved, and if costs are actually reduced by using EM.

It is also important to balance the cost and benefits of waiting for the results of on-going comprehensive reviews compared with the desire to address current needs. There is a potential cost of acting too soon. Within the herring fishery, the industry expressed concern about the cost of waiting to implement EM. Both slippage and discard rates can be monitored by onboard video cameras, but species determination cannot. In general, if the monitoring needs of a fishery are already being met, then more monitoring may not be necessary.

Participants also noted that there are institutional changes necessary by NOAA Fisheries to implement EM. If the EM program is a small-scale operation, then most services could be contracted out. Concerns were raised about what programs or services would need to be dropped in order for NOAA Fisheries to implement an EM program as there are trade-offs with capacity of federal staff. It was noted that national funds may be available to implement EM. Consider cost for Agency of having ASM and EM.

- *Establishing Standards and a Vessel Monitoring Plan*

The standards established for an EM system can affect costs. Although some participants suggested general standards for EM be developed, others remarked that it is difficult to set up an industry-wide standard, as there is too much variability with different gear types, handling procedures and vessel types. They suggested the initial goal be to implement EM in the groundfish fishery and then negotiate standards between the sector and NOAA Fisheries in sector's operations plan.

The question was raised whether EM video review could be tailored to a sector. For example, if dabs were an issue, then review 90% of the video, but only 50% for haddock. This would vary by fishery and could be used to set up a threshold. This information could be included in sector operations plan and then could be a negotiating point between sector and NOAA Fisheries. Some workshop participants noted that a standard derived by negotiation needs to balance conservation goals and achievable standards.

The cost of an EM system can have an impact on efficiency and effectiveness of the monitoring program. Incentives to reduce costs could lead to innovations in handling practice and the development of new technologies to achieve monitoring objectives. Costs for EM, especially the cost of data transfer and communication, should shift dramatically with technological improvements. These advances in technology should be considered when weighing potential costs of EM. GARFO will analyze the relative costs of EM and ASM to assist in cost analysis as part of considering EM; this report should be available in fall 2014.

A vessel monitoring plan was suggested as a way to verify that vessels are set up correctly, which should be part of the EM program agreed to by all parties. In British Columbia, penalties for failure to adhere to a vessel monitoring plan provide incentives for vessels to comply with management program requirements. For example, if the fishermen stand in the wrong place blocking camera view, then the fisherman has to bear the cost of additional video analysis. Feedback reports from the provider after each trip lead to improvements over time.

- *Monitoring for Maximum Retention*

Workshop participants briefly discussed some implications for establishing an EM system under a maximum retention scenario in the groundfish fishery. Costs for maximum retention include dockside monitoring, disposal of discards, time at the dock, etc. Some fishermen believe there are operational and ethical problems with bringing in small fish to the dock. Requiring maximum retention for research may be necessary, but it is not preferred on a daily basis by the fishing industry. However, there has been an academic argument for harvesting all age and size classes in the conservation literature. Participants questioned the social costs of a maximum retention system (e.g. landing undersize fish).

Process and Transparency for Determining Costs for EM

The discussion about cost drivers raised issues about who has responsibility for determining and addressing costs. It is important to determine what information is needed from the data and to make sure EM is a part of the decision tree early on in the process. Some participants questioned whether the New England Fishery Management Council's EM Working Group is the right venue for these discussions and suggested a larger group may be needed to move this forward.

Questions were raised about the benefits of some level of standardization and whether EM would be totally optional or required by the whole fleet. The Council is establishing an Observer Advisory Committee and it was suggested that this might be a relevant group for EM discussions. Although it is necessary to look at an overview of the overall costs among various fisheries (i.e., groundfish, herring, tuna, etc.), an EM program will vary for different fisheries management plans and it is more applicable for monitoring some than others.

Participants advocated for industry participation as a critical component to EM discussions. They felt industry members should be included in the development and implementation decisions along with NOAA Fisheries staff. Third party providers can also help determine cost estimates for EM. However, cost depends on the fishery and the program design and third party providers are not always eager to share all their costs. Cost categories should be identified early on with NOAA Fisheries, Council and industry. Again, workshop participants called for clear goals for using EM for monitoring in order to design a monitoring program and understand costs (e.g., audit or maximum retention).

The Council is delving more deeply into monitoring issues on a fishery-by-fishery basis. Workshop participants advocated for a transparent process through the Council. The Council needs to clarify broad monitoring to determine EM costs. A more thoughtful monitoring discussion by fishery may be most beneficial to see how EM fits into the context of current monitoring. For example, if a video camera is needed to monitor herring vessels in addition to dockside monitoring, is this less expensive than ASM? Many workshop participants are still not sure that EM is a cost effective tool for groundfish.

Completing a Cost Assessment and Analysis

Some workshop participants want to see objectives and a cost analysis completed before deciding to move forward with an EM program. A cost/benefit analysis of ASM versus EM in groundfish was suggested during the workshop discussions. However, it was unclear which organization should take responsibility to conduct an EM costs analysis. One suggestion was to separate costs into categories (data analysis, equipment, etc.) and then decide who should deal with each category. If the Council mandates EM for the groundfish fishery, then it was presumed that the Council is responsible for calculating costs. If sector operations plans become the avenue for negotiating an EM monitoring system, then a bigger overview by NOAA Fisheries may not be necessary.

Some fishery specific data is useful in cost analysis. The Fishery Dependent Data Modernization workshop at the end of June will help provide industry feedback. An "industry report" is expected by the end of September and then NOAA Fisheries will make recommendations afterward. A cost assessment could be done after the information is collected through the Data Modernization Project.

The fishing industry is anticipating that costs will be shifted to the industry shortly and they will want to do an industry cost analysis. A pressing question for the industry is whether the assumed discard rate will be more or less favorable with a video camera onboard the vessel. Some fishermen would rather have a person than a video camera while others just want to go with whatever is the least expensive. For example, there is a herring fishermen who called in for an observer on every trip to prove that there was no haddock bycatch occurring. For him, it was less expensive to pay for an observer in order to log "0" for the trip than pay the assumed bycatch rate. Some industry members consider comparing EM to ASM a "paper exercise" as they are assuming that cameras will be cheaper

than observers for the herring industry. Although a camera won't be able to identify species, dockside monitoring will provide that information and the system will presumably be cheaper than ASM.

Dan Morris (GARFO) and George Lapointe (NOAA consultant) committed to work on a cost estimate model for EM. Workshop participants all agreed that this should be simplistic with concrete examples and clear scope that outlines data flow, uses and costs. It may be worthwhile to develop a flow chart for EM cost comparison. Various monitoring design questions could lead to endpoints with varying cost ranges attached. We need comparison of NOAA Fisheries cost versus other costs for EM in order to compare "apples to apples" when considering EM options. The analysis should also clarify relative cost implications ranging from audit to maximum retention to census. It's likely that service providers know these numbers, although they have sometime been reluctant to share this information. The suggestion was made to contract one of the service providers to write a report that establishes cost estimates.

Questions were raised by participants about how coverage rates for EM are calculated. In BC, if data is used to validate the captain's VTR report then they look at 10% of the trip. That audit determines if the report is within the range of acceptability. If not, then more data/video would be reviewed. What percent review is required by compliance standards? If the captain fails then the industry pays for higher percentage review.

Ideas and Questions for Consideration

Technical design questions:

- What do you want the system to do?
- Can the current ASM model be modified to accommodate EM?
- Is camera on all the time?
- How many modifications are necessary to outfit the vessel?
- System maintenance and breakdowns are other factors. What happens if there is a technology failure?
- Size and type of gear influences initial set up.
- Camera resolution and specs and frame speed. Take a picture every five seconds vs running video?

Data analysis and storage questions:

- Which services, equipment and data storage and analysis is done by NOAA Fisheries and which are done by other third party providers?
- How much video needs to be reviewed? What percentage of video analysis is required?
- How long is data storage?
- How do you transfer data?

- Frequency of data retrieval and method of data retrieval impact cost. Cost/benefit for data advances.
- System design considerations: How many questions are you trying to answer? The higher the complexity, the higher the cost. Consider the minimum data needs. There could be different tiers of review with different functions.
- Data analysis, storage, archival plan.
- What's data turn-around time and who does the review?
- Training of monitors to review data. Will the Agency take that on in house and take on some of those costs with their capacity?
- Software licenses (1 per boat or 1 per sector) bundled or separated?

Benefits of Using EM as Part of a Monitoring Plan

Workshop participants also took time to talk about the potential benefits of using EM as a component of a monitoring plan. What's the realm of possibilities that may also impact the bottom line in terms of savings and other benefits? The following list of idea was generated during the discussion:

- Accurate discard analysis would be real versus assumed.
- Incentives for more eco-friendly fishing system. Credit for good conservation practices.
- Benefitting industry fishermen, incentivize better behavior.
- Impacts of social behavior – peer pressure to fish better.
- Use EM for security at the dock – leave cameras on.
- Proof for liability and injury.
- Office of Law Enforcement (OLE) cases proof.
- Confirmation of where fish come from. Accurate area catch accounting.
- Marketability, traceability levels the playing field.
- 100% accountability of discard leads to reduce assumed discards. If trip passes use real discard and if it fails use assumed discard.
- Impacts on management and scientific uncertainty.
- Regulatory streamlining. EM would eliminate "fish down to zero" practice.

There were two recommendations made by workshop participants for next steps:

- **Prepare a draft paper of basic cost estimates comparing EM and At-Sea Monitoring (ASM) in groundfish and EM and Northeast Fisheries Observer Program (NEFOP) in Atlantic herring fisheries.**
  The discussion on cost drivers for EM acknowledged that they relate to the full monitoring program and the monitoring goals. However, it was suggested that documenting some of the primary drivers that can impact cost of implementing EM and ASM/NEFOP would be a useful exercise to create a framework for future conversations.

Who: George Lapointe and GARFO
When: June 2014 (outline of paper)

- **Discuss costs for EM specifically and early on during the EM discussion process.**

  The potential to reduce the cost of fishery dependent monitoring is one of the primary motivating factors to explore EM in the groundfish fishery. An important consideration is the scope of the EM program in relation to the value of the fishery. Several questions and concerns were raised which should continue to be part of the ongoing dialog about the utility of EM.

  Who: Council EM Working Group
  When: early and often

Technical and Performance Standards

The workshop provided two opportunities to discuss the topic of technical and performance standards. Both breakout groups chose to focus on the groundfish fishery. However, workshop participants struggled to make progress discussing technical and performance standards without having a clear understanding of the specific goals and purposes of the EM system. The first group explored a systematic approach to determining goals, which points to the overwhelming need to be strategic and logical in developing EM as a component of the monitoring system. Participants noted that EM is one of a suite of tools that are used to provide fisheries dependent data.

In order to frame their discussion, the workshop participants made the distinction between technical versus performance standards.

> *Performance Standards*: What you need and when you need it to address an objective to x-level of precision.
> *Technical Standards*: The technology that is necessary to support the performance standard (e.g., what technology is needed to differentiate species reliably).

Participants suggested that technical and performance standards should be thought of as a feedback loop - as you define what you need, you refine the technical specifications and standards.

Identifying Facts and Issues

Workshop participants briefly assessed the current monitoring system for groundfish in order to develop a better sense of the objectives for incorporating EM and how to approach establishing standards. The following list represents their initial ideas and opinions and is not necessarily a consensus of the whole group.

- At-sea Monitoring (ASM) is expensive.
- ASM is used to document catch by area and gear type (including mesh size)
    - Catch information includes species and weight; both landed and discarded
- Under current ASM the captain is the source of landed data as well as the dealer
- ASM collects data at the tow level (for discards) as well as statistical area and gear type (for all catch)
- ASM collects data at point locations and provides spatial data for catch
- The current fishery dependent data system is expensive and has room for improvement in the quality and timeliness of the data.
- Work on the 'big picture' data problems is ongoing (i.e., visioning project and others)
- Current fishery dependent monitoring system components are not integrated (i.e., ASM, VTR, etc.). Each were introduced as independent components and are not linked to each other.

- There is a lack of knowledge and awareness of strengths and weaknesses of the current fishery dependent monitoring system.

The workshop participants created a table to help characterize the data provided by the current monitoring system (below). The table provided a framework for discussing when EM might make sense as a complement to or replacement for the current set of tools used to provide fisheries dependent data and the methods used to interpret and use the data. This table is not complete, but provides a possible pathway to understanding how technical and performance standards could be determined. Workshop participants noted that the data provided by either ASM or EM must be useable by enforcement and the fishery dependent monitoring system should document catch by area, gear, species, weight, and non-groundfish species.

Data	Current FDD* Source	EM?
Kept	ASM, VTR, dealer	
Discard	ASM, VTR	
Area fished	ASM, VTR, VMS	
Catch – weight	ASM, VTR, Dealer	
Catch – species	VTR, ASM, Dealer	
Catch - gear	VTR, VMS	
Effort	VTR, VMS	
Marine Mammals	ASM, VTR	

*Fishery Dependent Data

Moving Forward on Designing Technical and Performance Standards

Several workshop participants advocated for NOAA Fisheries to define the technical specifications that will need to be met by the fishing vessels using EM. However, others suggested that NOAA Fisheries focus on performance standards and avoid establishing restrictive technical standards. The only existing standard that was discussed is performance standard for sector ASM, which is a Coefficient of Variance of 30% for catch estimates. It is not clear how this performance standard would apply to EM, which relies on a census of discards reported by the VTR, or what other standard(s) should be developed for EM.

Some participants believe there is enough information to have a general roadmap for developing an EM and integrating EM into a fishery dependent data system, while others would like to have goals and targets for implementing EM defined first. The suggestion was made to undertake an iterative process by focusing on a tangible working example rather than trying to tackle a larger program during the initial start-up of EM. Standards could be created through engagement with a sub-section of the groundfish fishing fleet.

In order to move forward, workshop participants suggested prioritizing what information needs to be gathered by the fishery dependent monitoring system (e.g., enforcement information vs. ancillary biological data?). In addition, the costs of the current monitoring

system (both financial and data precision) should be compared to any proposed change in the system that includes EM.

During the course of their discussions, the workshop participants created a list of several recommendations:

- **Clarify the goals and scope of the proposed EM program, as well as the governance structure and roles and responsibilities for parties in the system.**
  In discussing standards for a proposed EM program in the groundfish fishery, participants identified the need to clarify the scope of the desired EM program. The participants raised specific questions:
  - *What are the goals of the EM program as part of sector monitoring programs?*
  - *What is the scope of participation in EM as is currently being proposed (i.e., voluntary vs. mandatory participation, EM on all trip vs. a subsample, expected number of participants)?*
  - *What is the desired governance structure of the EM program? What are the roles and responsibilities of the parties in the proposed system?*
  - *Should the EM program improve on the current system and, if yes, how so? Collect more data and/or better data?*

  Who: New England Fishery Management Council
  When: Summer 2014

- **Bring lessons learned from EM Workshop to Northeast Federal Fishery Dependent Data Visioning Workshop June 30-July 1, 2014 (see www.gmri.org/mini/index.asp?ID=60&p=189).**
  Several workshop participants are also involved in the fisheries dependent data review process being conducted by Greater Atlantic Regional Fisheries Office (GARFO), Northeast Fisheries Science Center (NEFSC), and Gulf of Maine Research Institute (GMRI). The upcoming visioning workshop may provide an opportunity to produce a schematic of data uses, sources, connections etc. perhaps on a fishery-by-fishery or sector level. This could provide the assessment of the current system and how EM can be incorporated and could motivate clearly defined goals.

  Who: EM Workshop Steering Committee and members of the workshop who are working on the Visioning Project
  When: Prior to Visioning Project workshop in June, 2014

- **Identify roles and responsibilities and accountability in the standard setting process.**
  Workshop participants were unsure about the pathway to implementation of EM, especially with regard to the performance and technical standards that the system must meet. There is uncertainty about the technological specifications that boats will need to meet and the industry is looking for direction from NOAA.

Who: EM Workshop Steering Committee to request that NRCC (and GARFO?) identify a person or group within the Northeast Regional Coordinating Council (NRCC) that has the responsibility for working on this, possibly with the Council's EM Working Group
When: Spring, 2014

- **Draft performance standards from NOAA Fisheries for implementing EM within larger set of data streams.**
  There was considerable discussion about performance standards and crafting a draft document was recommended as a first step. The draft standards document should be made as a proposal to get feedback from stakeholders (i.e., engage in development of a mutually acceptable set-up). The use of a specific, targeted example that is a good candidate for success was also suggested (e.g. work with one groundfish sector.) Specific consideration should be given to clarify what information we are asking EM technology to provide, potential trade-offs that must be made, and what are non-negotiable requirements.

  Who: NOAA/GARFO
  When: unspecified
  [This request is in accordance with 2010 commitment to provide guidelines for EM.]

- **Assess quality of the existing fishery dependent data system and current performance standards for fisheries dependent data.**
  The utility of the current fishery dependent data being collected through At-Sea Monitoring for groundfish sectors was raised throughout the workshop. Several participants noted that the current data collection may be sufficient for specific objectives, but not for others and this should be clarified and evaluated.

  Who: NOAA
  When: unspecified

- **Review technological options available for implementing EM.**
  The technology for video monitoring on vessels and analyzing video footage is continually evolving. EM systems are being used in Europe and Canada, as well as the U.S. The suggestion was made to continually share 'tools in the toolbox' to ensure that the best and most appropriate technologies available are used effectively.

  Who: unspecified, but Sea Grant Extension Network is a possibility
  When: unspecified

Data Issues

There was a series of questions and concerns raised by workshop participants regarding data issues. During the breakout discussions, the group decided to define "data," for the purpose of discussion, as raw information that is unanalyzed. Participants suggested that data elements can be used for multiple purposes, but data needs to be retained in its raw form and it is important to maintain data integrity. A copy of the data should be exported for analysis.

As was the case with the other breakout sessions, the participants found it difficult to discuss data issues without first identifying the goals of an EM system. Requiring EM as mandatory was raised as an important issue and considered by some as the only way to reach universal adoption. NOAA enforcement is the obvious primary user of the data if the goal is compliance purposes. Participants suggested that the design of the EM system should be through a collaborative process that includes NOAA Fisheries, NEFMC, IT professionals and fishermen, but mediated by the needs of whoever is paying for the system. There was a question whether EM is intended to replace the existing system or provide a new data stream.

For the EM system to be most useful for the fishermen, the data should map the vessel's activity and monitor the effect of various factors on fishing success. The fishing industry will also be more willing to implement a new monitoring system if it lowers the cost of data collection and provides added value to their catch through traceability of the product.

The discussion about data issues fell generally into four categories: confidentiality of the data, data ownership and chain of custody, transfer and storage of the data, and integration of the EM data with other data systems.

Confidentiality

Significant concerns regarding confidentiality of the video data collected by an EM system were raised during the breakout sessions and throughout the workshop.

The Study Fleet program provided an example of how NEFSC addresses confidentiality and how that can impact the science. Currently, location data is collected through 90 second GPS polling on the vessels but specific dot location data is not revealed. Study Fleet is monitoring where the net is actually towing by joining the GPS polling with temperature-depth data from sensors attached to the trawl door. This information is not collected in real-time, but rather picked up or transmitted monthly or after a trip and processed subsequently. The finer the scale of data desired, the more concerns about confidentiality arise among industry members. Tow by tow data provides maximum utility because the location of where the catch occurs is more accurate and electronically verified.

GPS data for VMS is different and completely separate at this time from the Study Fleet program. VMS uses longer GPS polling on vessels that are usually 40 minutes or more.

Longer polling frequencies don't always allow for accurate measurement of the tow duration. NEFSC has found across a large number of fisheries that by using catch data, you can get a very rough measure of effort. However, errors with the tow duration can introduce greater noise and catch-per-unit effort becomes distorted. Scientists will have to make a quality comparison when using an EM system tied to VMS.

There are standards for how GPS data is used and standardized by fishery managers and enforcement officers that are distinct and separate from research projects designed to improve stock assessments. VMS programs were designed to support fishery management and enforcement of days-at-sea and closed area regulations and were never designed to provide scientific data to improve effort duration data. However, VMS GPS data is now transmitted in real-time and it goes to NOAA Fisheries Enforcement. The question was raised if this is appropriate and/or should data go to a third party. If the data is being used for scientific purposes, permission needs to be granted to send the Boatracs and this is a fairly onerous process. There are also systems that don't collect specific GPS data, but rather use a general area, similar to paper logs, without information about activity tied to a specific position and without electronic verification. One problem is that it generates data that is not fine scale enough for management purposes.

For social science research, data has to be aggregated to maintain confidentiality. Fishermen can sign a release form to grant permission to share the data; otherwise it is limited to aggregations of at least three. There is a similar restriction in Canada. Data is shared with DFO if it is a compliance issue. A question was asked if the data in Canada is subject to subpoena in a civil suit. In this case, the vessel owner would have to agree to allow the data to be used in this way since that was not the intended use of the video.

Concerns were raised about confidentiality if the government owns the data. There may be advantages to who owns the data in terms of confidentiality and data use. Participants noted that there have been white papers and a discussion paper that consider the confidentiality issues of the different data elements. If data is collected under catch shares there are confidentiality rules that apply. There was a proposed rule published in May 2012 that proposed revisions to the regulations governing the confidentiality of information submitted in compliance with the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSA), which may apply to EM data. A final rule has been under development for a couple of years and it is not clear when it will be published.

NOAA Fisheries is not supposed to release vessel identification or other proprietary data that would compromise a business. However, under the Limited Access Privilege Program (LAPP), there is an exemption in MSA for catch information and the data is not confidential. The workshop participants discussed whether this exception in MSA includes catch shares.

Issues and Questions to Consider:

There were several questions raised regarding confidentiality issues that should be explored further including:

- Do catch shares fall under the same confidentially exemption in MSA as LAPPs?

- What kind of data can be released in public reports?
- Will EM data be substantively different from other data use/confidentiality agreements?
- Does the "rule of 3" apply and would that mean you could never show individual vessel data?
- Is there a case where the federal government requires cameras in a private sector building on land to ensure compliance that we can refer to? Can the federal government tap into private video systems? (e.g., purchase of an EZ pass permits certain access to information by DOT, but you're not required to get an EZ pass.)

Ownership and Chain of Custody

In order to address some of the concerns about confidentiality, participants explored issues of data ownership and the chain of custody. It would be useful to identify all data components of the EM system, define those data elements and then look at where the data is collected and where it is going on shore (i.e., for analysis, etc.) and how usage and confidentiality apply to each step.

If the EM system is being established for compliance purposes, the chain of custody has to be secure (i.e. no ability for tampering). One suggestion was exploring if the same data usage rules and structure used for observer data should be applied to EM data. If EM data were considered the same as observer data, then that would authorize certain usage and access to the data. Although NOAA Fisheries doesn't normally consider observer data as compliance data, it is being used as such for illegal discarding and intimidation or harassment of observers. NOAA Fisheries does not stipulate that observer data cannot be used for compliance, it is just not the primary purpose. The observer log can become part of a court record. The Northeast Fisheries Observer Program (NEFOP) does not pass along potential cases to the Office of Law Enforcement (OLE), but the enforcement officers are entitled to the observer information. NOAA Fisheries Enforcement is not automatically notified, unless the observers are asked to watch for certain things (e.g., illegal discarding of groundfish).

The development of the ASM program for groundfish sectors has moved NEFSC more into compliance issues. Although the at-sea monitors are not compliance officers, there is nothing prohibiting OLE from using the data collected by at-sea monitors for enforcement purposes. One participant suggested that the implementation of an EM system might start with compliance and go toward science. However, others felt that with the current technical tools at hand, it's hard to see EM as a science tool and is almost sure to be used for compliance purpose. Again, participates advocated for designing the EM system based on the goals (which, for many participants, was deterrence).

Participants discussed whether an EM system might have a similar chain of custody and corresponding protocol to VTR and other vessel data. Vessel trip reports are required to be submitted and falsifying reports is considered a criminal activity under MSA. Questions

were raised about who can submit VTR data on behalf of the vessel. At one point NOAA Fisheries tried to require dealers to report the VTR serial number (unique to each trip report) on the dealer report to make it easier to link the two for a single trip. If OLE decided to take a case to court based on EM, they would need the original video. This reinforces the need for tamper-proof technology, such as encryption or digital signatures.

Concerns were raised about who is responsible if the data provided is incorrect (e.g., is this similar to tax preparation?). Issues related to hardware performance and user error were also raised. The issue of whom in the chain of custody is responsible for the quality of the data, and who can submit data on behalf of the vessel, needs to be resolved in order to implement an EM system. The current VMS in place has dealt with similar issues with poor data from one satellite provider. The fishermen were not responsible in this case because the problem was tracked back to the specific provider.

Issues and Questions to Consider:

- Would EM have similar chain of custody and corresponding protocol to VTR and other vessel data?
- Who can submit data on behalf of the vessel?
- How do we ensure that data isn't manipulated and that it is tamper evident?
- Who is responsible for the data quality? The technology provider or the user of the technology?

Data Transfer and Storage

The workshop participants discussed how the data recorded on the vessel is transferred for analysis and stored. In Canada, Archipelago physically transfers the hard drive from the vessel but this is not sustainable on a large scale. The pilot EM project through the Maine Coast Fishermen's Association is also using external drives that are swapped out every 1-2 weeks. It was suggested that a mailing system could be used to retrieve data since it may be cost prohibitive to send a person to multiple vessels to change hard drives. Ecotrust uses external hard drives that sometimes have to be FedExed. The hard drives are encrypted so they will know if it has been tampered with.

There was a distinction made between electronic monitoring through video versus through a photo-based system. The EM in Scotland is through a photo-based system, which is easier to transfer over the Internet. The system is linked to the eVTR and images are associated with a time and trip stamp and can be viewed easily to audit a vessel's trip. If the EM data is stamped with time and location (either video or photo) the data can be useful for several purposes because it is easier to sync and can be linked to electronic reporting. It is less expensive to use EM as an auditing tool and it was suggested that the technology could be automated to trigger when suspicious events occur. It is important to remain aware of existing technology and its applications to EM.

Workshop participants discussed the option of having a third party review and analyze the data instead of NOAA owning the data. The video files in Canada are so large that the agency has access to the user interface on the Ecotrust server if they want to view the videos, but the data is stored with Ecotrust. Ecotrust reviews the data and sends reports to the agency and the agency sends egregious compliance violations to enforcement to address. However, the enforcement staff does not have direct access to the server and would need to request the video.

In Canada, EM is paid for by the fishing industry so they hire the service provider. Cameras could be observed in real time if someone wanted to pay for it. The agreement in BC is for the video to be recorded continuously but the fishing vessels are not being watched real-time.

Participants discussed the data retention policy for EM. NOAA Fisheries retains observer records indefinitely and there is a 5-year policy for some other kinds of information. Physical records are archived in an offsite property. Long-term observer data can be used to assess historical impacts on marine mammal stocks, recovery of populations, and other chronological events. The fishing industry expressed concern that the video images could be used for purposes other than the intended use.

Issues and Questions to Consider:

- What are the roles and responsibilities of a third party service provider?
- How long does the data have to be retained?
- Will fishermen own the data and have access to it after it is picked up (hard drive)?
- Potential use of images in other contexts than the intended use
- Evaluate the cost of EM versus the significant cost of enforcement (e.g. Coast Guard aerial patrol of closed areas)

Data Integration

Several questions were raised about how the data from EM would fit within the current data systems. It is important to consider data integration so we keep efficiencies, reduce redundancies, and ensure data utility. However, the purpose of data collection imposes constraints on how the data can be used and integrated into the current systems. In the draft strategic plan for integrating EM for Pacific fisheries, the language is not strong: "we intend to use the data to..." EM data is used when the VTR doesn't match the dealer reports (i.e. audit model). Data can be compiled to provide reports for infinite recipients and uses/needs. There needs to be some consistency of the data that is being collected (regardless of the tool) so the data are comparable. There is quite a lot that goes into syncing up the various data collection methods onboard. It is hard to integrate into one data stream and doing so would mean a higher cost due to the complexity of the software system. All data is likely to include date, time, and location, which would allow for future integration.

Fishermen expressed the need to prioritize what data is being collected onboard the vessel so it is feasible to implement. Observers deployed on the same trip as EM on small vessels would be difficult to manage without a different on deck set-up or additional training for observers. If EM replaces ASM, fishermen will still be required to have NEFOP observers. Fishermen still benefit from having an observed discard rate rather than an assumed discard rate. Fishermen want data to avoid bycatch, test gear, and provide a more accurate discard rate.

We may need a transition between onboard data collections measures rather than an immediate transition from one kind of data stream to the other to make time for calibration. The current EM pilot studies are limited in scope and have not been fully vetted by NOAA Fisheries so additional work is necessary.

Although EM is being considered as something that will complement the existing systems, there are different spatial scales. These differences limit the usefulness of the data for some purposes. For example, in the Pacific Northwest, the stock assessment scientists are not currently using EM for stock assessment purposes. The ASM program in groundfish was created for the purpose of monitoring ACE catch. However, scientists are now using the data for other purposes. The argument was made that therefore the costs should be distributed among those who are going to use the data. Some participants suggested that the original intention was EM would replace ASM, but others recognize additional utility of ASM as it has been used so they want to maintain those uses.

NOAA Fisheries needs to create the data standards for EM. However, workshop participants suggested the development and implementation of EM needs to include the Council process, end users of the data, NEFSC and GARFO and IT expertise.

Issues & Questions to Consider:

- Can we define new places within NOAA to put this data or does it have to fit into the existing data? For example eVTR had to fit into VTR, does EM have to fit into ASM structure? How constrained are we in terms of framework for the data?
- If EM is implemented in some but not all fisheries - how does it integrate well so we have consistent data regionally across fisheries?
- How does NOAA Fisheries visualize the data being incorporated? How will ASM, EM and NEFOP fit together? Will it fit into the ASM structure or create its own? (This may be different for different fisheries.)
- Will it be more cost efficient for fishermen to collect data and use EM to audit, rather than relying solely on EM?
- How does adding EM affect the current use of VTR to supplement dealer reporting?
- Does EM have uses for seafood marketability/traceability?

- There will be a need for education and outreach since skippers are responsible for the accuracy of the data/successful use of the technology.
- What is the cost-benefit analysis of syncing various streams of data? Is there a way to make the data useful for the region rather than select fisheries?
- If EM is voluntary, and not universally adopted by a fishery, will the data be useful?

Other Keys Issues Raised at the Workshop

Ideas from Breakout Discussions at Tables

During Day One of the workshop, participants were asked to brainstorm with their table to determine the most important issues for breakout groups to discuss on Day Two. Each table was assigned a facilitator and note taker to quickly generate ideas and prioritize them. The top suggestions were reported out from the tables to the larger group. The list below represents top ideas from each table that were reported out, but they are *not* in any priority order.

- Cost drivers and cost hurtles
- Compliance standards
- Timeliness of EM data relative to ASM data and is more timely data more expensive?
- How to transition from successful pilot to full implementation
- What are the positive uses for EM that will make people want to use it
- Need technical standards -- not the same for all fisheries
- We need goals for monitoring more broadly. There is a lack of clarity about goals. How does EM fit into overall goals of monitoring program?
- It's important to set timeline, deadlines and milestones.
- Cost is a question to manager. If you had a million dollars to spend on this fishery monitoring program, how would you spend it?
- Governance and process, leadership and guidance.
- Inventory data needs. What's "low hanging fruit" that we can start with and then learn from?
- Implementation through a stepwise approach.
- Meaningful comparisons between current data system and some new idealized EM standard.
- Cost/benefit analysis.
- Timing of implementation.
- Start small scale and build up.
- How ASM and EM fit together and overlap.
- Recognize first step for each fishery at different stages.
- Clear objectives as foundation for design.
- Shared definition and understanding.
- What gear type to focus on – high need.
- Developing overarching guidance – performance and technical standards
- Set a deadline, milestones
- What are the success measures – metrics for evaluation
- Cost drivers

- Data management, ownership, and usage
- Until you have clear objectives you can't design appropriately
- Define the scope that allows you to get to standards and cost and move forward. Who is responsible for developing standards? First they are general, but then need to boil down to specific technical requirements. What are standards for service providers?
- Purpose of EM has to be clear first.
- Who owns the data and who pays for it? Suggestion that government owns the report, but the fishermen gets raw data.
- Integration of electronic tools – use VMS.
- Legal and confidentiality limitations.
- Demonstrate tangible benefits.
- Map the flow of EM data through various channels.
- Relevant to enforcement.
- Law enforcement discretion.
- Performance and law. When is EM on and off? What happens if EM fails?

Suggestions Posted to the "Ideas Board"

An "Ideas Board" was posted on the wall for both days of the workshop. Participants were encouraged throughout the workshop to write down their concerns or ideas regarding EM on a sticky note and post it to the board. This allowed for ideas that were not voiced during the discussions to be captured. The items listed on the "Ideas Board" are provided below in no particular order.

- Data confidentiality
- Who will "own" the data?
- Flesh out the carrot and the stick
- What are the roles and responsibilities of the service providers?
- What are the objectives of the ASM program?
- Implications across fisheries (e.g. how would "full/max" retention in groundfish affect fluke management?)
- Emphasis on sector system – what about the common pool?
- National Standard 8 – if EM helps small scale fishermen survive then rural communities may have benefit (e.g., if it costs less than observers).

Appendices

Presentations

The workshop included several presentations that are summarized briefly below. The PowerPoint slides and full audio of Day One of the workshop can be found on the workshop website (http://www.nero.noaa.gov/mediacenter/publicevents/upcomingevents/em/index.html).

Opening Remarks: Northeast Electronic Monitoring Workshop in the National Framework

Russell Brown, Deputy Science and Research Director, NOAA Fisheries/NEFSC

Our regional discussions on EM are maturing, from trying to figure out whether we were "there yet" on EM, to now realizing we need to evaluate how our entire regional fishery dependent data collection system needs to change in order to cost-effectively and efficiently monitor fisheries and where EM fits in that context. The fishery dependent data system in the Northeast did not evolve to be responsive to the need for near-real time monitoring of quotas, as expected under some of the region's Fishery Management Plans. We recognize the need to modernize this system. At the regional level, a joint NEFSC/GARFO and GMRI visioning project is underway to determine fishery dependent data needs, to develop the next generation systems for fishery dependent data collection. There have been several recent national initiatives to provide guidance on EM, specifically. Examples include:

- A series of white papers on electronic monitoring and electronic reporting developed by the agency in February 2013.
- A policy directive from NOAA Fisheries on electronic technologies and fishery-dependent data collection was released in May 2013, to provide guidance on adoption of electronic technologies including video cameras for electronic monitoring.
- In 2013, the Environmental Defense Fund released the "Fishery Monitoring Roadmap" which outlined a process for designing or revising monitoring programs, and matching monitoring tools such as EM with those program goals.
- In January 2014, a national workshop on electronic monitoring was convened to bring together a wide range of partners with experience in different aspects of EM research and application.
- In April 2014, the agency released a summary of guidance and best practices for use of electronic monitoring and reporting in federally managed fisheries.

The New England Fishery Management Council has an active Electronic Monitoring working group that is generating a white paper that will be presented to the Council later this year. And the Northeast Region Coordinating Council discussed two models for EM that held "promise for effective use in Northeast fisheries." These two models are: 1) full retention with monitoring for compliance and 2) EM for validation of the vessel trip report. Next steps include identification of the range of statistical, operational, regulatory and enforcement issues and questions; and development of a plan for resolution.

Where do we go from this workshop? We need a common understanding of where we are on EM in the region; we need to develop a common vocabulary and baseline understanding as we move forward collaboratively. We also need to identify how to integrate EM into existing data systems. However, the application of EM needs to rest on the firm foundation of a comprehensive fishery dependent data collection system.

Panel: Setting the Context for Electronic Monitoring in the Northeast

Key Lessons from the National EM Workshop

Dorothy Lowman, Pacific Fishery Management Council

The National EM Workshop was held in Seattle on January 7-8, 2014. The workshop was organized by a thirteen-member steering committee, which had representatives from all Regions and included managers, Council members, scientists, industry representatives, law enforcement and service providers and conservation interests. The workshop was funded through a grant from the NFWF with matching funds from EDF and significant planning support from NOAA Fisheries as well as industry partners.

The workshop objectives were as follows:

- Gain a better understanding of the possible range of electronic monitoring applications
- Identify solutions to current challenges to integration of electronic monitoring
- Share lessons from each of our experiences with pilot studies and early design and implementation efforts
- Identify key program and design elements
- Discuss electronic reporting needs to support effective monitoring implementation plans
- Obtain tools to facilitate development of regional electronic monitoring implementation plans
- Build professional networks to exchange electronic monitoring information

Approximately 150 participants from all regions of the country as well as BC, Denmark and Australia participated in the national workshop. There were several key takeaways from the workshop.

1. Setting clear, well-defined program objectives up front is critical.
2. Everyone needs to be at the table throughout the goal setting, design and implementation process.
3. Have a clear understanding of roles and responsibilities.
4. Think about program design in a holistic way: Think of EM systems as a 3 –legged stool where technology, field services and data services are all vital components which need to be thought about as a package.
5. Incentives are important - think about both the carrot and the stick.
6. Think about costs upfront.
7. Make the commitment to implementation and follow through.
8. Finally – we need to learn from each other and not always and re-invent the wheel.

The final workshop report with summaries of each session and an executive summary of highlights and key takeaways should be available in June. Visit www.eminformation.com to download the report and get information on current activities in other areas of the country. If you wish to get announcements of new advances in EM as they become available, please subscribe where indicated at the website.

Overview of NEFMC Work on Electronic Monitoring (including EMWG)
Jamie Cournane, NEFMC Staff

The NEFMC has been working with EM in various contexts within the respective fishery management plans. In general, Council discussions on EM focus on the groundfish fishery, and to a lesser extent the scallop and Atlantic herring fisheries.

For sea scallops, electronic technology is often used in gear research. For example, cameras have been used in gear studies to identify flatfish bycatch and monitor operational/catch efficiency. The Council's Research Steering Committee often reviews findings from these studies. However, EM as a tool in the scallop fishery has not been the subject of management discussions to date.

During the course of developing Amendment 5 to the Atlantic herring fishery management plan, managers discussed the potential use of EM as a means to address compliance issues and possible bycatch reduction. Without any studies using EM in the herring fishery, managers recognized that further work was needed such as a pilot project for the fishery. Amendment 5 research priorities includes such a recommendation.

With respect to the groundfish fishery, however, the Council is moving forward with EM discussions. Unlike the other fisheries, there have been several past EM projects and there are current pilot projects as well to test EM on fishing vessels. Amendment 16 to the groundfish fishery management plan established the sector system and included EM as a potential tool. However, NOAA Fisheries was not ready to adopt EM and has not developed guidelines for use of EM as a tool within the sector operations and monitoring plans.

The Council's EM Working Group (EMWG) was formed a year ago to develop a list of barriers to implementing EM in the groundfish fishery and potential solutions to overcome those barriers. The EMWG is focusing on two EM models – a maximum retention model and an audit model to examine barriers and solutions in more explicit detail. Currently, the EMWG is summarizing the work being done with the goal of providing a summary report to the Council by the end of 2014. The report will also include a list of recommendations for the Council to consider in its discussions on EM use in the groundfish fishery.

Current Efforts within NOAA Fisheries New England Region
Melissa Hooper, Fishery Policy Analyst, NOAA Fisheries/NERO

There are several regional and national projects targeted at expanding electronic technology of various kinds. Electronic monitoring is being used elsewhere as a cost

effective data collection tool. This workshop today is timely as there are several efforts underway in the Northeast region on development and implementation of EM and modernizing Northeast data collections overall. At the national level, in May 2013, NOAA Fisheries released a policy statement on electronic technologies that:

- Encourages use of open source code and standards;
- Requires identification of funding sources for new programs; and
- Calls for each region to develop a Regional Implementation Plan
  NOAA Fisheries has also developed EM/ER resources, including a guidance and best practices document and several white papers summarizing existing information and discussing implementation issues.

At the regional level, NOAA Fisheries has been conducting a comprehensive end-to-end review of Northeast fishery dependent data collection systems, dubbed the Fishery Dependent Data Visioning Project. This is a joint project among GARFO, NEFSC and GMRI to evaluate fishery dependent data needs in the region and match them with the best tools to meet those needs.

The Fishery Dependent Data Collections Working Group is a joint effort between GARFO and NEFSC. Their objective is to improve efficiency, consistency, data quality and timeliness of existing data systems. The work at this workshop on EM will feed into a regional plan that is being developed and is due to be completed by the end of 2014. NMFS has moved forward with approving eVTR for all vessels, which are submitted via VMS. This removes the need for paper forms. There are currently two approved on-board systems. The VMS on fishing vessels is another technology tool.

The NEFSC is wrapping up a 4-year pilot project to test the applicability of EM in the groundfish sector fishery. Most recently, the pilot project tested the two approaches identified as the most promising for using EM in groundfish – maximum retention and audit model. This project built capacity and provided information about how EM could be used to meet sector ASM requirements. The next step is to develop the broader program that would support an operational at-sea EM system. For groundfish specifically we need to consider the capacity and the infrastructure that will be necessary to move forward with an EM system.

Issues Raised from the Audience:

1. There are broad initiatives in progress at a national level that are cross-cutting. That's good, but he hopes that the slower pace moving forward on those doesn't stall projects that are close to the finish line. How can we accommodate those projects that are further along and keep in mind the infrastructure to move forward with EM more broadly also?

2. There is huge progress in Europe – how is that fitting into the local process? EM is used extensively in Europe. There were representatives from Denmark at the national workshop and they have more comprehensive implementation. One challenge is the need for clear definition of terms.

Panel: Perspectives on Electronic Monitoring – Potential Goals & Implementation Strategies

Reflections from British Columbia
Rick Stanley, Fisheries Consultant, B.C.

It is important to remember that EM has no goals or objectives; it is simply a tool that may, or may not be, useful within a more complex monitoring package. There is no silver bullet or "shiny bauble" that will solve all problems. In British Columbia, prior to 2006 and integration, there were seven different licenses in the hook and line fishery and significant amounts of unknown discards. The two key objectives of the fishery integration project were 1) conservation and 2) industry sustainability. The two key elements of the project were effective monitoring and transferable quotas (quota shares). The new monitoring program was a combination of, among other elements, dockside monitoring (by weight/species and piece counts) and at-sea video capture and GPS with EM.

While the new monitoring system is far from prefect, it has nevertheless met the key conservation (i.e. stock quota management) and operational (vessel quota management) needs for the individual vessel quota system. It provides the best catch estimates (including discards) for rockfish where there is 100% retention. It works well for non-rockfish quota species. Estimates of non-target discarded species have improved, but require more work, such as for birds. The cost (2009) for the monitoring is about 2-3% of landed fishery revenue (~$150 USD per day) however costs can vary widely among sectors, individual vessels, and years.

During the design of the monitoring, the industry established key principles and focused on these principles, not data or tools:

Government Principles:

- Account for all rockfish catches.
- Rockfish catches will be managed to area.
- Fishermen will be individually accountable for their catch.
- Monitoring standards will be established to meet the above three objectives.
- Species of concern will be closely examined.

Industry Principles:

- Conservation with improved research and assessments.
- Improved catch utilization.
- Sector and individual accountability.
- Increased industry responsibility and cost recovery.
- Security of access and a "year-round" fishery.
- Economic viability and efficiency.
- Improved social benefits.
- Comprehensive management with administrative and operational simplicity.

One lesson learned too late was not to wait until the last minute to include the IT expertise, and develop the IT/data management system.

Key Ingredients for Success:

- A "carrot" (IVQs, retention of all species) and a "stick" (industry better fix it, or the government will).
- A long history of failure to trying solve the fishery's problems with small fixes led to an acceptance that solution will require complexity, hard work and compromise.
- Effective leadership with effective facilitation. During design, little time and energy was wasted revisiting old arguments.
- Clarity of purpose.
- Focus on the principles not "shiny baubles".
- Focus on information not data.
- Focus on what is needed, not wanted, and work from hypothetical or real budgets to make the discussions realistic.
- Risk manage the needs.
- Consistent attendance at the design table with everyone "owning" the decisions.
- Industry/fishers represented more than half the design team.
- Learn from the results to improve the system.

Reflections from the West Coast

Dorothy Lowman, Pacific Fishery Management Council

EM was used to monitor west coast whiting vessels from 2004 to 2010 in a maximized retention fishery. During that time the program evolved over time with operational efficiencies and technological advances. While the program was generally considered a success, it was discontinued in 2011 when all vessels participating in a trawl catch share program were required to carry an observer.

However, the Pacific Fishery Management Council (PFMC) recognized that the 100% monitoring requirement placed a considerable cost burden on the fleet and the agency. In 2012, PFMC began exploring how EM might be utilized in all sectors of the catch share fishery.

Early on EM has been looked at as a tool for compliance monitoring and catch accounting, not as a scientific data collection tool. The Council adopted the following objectives to guide development of any EM program:

1. Reduce total fleet monitoring costs to levels sustainable for the fleet and agency;
2. Reduce observer costs for vessels that have a relatively lower total revenue;
3. Maintain monitoring capabilities in small ports;
4. Increase national net economic value generated by the fishery;
5. Decrease incentives for fishing in unsafe conditions;
6. Use the technology most suitable and cost effective for any particular function in the monitoring system; and
7. Reduce the physical intrusiveness of the monitoring system by reducing

observer presence.

Beginning in 2012 and ramping up in 2013, the Pacific States Marine Fisheries Commission (PSMFC) began a "pre-implementation" study of EM for mid-water trawl vessels targeting whiting, as well as fixed gear and bottomtrawl groundfish vessels. PSMFC's fieldwork had also been preceded by some earlier pilot studies conducted through an Experimental Fishing Permit (EFP) on fixed gear vessels as well as on bottomtrawl vessels through National Fish and Wildlife Foundation (NFWF) grants.

Encouraged by this work, the Council established two EM working groups in June 2013 – a policy advisory group (made up of active fishermen and industry representatives from whiting, bottomtrawl and fixed gear fleets as well as a service provider) and an EM technical advisory committee. They were tasked with developing a range of alternatives for the Council with a hope of having implementation in 2016. Preliminary preferred alternatives will hopefully be available by September. Exempted fishing permits (EFP) for pre-implementation study are under review and scheduled for approval in June. The agency believes strongly that EFP work needs to be done prior to implementation but others argue not to wait for EFP results before working on the regulatory package.

An impact and trade-off analysis is currently underway to be presented to the Council in September. Among the key questions before the Council are the following:

- Given that the fishery has several rare event constraining species, is it necessary to review all of the video from each fishing trip even if maximized retention is required?
- Are there other approaches that might provide the necessary information such as an audit approach, where logbooks would be the primary source of catch information and discard information and the EM video used primarily as an audit tool for the logbook information?
- What are the tradeoffs between level of review and risk of missing a discard event? How can a risk assessment best be developed?

Lessons Learned from NMFS Data Review Process
Holly McBride, NOAA Fisheries/NEFSC

The fisheries dependent data collection systems in the Northeast are a patchwork of data collection systems with poorly linked databases, redundant reporting, and are slow to respond to change. The Greater Atlantic Regional Fisheries Office (GARFO) and the Northeast Fisheries Science Center (NEFSC) have embarked on a joint project, the Northeast Federal Fishery Dependent Data Visioning Project, to develop a vision for an improved fisheries dependent data system to meet existing and future data needs. The project includes a comprehensive data needs and requirements analysis on all sources of fisheries dependent data in the Northeast with input from a sample of all stakeholders affected by or using GARFO and NEFSC data. All options for improving the federal fishery dependent data system are being considered. The project team includes GARFO, NEFSC and GMRI.

The first step was to interview internal and external constituents as part of a needs analysis. There were 170 total interviews conducted with representatives from NMFS, Councils, Commission, ACCSP, other regions, state partners, NGOs, third-party software developers, and industry. The interview questions were focused around the following approach:

1. Identify current data needs/uses
2. Evaluate existing data collections
3. Consider the existing system's strengths and weaknesses
4. Solicit ideas for tools, methods, and approaches
5. List desired characteristics of future system
6. Anticipate future data needs

Preliminary feedback from the interviews included the following suggestions:

- Integrate existing systems
- Standardize data formats, codes, and definitions
- Move toward electronic data collection
- Reduce manual data entry
- Automate validation
- Retain some redundant data for validation
- Improve documentation of metadata
- Increase awareness and data access
- Collect more precise area data

Electronic monitoring was not identified as a component of the future fishery dependent data system. Many did not know about EM. Those that did either had strong support for or strong opposition to EM. There were concerns about cost, system failures, and lack of understanding about EM. Whatever tools are used now or in the future will need to ensure that the outputs are consistent with the recommendations identified by this project.

Questions Raised from the Audience:

Q: A question was raised about evaluating the consistency of the observer report and EM in BC. Was there "observer effect"? Was there any "groundtruthing" to see how these two compare?

A: This was considered during experimental design. DFO felt EM was close enough to the observer system. The observer is the expected higher standard; expect fishermen to do 90% -- not 100% perfection.

Q: When you did interviews [for the Visioning Project] was there any discussion that data collection should be managed centrally? Is that something DFO did in BC (i.e. one entity to manage fisheries dependent data)?

A: There was a question about centralization of data and this is something NOAA Fisheries is evaluating.

A: DFO built a shell to take all the data, but the shell was built in haste and not well built. Fishermen regret the data being in one place in some ways as it is hard to parse out so other entities can bid on it. Chain of custody is important. If you have many parties, it's important to define responsibilities.

Q: Has the Visioning Project considered bringing in data design expertise for perspectives to design the system? Someone from IBM or Google?
A: This is a good idea. Right now we are in data needs analysis, but as we move to design that would be good to think about.

Q: Did I understand correctly that the cost is $150/day was the cost to the fishermen [in BC] and that represents 2-3% of value of fishery? At what point is the value estimated?
A: Yes, this is the cost to the fisherman.

Q: Is the system [in BC] to monitor compliance or also to collect data for future management? How is it working from a compliance standpoint?
A: It provided everything. Yes, it has been used for compliance (infamous court case recently), but one theme of the working group was always to be positive. The intention was not to find cheaters, but to prove honesty so those telling the truth in their logbooks could prove it. Repeat offenders bear the cost of full video review. Became a two-parameter review - specific trip and history. There is a strong will to comply from the rank and file. The word is out among your peers.

Q: 100% retention versus maximize retention? Are we talking about 100% on all species caught?
A: EM is not the "be all end all" but EM is an augmentation to observers. "Maximize retention" – clarify distinction. 100% video capture for rockfish. Use in combination with logbooks, piece counting and genetic sampling. It is a massive hybridization of everything to make it work.

Q: How do we create a penalty structure?
A: Create a contract as part of commitment to using EM – not a legal action through OLE.

Panel: Lessons and Observations from Pilot Electronic Monitoring Projects

Archipelago Marine Research, Ltd.
Maria Jose Pria

Archipelago has been using Electronic Monitoring in commercial fisheries for over a decade. Recently, Archipelago worked with the NEFSC on a four-year pilot project in the Northeast Groundfish fishery. When designing monitoring programs, there are three overarching considerations.

1. Think about the whole package – not just any one component.
2. There are financial limitations – costs of the entire package. Look at those issues right up front. Consider what overall percentage of the fishery is the monitoring –

5% or less in the groundfish context. $70 million fishery leads to approximately $4 million in monitoring cost expectations.

3. Balancing act: Cost, speed, and data quality.

Step away from proof of concept and move into the mindset of how can EM be implemented in the fishery? And how do we operationalize it? Design considerations include:

- Monitoring objectives
- Management regulatory needs
- Vessel characteristics
- Catch method and catch composition (i.e. Is there a lot of catch handling?).
- Fleet receptiveness (i.e. How much is the fleet willing to change?)
- Fishery value

Consider the strategies for fulfilling the monitoring objectives and information requirements. For each monitoring objective, what is the EM analysis of effort and the crew effort? It's a comprehensive planning approach. EM operational components include outreach and management, data analysis services, and field services.

A flexible program design allows you to "adjust the dials" based on several factors including the level of video review, data detail, reporting frequency, data retrieval frequency, travel, outreach, and program management.

Finally, the EM program delivery considerations include:

- Program governance
- Service delivery framework (who is doing what?)
- Cost recovery framework (how is program funded?)
- Level of industry engagement
- Incentive structure (carrot or stick)
- Regulatory framework

Ecotrust Canada
Amanda Barney

Ecotrust is currently partnering with GMRI, TNC, ME Coast Fishery Sector on a pilot EM project. Ecotrust works with the idea of creating solutions that demonstrate that a specific kind of economy is possible. Currently working with seven fishermen (five gillnetters and two trawlers). It is important to make sure your system has enough different pieces to be scaleable to different scales of fishing businesses (i.e. make a system that isn't going to "break a guy")

Success depends on feedback in the system design that is not just technology, but the whole management system (i.e. quick feedback from the fishermen). Need feedback from partners and regulators and ability to convey that to fishermen so they know how data is being used. It is important to fix glitches when they happen.

NEFSC - Application and Results for Two Approaches of Electronic Monitoring
Nichole Rossi, Northeast Fisheries Science Center

The NEFSC tested two EM models.

1) Maximized retention:
   - All catch retained with exception of allowable discards
   - All discarding recorded and verified by EM
   - Dockside monitoring component
   - EM used to monitor discard compliance and catch stowage

2) Discard Audit:
   - Fished as normal
   - EM used to verify industry-reported data (count and/or weight and species identification)
   - Discard chute - one at a time to allow species ID and length estimation
   - Marketable and unmarketable catch were monitored.

The preliminary results showed that the species identification has limitation and the captain's weights were much lower as they are estimating and EM is based on a length/weight model. However, the study employed a single vendor to test specific objectives and is therefore not necessarily representative of the full utility of EM (not a research and design contract). The intricacies associated with the integration of a new data stream into current data structure need to be considered and a comprehensive monitoring program should utilize the most appropriate tool to collect specific data elements. EM is most effective when used as one of a suite of tools. The design, development and implementation need to be collaborative with industry.

The EM study reports can be found at www.nefsc.noaa.gov/fsb/. Phase III report is due out this summer.

Fishing Experts

Rodman Sykes, Point Judith, RI
There is a feeling of doom in Point Judith due to the expense of observers. At first there was a lot of opposition and scepticism about EM from fishermen who didn't want video on their boat, but three years later folks are curious. This was a new experience, which was scary at first. My crew has worked with me for 30 years and there is a strong level of trust. There were very few problems with using the cameras. There were some technical issues, but the staff that came to fix it were good. It's important to get the camera angles right and just turn them on and off. Otherwise the fishermen didn't even think about it.

Rodman runs a high volume, low discard operation – getting skates for lobster bait. There was low discard so they used an audit approach. He handles 4,000-6,000 pounds in an hour so very work intensive. They would separate species, count them and run them down the

chute one at a time. It turns out that the crew missed a few that were seen by the camera, they got better with practice and brought the percent error down.

The primary question is the costs. Is it cheaper than an observer? That may depend on the percentage of video being reviewed. In the future we assume technology will improve and we'll have better cameras and better technology systems. At this time the camera can't differentiate some species (e.g., hake). What if the camera breaks in mid-trip? Do we have to turn around and come home? Overall it was a good experience working with Archipelago and the Science Center. Everyone is dedicated to making it work.

Frank Mirarchi, Scituate, MA
In May 2010, Frank worked on an EM pilot project and it was a great learning experience. The partners were very helpful. Using EM can't be "forced down our throats" – it has to be collaborative. Each boat is unique and provides an opportunity for success. Opportunities for groundfish compared to standard monitoring:

1. Risk aversion – At Sea Observer is always a new person untrained on the boat creating extra risk.
2. Uncertainty – EM eliminates "observer effect." The fishermen get used to having the camera on the boat.
3. Calculation of discards – dogfish. If you have a larger than normal landing, then bycatch can eliminate your profit for low-value fish. Discards eat away at the value of the landed fish.
4. Science/research.
5. EM system provides opportunity to market. EM could help value the fish more. Consider a certification system.
6. Expand the horizons beyond science and management and look to business implications.

Vincent Balzano, Saco, Maine
Simple approach – industry will have to pay for monitoring at some point so Vincent wanted to know if EM was going to work. In 2011 he had 25 day trips using EM. Equipment was easy to use and reliable and didn't require a generator. The partners were wonderful people to work with. It was designed to weigh and measure all discards. Vincent did two-hour tows with larger mesh targeting cod. It was relatively simple with not much handling. It did not replace fishery observer. It is a policy decision of what we are going to do with the technology. We are asking too much of it right now and it should be voluntary.

Panel: Issues & Implications for EM Implementation

Analytic Challenges Associated with Electronic Monitoring
Wendy Gabriel, NEFSC

EM is not yet operational. Raw data requirements are needed for catch monitoring and characterizing removals. There are different uses of catch data. Data can be for stock assessment or quota monitoring (measures of quantity, application, and timeliness vary

across the two). EM could be used for full retention or audit model. Weight and species recording is best done by at sea observers. Characterization of raw data:

1. species identification
    a. non-target species should be included
        i. attribute catch of other species to ACLs
        ii. consistent with ecosystem approach
2. statistical area to derive stock area (can be identified by VTR)
3. gear type & mesh size
4. calendar quarter/month
5. weight (need accurate weights for stock assessments)
    a. ratio estimators (weight of species discarded/weight of all species kept/
6. length composition
7. age composition

The value of ASM is improved precision over SBRM/NEFOP alone. We may not be able to do an ASM/EM replacement as an exact equivalent. Increased uncertainty adds to the cost of fishermen. If EM data costs less but may lower precision; should be accounted for in cost estimates. Adding EM could slow the process of compliance.

If EM is used:

- no observer bias
- vessel-specific discard amount
- could be subsampled and applied to un-observed trips
- evaluate EM for compliance
- non-compliant trips can be removed from ratio estimator

Some outstanding questions include:

- How will delivery of EM data affect ability to estimate total catch?
- What constitutes compliance? how long before compliance rate stabilizes?
- How good is correspondence between ASM and EM?
- How much video should be monitored?

Legal Issues to Consider for EM Implementation

Mitch MacDonald, General Counsel Northeast

This is not an exhaustive list of legal considerations, but a guideline of the kinds of things that we look for. The devil is in the details and using EM is an evolving issue. EM is a tool to bring information to the Agency for different purposes. First determine the purpose/need. EM has strengths and weaknesses. The reason for using EM is important when the Council is considering an EM program. There are different management purposes such as: 1) socio economic data, 2) enforcement data, 3) management or stock assessments, and 4) monitoring landings.

The Magnuson Act and National Standards are our guidelines. Section 301 is about optimum yield and preventing overfishing; these are the overarching principles that

govern the use of any management tool. For example, when implementing EM, how does EM give you a reliable estimate of bycatch to ensure ACL's are not exceeded? National Standard 2 requires the consideration of "best available science" and relates to what quality of data will be used for determining bycatch and how that affects assessments and management decisions. Cost effectiveness is another consideration in the National Standards. National Standards 5, 7, and 8 regard economics and efficiency. National Standard 5 refers to "efficient use of resources." National Standard 7 requires a cost/benefit analysis and systems that are not duplicative. How does EM compare to ASM? If used for compliance, is the cost worth the benefit gained? Can you increase the catch limits? Can you reduce scientific uncertainty? National Standard 9 requires minimizing bycatch to the extent practicable, which is another cost/benefit analysis. Is EM a practical tool? National Standard 10 refers to the need to promote safety at sea. When collecting data, if it's used for compliance, are there safeguards for "chain of custody." Is the data reliable, accurate and authentic? Does it work in dark or inclement weather? All of these questions relate to required National Standard considerations.

Data confidentiality is also required by the Magnusson Act. EM data requires confidentiality. Information that goes to any third party may be subject to confidentiality agreements for certification. Other legal issues may include data storage. EM provides a great deal of information. That information at some point is or becomes a federal record. As a federal record, it needs to be stored appropriately and that has associated costs. There are cost concerns and restrictions relating to ASM and EM. The government can't accept money supplementing its budgeted funds, and any money directly paid to an agency that is not otherwise covered by statutory provisions goes directly to the U.S. Treasury, so there is a line separating government costs of maintaining and collecting data versus at-sea EM costs that are the industry's responsibility. This requires careful consideration of allocating government costs versus the industry's costs. A question was raised as to who will own the data? This question appears to arise from a concern about how the data will be handled. EM data will be handled similarly to vessel monitoring system, observer data, and trip reporting data.

Questions Raised from the Audience:

Q: Can we use a private entity to save money if the purpose of EM is compliance? Could fishermen use a third party and then turn data over to OLE?
A: The model is similar to VMS now. Data held by third party is then sent to government.

Q: How could EM lead to less fish?
A: If EM failed it could cost the fishing industry fishing time. EM pilots were done by motivated fishermen. We could get lower quality results if fishermen aren't using it to its potential. We don't want to erode the precision. Assessment is less certain so you get less fish.

Q: If there is an unmonitored trip then captain is assigned bycatch average. Is EM a positive incentive for minimization of discards because of assigning discards specifically to fishing vessels?

A: Yes. You get vessel-specific estimate and no longer need ratio estimator.

Q: Is the Agency developing performance standards in order to prepare for EM use. It would be helpful to have standards from the Agency. When could we expect those? Will the Agency develop standards?

A: It depends. Standards are best developed in a specific context. The standards you set may be different depending on the purpose. Let's have some conversations of particular scenarios.

Closing Remarks and Next Steps

Dan Morris, GARFO

Thank you for attending the Northeast Electronic Monitoring Workshop. This has been a very important meeting for NOAA Fisheries to hear and learn about the potential utility of and the concerns people have about EM. Thanks also to The Nature Conservancy, the Moore Foundation, the workshop steering committee, and the New England Fishery Management Council for supporting this workshop and for helping to orchestrate it. Thanks also to UNH and MIT Sea Grant, and especially to NOAA's Melissa Hooper. A workshop like this takes an extraordinary amount of time and energy to orchestrate. Well done, and thank you.

There's no doubt, we need to modernize our fishery dependent data collections and EM is a tool we should be thinking about. EM is a compelling idea, and it has captured interests in New England and Washington, DC. EM is a tool. We have working hard these past several months to begin modernizing our fishery dependent data collections. We have approached the matter from a requirements basis. Our thought is that specified requirements will dictate what tools are best in each fishery. And we've avoided jumping to a conclusion about what the tools should be. So the idea that EM is a tool and we need to find a place for its use is contrary to our approach.

Still, we've learned a lot here these past couple days about EM. We've learned that we need to begin by clearly and fully defining out objectives for an EM program. I hope the workshop conversations have brought us closer to articulating those objectives we are trying to satisfy with EM.

The costs are going to be significant. We must think about where the resources are going to come from as we adopt EM. We may need to have conversations about tradeoffs between data quality, sampling rates, camera coverage, etc. and the confidence levels we can achieve and tolerate. We are committed to developing a cost estimate for EM. That analysis will require us to make assumptions about EM (methods, sampling rates, etc.) to get to pin down a cost estimate. While no future EM program may abide by all of those assumptions, we'll still have a starting point and an adaptable model for our conversations about EM costs, so we can move forward with EM wisely from a position of knowledge.

As I mentioned previously, the Agency is committed to overall modernization of our fishery dependent data collections. We know there is a compelling interest in EM. Our broader

modernization may or may not include EM. We are mindful for opportunity for innovation in technology and scale variables. This isn't a one-time conversation. There is a lot of growth going on in the fields of communications and data management. It's a great time to be tackling these challenges.

One last thing – Special thanks to the fishermen and other industry representatives for coming to the workshop and for sharing your insights into the use of this emerging fisheries monitoring technology.

Agenda

DAY 1
Wednesday, May 7, 2014

9:30 Welcome **Geoff Smith, The Nature Conservancy**

9:40 Overview and Introductions Laura Taylor Singer, SAMBAS Consulting

9:50 Opening Remarks: Northeast Electronic Monitoring Workshop in the National Framework

Russell Brown, Deputy Science and Research Director, NOAA Fisheries/NEFSC

10:05 Panel: Setting the Context for Electronic Monitoring in the Northeast

- **Key Lessons from the National EM Workshop,** Dorothy Lowman, Pacific Fishery Management Council
- **Overview of NEFMC Work on Electronic Monitoring,** Jamie Cournane, Groundfish Plan Coordinator, New England Fishery Management Council
- **Current Efforts within NOAA Fisheries New England Region,** Melissa Hooper, Fishery Policy Analyst, NOAA Fisheries/GARFO

10:45 Perspective on Electronic Monitoring – Potential Goals & Implementation Strategies

- **Reflections from British Columbia,** Rick Stanley, Fisheries Consultant, B.C.
- **Reflections from the West Coast,** Dorothy Lowman, Pacific Fishery Management Council
- **Lessons Learned from NOAA Fisheries Data Review Process,** Holly McBride, NOAA FIisheries/NEFSC

11:40 Panel: Lessons and Observations from Pilot Electronic Monitoring Projects

- **Archipelago Marine Research,** Maria Jose Pria
- **NEFSC Observer Program**, Amy Martins
- **Ecotrust Canada,** Amanda Barney
- **Fishing Experts –** Rodman Sykes, Frank Mirarchi, Vincent Balzano, Greg Walinski

12:40 Lunch

1:40 Breakout: Establishing Goals for Electronic Monitoring in the Groundfish, Scallops, and Herring Fisheries

2:45 Reconvene and Report Out

3:10 Break

3:25 Panel: Issues & Implications for Electronic Monitoring Implementation

- **Data Handling, Analysis, and Other Issues,** Wendy Gabriel, NOAA Fisheries/NEFSC

- **Legal Issues to Consider for EM Implementation,** Mitch MacDonald, General Counsel Northeast

4:05 Table Discussion

1. Brainstorm a list of data issues/concerns/questions that need to be addressed in order to implement EM (this could be broadly or by fishery)
2. Prioritize the TOP THREE for potential further group discussion

4:30 Summarize Table Discussions and Brainstorm Issues for Day Two

5:00 Wrap up and Final Thoughts, George Lapointe, Contractor, NOAA Fisheries Electronic Technologies Initiatives

5:15 Adjourn

5:30 Light reception and poster viewing in hallway outside of Ballroom

6:30 Dinner on Your Own (see list of suggested restaurants)

DAY 2
Thursday, May 8, 2014

9:00 Welcome and Overview — **Melissa Hooper**

9:05 Summary of Day 1 Discussions and Overview of Day 2 — **Laura Taylor Singer**

9:30 Breakout Discussion 1

11:00 Break

11:15 Breakout Discussion 2

12:45 Lunch

1:45 Report Back and Synthesize — **Facilitators and Laura Taylor Singer**

2:40 Next Steps and Closing Remarks, Daniel Morris, Deputy Regional Administrator, NOAA Fisheries/GARFO

2:55 Adjourn

Participant List

FIRST	*LAST*	*EMAIL*	*Affiliation*
Terry	Alexander	jlinc1000@aol.com	*F/V Jocka*/ NEFMC
Mark	Alexander	mark.alexander@ct.gov	Connecticut DEP/NEFMC
Richard	Allen	rballen63@gmail.com	R.B. Allen Associates
Vincent	Balzano	vbalzano@maine.rr.com	*FV North Star*/NEFMC
Amos	Barkai	amos@olsps.com	OLRAC SPS
Amanda	Barney	amanda@ecotrust.ca	Ecotrust Canada
Natalie	Berthiaume	natalie.berthiaume@noaa.gov	NOAA Fisheries
Gabriela	Bradt	Gabriela.Bradt@unh.edu	UNH Sea Grant
Gib	Brogan	gbrogan@oceana.org	Oceana
Russell	Brown	Russell.Brown@noaa.gov	NOAA Fisheries
Susan	Caldwell	scaldwell@tnc.org	The Nature Conservancy
Croy	Carlin	ccarlin@gmri.org	GOM Research Institute
Glenn	Chamberlain	glenn.chamberlain@noaa.gov	NOAA Fisheries
Erik	Chapman	erik.chapman@unh.edu	UNH Sea Grant
Barry	Clifford	barry.clifford@noaa.gov	NOAA Fisheries
Jamie	Cournane	jcournane@nefmc.org	NEFMC
Darcie	Couture	darcie.couture@att.net	Resource Access International
Karl	Cygler	karl@ewts.com	East West Technical Services
Tom	Dempsey	tom@capecodfishermen.org	Cape Cod Fishermen's Alliance
Tim	Donovan	timothy.donovan@noaa.gov	NOAA Fisheries
Aaron	Dority	aaron@penobscoteast.org	Penobscot East
Morgan	Dyas	morgan.dyas@saltwaterinc.com	Saltwater Inc.
Elizabeth	Etrie	Libby.Etrie@gmail.com	NE Sector Services Network
Erika	Feller	efeller@tnc.org	The Nature Conservancy
Don	Frei	don.frei@noaa.gov	NOAA Fisheries
Wendy	Gabriel	Wendy.Gabriel@noaa.gov	NOAA Fisheries
Hannah	Goodale	hannah.f.goodale@noaa.gov	NOAA Fisheries
Mark	Hager	hager.mark@gmail.com	East West Technical Services
Madeleine	Hall-Arber	arber@mit.edu	MIT Sea Grant
Dennis	Hansford	dennis.hansford@noaa.gov	NOAA Fisheries
John	Haran	sector13@comcast.net	NEFS Sector XIII
Joe	Heckwolf	joseph.heckwolf@noaa.gov	NOAA Fisheries
Heidi	Henninger	heidi@offshorelobster.org	Offshore Lobstermen's Assoc.
John	Hoey	John.Hoey@noaa.gov	NOAA Fisheries
William	Hoffman	Bill.Hoffman@state.ma.us	Massachusetts DMF
Fiona	Hogan	fhogan@nefmc.org	NEFMC
Melissa	Hooper	melissa.hooper@noaa.gov	NOAA Fisheries
Jessica	Joyce	jjoyce@gmri.org	GOM Research Institute
Peter	Kendall	peter.kendall@comcast.net	NEFMC Member
Amanda	LaBelle	amanda.ruth.labelle@gmail.com	Recorder/Facilitator
Michael	Lanning	J.Michael.Lanning@noaa.gov	NOAA Fisheries

George	Lapointe	georgelapointe@gmail.com	NOAA Fisheries Contractor
Najih	Lazar	nlazar@uri.edu	University of Rhode Island
Rachel	Long	rlong@gmri.org	GOM Research Institute
Dorothy	Lowman	dmlowman01@comcast.net	Lowman and Associates
Mitch	MacDonald	mitch.macdonald@noaa.gov	NOAA Fisheries
Dawn	Mann	dawnm@archipelago.ca	Archipelago Marine Research Ltd.
Ben	Martens	ben@mainecoastfishermen.org	Maine Coast Fishermen's Assoc.
Holly	McBride	holly.mcbride@noaa.gov	NOAA Fisheries
Sally	McGee	smcgee@tnc.org	The Nature Conservancy
Chris	McGuire	cmcguire@tnc.org	The Nature Conservancy
Brad	McHale	brad.mchale@noaa.gov	NOAA Fisheries
Frank	Mirarchi	kaminc@comcast.net	*F/V Barbara L. Peters*
Daniel	Morris	daniel.morris@noaa.gov	NOAA Fisheries
Matt	Mullin	mmullin@edf.org	Environmental Defense
Thomas	Nies	tnies@nefmc.org	NEFMC
Gerry	O'Neill	gerryjr@capeseafoods.com	Cape Seafoods, Inc.
Cate	O'Keefe	cokeefe@umassd.edu	UMass SMAST
Ken	Ortiz	ken.ortiz@noaa.gov	NOAA Fisheries
Michael	Palmer	michael.palmer@noaa.gov	NOAA Fisheries
Michael	Pentony	michael.pentony@noaa.gov	NOAA Fisheries
Maria Jose	Pria	mariap@archipelago.ca	Archipelago Marine Research Ltd.
Maggie	Raymond	maggieraymond@comcast.net	Associated Fisheries of Maine
Nichole	Rossi	nichole.rossi@noaa.gov	NOAA Fisheries
Rich	Ruais	rruais@aol.com	American Bluefin Tuna Association
Daniel	Salerno	daniel.j.salerno@gmail.com	NEFS Sector V
Bradley	Schondelmeier	brad.schondelmeier@state.ma.us	Massachusetts DMF
Laura	Skrobe	lskrobe@uri.edu	University of Rhode Island
Geoffrey	Smith	geoffrey_smith@tnc.org	The Nature Conservancy
Ronald	Smolowitz	cfarm@capecod.net	Coonamessett Farm
Barbara	Somers	bsomers@ds.uri.edu	University of Rhode Island
Rick	Stanley	hamert@shaw.ca	Fisheries Consultant
Lori	Steele	lsteele@nefmc.org	NEFMC
Rachel	Strader	Rachel.Strader@moore.org	Gordon & Betty Moore Foundation
Jill	Swasey	jill.swasey@mragamericas.com	MRAG Americas
Rodman	Sykes	crfisheries@verizon.net	*F/V Virginia Marise*
Laura	Taylor Singer	lsinger@maine.rr.com	SAMBAS Consulting LLC
Mary Beth	Tooley	mbtooley2@ive.com	O'Hara Corp/NEFMC
Amy	Martins	Amy.Martins@noaa.gov	NOAA Fisheries
Lucy	Van Hook	lvanhook@gmail.com	Maine Coast Fishermens Assoc.
Lauren	Wahl	laurenw@aisobservers.com	AIS, Inc.
Greg	Walinski	tom@capecodfishermen.org	Cape Cod Fishermen's Alliance
David	Wallace	dhwallace@aol.com	Wallace & Associates
Tom	Warren	Thomas.Warren@noaa.gov	NOAA Fisheries

Denise	Washick	Denise.Washick@noaa.gov	NOAA Fisheries
Stephen	Weiner	weinersb@gmail.com	American Bluefin Tuna Association

Strawman EM Goals for Northeast Fisheries

(Day 1 – Breakout: Establishing Goals for EM in the Groundfish, Scallop and Herring Fisheries)

The Workshop Steering Committee developed these potential goals for EM in certain Northeast fisheries as a basis for discussion during Day 1. Do you think these are good goals for EM? Do you have other goals that are not captured in this list?

Groundfish

What are the general goals for monitoring?

1. Improve documentation of catch
    a. Determine total catch and effort, for each sector and common pool, of target or regulated species
    b. Achieve coverage level sufficient to minimize effects of potential monitoring bias to the extent possible while maintaining as much flexibility as possible to enhance fleet viability
2. Reduce the cost of monitoring
    a. Streamline data management and eliminate redundancy
    b. Explore options for cost-sharing and deferment of cost to industry
    c. Recognize opportunity costs of insufficient monitoring
3. Incentivize reducing discards
    a. Determine discard rate by smallest possible strata while maintaining cost-effectiveness
    b. Collect information by gear type to accurately calculate discard rates
4. Provide additional data streams for stock assessments
    a. Reduce management and/or biological uncertainty
    b. Perform biological sampling if it may be used to enhance accuracy of mortality or recruitment calculations
5. Enhance safety of monitoring program
6. Perform periodic review of monitoring program for effectiveness.

What are the specific goals for EM as part of a monitoring program?

- Validation (audit) model: validate self-reported discard information reported by captain.
- Maximized retention model: document compliance and facilitate enforcement of prohibitions on discarding of specific species to facilitate documentation of catch at the dock.
- Under either model, could contribute to meeting other groundfish monitoring goals.

Herring

What are the general goals for monitoring?

- Documentation of catch of herring, and bycatch of river herring, shad, and other species.
- Compliance with slippage restrictions.

What are the specific goals for EM?

- Compliance: document slippage events and facilitate enforcement of restrictions on slippage.
- Maximized retention: ensure compliance with prohibitions on discarding of specific species and/or slippage to facilitate documentation of catch at the dock.

Scallops

What are the general goals for monitoring?

- Documentation of bycatch of flatfish.
- Documentation of bycatch of protected species.

What are the specific goals for EM as part of a monitoring program?

- Validation (audit) model: validate self-reported discard information reported by captain.
- Maximized retention model: document compliance and facilitate enforcement of prohibitions on discarding of specific species to facilitate documentation of catch at the dock.

Electronic Monitoring Workshop Steering Committee

Susan Caldwell, The Nature Conservancy
Barry Clifford, NOAA Fisheries, Regional Office
Jamie Cournane, New England Fishery Management Council
Tom Dempsey, Cape Cod Commercial Fishermen's Alliance
Susan Gardner, NOAA Fisheries, Science Center
Wendy Gabriel, NOAA Fisheries, Science Center
Logan Gregory, NOAA Fisheries. Office of Law Enforcement
Melissa Hooper, NOAA Fisheries – Regional Office
Jessica Joyce, Gulf of Maine Research Institute
Peter Kendall, Commercial Fisherman
George Lapointe, Contractor, NOAA Fisheries, Electronic Technologies Initiatives
Frank Mirarchi, Commercial Fisherman
Mitch MacDonald, NOAA Fisheries, General Counsel
Tom Nies, New England Fishery Management Council
Laura Taylor Singer, SAMBAS Consulting
Geoffrey Smith, The Nature Conservancy
Rachel Strader, Gordon and Betty Moore Foundation

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