Electronic Monitoring in the West Coast Groundfish Fishery
Exempted Fishing Permit Report
2015-2018

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Executive Summary

The California Groundfish Collective (CGC) and The Nature Conservancy (TNC) have managed an Exempted Fishing Permit (EFP) project in the West Coast groundfish Individual Fishing Quota (IFQ) fishery since 2014. The original goals of this project were to 1) implement electronic video monitoring (EM) in lieu of human observers for catch compliance purposes; 2) inform the development of new regulations while preserving community access to the West Coast fishery through an alternative catch monitoring option; and 3) inform proposed EM programs in other fisheries.

The transition to an IFQ program in 2011 created new monitoring challenges in the West Coast groundfish fishery, including high costs and logistical problems associated with the requirement for 100% human at-sea observer coverage. The use of an EFP has provided an important opportunity to demonstrate the use of EM across multiple gear types as an alternative option for at-sea compliance monitoring. The on-the-water learning generated by this EFP project has directly informed the development of new EM regulations, including program standards for whiting, non-whiting midwater trawl, fixed gear, and bottom trawl gear in the groundfish IFQ fishery. The program standards developed for the West Coast will likely influence EM programs across the U.S. and may benefit fishermen and managers seeking alternative monitoring options.

From 2015-2018 this EFP project deployed EM systems on three trawl vessels and three fixed gear vessels operating out of the ports of Fort Bragg, Half Moon Bay, and Morro Bay, California. Three other EM EFPS were issued by National Marine Fisheries Service (NMFS) in 2014, covering over 40 vessels in total. The NMFS monitors and enforces the terms of the EFPS. The Pacific States Marine Fisheries Commission (PSMFC) has conducted EM video review for the EFP projects. Vessels participating in the project follow catch-handling requirements to aid video review per a Vessel Monitoring Plan (VMP) and use state logbooks as well as specific EM logbooks developed by PSMFC to report priority species catch and discard data. This EFP project has produced a total of 282 unique fishing trips (32 in 2015, 48 in 2016, 94 in 2017 and 108 in 2018), which have been reviewed by PSMFC staff.

Participants in this EFP project are members of the CGC, which is a voluntary collective agreement between fishermen that creates an insurance pool of quota for constraining groundfish species. Fishermen in the CGC collect and share information about the catch of constraining species and use spatial fishing plans to mitigate risk. This annual arrangement has helped participating members maintain a lower utilization rate of overfished species and a higher utilization of target species.
Key lessons learned over the course of the four-year project include:

- EM systems can accurately validate logbook data provided by fishermen and are comparable to human at-sea observers in validating required discard information.

- Fishermen are able to develop and adapt new catch handling techniques to meet review requirements, reduce review time, and ensure the success of EM.

- Collaboration and regular communication between fishermen, NMFS, PSMFC, and private EM service providers is critical to success of the program. Establishing a single point of contact for a group of vessels can improve communication among stakeholders and streamline administration.

- A Collective Enforcement Agreement creates an opportunity for a cooperative approach to implementing EM that may increase efficiency for industry and managers.

- A comprehensive and adaptable individual VMP is imperative for compliance and enforcement.

- Many costs associated with implementing an EM program are variable and highly dependent on final program design.

The dedicated efforts of the project partners, fishermen, PSMFC and NMFS staff resulted in many of the project goals and objectives being met, and this project has provided valuable insight into the ongoing efforts to advance EM at the regional and national level. The learning generated through this EFP project and other concurrent EFP projects has informed the Pacific Fishery Management Council (PFMC) discussions and deeming of draft regulations for whiting and fixed gear EM programs at its April 2016 meeting. After taking PFMC recommendations into consideration, NMFS published a proposed rule for whiting and fixed gear EM programs in September 2016 and took final action on whiting and fixed gear EM in April of 2017 and on third party review in November of 2017. The final rule for whiting and fixed gear was published in June 2019 and the proposed rule for mid-water trawl and bottom trawl is expected later this year.
Introduction and Background:

The West Coast groundfish fishery includes over 90 different species that live on or near the bottom of the ocean. This diverse group of species including Pacific whiting, sole, rockfish, lingcod, and sablefish are harvested by the Individual Fishing Quota (IFQ) fishery using different gear types such as trawl, Scottish seine, longline, and pot gear. For generations, this fishery has contributed to the cultural and economic fabric of coastal communities in Washington, Oregon and California, including the California homeports of the vessels participating in this project: Fort Bragg, Half Moon Bay and Morro Bay.

The National Marine Fisheries Service (NMFS) and the Pacific Fishery Management Council (PFMC) manage groundfish stocks, which are targeted by five different fisheries: limited entry trawl, limited entry fixed gear, open access, recreational, and tribal. The limited entry trawl sector transitioned to an IFQ management program in 2011. Since the implementation of the IFQ program, vessels operating with limited entry trawl permits may use alternative gear types (e.g. fixed gears) to harvest groundfish.

The IFQ program includes requirements for 100% monitoring for compliance at sea, and 100% monitoring of landings on shore to ensure full accounting of every pound of retained and discarded IFQ species. Fishermen are required to use logbooks to report all fish retained and discarded during each fishing event (i.e. a haul or pull) on every trip. Human observers verify and quantify discards at sea and Catch Monitors (CM) verify and quantify retained catch during vessel offloads. Though vessels are required to contract at-sea human observers, and offload company/first receivers are required to provide CM, the same qualified human observer has typically performed both duties.

The monitoring requirements of the IFQ program have presented challenges such as high costs and logistical problems associated with requiring the use of human observers. As of 2015, the fishing industry has been responsible for covering all costs associated with at-sea compliance and CM/shoreside monitoring. The average daily cost for an at-sea observer is estimated at $500\(^1\), and fishing trips tend to last between two and five days. While monitoring is conducted continuously during a trip, vessels can spend many hours steaming to fishing grounds and setting gear, which can result in a day or more of


*footnote continued*
paid observer coverage during which there is no fishing activity to observe. Based on information from NMFS’s Economic Data Collection program, observer costs can be upwards of 30-60% of an average fixed gear or trawl vessel’s total cost net revenue. In some regions, particularly in smaller and more remote ports, deployment of human observers results in significant inefficiencies due to the logistical and operational challenges of moving people between port locations along the coast. These inefficiencies tend to be passed onto fishermen by restricting when fishing can occur – sometimes resulting in lost fishing windows - and requiring vessels to pay for observer travel fees in addition to daily rate charges.

These monitoring challenges are not unique to the West Coast. In May of 2013, NMFS issued a policy directive to all regions of the U.S. urging consideration of and providing guidance on the adoption of electronic technology solutions for fisheries monitoring. At the same time, the PFMC was moving forward with consideration of regulatory objectives for electronic monitoring. In 2012, the PFMC commissioned a research project for PSMFC to partner with vessels and test the feasibility of EM for catch and discard accounting. Fishing vessels volunteered to test this technology while also carrying a human observer. The learning from this research project informed the PFMC decision to permit out-of-cycle applications from interested stakeholders for Exempted Fishing Permits (EFPs) to test EM on vessels without the use of at-sea observers on board. The EFP process in the West Coast groundfish fishery has provided an important opportunity to demonstrate the use of EM across multiple gear types in a high-volume, multi-species fishery, proving it can serve as an alternative to human observers for catch compliance monitoring.

Project Description

The CGC and The Nature Conservancy (TNC) have managed an EFP project in the West Coast groundfish fishery since 2014. The original goals of this project were to 1) implement EM in lieu of human observers for catch compliance purposes; 2) inform the development of new regulations while preserving community access to the West Coast

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2 https://www.nwfsc.noaa.gov/research/divisions/fram/economic/economic_data_reports.cfm

Electronic Monitoring in the West Coast Groundfish Fishery

During late 2014 and early 2015, the project partners collaborated with PSMFC to build upon the lessons learned from previous research projects and worked with NMFS staff to develop terms and conditions for EFPs. This work included drafting and submitting EFP proposals, assessing vessels’ interest in participation, reviewing and negotiating exempted permit terms, developing vessel participation selection criteria, and attending and providing public comment at PFMC and advisory body meetings. The EM EFPs were recommended for approval by the PFMC and issued by NMFS in June 2015, permitting the project partners to include up to seven groundfish IFQ vessels (three fixed gear and four bottom trawl) to carry EM systems in lieu of human observers.

Over the project period from 2015-2018, EM systems were deployed on three trawl and three fixed gear vessels (Table 1). EM systems consist of closed-circuit cameras, drum rotation and hydraulic pressure sensors, a control box and monitor, and a GPS receiver (Figure 1).

![Figure 1. Illustration of EM system aboard typical groundfish trawl vessel. Courtesy Archipelago Marine Research.](image)

Figure 1. Illustration of EM system aboard typical groundfish trawl vessel. Courtesy Archipelago Marine Research.

This integrated system collects video imagery and fishing activity information on a hard drive that vessel operators remove and mail to PSMFC for analysis and review following fishing trips. All equipment is designed to be tamper evident.

Captains agreed to follow catch-handling requirements for video review per individual Vessel Monitoring Plans (VMP), and report landings and discard data using state logbooks as well as additional EM discard and priority species logbooks developed by PSMFC. The video is reviewed to validate logbooks and ensure compliance for reporting all catch and discards. This EFP project resulted in video footage gathered during 282...
individual fishing trips, representing approximately 705 sea days and 2,848 individual fishing hauls (Table 1).

Table 1: EFP Participation and activity by gear type (2015-2018 total):

<table>
<thead>
<tr>
<th></th>
<th>Bottom Trawl</th>
<th>Fixed Gear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Trips</td>
<td>210</td>
<td>71</td>
</tr>
<tr>
<td>Hauls</td>
<td>1342</td>
<td>1506</td>
</tr>
</tbody>
</table>

Over the project period, PSMFC conducted a total of 1,623 hours of video review (Table 2).

Table 2: Total video review hours of sorting activity during project period by gear type:

<table>
<thead>
<tr>
<th></th>
<th>Bottom Trawl</th>
<th>Fixed Gear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Review Hours of Sort</td>
<td>1306</td>
<td>320</td>
</tr>
</tbody>
</table>

Many costs associated with an EM program are variable and highly dependent on final program design. The costs of EM use during this EFP are broken down into the following categories:

- **Equipment and installation** - includes EM system control box, cameras, pressure sensors, removable hard drives, monitors and other related components which are amortized across a five-year period, as well as equipment installation costs.
- **Fixed annual costs** – includes technical support for hardware systems, program management costs, and annual software license fees.
- **Variable annual costs** – includes on-the-ground technical support or repair costs.
- **Annual video review and data analysis** – includes costs associated with reviewing video footage, analyzing the data collected, data analysis, data storage, and reporting.
YEAR ONE (2015)

After receiving approved EFPs halfway through the fishing year in June 2015, the project partners developed and distributed a request for bids for EM service providers. After considering five proposals, the project partners hired Archipelago Marine Research (AMR) for the 2015 fishing season to provide, install and service EM systems, assist in the development of initial VMPs, and establish a network of service technicians in primary service ports. The project partners also hired a Project Manager, Ms. Lisa Damrosch, to coordinate all parties involved in the EFP, facilitate data collection to meet project goals, assist in development and troubleshooting of the VMP development, address technical and logistical challenges, assist in representing the project in public forums, and collaborate with external parties on compliance and reporting issues.

In 2015, five vessels (three fixed gear vessels and two trawl vessels) participated in the EFP, completing 32 trips. In July 2015, NMFS revoked the privilege to obtain an EFP from one trawl vessel in the EFP as a result of the vessel failing to meet eligibility criteria.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Installation 29%</th>
<th>Fixed annual costs 59%</th>
<th>Variable annual costs 1%</th>
<th>Annual video review and storage 11%</th>
</tr>
</thead>
</table>

2015 Average Vessel Costs

The estimated average total cost per vessel in 2015 was $15,119, with the largest expense type being fixed annual costs (Fig. 2). Equipment costs in this report are amortized across a 5-year period. Annual video review and data analysis costs are currently paid by NMFS and were estimated for 2015 based on days at sea and data provided by NMFS in the draft Regulatory Impact Review and Initial Regulatory Flexibility Analysis for the proposed rule for whiting and fixed gear EM programs. All other costs were paid using a combination of public and private grant support.

Figure 2: Estimated average vessel cost breakdown for EM EFP Project- Year One (2015)
Results (YEAR ONE)

In 2015, PSMFC reviewed a total of 425 hours of sorting time, representing 384 individual hauls (95 bottom trawl and 289 fixed gear) from this EFP project.

Estimated discard weights recorded in logbooks were compared to estimated discard weights recorded by video reviewers. Figure 3 shows that in 2015, logbook estimates for trawl vessels in total differed by 713 lbs compared to EM video review estimates. Fixed gear vessel logbook estimates differed by 320 lbs.


Figure 3: Comparing estimated discards from EM video review to logbook records for 2015.
YEAR TWO (2016)

The project partners secured approval to continue the EFP project in 2016 and add up to 10 additional vessels. In January 2016, the project partners began working with NMFS and PSMFC to develop a new, singular EFP document for 2016 that incorporated a Collective Enforcement Agreement (CEA).

The CEA is a cooperative approach to implementing EM in which all involved vessels and parties assume responsibility for compliance with the terms and conditions of the EFP and individual VMPs. This approach is intended to reduce NMFS enforcement costs related to an EM program and provide the fleet with more flexibility. Given the need to ensure accurate catch accounting, NMFS Office of Law Enforcement needs a timely way to respond to technical issues, as well as noncompliance with provisions of EM VMPs. However, regulations and corresponding due process requirements may make timely response difficult. Under a CEA option, agreements would become one of the criteria that vessels must satisfy to qualify for authorization to carry EM in lieu of an at-sea observer. This option also provides fishermen members with the ability to more easily and quickly adapt monitoring plans as needed.

The CEA must be vetted with NMFS and must be developed in cooperation with participating vessels. The core components of a CEA include criteria for participation, EM program and VMP requirements, prohibited activities, responsibility for enforcement, penalties and other remedial actions, and individual and collective liability.

As a condition of issuing this new type of EFP, NMFS required the project partners to assume primary responsibility for ensuring that vessels, vessel owners, and vessel operators participating in operations under the EFP complied with the terms and conditions of the EFP and CEA (however, NMFS retained full discretion to independently enforce the terms and conditions of the EFP). NMFS issued the new EFP referencing the CEA in August 2016 and all vessels switched to operating under this agreement at that time.

After distributing a request for bids for EM services, the project partners again hired AMR for the 2016 fishing season to provide, install and maintain EM systems.

<table>
<thead>
<tr>
<th>Year Two (2016) Participation</th>
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<tbody>
<tr>
<td>In 2016, four vessels (two fixed gear vessels and two trawl vessels participated in the EFP, completing 48 trips. One fixed gear vessel did not fish in 2016 due to vessel construction, a Scottish Seine vessel was added as a second trawler.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Costs Year Two (2016)</th>
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<tbody>
<tr>
<td>The estimated average total cost per vessel in 2016 was $12,320. As in 2015, the largest expense type remained fixed annual costs, though there were some cost savings attributable to reduced EM service provider fees. Equipment costs are amortized over a 5-year period. The annual video review and data analysis costs were paid by NMFS and are thus presented as estimates based on days at sea and data provided by NMFS. Additional costs in 2016 were again covered through a combination of public and private grants.</td>
</tr>
</tbody>
</table>

Table 4: Year Two (2016) Project Participation by Gear Type

<table>
<thead>
<tr>
<th>Gear Type</th>
<th>Bottom</th>
<th>Fixed Gear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessels</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Trips</td>
<td>31</td>
<td>17</td>
</tr>
<tr>
<td>Hauls</td>
<td>230</td>
<td>415</td>
</tr>
</tbody>
</table>

Figure 4: Estimated average vessel cost breakdown for EM EFP Project- Year Two (2016).
Results (YEAR TWO)

In 2016, PSMFC reviewed a total of 748 hours of sorting time, representing 645 individual hauls (230 bottom trawl and 415 fixed gear) from this EFP project.

Estimated discard weights recorded in logbooks were compared to estimated discard weights recorded by video reviewers. Figure 5 shows that in 2016, logbook estimates for trawl vessels in total differed by 544 lbs compared to EM video review estimates. Fixed gear vessel logbook estimates differed by 575 lbs.

![Comparison of EM Video Review Discard Estimates and Logbook Discard Estimates - 2016](image)

Figure 5: Comparing estimated discards from EM video review to logbook records for 2016.

At the March 2016 meeting, the PFMC chose to extend the expiration date of the EM EFPs for the bottom trawl, non-whiting mid-water trawl, whiting mid-water trawl, and fixed gear sectors through 2018.

In April 2016, the PFMC deemed draft regulations for whiting and fixed gear EM programs. After taking PFMC recommendations into consideration, NMFS published a proposed rule for whiting and fixed gear EM programs in September 2016.
YEAR THREE (2017)

Given the delayed implementation of a regulatory EM program, NMFS extended the term of the EFP and CEA for both fixed gear and trawl vessels in this project through 2018.

During 2017, project partners continued to work with vessels and NMFS and PSMFC to fine tune Vessel Monitoring Plans and increase catch handling efficiency.

The project partners also continued to engage in the regulatory process to clarify cost analyses and advocate for preferred options to include in the pending trawl and mid-water trawl sectors draft EM program regulations.

In the fall of 2017, Lisa Damrosch, the EFP project manager, published a report documenting the challenges of training, employing, and securing catch monitors when using EM. The report included recommendations to improve the availability and affordability of catch monitors for offloads and was submitted as formal public comment to the PFMC and advisory bodies in November 2017.

In 2017, five vessels (three fixed gear vessels and three trawl vessels [one vessel used two gear types]) participated in the EFP, completing 94 trips. In 2017, all active CGC vessels participated in the EM EFP.

<table>
<thead>
<tr>
<th>Year Three (2017) Participation</th>
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<tbody>
<tr>
<td>In 2017, five vessels (three fixed gear vessels and three trawl vessels [one vessel used two gear types]) participated in the EFP, completing 94 trips. In 2017, all active CGC vessels participated in the EM EFP.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5: Year Three (2017) Project Participation by Gear Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment and installation</strong></td>
</tr>
<tr>
<td>Vessels</td>
</tr>
<tr>
<td>Trips</td>
</tr>
<tr>
<td>Hauls</td>
</tr>
</tbody>
</table>

2017 Average Vessel Costs

Annual estimated average vessel costs associated with the EFP project in 2017 are presented in Figure 6. In 2017, annual video review and storage costs surpassed fixed annual costs as the largest cost category per vessel due to an increase in fishing activity. These costs were paid by NMFS and thus are presented as estimates based on data provided by NMFS and days at sea. The estimated average total cost per vessel in 2017 was $11,656, indicating additional savings compared to the two previous years, mostly attributable to a reduction in fixed annual costs related to EM service provider fees. While public and private grants covered certain costs, participating vessels did incur small installation related costs for various equipment parts.

Figure 6: Estimated average vessel cost breakdown for EM EFP Project- Year Three (2017)
Results (YEAR THREE)

In 2017, PSMFC reviewed a total of 1,281 video hours of sorting time, representing 920 individual hauls (468 bottom trawl and 452 fixed gear) from this EFP project. In 2017 the EFP project realized a 30% increase in fishing activity.

Estimated weights for discards recorded in logbooks were compared to estimated weights for discards recorded by video reviewers. Figure 7 shows that in 2017, logbook discard weight estimates for trawl differed by 2,973 lbs compared to EM video reviewer estimates, which represented less than a 3% difference. Fixed gear vessel logbook discard weight estimates differed by 499 lbs.

One of the CGC vessels also participated in a review study with PSMFC in 2017 which allowed for discards of Pacific Sand Dabs. The result of this study was that Pacific Sand Dabs were added to the allowable discard list for 2018.

In April of 2017, the PFMC heard updates on EM EFP projects and took final action to approve EM programs for the bottom trawl and non-whiting midwater trawl sectors. At this meeting, the Council provided direction to NMFS to develop a process that would not require a rulemaking to adjust the discard species list in a VMP and to examine the feasibility of using a sole video review provider (PSMFC) model indefinitely.

While the EM program was originally slated for implementation in 2018, NMFS delayed promulgating the final rule for the whiting and fixed gear sectors, and delayed publishing the proposed rule for bottom trawl and midwater trawl.
YEAR FOUR (2018)

Following the extension of EFPs into 2019, project partners developed and distributed a request for bids for EM service providers. After considering three proposals, the project partners hired Archipelago Marine Research (AMR) to extend services for the 2018 fishing season.

The project partners also continued to engage in the regulatory process to clarify cost analyses and advocate for preferred options to include in the pending trawl and mid-water trawl sectors EM program regulations.

In the fall of 2018, Lisa Damrosch, the EFP project manager, presented a Catch Handling memo to NMFS and PSMFC to explore options for improving catch handling guidance in 2019 under the EFP to inform future guidance documents. This work is still ongoing.

Year Four (2018) Participation

In 2018, five vessels (two fixed gear vessels and three trawl vessels) participated in the EFP, completing 108 trips.

<table>
<thead>
<tr>
<th>Equipment and installation</th>
<th>Fixed annual costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>14%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Table 6: Year Four (2018) Project Participation by Gear Type.

COSTS YEAR FOUR (2018)

2018 Average Vessel Costs

Annual estimated average vessel costs associated with the EFP project in 2018 are presented in Figure 8. As in 2017, annual video review and storage costs were the largest cost category per vessel due to an increase in fishing activity. These costs were paid by NMFS and thus are presented as estimates based on data provided by NMFS and days at sea. The estimated average total cost per vessel in 2018 was $13,665, slightly higher than the previous year due to an increase in service provider costs and increased fishing activity. Private grants covered a majority of non-review and storage related costs.

Figure 8: Estimate average vessel cost breakdown for EM EFP Project- Year Four (2018)
Results (YEAR FOUR)

In 2018, PSMFC reviewed a total of 1298 video hours of sorting time, representing 899 individual hauls (549 bottom trawl and 350 fixed gear) from this EFP project.

Estimated weights for discards recorded in logbooks were compared to estimated weights for discards recorded by video reviewers. Figure 9 shows that in 2018, logbook discard weight estimates for trawl differed by 7589 lbs compared to EM video reviewer estimates, which represented less than a 5% difference.

Figure 9: Comparing estimated discards from EM video review to logbook records for 2018.

In 2018, the PFMC’s Groundfish Electronic Monitoring Policy and Technical Advisory Committees met to review NMFS’s draft Procedural Directive on Cost Allocations in Electronic Monitoring Programs and made recommendations related to the need to engage constructively with NMFS to support the development of guidance documentation for the groundfish EM program. Concerns were raised related to the planned transition to third-party service provider model, given lack of clarity on draft business rules that would govern primary and secondary video review and storage requirements, given their significant impact on the cost of the program for vessels.
OVERALL RESULTS: 2015-2018

Costs (2015-2018)

The average annual per vessel costs associated with the EFP project are presented in Figure 10 for all years of the project (2015-2018). Equipment costs for vessels are amortized over a 5-year period. Annual video review and data analysis costs were paid by NMFS and thus are presented as estimates based on total days at sea and data provided by NMFS in the Regulatory Impact Review and Regulatory Flexibility Analysis 6. The average annual total cost per vessel across all four years of the project is $13,190. The largest average cost category is fixed annual costs, though in recent years, this EFP project has seen increased fishing activity cause annual video review and storage costs exceed fixed annual costs like annual program service fees.

AVERAGE VESSEL COSTS 2015-2018

Figure 10: Average annual vessel costs breakdown for EM EFP Project across 2015-2018.
**Comparison of Logbook Data and EM Data (2015-2018)**

Over the four-year project period, logbook discard weight estimates overall differed from EM video reviewer estimates for both gear types by approximately 2%, overall (Figure 11).

![Comparison of Logbook Data and EM Data (2015-2018)](image)

*Figure 11: Comparing estimated discard weights from EM video reviewers to logbooks records for project period (2015-2018).*
Lessons Learned

The four-year EFP project has resulted in useful on-the-water learning that has been incorporated during the regulatory development process, and which can also provide insight for the development of future EM programs in other fisheries.

EM systems can accurately validate logbook data provided by fishermen.

Over the project period, when comparing logbook estimates to EM video review estimates there is not a significant difference between the two (Fig.12, PSMFC). This remained true even as vessels transitioned in and out of the EFP project and while the list of allowable discard species increased due to better review capabilities. Over the 4-year project period, logbook estimates for trawl vessels differed from EM video review estimates in total by less than 5,000 lbs - or less than 2% difference, indicating the ability to use EM to accurately validate logbook records. Fixed gear vessel logbook estimates differed from EM video review estimates by approximately 700 total pounds or 7%. (Fig. 11, PSMFC).
Increases in allowable discards does not decrease accuracy. Since the beginning of the project period in 2015, the number of pounds discarded by bottom trawl vessels has increased, due in part to additional vessel participation in the EM EFP and an increase in the allowable discard species. The total trawl vessel discard weight increased by 85% from 2016 to 2017 (when allowable discards were increased), but the difference between logbook discard estimates and EM discard estimates remained at under 3%.

Figure 12: Comparing estimated discard weights from logbooks and EM video review estimates for project period (2015-2018).

Figure 13: EM review estimates and logbook record discard estimates by species (2015-2018).
Fishermen can develop and adapt new catch handling techniques to ensure the success of EM.

Participating fishermen have demonstrated that - when committed to participating in an EM program - they can change and adapt onboard behavior to meet video review requirements, and thus reduce required video review time and ensure the success of EM in meeting compliance monitoring requirements. However, potential future participants in EM programs should understand that EM is not a passive replacement for human observers due to active participation and commitment to adaptation. Changes to catch handling may influence costs to the vessel due to increased sorting time, increased retained catch, and other considerations.

Placing clearly visible computer monitors in the wheelhouse allows for captains to easily view EM camera views to oversee crew catch handling. All crew members (and scientific observers when onboard the vessel) must be trained not only in catch handling, but also in camera awareness during fishing activity.

Collaboration across stakeholders is essential.

Captain and crew participation, collaboration across various stakeholders, and frequent communication between all parties involved was essential during the development and implementation this EM project. This type of planned collaboration and communication should be incorporated into the development of EM programs elsewhere. In addition, working with a single point of contact for a group of vessels can improve communication and streamline administration of an EM program.

Many costs associated with implementing an EM program are variable and highly dependent on final program design.

Results from the project indicate that EM systems have the potential to reduce existing monitoring costs without compromising data quality or integrity. Actual costs, however, will depend on program goals (e.g., regulatory compliance vs. discard estimation) and the actual program design (e.g., audit-based review vs. 100% video review [also known as a census approach]). Fishery characteristics such as the relative geographic isolation and number of ports, and the amount of fishing activity (by vessels or fleet) also drive
Electronic Monitoring in the West Coast Groundfish Fishery

EM costs. In addition, any analysis of cost-effectiveness depends on a detailed accounting of the costs of deploying human fishery observers. Given ongoing uncertainties in the groundfish fishery, a conclusive evaluation of the cost-effectiveness of this EM programs is not yet possible. However, this project can inform the relative cost picture and help shape perspectives on how to advance EM regulations that have a likelihood of being more cost-effective than current monitoring approaches.

A Collective Enforcement Agreement creates an opportunity for a cooperative approach to implementing EM that may increase efficiency for industry and managers.

The use of a CEA requires close collaboration with NMFS to ensure compatibility with existing rules and regulations. The benefits of a CEA include:

- Reduced need for direct enforcement actions, reducing NMFS administration and enforcement costs while retaining flexibility
- Collective oversight and collective incentives for vessels to comply with EM rules and regulations
- Allows for more timely response to technical challenges or misuse of EM
- Non-compliance can be quickly addressed (the exemption to use EM systems can be quickly nullified for non-compliant vessels)
- Ability to enter into collective agreements with service providers, if desired
- Provides centralized contact points for service providers, PSMFC and NMFS
- Allows for flexible adaptation of monitoring plans as needed without requiring revision of all EFP documents

The challenges of a CEA include:

- Developing and vetting the components and terms within the agreement in collaboration with all stakeholders, including NMFS
- Securing final approval and signatures
- Ensuring compliance if participation is widely distributed geographically

Sylvia et al. 2016
Conclusion
This EFP project has served as an important demonstration of how EM can be used in lieu of at-sea observers for compliance monitoring in a dynamic and complex fishery. This project implemented EM across multiple gear types in a high-volume, multi-species fishery, and project results have informed the development of new EM regulations and guidance documents.

The participants in this EFP project have identified challenges facing the implementation of EM in the groundfish fishery. For instance, vessels using EM face the challenge of limited or reduced availability of CMs for offloads. In ports with fewer landings, it can be difficult to hire, train and retain people to serve in CM roles given the education and training requirements and the inability of CM providers to recoup costs. CM service costs borne by first receivers are typically passed on to vessels, and the logistical challenges associated with moving CMs between remote ports can delay offloads. In some cases, the costs of securing a CM may offset cost savings achieved by using EM. The project partners and other stakeholders are continuing to advocate for the evaluation of potential solutions to CM challenges, including revising educational and training requirements, the types of entities that can serve as certified CM providers, and testing the use of EM technology to monitor offloads.

The role of scientific observers and how they are assigned to EM vessels will need to be explored as the fishery transitions into the implementation of the regulatory EM program in order to ensure adequate data collection can continue without interrupting fishing operations or increasing the workload on only vessels that choose to carry EM. Moving forward, a process for flexibly adapting VMPs will be important as technologies improve and review capabilities change.

The project partners and other stakeholders recognize there are significant outstanding questions related to the ongoing costs of EM. The full cost of an EM program is dependent on final EM program design, and pending decisions related to issues such as the required levels of primary and secondary video review and video storage requirements will significantly impact the full cost of the EM program – and a vessel’s decision to participate or not. In addition, the number of vessels that participate in the west coast EM program will likely directly affect the costs charged by EM vendors to deliver key services such as technical support and primary video review. These critical program guidelines will not only affect costs to the industry and to government, but will determine whether EM can serve as a more cost-effective alternative to human at-sea observers in the groundfish fishery.

Nevertheless, results from this EFP project indicate that EM systems have the potential to reduce existing monitoring costs without compromising data quality or integrity, and therefore may be an alternative compliance monitoring option for some fishing operations in the groundfish fishery.
The project participants look forward to continuing to work with the PFMC, NMFS, PSMFC and other stakeholders to resolve outstanding concerns and reach successful implementation of EM as an alternative catch monitoring option.

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