GETTING UP TO SPEED

Potential Application for Video Monitoring in Atlantic Canada

May 5, 2016

Ecology Action Centre

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Acknowledgements

In preparing for the workshop, we worked closely with and offer a sincere thank you to Amanda Barney, the Marine Monitoring Initiative General Manager with Ecotrust Canada, Mark Hager, the Technical Programs Manager with the Gulf of Maine Research Institute, Randy Cushman, a New England Fisherman and Dan Edwards, the Executive Director of Area "A" Crab Association and Groundfish Fisherman from British Columbia. We thank the Ecology Action Centre staff and volunteers who were instrumental in making this workshop a success including Colleen Turlo, Justin Cantafio, Shannon Arnold, Celene Burnell, Brenna Walsh and Wenhui Gao.

We appreciate the constructive role the DFO-ENGO Forum in the Maritimes Region played during early conversations regarding video monitoring in Atlantic Canada. In particular, support for the workshop from DFO staff Stefan Leslie, Sara Quigley, Heath Stone, Marc Clemens, and Morley Knight was instrumental.

Workshop participants – including the fishing industry, fishing associations, fishermen, First Nations, non-government organizations, and DFO fisheries scientists and managers – ensured productive dialogue throughout the workshop, including helping to develop key next steps.

The workshop was supported by the Government of Canada and the Donner Canadian Foundation.

Information contained in this report has been collected and summarized on a "best efforts" basis, and is a reflection of the discussions and comments presented by workshop participants.

Acronym List

DFO – Department of Fisheries and Oceans
EAC – Ecology Action Centre
EM – Electronic Monitoring
ENGO – Environmental Non-Governmental Organization
GMRI – Gulf of Maine Research Institute
SFF – Sustainable Fisheries Framework
VM – Video Monitoring

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Executive Summary:

Workshop Overview, Results and Next Steps

This report summarizes the findings and discussions from the workshop entitled "*Potential application of video monitoring in Atlantic Canadian Fisheries*" held at the Bedford Institute of Oceanography in Dartmouth, NS on March 31st, 2016. This workshop was a collaborative effort between the Ecology Action Centre (EAC), Ecotrust Canada, Gulf of Maine Research Institute (GMRI), and co-hosted by the Department of Fisheries and Oceans. Funding for the workshop was provided by the Government of Canada and the Donner Canadian Foundation. The workshop successfully brought together more than 80 people representing fishing associations, unions, harvesters, processors, Fisheries and Oceans Canada (DFO), and non-profit organizations.

Video monitoring (VM) is a form of electronic monitoring (EM), used internationally to collect data on fisheries bycatch, discards and other information. Video monitoring uses two types of software; open source data collection software and private data analysis software, which is often highly technical and fisheries specific. VM can be used to verify catch of target and bycatch species, as well as to determine length, size, and sex of species. This form of fisheries monitoring is used on the west coast of Canada in multiple fisheries. In Atlantic Canada, video and/or electronic monitoring could help solve some known challenges, such as helping observer coverage providers to meet the requirements for all fisheries, as well as collecting sufficient data on non-target or bycatch species. Video monitoring has the potential to help alleviate the data collection challenges by offering an alternative tool for monitoring, as well as increase data collection of non-target, bycatch, and discard species in Atlantic Canadian fisheries.

The purpose of this workshop was to:

1. Bring together fishermen, fishing associations, non-profit organizations and Fisheries and Oceans to introduce electronic and video monitoring in the context of Atlantic Canadian Fisheries.
2. Outline and discuss the current use of fisheries monitoring and data collection in Atlantic Canada.
3. Share information on the use of Electronic and Video monitoring in British Columbia and New England fisheries, through experiences of fishermen from these regions.
4. Facilitate open discussions around the potential for implementing electronic and video monitoring in Atlantic Canadian fisheries, with a specific focus on at-risk marine fish which require additional information to determine fishing impacts and status (e.g. cusk and porbeagle sharks).
5. Determine if there is interest in implementing video monitoring.

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Key Findings

Through workshop discussions, questions, answers and workshop evaluation surveys, the following key results were derived:

- Participants appreciated the introduction to VM and opportunity to participate in open discussions about fishermen experiences using VM in other fisheries and regions.
- The fishing industry seeks clarification of DFO intent in considering the use of VM, and which current technologies are available for data collection and monitoring.
- There is desire for improved communication between industry and the DFO science and management branches.
- Primary concerns include privacy, data use, and the cost to implement VM in their fleets. Many fishermen felt that VM would be cost-prohibitive. A few fisheries expressed interest in helping to develop pilot projects in their fleets.
- For a pilot project to be successfully implemented, it should be an industry led initiative, with support from the DFO.

Specific Recommendations

Break out groups were asked to develop specific next steps related to video monitoring in Atlantic Canada. They are listed below, categorized by specific stakeholders.

Department of Fisheries and Oceans should:
- Define requirements for catch monitoring under the Sustainable Fisheries Framework and related policies.
- Provide clarity on expectations for video monitoring in Atlantic Canadian fisheries, as related to policy implementation.
- Undertake a comprehensive review of new technologies across regions that could improve catch reporting, monitoring, and enforcement. This should include, but is not limited to, EM/VM.
- In collaboration with ENGOs, increase communication and outreach with fishermen and develop a better connection between DFO management, science, and enforcement.

Fishing industry should:
- Define what an industry-lead process needs to further explore catch monitoring and EM/VM, and identify potential fisheries for a pilot project.
- Workshop participants who are either representatives of fishing organizations or fishermen need to communicate workshop results to their associations.

Continued dialogue and coordination:
- Additional workshops and meetings should be convened to continue the conversation and provide further information on VM, possibly coordinated by a third party like an ENGO.

Next Steps

Break out groups were asked to identify clear next steps following the workshop. These are summarized below.

As primary conveners and organizers of this workshop, and as an organization with some capacity to follow up on next steps, the EAC will work to:
- Facilitate the use of the Ecotrust e-logbook system through continued dialogue with Ecotrust and interested fishing industry participants.
- Steward continued discussions, specifically with fishermen, and help connect fishermen with service providers and options for VM systems.
- In collaboration with fishermen and DFO:
  - Work towards the organization of a multi-stakeholder working group to further the discussion.
  - Assess potential pilot projects, including cost-benefit analyses and suitability of specific fisheries.

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I. Introduction

In 2010, Ecotrust Canada developed a cost effective and user-friendly electronic video monitoring system to support better resource management and stewardship, increase social and financial equity across fleets, promote information democracy, increase monitoring capacity, and improve financial viability of fleets and coastal communities. In New England, the Gulf of Maine Research Institute (GMRI), in collaboration with Ecotrust Canada, the National Ocean and Atmospheric Association (NOAA) and several groundfish fishermen, has been working towards using video monitoring technology to meet federal specifications, and to collect data comparable to their current at-sea monitoring program.

Currently, Atlantic Canadian fisheries depend largely on at-sea observers to collect information on catch and bycatch, and to support at-sea enforcement. Reaching required levels of observer coverage can be further constrained by vessel size, observer availability, and cost considerations. Video monitoring and electronic logbooks have been proven to be adaptable to multiple fisheries' gear types, and may be useful within the Atlantic Canadian fishery sector to complement current monitoring practices.

The workshop brought together fish harvesters, associations, fisheries scientists, and managers from across Canada to learn more about video monitoring systems used in Canada's west coast fisheries and in the Gulf of Maine. Presentations included information sharing on current technology, costs, experiences of fishermen with video monitoring in their fleets, Fisheries and Oceans policy frameworks, science requirements, as well as certification conditions that require increased catch and bycatch monitoring.

II. Presentation Summaries

Amanda Barney, Ecotrust Marine Monitoring Initiative General Manager, Ecotrust Canada

What is Electronic Monitoring? What is Involved in Electronic Monitoring? And What Costs are Associated with Electronic Monitoring?

Electronic monitoring incorporates data capture, data retrieval, and data analysis. It includes various types of monitoring, from GPS and fishing activity monitoring, to video monitoring. Video monitoring can be used in combination with various other sensors, which allows fishermen and fisheries managers to collect multiple sources of data per vessel (Figure 1).

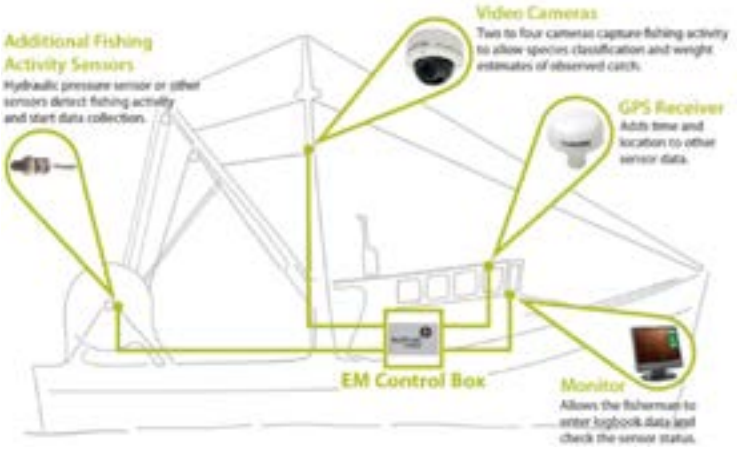

Figure 1. Diagram of an electronic monitoring system on a gillnet fishing vessel. Source: Ecotrust Canada.

Examples of other sensors include hydraulic, buoy, GPS, temperature and pH. There are two types of data software involved in video monitoring; data collection and data analysis. The data collection software is open source, while the data analysis software is highly technical, specific to individual fisheries and even to particular vessels. For this reason, the data analysis software is not open source.

There are multiple costs which can be associated with video monitoring, including, but not limited to, data retrieval, analysis, equipment, and video audit requirements.

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Dan Edwards, Executive Director of Area "A" Crab Association

The Perspective of Fishermen in Using Electronic and Video Monitoring, Based on the Multi-Species Hook and Line Groundfish Fleet and the Area 'A' Crab Fleet in British Columbia.

The British Columbia groundfish fleet implemented electronic and video monitoring in 2006 to address the issue of bycatch discards, particularly of species of concern (i.e. rockfish). The implementation of VM helped move the fishery to an integrated groundfish fleet; from a single species to a multi-species fishery with over 60 species of groundfish. The implementation of VM was beneficial for the smaller vessels who had difficulty finding space to carry observers on-board, and also significantly beneficial as the move to an integrated fleet changed the observer coverage requirements from 12% to 100%.

The Area 'A' crab fleet implemented VM in 2010 based on internal fleet issues surrounding catch and gear theft, as well as vandalism and gear loss. Industry decided that the solution to these issues was to install video monitoring on all vessels 24/7 including Radio Frequency Identification (RFID) chips in all traps -- so every trap is scanned during hauls. This VM program has been valuable to fishermen, industry, and regulators. For example. during consultations for a proposed windfarm, fishermen were able to show GPS tracks of fishing vessels and how the windfarm would obstruct their fishing activities. It also can be used to save gear by providing trap line data to shipping companies, thus preventing hundreds of traps from getting tangled in their propellers.

Electronic and video monitoring are expensive, however, on smaller vessels it is less expensive and less obstructive than having an observer. Using VM has been effective in providing accurate data on catch as well as discards, unlike dockside validation. VM has also been beneficial in monitoring GPS, trap limits, illegal catch, shipping and ferry lanes, and closed areas. This program provides fishermen with a means to collect various types of data which is useful for both fishermen and management.

Mark Hager, Technical Programs Manager, Gulf of Maine Research Institute

The pilot program runs for 3 years and includes 2-7 gillnet and trawl vessels between 32-45ft. For this program, captains fill out logbooks per haul, the video records the hauls and then the electronic video is used to check or audit a percentage of the Captains logbook. The electronic and video monitoring process involves several components both on and off the water. The install in every boat is custom and may take an entire day. It requires using the

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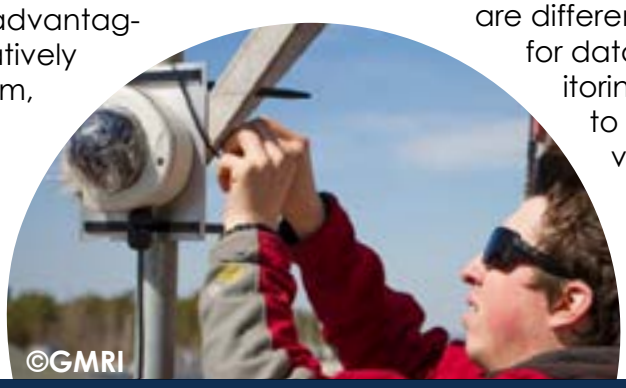
vessels power source and potentially drilling holes in the boat to run wires or mount cameras. When on the water, there are four cameras with a video view of the entire deck. The cameras cover multiple angles and crew are asked to keep standardized practices on the vessel. The maintenance of the VM equipment is the responsibility of the vessel operator and the service provider. The vessel captain or crew must keep the cameras clean and make sure there is appropriate light provided. The service provider, upon being notified by the vessel operator, must fix any technical issues with the system. When back at the dock the hard drive needs to be collected or mailed to the service provider. The video review is used to identify the species, note length, and calculate the weight of each discarded fish.

VM monitoring can be useful, based on the objective of the individual program or fishery. There are challenges associated with using a VM program, ranging from the acceptance and compliance of the Captain and crew in following the protocols, to identifying fish measurement and receiving approval from the federal government to use this data in official management. In New England, fishermen who want to use the program are very careful about following protocols --they then receive better data collection and subsequent analysis. Some initial concerns from participants of the pilot program were based on the uncertainty of confidentiality -- sharing the video with the government and similarly the encroachment on the privacy of fishermen. Some of these concerns have been off-set by the various advantages gained, including the comparatively cost-effective value of the program, how easy it is to increase coverage rates, and the removal of an observer from the boat, which can result in increased safety, space, and peace of mind.



Marc Clemens, Fisheries and Oceans Canada

How is Catch Reporting and Fisheries Monitoring Essential for Implementing the Sustainable Fisheries Framework Developed by Fisheries and Oceans Canada?

Catch reporting and monitoring provide important information for the Sustainable Fisheries Framework and include information on the number of fish caught/discarded, location, timing, biological characteristics, and fishing methodology. This information supports the implementation of Fisheries and Oceans core fisheries management responsibilities, including stock assessments, framework policies, fisheries management decisions, and the species at risk program. There are multiple types of monitoring strategies available to DFO and fishermen, including at-sea data collection and dockside data collection.

At-sea data collection gathers information on catch, discards, protected species interactions, fishing location, fishing effort, and collection of biological samples. It can be self-reported through hails, logbooks, and samples collected by industry or collected by third-parties through at-sea observers, fishing log audits, VMS, and electronic or video monitoring.

Dockside data collection gathers information on landings, weight verification, and collection of biological samples. It can be self-reported through hails or e-hails, or collected by a third party through dockside monitoring, port sampling, or plant audits. Currently, there are different system requirements for data reporting and monitoring. The mechanisms to collect data can also vary between fisheries.

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Catch reporting and monitoring are critical to the implementation of the Sustainable Fisheries Framework policies to support the sustainable management of target species, bycatch species, forage species, and habitat. By using catch reporting and monitoring, the Sustainable Fisheries Framework aims to avoid losses to market access, cost inefficiencies to industry, imposing requirements that are not scientifically defensible/transparent, and weakening Canada's position within RFMOs. The goals of the national framework are (1) to have accurate, timely, and accessible fishery-dependent information to deliver core responsibilities; to collect information which is needed (2) To have consistent, not one size fits all, monitoring approaches in fisheries using a risk-based method to establish these requirements (3) To ensure that the rationale for coverage levels is evidence-based and verifiable by DFO and third parties.

Heath Stone, Fisheries and Oceans Canada

How Does Fisheries and Oceans Canada Science Department Currently Uses At-Sea Observer Data? Examples of Observer Data Case Studies.

At-sea observers are currently the only reliable means of estimating discards in Atlantic Canada. Through direct observation, they provide the main source of data collection for harvested species which are not retained. Observer coverage varies annually between fishery, gear type, and location. For example: ~2% coverage for 4X groundfish, 5-10% for pelagic longline and 60% for 5Z groundfish mobile gear sector. Lower levels of observer coverage result in increased error in bycatch estimations, with literature suggesting coverage of at least 20% is required for common bycatch species, and more than 50% required for rare species. Effective management of bycatch and discards is a key part of the ecosystem approach to fisheries management. This approach has become more important with the increase in Marine Stewardship Council (MSC) certified fisheries in Canada, as well as the increased need for monitoring species protected under SARA (i.e. wolffish), and those designated at-risk by COSEWIC (i.e. winter skate, thorny skate, cusk).

Currently, at-sea observation and dockside monitoring is used to determine if a fishery is high-grading, illegal discarding of sub-optimal catch, or discarding small fish. In the scallop fishery they are used to determine areas of high bycatch aggregation in relation to fishing areas. This data is then used to implement area/time closures. At-sea observer data is also used to collect important data for industry and science, including length, sex, distribution, abundance, shell hardness, trap numbers, location, depth of fishing, retained, discarded, incidental catches, turtle tagging, etc. Finally, the observer program is used as one of the primary data collection tools for various fisheries stock assessments, including the Scotian shelf snow crab and offshore lobster stock assessments. These examples outline how DFO science and fisheries management rely on the observer program to provide multiple types of data on retained and discarded species. In the future, there is a need for increased observer coverage in Atlantic Canadian fisheries as there are still low levels for many fisheries (i.e. pelagic longline, groundfish and offshore scallop). Vid-

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eo monitoring may be a helpful tool to increase coverage in these fisheries. It may also be used to address common themes associated with at-sea observer coverage, including measuring target species.

Jay Lugar, Program Director for Canada, Marine Stewardship Council

What are the Marine Stewardship Councils (MSC) Standard Requirements for Information and Monitoring?

The MSC fisheries standard is a global practice based on scientific determination of sustainable outcomes. It relies on three key standards, 1) the health of a target stock, 2) the impact of the fishing operating and 3) the management system that enables both of them to function correctly. Throughout the MSC certification or assessment process, numerous indicators depend on bycatch monitoring. Previously, certifiers had limited guidance to assess these indicators. Guidance has since increased and should aid the accuracy of fishery certification. The focus of increased guidance was on information and monitoring requirements for retained species, which should include all information needed to determine the risk posed by the fishery, and effectiveness of the strategy to manage retained species. The information required must be sufficient enough to estimate the stock status or undertake the assessment impacts of the fishery to inform the management of retained species. The information on discards can be estimated through observer programmes, interviews with fishermen, research programs, electronic monitoring, video monitoring, logbooks, etc.

Some guidance has been given to aid the observer program specifically, focusing on the coverage level of a fishery. Although there are no general coverage levels, for species which are highly variable there is an increased need for higher levels of coverage, and for normal species, observer coverage rates of 20% provide accurate estimates.

Out of the 287 fisheries MSC certifies globally, 35 currently have observer elements within their information conditions, (i.e. Icelandic Gillnet lumpfish). There are several examples from Canadian fisheries where observation or monitoring is outlined within their information conditions, including FBSA scallops and PEI lobster. In the FBSA scallop condition, there is a requirement to collect bycatch data on a regular basis. This will help detect any increase in the risk to main bycatch species, as well as obtain sufficient information related to mortality and the impact to the fishery, that will allow for quantitative estimation of endangered, threatened or protected species. This has been addressed through the development of a Catch Monitoring Program and initiated observer coverage.

III. Q & A Summaries

Q1: *What is the life expectancy of components of the video monitoring system?*

A1: The systems in Area 'A' are 5 years old and over half have been repaired, but no new boxes have been needed yet. Their life expectancy is largely dependent on the placement of the equipment on the vessel. Some may have major power issues and be fried, others may get too hot if they are placed in areas which are not well ventilated. The video cameras are more than 12 years old. Hydraulic pressure sensors have the shortest life span of 2-5 years and the Radio Frequency Identification (RFID) scanners have a lifespan of 3-9 years.

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Q2: *What are the size ranges of vessels that have been used?*
A2: Vessels of 30ft to 70ft are typical, but they have been used successfully on boats up to 110ft.

Q3: *How does data retrieval occur?*
A3: The data is collected every 2 ½ to 3 weeks and currently retrieval is not done in real time. The data is from a removable 500GB hard-drive which is either collected by technicians, as is done for the Area 'A' fleet, or can be mailed, as is done in New England. There has been a pilot project in New Zealand where they invested in cell towers for the country which allows for the vessel to transmit from sea.

Q4: *What gear types have they been tested on?*
A4: Most fisheries have had pilot work or experiments on whether video monitoring would work. The best fisheries for video monitoring are trap and longline.

Q5: *What are the staffing requirements for video review?*
A5: For Area 'A' there are two part-time anaFor Area 'A' there are two part-time analysts who can adequately service a 35 boat fleet, that runs most of the year. Every vessel has to have footage reviewed and reported monthly. For the pilot study in New England, with an entire sector, there are 1-2 video analysts per fleet. The New England program recruits former observers, as they have experience in identification of species. Staffing also depends on the quality of video and the type of analysis required. Technicians are available 24 hours a day/7 days a week. An entire project requires a coordinator or project manager to ensure that everything is working correctly and delivery happens on time. Therefore, to service one fleet you need 3-4 people with different specialities versus the 10-15 observers you would need to have to meet observer coverage.

Q6: *What were the levels of observer coverage that were replaced? Have you completely removed observers?*
A6: For the Area 'A' fleet, industry put video cameras on the boats themselves, at a similar time observers were then implemented for other reasons, as they had not been present in this fishery previously. The option to use observers 100% of the time has been replaced by 100% video monitoring, which is now chosen by fishermen, especially those who have small boats. In New England, observers are still needed part time and they offer different options related to observers for different fisheries.

Q7: *Do you have footage that allows you to see what happens on deck?*
A7: Typically, there is a long-view camera that can view the full deck.

Q8: *How do you get size of the species which you can identify from the camera footage?*
A8: There is a strip or grid which is 10cm wide and is used to measure fish as they come up over the side of the boat. Also, if you show the camera a particular species you may be able to see the sex. If your camera footage is not compliant you may be forced to go from 10% to 100% audit of footage.

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Q9: *What is the number of fishing days available and what is the approximate size of the fishing area?*
A9: Area 'A' covers a huge area on the eastern coast of Vancouver Island and west coast of Haida Gwaii. There is a soft-shell fishery closure which lasts 1-3 months of the year. The full fleet fishes for 6 months of the year and a small portion of the fleet pushes through even in the winter.

Q10: *Can a system download tag numbers specific to a vessel?*
A10: The system will flag the wrong tag and every buoy has an individual paint job which can be reviewed on the video if necessary. The video will also flag if the hydraulic sensor is used and there is no scan for the buoy.

Q11: *What is the duration that the camera is on?*
A11: There is GPS tracking on at all times, the frame rate when the vessels are in the GPS zone of 'home port' is every 10 seconds and once out of this zone the camera is continually recording. There is no pinging of information, everything is done on hard-drives. All data must be reviewed before the next trip.

Q12: *Could the system be used across fisheries?*
A12: You need to have a separate main system for each fishery which is being monitored. Cameras are generally for individual fisheries however, some sensors can be plugged into different systems to cut down on redundancy of sensors and reduce costs.

Q13: *How long to you store data and how would that change in the case of a subpoena?*
A13: Data is currently stored for the life of the project, which is three years. Supplying government access to video, if they do not use it, is still only three years. If the government decides to use the video footage, then it is legally the property of the government and they can store it as long as they wish. The United States government is still working on policies for this and it is important to note that once they do use the video the cost burden to store it falls to them.

Q14: *VMS, Electronic Monitoring and dockside monitoring may be duplication of services, how is this being addressed?*
A14: This is an important starting point, need to consider what info needs to be collected, how often and what level of accuracy for each fishery.

Q15: *What are the science needs from the perspective of the policy side?*
A15: Science needs are currently being identified and may be sourced outside of DFO. Technical expertise will be needed in the development of the policy. At this time, it is still unsure when policies will be ready, however, consultation will take place along the way.

Q16: *What is the ramp-up, pros and cons?*
A16: Ramp-up would take industry buy-in and would be the most cost effective way to implement video monitoring. The larger the fleet, you then begin to rescale cost and individual costs will go down; more people paying for the infrastructure to collect and analyze the data. It would be ideal to partner with groups or organizations that already exist, such as Ecotrust. It is also important to consider that the more boats using the technology the faster the technology will grow and get better, which may mean a cheaper product.

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IV. Breakout Session Overview & Summaries

In order to achieve the objective of open dialogue and information sharing, the breakout sessions were designed to have a diversity of stakeholders in each group, including representation from DFO, fishing industry, non government organization, first nations and others. The Initial breakout session was designed to provide space for participants to give feedback on presentations, and their initial comments on whether or not video monitoring could be used to address some challenges in Atlantic Canadian fisheries, including low observer coverage, high bycatch of at risk marine fish, illegal catch in some fisheries, fishing in closed areas, etc. The final breakout session was designed to build upon the first session and support a deeper conversation around the use of video monitoring in Atlantic Canadian fisheries and potential next steps which could be taken; including steps for DFO, fishermen, the Ecology Action Centre and Ecotrust Canada.

Breakout Session 1:

What did you like about what you heard during the presentations from Ecotrust, Dan Edwards and GMRI? Do you think EVM would be useful for you?

Participants felt that it is good to know that video monitoring has been tried and proven successful in other areas and that fishermen took leadership on the implementation, before DFO requirements came into place. They also liked that this work has been done collaboratively with non-governmental organizations. The cost, although potentially a serious challenge in Atlantic Canada, seems to be reasonable and efficient compared to at-sea observer data collection, although fisheries need to be considered on a case-by-case basis. Participants found it is very useful to understand the experience and perspective from other fishermen and regions, in order to consider how video monitoring may be applied in Atlantic Canadian fisheries.

What factors should be considered for your fishery and/or region, for implementing video monitoring? What are the Opportunities, challenges or potential adaptations?

Video monitoring could be useful, as it increases accountability and accuracy of data by removing the observer effect and allowing for fishermen to prove compliance. The technology is versatile and expandable, fishermen and DFO will not have to rely on observer availability, data collection is done by industry and can be collected for all seasons, vessel sizes and fisheries and the data can be stored as long as fishermen want. Data collected from VM could also be used to inform Marine Protected Area (MPA) decision making and help limit the disturbance to fisheries.

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The final opportunity is the cost effective versus cost prohibitive possibility of using VM in Atlantic Canadian fisheries; cost efficiency needs to be evaluated on a case-by-case basis. There are also several challenges to consider for Atlantic Canadian fisheries, including fishery diversity/ size of fleets, cost, species identification, implementation, acceptance by industry and ability by DFO to process and use the data. There are many different fisheries in Atlantic Canada, these fisheries vary per vessel, gear, species, etc., this would make it substantially more challenging to implement a single VM program across the region. The cost of video monitoring seems to be the most significant challenge for implementing video monitoring in Atlantic Canadian fisheries. The challenge of cost is linked to the different requirement for observer coverage, short vs. long seasons and the disparity of fishing incomes in different communities. Finally, fishermen acceptance will be a challenge and could be mediated by industry driven implementation and/or consultation between fishermen and DFO. Several potential adaptations for video monitoring implementation in Atlantic Canadian fisheries were discussed, such as using a streamlined system with data collection from multiple service providers, flexibility of the program when fishing for different species and gear types, addition of traceability into the VM program and using the VM program as a tool for CMP enforcement.

Any further questions, comments or concerns?

Throughout the discussions a few main concerns were outlined including privacy, cost, current fisheries management practices and intent by DFO. The economic cost to fishermen needs to be examined before implementation is considered by regulators and fishermen want to know the intent by DFO in implementing video monitoring in Atlantic Canadian fisheries and make sure they are consulted and included in any discussions about this.

Breakout Session 2:

Do you think there are opportunities to move video monitoring forward in Atlantic Canadian fisheries?

A number of fishermen feel that it is uncertain whether there are opportunities to move video monitoring forward in Atlantic Canadian fisheries. Potential options were discussed, including the use as an enforcement tool, supplementation of at-sea observer coverage and self-collected verifiable fisheries data collection to supplement RV survey data collection. It was generally concluded that the best way to successfully implement VM is if industry understands all of the tools and benefits associated and are motivated to lead the implementation of application in individual fisheries.

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V. Evaluation Results

Survey results from 21 participants are summarized in Table 1. Out of 21 respondents, 95% were satisfied to very satisfied with the workshop and thought the content was just right. All of the participants thought the information presented and breakout sessions were somewhat useful to extremely useful and 90% were satisfied to very satisfied with the opportunity for discussion.

	Very Dissatisfied	Neutral	Satisfied	Very Satisfied	Too Basic	Just Right	Too Advanced	Not Useful	Somewhat Useful	Extremely Useful
Overall, how satisfied were you with this workshop?	0%	4.76%	52.38%	42.86%	-	-	-	-	-	-
Was the content of this workshop:	-	-	-	-	0%	95.24%	4.76%	-	-	-
The information presented in the workshop was:	-	-	-	-	-	-	-	0%	33.33%	66.67%
The breakout sessions were:	-	-	-	-	-	-	-	0%	42.86%	57.14%
How satisfied were you with the opportunity for discussion?	0%	9.52%	52.38%	38.10%	-	-	-	-	-	-

Table 1. Video monitoring workshop evaluation results from 21 surveys, representing 25% of workshop participants.

Two additional qualitative questions were asked:

1. What did you like most about the workshop?
   - Introduction to video monitoring technology and costs.
   - Examples from other regions.
   - Diverse background of speakers.
   - The level of engagement between participants.
   - Initiative taken to facilitate dialogue.
   - Breakout sessions.
   - Opportunity to speak with others.
2. What did you like least about the workshop?
   - Some presentations were content heavy and dry.
   - There was limited time to convey results and ask additional questions.
   - The venue was difficult to hear in.

Based on the in-depth, open dialogue, discussions and positive evaluation of the workshop, several next steps for moving forward are discussed below.

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VI. Moving Forward/Next Steps

The workshop determined several next steps for DFO, as the fisheries management body, for the fishing industry and fishermen and for the Ecology Action Centre, as workshop convener and facilitator. Of particular importance is the need for DFO and the fishing industry to work together to identify priorities or requirements of Atlantic Canadian fisheries that might benefit from video monitoring or electronic monitoring. To achieve this, DFO should clarify catch and monitoring requirements under the Sustainable Fisheries Framework (SFF) and outline their intent for video monitoring in Atlantic Canada's fisheries, particularly through consultations and development of the Catch Monitoring Policy.

Improved communication between DFO and industry, as well as a better connection between DFO management, science and enforcement would serve to determine data needs, and options for monitoring and collection. The fishing industry expressed a desire to better understand the suite of tools that exist, their efficacy and what more is needed. This will require a comprehensive review, across regions, of new technologies, including but not limited to electronic and video monitoring, that could improve catch reporting, monitoring and the enforcement system. Industry, management and science would also benefit from a review of the entire electronic and video monitoring system, including a cost-benefit analysis.

Although there was hesitation in the potential application of video monitoring in Atlantic Canada, there was also interest in the assessment and implementation of pilot projects for selected fisheries. In order to move forward with piloting VM in Atlantic Canadian fisheries, additional workshops and meetings are required. Further detail is needed on cost-benefits for fisheries, as well as comparative analysis between observer coverage and VM for vessel types and gear. Finally, DFO needs to clarify the level of resource commitment and policy direction, for there to be successful industry buy-in. While one of the key outcomes is a strong message from industry to lead VM implementation, there is also a desire for DFO to provide clarification in whether or not it intends to move ahead with video monitoring as a tool. A collaborative process will likely be the most successful, where needs of industry and DFO are identified at the outset.

There was recognition that the role played by the Ecology Action Centre, as a non-government organization was useful. If this role is to be continued, additional next steps were identified and include:

- Steward the discussion with fishermen and help connect them with service providers and options for VM systems.
- Continue the discussion, with DFO, fishermen and service providers including:
    - Cost-benefit analysis for interested fisheries.
    - Use of the Ecotrust e-logbook system with interested fishing industry members
    - Potential to link the EM/VM system with oceanographic data collection and determine how valuable this would be for DFO, academics, industry, etc.
- Organize and mediate a working group, lead by DFO and industry; in collaboration with non-governmental organizations and service providers.

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VII. Conclusion

The workshop was well received and generated meaningful discussion around monitoring and data collection systems and needs. Presentations outlined the cost of electronic and video monitoring, experiences from British Columbia and New England fishermen, Fisheries and Oceans (DFO) sustainable fisheries framework and catch monitoring policies, how DFO science uses observation data, and what the monitoring and data collection requirements are for MSC. Primary concerns regarding implementation included cost and privacy. Participants felt that cost could be mitigated by grants, gifted systems, and additional data gathering such as oceanographic data. It was suggested that the concern of "big brother" monitoring could be mitigated by follow-up meetings with individuals who were interested or would like to learn more information.

Inaction or lack of direction from DFO was another main point of discussion throughout the workshop. Participants were concerned that DFO has not been clear about their interest in electronic and video monitoring, and this creates a lot of uncertainty and fear for industry. This is important to note as people will not be fully open to a new technology or program if they are in fear of how it will be used and how it will impact them. There needs to be clarification from DFO to the fishing industry on where they see VM fitting in, and if this is something which will be pursued in the future.

Although there was initial hesitation, discussions on the potential for VM to be used in four promising pilot fisheries were suggested by participants: halibut survey, crab fisheries, scallop and tuna. The opportunities within these fisheries are based on high observer coverage and self-started desire for sustainability and enforcement. Industry, DFO, service providers, and ENGOs will need to work together if successful implementation of video monitoring is going to be used to monitor and collect data on Atlantic Canadian fisheries.

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Appendix I: Participants

List of registrants and workshop participants

Adam Mugridge, Louisbourg Seafoods
Aimee Gromack, DFO
Alain D'Entremont, Scotia Harvest
Alissa Dean, Atlantic Catch Data
Allison McIsaac, Eskasoni Fish & Wildlife Commission
Amanda Barney, Ecotrust Cabada
Amy Moulton, Atlantic Policy Congress of First Nations Chiefs Secretariat
Bernie Berry, Fisherman
Bill Hatt, Fisherman
Bonnie Morse, Grand Manan Fishermen's Association
Brenna Walsh, Volunteer
Brian Guptill, Grand Manan Fishermen's Association
Carmen Burnie, FBSA Vice President
Celene Burnell, Volunteer
Chelsey Karbowski, Ecology Action Centre
Colin MacCuspic, Richmond Inshore Fisherman's Association
Colleen Smith, DFO
Colleen Turlo, Ecology Action Centre
Dan Edwards, BC Fisherman
Derek Fenton, DFO
Elizabeth Baker, Fishermen and Scientists Research Society (FSRS)
Eric Enno Tamm, Ecotrust/This Fish
Eugene O'Leary, Guysborough County Inshore Fishermen's Association (GCFIA)
Geoff Irvine, The Lobster Council of Canada
Ginny Boudreau, GCFIA
Greg Connor, Atlantic Catch Data
Greg Croft, DFO
Greg Organ, N-ENS Snowcrab Assoc
Heath Stone, DFO
Heather Grant, Ecology Action Centre
Jason Keoughan, Buctouche First Nation
Jay Lugar, MSC
Jen Ford, DFO
Jessica Cosham, FSRS
Jessica Seward, Maritime Aboriginal Aquatic Resources Secretariate
Jill Curry, DFO
Jim McKinnon, DFO
John Salsbury, SPANS
Jordan Crane, Native Council of PEI
Joshua McNeely, IKANAWTIKET
Justin Cantafio, Ecology Action Centre
Justin Martin, Native Council of Nova Scotia
Katherine Hastings, DFO
Katherine Miller, Tall Ship Whale Adventures
Katie Schleit, Ecology Action Centre
Ken Paul, Atlantic Policy Congress of First Nations Chiefs Secretariat
Kevin Corbett, Port Representative
Kevin Squires, Maritime Fishermen's Union
Koren Spence, DFO
Kristina Boerder, Dalhousie University
Laura Hussey-Bondt, DFO
Leon LeBlanc, Comeau's Sea Foods
Lisa Setterington, DFO
Lori Baker, Eastern Shore Fisherman's Protective Association
Marc Clemens, DFO
Marilyn Sweet, DFO
Mark Craig, DFO
Mark Hager, GMRI
Melanie Sonnenberg, Grand Manan Fishermen's Association
Michael Cherry, DFO
Natasha Mood, James L Mood Fisheries
Norma Richardson, Eastern Shore Fisherman's Protective Association
Patrick Conway, GCIFA
Peter Saunders, Eastern Shore Fisherman's Protective Association
Randy Cushman, New England Fisherman
Roddie MacCuspic, Richmond Inshore Fisherman's Association
Roddie Milton, Maritime Aboriginal Peoples Council
Roger Hunka, Maritime Aboriginal Peoples Council
Ruth Inniss, Maritime Fishermen's Union
Samuel Elsworth, Fisherman
Sara Quigley, DFO
Sarah Deller, DFO
Sarah Delorey, GCIFA
Scott Coffen-Smout, DFO
Sean Butler, DFO
Shauna Sands, Tall Ship Whale Adventures
Stephanie Boudreau, Oceana Canada
Stephane Kirchhoff, NSCC Waterfront Campus

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Susanna Fuller, Ecology Action Centre
Tammy Saunders, Eastern Shore Fisherman's Protective Association
Tiffany Trecartin, Grand Manan Fishermen's Association
Tim Hayman, DFO
Tim Martin, Native Council of Nova Scotia/ Mime'j Seafoods Limited
Tony Hooper, Connors Bros
Tonya Wimmer, WWF
Tricia Pearo Drew, FSRS
Troy Atkinson, Nova Scotia Swordfishermen's Association
Wenhui, Volunteer

Appendix II:Speaker Biographies

Amanda Barney, Marine Monitoring Initiative General Manager, Ecotrust

Amanda Barney manages the marine monitoring initiative program for Ecotrust Canada, based in Skeena British Columbia. This initiative was developed in collaboration with the Area 'A' crab fleet to benefit small-scale fishermen and communities. She has a background in sustainable development of coastal communities and linking social issues with resource management and policy.

Dan Edwards, Executive Director of Area "A" Crab Association

Dan Edwards is the executive director of the Area 'A' crab association and a groundfish fisherman. Dan lives in Ucluelet British Columbia and has worked with electronic monitoring in the Area 'A' crab fleet since 2009 and the groundfish fleet since 2004.

Mark Hager, Technical Programs Manager, Gulf of Maine Research Institute

Mark Hager is the manager of technical programs at the Gulf of Maine Research Institute, located in Portland Maine. Marks work focuses on fisheries dependent data projects and he is currently working on the groundfish pilot of electronic monitoring. He has a background in environmental sciences and marine biology.

Marc Clemens, Fisheries and Oceans Canada, Ottawa

Marc Clemens is a manager in National Fisheries Policy at Fisheries and Oceans Canada (DFO) in Ottawa. Since 2007, he has worked on the development of DFO's Sustainable Fisheries Framework policies.

Heath Stone, Fisheries Biologist, Fisheries and Oceans Canada

Heath Stone is a Fisheries Biologist with the Population Ecology Division (PED) at the Bedford Institute of Oceanography in Dartmouth NS. Over the past 22 years he was involved with the stock assessments of large pelagics and groundfish species at the Biological Station in St. Andrews, NB, and recently relocated to Dartmouth to lead the Observer, Port Sampling and Ageing programs for PED.

Jay Lugar, Program Director for Canada, Marine Stewardship Council, Halifax

Jay is Program Director, Canada for the Marine Stewardship Council and prior to late 2014 held the position of Fisheries Outreach Manager, Americas. He is based in Halifax and manages MSC relations with all channels of engagement in Canada, including commercial partners, fisheries representatives, NGOs, academics and government. The Marine Stewardship Council is headquartered in London and operates the world's largest international eco-labeling and third-party certification program for environmentally sustainable fisheries.

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Appendix III: Links

All presentations and post-workshop survey results can be found online:
http://ecologyaction.ca/videomonitoring2016

Ecotrust Canada: **http://ecotrust.ca**

Gulf of Maine Research Institute: **http://www.gmri.org**

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