Final Report
Alaska Track 1:
Review of the 2014 Season

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Contents

Overview

Pacific States Marine Fisheries Commission (PSMFC) launched the Electronic Monitoring (EM) program in 2012 in anticipation of the Pacific Fishery Management Council (PFMC) considering EM as a compliance monitoring tool in the newly implemented Pacific Trawl Rationalization Program. In 2014, PSMFC expanded its EM program to work with the National Marine Fisheries Service - Electronic Monitoring Cooperative Research and Implementation Program which "has been developed to be responsive both to the implementation of the North Pacific Fishery Management Council (NPFMC) EM Strategic Plan, and to Senate language included in the 2014 NMFS appropriations bill, which directed NMFS to work with the small boat fixed gear fleet to implement a program designed to test the functionality of available electronic monitoring systems." (NMFS 2014) Multiple research tracks are being undertaken as part of this cooperative research.

At the February 2014 EM workshop in Juneau, a draft EM monitoring approach (EM approach 1) for deploying standard EM cameras was presented by industry members based on information needs outlined in a NOAA memo delivered to the EM workgroup. EM approach 1 identified fishery specific data elements, priority species, operator responsibilities and other operational factors to be tested in order to identify and inform decision points for NPFMC consideration.

The 2014 field work that resulted from EM workgroup discussion had two initial objectives. The first was to collect field data to define, evaluate and verify assumptions associated with specific information requirements for technology-based monitoring of Alaskan fixed gear fleets. Tasks under this objective include: evaluating the ability of EM reviewers to identify species groupings suggested by the NOAA memo, testing the feasibility of EM review to determine halibut release methods and injury codes, and evaluating logbook effort data needed to support an EM program. The second objective involved testing operational components of an EM program in order to identify field service needs and develop local support capacity. Tasks under this objective include: evaluating camera configurations, testing handling procedures such as full retention of rockfish to aid in the identification of cryptic species, identifying field support services needed to ensure data quality, and evaluating the role of dockside monitoring in validating handling procedures and/or improving data quality. Also included in this objective was collecting cost data and identifying decision points related to cost factors.

Track 1 began in spring 2014 with deployment of EM systems on nine vessels in two home ports. The vessels were all longline vessels targeting sablefish (*Anoplopoma fimbria*) and/or Pacific halibut (*Hippoglossus stenolepis*). Forty-eight trips were monitored using systems from Archipelago Marine Research Ltd (AMR) and Saltwater, Inc. (Saltwater) before the end of June when host vessels transitioned to other fisheries. The interim funding for the track 1 effort also ended in June. Overall, the 2014 field work helped provide a better understanding of field operation requirements in an Alaskan setting. It also created a controlled setting for deployment of EM technology and enabled industry to gain familiarity with EM systems. Technicians were trained and EM systems were deployed on vessels as a part of the field testing. Therefore, the basic operational elements are in place to carry out technology-based monitoring on a limited scale, to experiment with different approaches, and to develop procedures that inform program design and facilitate future scaling to other ports.

PSMFC analyzed data sets from trips where the EM data are complete and where dockside monitoring information could be used to assess rockfish species identification. Both service providers were tasked to document their respective efforts and provide a summary of lessons learned (see attachments 1 & 2). Data from the 2014 field work will continue to be used to inform recommendations for the 2015 field season.

The information presented in this document pertain to the work completed to date on Track 1 - Operationalizing Deployment of EM Systems.

Definition of Catch

For the purposes of EM review, catch is defined as anything seen by an EM reviewer, excluding sea birds and marine mammals that are swimming freely alongside the vessel. If catch is kept on the vessel, it is recorded as retained, if not, it is recorded as discard. Discards includes marine organisms that wash out of the net before the net comes onboard the vessel, that fall off or out of fishing gear before it comes onboard the vessel, or are free floating on the surface.

Some of the vessels only had rail cameras with no deck overview cameras. In those instances, fish were recorded as retained or discarded based on whether they were retained or discarded at the rail. It is possible that some fish brought onboard and recorded as retained were later discarded out of view of the rail cameras, these fish would be recorded as retained in the EM data since the discard could not be observed due to the camera angles. In instances where fish were initially retained and later discarded in view of the rail cameras, a discard record was created.

Providers

PSMFC contracted with both AMR and Saltwater to provide and install EM systems on nine volunteer fishing vessels, collect data drives from the vessels, collect dockside monitoring data, collect logbooks, and provide logistical support. The vessels primarily fished out of Sitka and Homer but made some landings in other ports during the season.

Archipelago Marine Research (AMR)

The on-board AMR EM Observe system included a sensor to capture hydraulic pressure, a GPS to capture locations from which the speed of the vessel was calculated, and 1-4 cameras. The system included an engine oil pressure sensor that triggered the system to power down to sleep mode during periods of inactivity (e.g., night, in port), and reduce power drain.

The system collected sensor data (GPS and hydraulics) at a 10-second interval when fully powered on. Video was triggered to record when the hydraulic pressure exceeded a threshold that was set by the EM technician and was specific to each vessel. Imagery recording would then continue for 30 minutes past the last point when pressure was above the threshold to allow for all catch handling to be captured for each haul. For 10% of the reviewed hauls, 30 minutes was not long enough to capture all of the catch handling done after by the crew after hauling ended (Table 1).

Video feed and system information were displayed on the user interface (typically installed in the wheelhouse) providing vessel operators with a live update of system performance, and continuous video feeds (even when not recording).

To aid in review and interpretation of the video data, AMR provided EM Interpret™ Pro (EMI) software for converting the raw data into usable catch information. EMI integrates the hydraulic sensor and GPS data to the video output to expedite the review process.

When the raw sensor and video data were received by PSMFC, annotations were made using EMI to identify and document start and end dates, times, and locations for trips and hauls, as well as gear and catch information. The sensor and catch annotation data were imported into a Microsoft Access Database for analysis.

System sleep gaps were expected when the vessel was in port, or when the engine of the vessel was shut off. Unexpected sensor and video gaps includes when the system was turned off manually during a trip or the system lost power during a trip.

AMR EM viewers stationed in the ports reviewed video clips from each vessel after the data retrieval to assess the video quality, camera placement, and system function. These data were then used to make adjustments to the installation as necessary. Data were first shipped to PSMFC in July 2014, and as such, there was no opportunity for feedback from PSMFC viewers on camera placement, video quality or catch handling.

Saltwater, Inc.

The on-board Saltwater system included a sensor for hydraulic pressure, a GPS for location data which was incorporated into the video record of one of the cameras, an independent GPS data logger, and 2 cameras. One camera was situated high above to capture the entire deck in a single view, while the second camera was positioned closer to the fishing activity to get a better view for the identification of retained and discarded fish. The cameras were capable of initializing and recording either 100% of the time or only when the hydraulic sensor achieved a pressure level preset by the technician and for 15 minutes after the pressure dropped below that set level. In 23% of the reviewed hauls, these 15 minutes were not long enough to capture all of the catch handling by the crew after hauling ended (Table 1) The sensor and video data were not integrated and there was no independent and quantitative hydraulic sensor data recorded. The lack of a time series from a sensor that is directly integrated with fishing gear/activity made it impossible, independent of fisherman reported data (i.e. logbooks), to determine whether video was captured for all hauls completed on the trip. In other words, PSMFC video reviewers assessed video completeness at the haul level when video was present, but were unable to determine if video was captured for all hauls of the trip.

One vessel carrying a Saltwater system did not have GPS locations incorporated into the video images for their first delivery. This issue was corrected for subsequent deliveries. One trip had the frame rate set at one frame per second as contrasted to the usual 15-20 frames per second. Video from this particular trip was not reviewed for catch.

Saltwater began sending data drives to PSMFC soon after drives were pulled from the vessel. Feedback was provided by the PSMFC video reviewers for the one Saltwater vessel where a change was needed.

When the raw sensor and video data were received by PSMFC, Mobotix software was used to identify trips and hauls. Since no data capture tool was provided, video reviewers recorded all information on sheets of paper that were then keypunched into a database created by PSMFC. Start and end dates, times, and locations, for trips and hauls as well as gear and catch information were captured.

Table 1. Video completeness of reviewed hauls (haul count and percent of total) for each provider.

Video Completeness of Reviewed Hauls	AMR		Saltwater		Total	
Video complete	73	84%	37	62%	**110**	**75%**
Intermittent gaps in video coverage	0	0%	5	8%	**5**	**3%**
Video ends before catch handling ends	9	10%	14	23%	**23**	**16%**
Video starts after haul start	5	6%	4	7%	**9**	**6%**
Total	**87**	**100%**	**60**	**100%**	**147**	**100%**

Dockside Monitoring

Dockside monitors were deployed in multiple ports to collect landed catch data from fishing vessels. All vessels were instructed to keep all of their rockfish or report any discarded rockfish to the dockside monitor. The two providers gave slightly different instructions to the dockside monitors. The instructions, as they were given to PSMFC by the providers, are provided below.

AMR

- Attend all landings or offloads when possible,
- Document piece counts and weights of landed rockfish,
- Collect logbooks from fishers and conduct a data retrieval if the drive is nearing full,
- Discuss EM system use, any issues that arose during the trip, and future fishing plans with the fisher [Comment: Skippers were not directly asked whether they discarded rockfish on each individual trip]

Saltwater

- Ask them if they discarded any rockfish.
- Top priority goes to boats which did not discard. If they did discard rockfish to stay below the MRB [*Maximum Retainable Bycatch*], ask them if the discards occurred in front of the camera. 2nd priority for a dockside unload.
- Monitor the offload to ensure no home pack escapes un-noticed. When all rockfish are off, ID to species in separate bins and count numbers by species. You can let the grader sort as long as you monitor for correct species id.
- Have plant weigh totes by species and record weight. Collect the EM set log for effort data and generally do some QA/QC with the skipper.

Dockside monitor data were transmitted by each provider to PSMFC where a spreadsheet was maintained with all dockside monitor data received. Moving forward, having a single dockside monitoring process would likely make the data collected more consistent and more valuable.

Logbooks

Logbooks developed by the Alaska Longline Fisherman's Association (ALFA) were distributed to all of the participating vessels by the providers. The two providers gave slightly different logbooks to the skippers of the vessels. Both providers asked skippers to report vessel name, trip number and trip start date, set number, hook size, hook spacing, skate length, and number of skates per set. The logbook supplied to Saltwater vessels also requested trip start time, trip end date and time, the date of each haul, and the begin and end times of fishing for each day. As a result of discussions in the EM workgroup, a field for number of hooks was also added to the Saltwater logbook. The two logbooks supplied to each provider by ALFA are provided in Appendices 1 and 2. Moving forward, having a single logbook would likely make the data collected more consistent and more valuable.

Review Rules

A subgroup of the EM work group assessed the possible data that could be valuable to capture from the vessels in Track 1. The group developed rules for which types of data should be captured from each trip depending on how a trip's on-board system performed and whether or not dockside monitoring was successfully completed.

The rules of review were as follows:

a. For all trips: capture #1-3 below (Metadata, Initial review and Trip data).
b. If the video data is complete: add #4 Haul data (Metadata, Initial review and Trip data + Haul data).
c. If the video and sensor data are both complete and dockside monitoring was conducted: add #5 Complete video review (Metadata, Initial review, Trip data and Haul data + Complete video review)

There were 5 levels of information identified:

1) Metadata
    a. ADFG permit #
    b. Date drive retrieved
    c. Field assessment notes (Saltwater/Archipelago notes when drive was picked up)
    d. Logbook: Y/N
2) Initial review to answer the following:
    a. Is sensor data complete? Y/N
    b. Is imagery/video complete? Y/N
    c. Was there dockside monitoring? Y/N
3) Trip data
    a. Port code
    b. Date/time/location start of trip
    c. Date/time/location end of trip
4) Haul data
    a. Date/time/location start of haul
    b. Date/time/location end of haul
    c. Imagery quality:
        i. Useful or
        ii. Something else
5) Complete video review: If useful haul data (4c) and complete video & sensor (2a) and there was dockside monitoring (3b) then review capturing the following data:
    a. Time to review
    b. All fish species IDs to lowest level
    c. All fish counts
    d. All fish disposition (discarded at rail; retained at rail)
    e. All other species
        i. Birds, inverts, mammals
    f. Hook counts (including empty hooks)
    g. Skate/segment counts
    h. For halibut:
        i. Injury key/Release condition
        ii. Release method

Video Review

Data from each hard drive were stored on a server maintained by PSMFC. Video reviewers assessed each hard drive for dates and times of trips and hauls, along with location information and any information that could be assessed regarding the completeness of the sensor and video data during each trip and whether or not dockside monitoring was successfully completed. In the case of AMR vessels, the quantitative data available on the sensor readings and location made us confident in our assessment of trips as having complete or incomplete video. For Saltwater vessels, as noted above, the lack of useful quantitative sensor and location data when cameras were not recording made us less confident of the assessment of video as 'complete'. To assess completeness of Saltwater video, reviewers:

1) Assessed completeness of those hauls for which some video was captured, and
2) Relied on their knowledge of the fishery practices to identify video as complete for a trip.

Regardless of EM provider equipment, if a trip's video was deemed to be incomplete, the video reviewers noted the reason for that assessment and the duration of the longest video failure during a haul.

Due to the systems being programmed to stop recording video a fixed number of minutes after the vessels' hydraulic pressure dropped below a programmed threshold, catch handling was not always completed before the video ended. This means that fish that were on board at the time of the video ending are reported as retained. The video ended before processing was complete for 16 of the total 111 reviewed hauls. The target species tended to be the species on deck at the time the video ended. The length of time video is captured after the hydraulic pressure drops below the programmed threshold is adjustable with the AMR systems and will be adjusted for the 2015 field season for those vessels carrying this equipment.

The PSMFC video reviewers were trained by a PSMFC staffer working with the North Pacific Groundfish Observer Program (NPGOP) on Alaska species reporting conventions including species names and species that are reported within a species grouping and not reported as individual species. These groupings were: Kamchatka/Arrowtooth flounder, northern/southern rocksole, shortraker/rougheye rockfish, all thornyheads, all *Bathyraja* species, all *Myoxocephalus* species, all Irish lord species, all tanner crab species, all king crab species, and all grenadier species. This protocol was followed for the first half of the reviewed trips. The reviewers were then instructed to record species to the lowest identifiable taxonomic level regardless of the grouping as requested by the EM working group.

Video reviewers recorded skate knots, species, count, whether the fish was damaged or not, disposition (retained or discarded), whether the discard was intentional or was a drop-off from the line, confidence in the data collected from the video, whether the video was complete, and the number of minutes it took to review each haul. If the fish was a discarded halibut, reviewers assessed the release method and condition for each fish. Reviewers did not estimate weight of catch.

Discards were categorized as intentional or unintentional depending on the method of discard. Any fish that dropped off of the gear without any interaction with the crew or vessel (i.e., without visible shaking or intentionality by a crew member, or without hitting the roller) was defined as unintentional. All other discards were categorized as intentional.

Testing Review Rate

Video reviewers were initially given direction to count hooks on all hauls. Soon after beginning catch annotation, it became clear that counting every hook on the line was slowing the review process substantially. In order to provide information about how much time this accounted for, the video reviewers were instructed to count hooks only on every other haul. The reviewers were recording length of time for catch annotation of each haul from the beginning of the study. Out of the 147 hauls, 80 were reviewed to capture hooks, retained, and discarded catch, and the other 67 hauls were reviewed to capture retained and discarded catch without hooks. To assess time to review discards only, 10 hauls were randomly sampled from Halibut and Sablefish targeting hauls each (20 hauls total) from vessels using AMR equipment. Results are reported in Table 6.

Results

Data summary

PSMFC received EM data for 30 halibut trips and 18 sablefish trips containing 222 and 89 hauls respectively from 9 fishing vessels (Table 2). Seventeen of the halibut trips (57%) and ten of the sablefish trips (56%) had the landing monitored by a dockside monitor. The data spanned 134 longline halibut sea days and 73 longline sablefish sea days with trips averaging 4.47 and 4.06 days respectively. Not included is one halibut trip where the skipper intentionally turned the system off due to someone onboard being uncomfortable with the cameras recording.

Most of the reviewed hauls had medium and high confidence in the data that was captured from the video. There was no difference in data confidence between the two fishery sectors. The three reviewed hauls with low data confidence were due to night lighting (Table 2).

Table 2. Summary of data including: number of vessels, number of trips, number of hauls, haul level distribution of confidence in data from video, reasons for low confidence or no confidence (unusable), and video completeness. Not included is one halibut trip where the skipper intentionally turned the system off due to someone onboard being uncomfortable with the cameras recording.

Number of Vessels	**Longline Halibut**	**Longline Sablefish**	**Total**
Total	9	5	**9**

Trips

Number of Trips

Review Level Perscribed			
1-3	10	4	**14**
1-4	9	5	**14**
1-5	11	9	**20**
Total	30	18	**48**

Number of Trips with Dockside Monitoring			
Total	17	10	**27**
Percent of total trips	57%	56%	**57%**

Sea Days			
Average Sea Days per Trip	4.47	4.06	**4.31**
Total Number of Sea Days	134	73	**207**

Table 2, cont. Summary of data

Hauls

Number of Hauls	Longline Halibut	Longline Sablefish	
Total	222	89	**311**
Number of Hauls Reviewed for Catch in This Report	106	41	**147**
Average Number of Hauls per **Sea Day**	1.66	1.22	**1.50**
Average Number of Hauls per **Trip**	7.40	4.94	**6.48**
Confidence in Data from Video (Number of Hauls)			
High	44	21	**65**
Medium	60	19	**79**
Low	2	1	**3**
Unusable			
No Video			
Reason for Low Confidence in Data from Video (Number of Hauls / Number of Vessels)			
Corrupt Video Files			
Crew Catch Handling - Not in Camera View			
Poor Image Quality - Glare			
Poor Image Quality - Night Lighting	2 / 2	1 / 1	**3 / 3**
Poor Image Quality - Out of Focus			
Poor Image Quality - Poor Camera Angles			
Poor Image Quality - Poor Camera Resolution			
Poor Image Quality - Water Spots			
Unclosed Video Files			
Total	2 / 2	1 / 1	**3 / 3**
Video Completeness			
Video complete	80	30	**110**
Intermittent gaps in video coverage	5	0	**5**
Video ends before catch handling ends	17	6	**23**
Video starts after haul start	4	5	**9**

Of the total 48 trips, 20 were prescribed review through level 5 (Table 3)

Table 3. Number of trips and hauls prescribed to each level of review for each fishery, and the number of trips where review has been completed or remains to be reviewed.

Number of Trips (Hauls)

	Review Level Prescribed						
Review	Longline Halibut			Longline Sablefish			
Complete?	1-3	1-4	1-5	1-3	1-4	1-5	**Total**
No							
Yes	10 (47)	9 (69)	11 (106)	4 (25)	5 (23)	9 (41)	**48 (311)**
Total	**10 (47)**	**9 (69)**	**11 (106)**	**4 (25)**	**5 (23)**	**9 (41)**	**48 (311)**

For trips where video was assessed as incomplete, no pattern emerged for the reason of video failure. The reasons and duration varied widely for all of the failed trips (Table 4). In the halibut fishery, 6 of the 10 failed trips had technical problems on every haul of the trip (Table 5). One of the 4 failed sablefish fishery trips had every haul affected.

Table 4. Reason for incomplete video assessment for trips prescribed review level 1-3. The "Portion of System" that failed can either be "Video Only", which means that the system was recording GPS and hydraulic pressure data but no video during a haul, or "Whole System Failure" which means that there was a complete lack of data from the system including missing GPS and hydraulic pressure.

Fishery	Partial or Full Trip	Reason for failed video	Portion of System	Trip Count	Duration of longest occurance of problem for each failed trip
Longline Halibut	Full trip	Intermittent gaps in video coverage	Whole System Failure	2	
		No video present/not recorded	Video Only	3	
	Partial trip	Intermittent gaps in video coverage	Video Only	1	17 minutes
		No video present/not recorded	Video Only	1	2 hours
			Whole System Failure	2	40 minutes - 10.5 hours
		Video ends before catch handling ends	Video Only	1	40 minutes
Longline Sablefish	Full trip	No video present/not recorded	Video Only	1	
	Partial trip	Intermittent gaps in video coverage	Whole System Failure	1	4 minutes
		No video present/not recorded	Whole System Failure	2	33 minutes - 3 days

Table 5. Summary of hauls affected in trips prescribed review level 1-3 and the number of hauls affected and not affected by the technical problem. The "Portion of System" that failed can either be "Video Only", which means that the system was recording GPS and hydraulic pressure data but no video during a haul, or "Whole System Failure" which means that there was a complete lack of data from the system including missing GPS and hydraulic pressure.

Proportion of hauls affected	Portion of System	Longline Halibut			Longline Sablefish		
		Trip Count	Hauls Affected	Hauls Not Affected	Trip Count	Hauls Affected	Hauls Not Affected
14%	Whole System Failure	1	1	6			
18%	Whole System Failure				1	2	9
33%	Video Only	1	1	2			
40%	Whole System Failure	1	2	3			
44%	Whole System Failure				1	4	5
50%	Video Only	1	2	2			
	Whole System Failure				1	1	1
100%	Video Only	4	16	0	1	3	0
	Whole System Failure	2	12	0			
	Grand Total	**10**	**34**	**13**	**4**	**10**	**15**

Logbooks

Only 27 of the 48 trips (65%) had a logbook submitted with the video data (Table 6). Four of the 27 submitted logbooks did not contain a number of hauls equal to what was recorded in the video data. Forty-eight percent (11 logbooks) of the 23 logbooks that were submitted and contained an equal number of hauls, were from trips whose video were reviewed for catch (Figure 1).

Table 6. Summary of logbook data submissions including whether the submitted logbooks contained the same or different number of hauls as the video for a given trip.

Logbooks Data Available (Number of Trips)	**Longline Halibut**	**Longline Sablefish**
# EM Hauls **equals** # Logbook Hauls	13	10
# EM Hauls **Less than** # Logbook Hauls	1	
# EM Hauls **Greater than** # Logbook Hauls	2	1
Total Submitted	*27*	
No Logbook	14	7
Total Not Submitted	*21*	

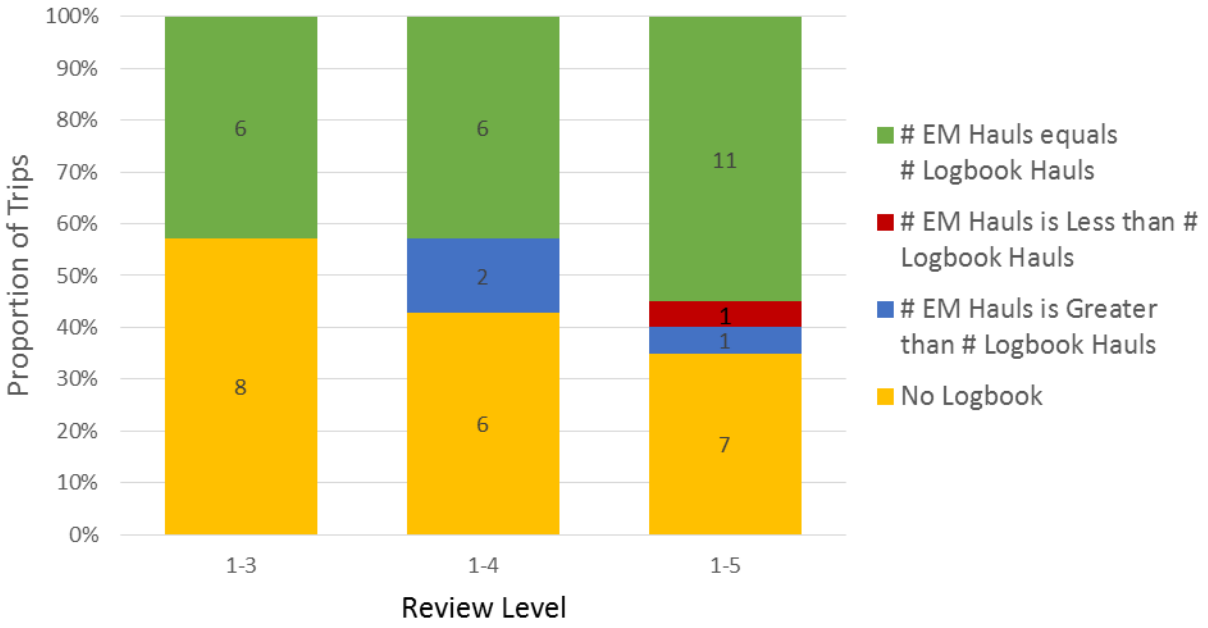

Figure 1. Proportions of trips within each review level designation with logbooks containing either: equal number of hauls, greater number of hauls, smaller number of hauls, or have no logbook record.

Logbook data contained several data points that were not comparable to the EM data, such as hook spacing or hook size. The only comparable data point that was collected by both providers' logbooks was the number of skates counted at the haul level. Video reviewers tended to count more skates than were reported on the logbook (Figure 2). This is due to the difficulty of distinguishing the ends of a skate from a knot in the line in the video. Clearly marking skate knots may ease or even eliminate this problem.

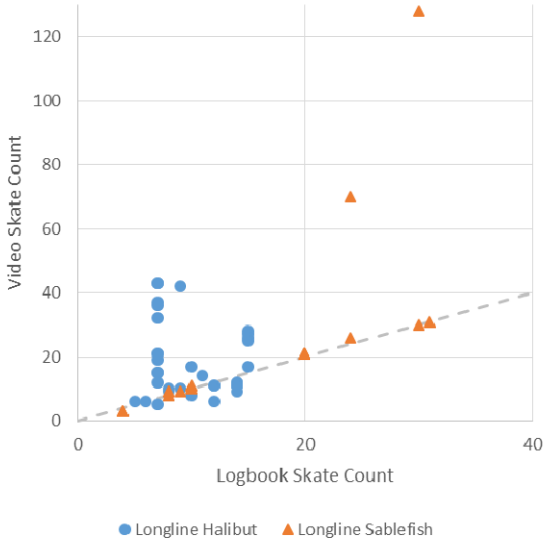

Figure 2. Comparison of logbook and video counts of skates at the haul level of 10 of the 11 trips with 1-5 review level and equal number of hauls between logbooks and video. The dashed grey line is the video = logbook line. If video and logbook counts agreed, the point would fall on the dashed line. In general, video counts higher numbers of skates than are reported in the logbooks.

Rate of review

Rate of review is greatly increased by eliminating hook counting in the AMR data (Table 7). Hook counting slows the rate of review by 50% in both the halibut and sablefish fisheries. This pattern does not hold with the Saltwater data and is likely explained by the inability of the Mobotix software used to review Saltwater video to play video faster than real time when both camera views are displayed in sync. This means that when there is a string of bare hooks, the video reviewer cannot fast forward through that string until a fish is seen on the line. The faster review rate for AMR video is due to both an ability to watch video faster than real time and the automated data capture tool provided by AMR, eliminating the need to pause the video to record catch data on paper.

Capturing discards without retained decreases the review time by an additional 30% relative to the time it takes to review both retained and discarded catch in both target fisheries.

Table 7. Review rate by fishery, provider, and whether or not video was reviewed to capture: hooks + retained + discarded catch, only retained + discarded catch, or only discarded catch were counted during catch assessment.

	Longline Halibut					Longline Sablefish			
	AMR			Saltwater		AMR			Saltwater
	Hooks, Retained and Discarded	Retained and Discarded	Discarded Only	Hooks, Retained and Discarded	Retained and Discarded	Hooks, Retained and Discarded	Retained and Discarded	Discarded Only	Hooks, Retained and Discarded
Haul Count	32	22	10	16	36	24	9	10	8
Average Sort Min/Haul	135	125	113	143	171	174	178	179	109
Average Review Min/Haul	165	75	44	357	408	251	123	70	296
Average Review Min/Sort Min	1.23	0.60	0.38	2.50	2.38	1.44	0.69	0.39	2.73

Catch summary

Retained and discarded catch were summarized to the target fishery level (Table 8). It is important to note that the dockside monitor was asked to only record landed rockfish bycatch. Given these instructions, landed catch of all other species were inconsistently recorded by the dockside monitor, causing the appearance of much lower or absent numbers of retained catch by the dockside monitor than the video reviewer. In the interest of presenting all available data given to PSMFC, these sporadic data were included in this report.

Results indicate that EM can be used to effectively quantify and speciate bycatch of rockfishes or rockfish groups. Video reviewers were initially given instructions to report thornyheads, and shortraker/rougheye rockfish at the grouping levels. They have since begun recording these species at the species level when they are able to identify the species.

The counts of each rockfish species or grouping were aggregated to the trip level to compare to the dockside monitor records. Graphs were created for those species that were recorded on more than one trip between the two target fisheries (Figure 3). The dockside monitor shortraker and rougheye rockfish counts were aggregated to compare trip level retained counts to the shortraker/rougheye rockfish recorded by the video reviewer. The dockside monitor shortspine thornyheads counts were treated similarly, comparing them to the thornyheads recorded by the video reviewer.

Any fish that dropped of the line before interaction with the vessel or a crew member were considered unintentional discards. For most discarded species, the majority of discards were intentional (Table 9). One quarter (27%) of the sablefish discards in the sablefish fishery were unintentional.

Table 8. Counts of landed (dockside monitor), and video recorded retained and discarded catch. The dockside monitor was tasked with recording rockfish bycatch only. Non-rockfish species information is included for completeness. The shaded rows indicate species groupings that video reviewers were specifically given instruction to report at the grouping level.

	Longling Halibut				Longline Sablefish		
	Dockside Monitor	Video			Dockside Monitor	Video	
Species	**Retained**	**Retained**	**Discarded**	**Unknown**	**Retained**	**Retained**	**Discarded**
Rockfish and Thornyheads							
Rockfish - unidentified		12	2			3	5
Rockfish, Black			1				
Rockfish, Canary					1	1	
Rockfish, Dusky (was Light Dusky)	1						
Rockfish, Quillback	2	2	1		2	2	
Rockfish, Red Banded	97	99	7		6	6	16
Rockfish, Rosethorn	3	3			1	1	
Rockfish, Rougheye	60	1			156	23	9
Rockfish, Shortraker	246	7	1		186	41	19
Rockfish, Shortraker/Rougheye		290	44			260	28
Rockfish, Silvergray	6	8			5	5	
Rockfish, Widow	1	1	1				
Rockfish, Yelloweye	287	298	17		41	41	
Rockfish, Shortspine Thornyhead	371				774	58	31
Rockfish, Thornyheads		374	95		89	826	905
Sablefish	9	1,399	221		NA	14,564	1,457
Pacific halibut	NA	7,073	8,328	2	NA	289	684
Pacific cod	444	3,399	582		46	107	17
Lingcod	NA	27	156		4	6	
Flatfish							
Flatfish - unidentified	NA		55		NA	1	19
Flounder, Arrowtooth	NA	3	3		NA		
Flounder, Kamchatka	NA	9	6		NA		
Flounder, Kamchatka/Arrowtooth	NA	56	1,132		NA	13	243
Sole, Dover	NA	1	1		NA		18
Sole, Flathead	NA		6		NA	1	4
Turbot, Greenland	NA		14		NA		1
Other Fish							
Fish - unidentified	NA	2	24		NA		5
Fish head /lips or parts	NA		27		NA	3	38
Flatnose, Pacific (Codling)	NA				NA		1
Grenadier (Rattail), Giant	NA	55	129		NA		6
Grenadier, (Rattail) - unidentified	NA		28		NA	2	3,469
Pollock (Walleye Pollock)	NA		3		NA		
Ratfish, Spotted	NA				NA		3
Roundfish - unidentified	NA		2		NA		
Sculpin - unidentified	NA	15	1,662	4	NA		
Sculpin, Great	NA	1	236		NA		
Wolffish, Bering	NA	1	1		NA		

Table 8, cont. Counts of landed (dockside monitor), and video recorded retained and discarded catch.

	Longling Halibut				Longline Sablefish		
	Dockside Monitor	Video			Dockside Monitor	Video	
Species	**Retained**	**Retained**	**Discarded**	**Unknown**	**Retained**	**Retained**	**Discarded**
Shark							
Shark, Blue	NA		1		NA		
Shark, Pacific Sleeper (Mud)	NA		32		NA		
Shark, Spiny Dogfish	NA	3	517		NA	156	1,054
Skate							
Egg Case, Skate	NA		4		NA		
Skate - Soft Snout unidentified	NA	1	96		NA	9	100
Skate, Alaska	NA		1		NA		
Skate, Aleutian	NA		489		NA		12
Skate, Big	NA	2	450		NA		4
Skate, Longnose	NA	6	1,052		12	15	196
Ray, (Skate) - unidentified	NA		20		NA		1
Coral							
Bryozoans/Coral Unid	NA	1	5		NA	4	7
Coral - unidentified	NA	1			NA		
Crab							
Crab, Hermit - unidentified	NA		5		NA		
Crab, King, Red	NA				NA	1	
Crab, Paralomis verrilli	NA				NA		1
Crab, Tanner	NA		1		NA		6
Invert							
Crinoids - unidentified	NA				NA		26
Invertebrate - unidentified	NA	1	1		NA		4
Jellyfish - unidentified	NA				NA		3
Octopus - unidentified	NA	52	59		NA	1	1
Oysters, Clams, Mussels, Scallops	NA		2		NA		
Sand Dollars, Sea Urchins	NA		1		NA		1
Sea Anemone - unidentified	NA		2		NA		
Snail - unidentified	NA		9		NA		2
Sponge - unidentified	NA		128		NA		11
Starfish - unidentified	NA	1	325		NA		10
Starfish, Basket	NA	1	2		NA		77
Starfish, Brittle	NA	1	2		NA		54
Starfish, Sunstar	NA		9		NA		18
Bird							
Albatross, Black-footed	NA		1		NA		2
Miscellaneous - unidentified (rocks, mud, garbage, etc)	NA	1	28		NA		2
Waste -- Decomposed Fish	NA				NA		1

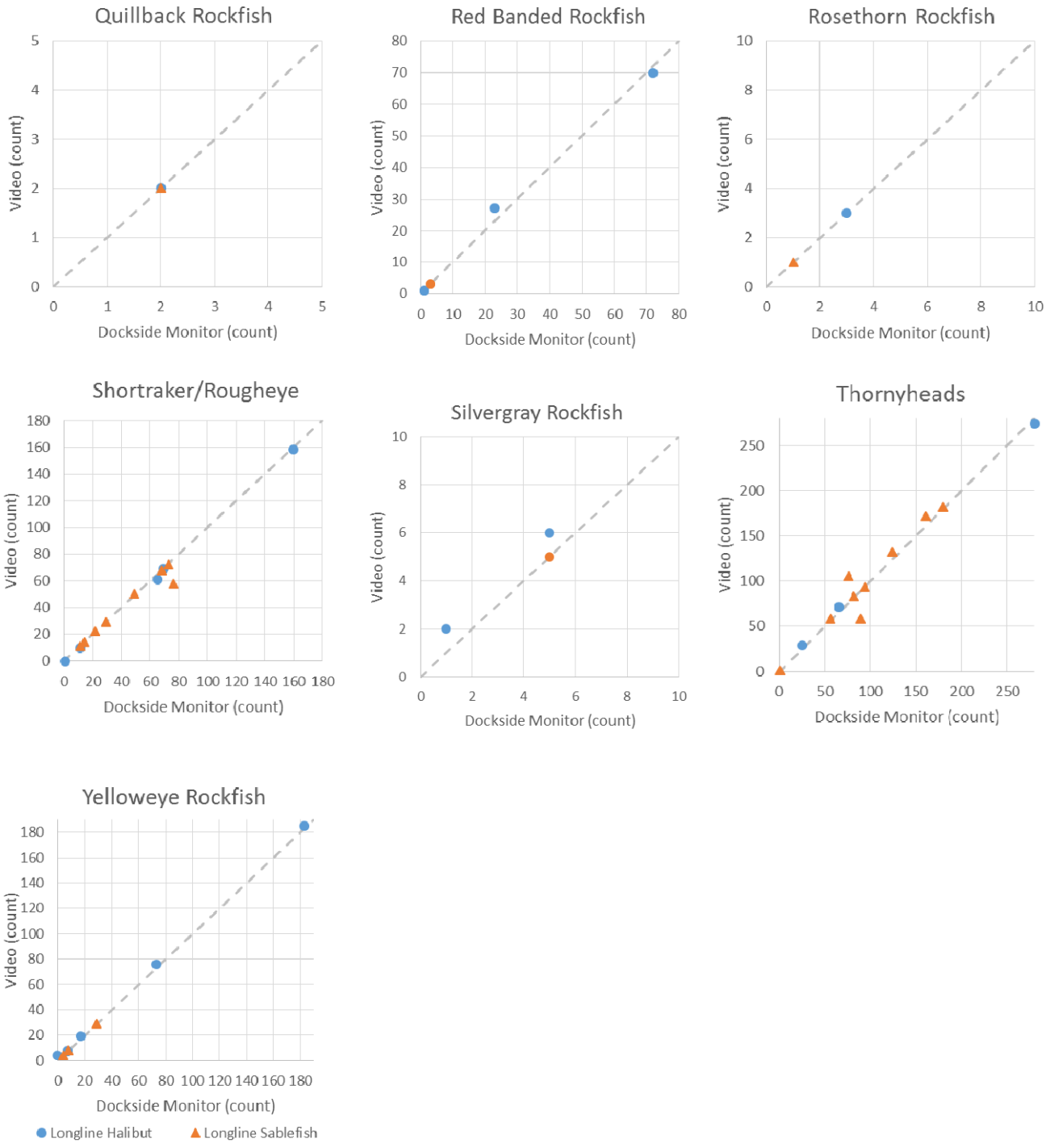

Figure 3. Comparison of dockside monitor and video retained rockfish counts aggregated to the trip level. The dashed grey line is the video = dockside monitor line. If video and dockside monitor counts agreed, the point would fall on the dashed line.

Table 9. Counts of discarded catch divided as intentional or unintentional discards. Any fish that dropped off of the gear with no visible shaking or intentionality by a crew member was defined as unintentional. The shaded rows indicate species groupings that video reviewers were specifically given instruction to report at the grouping level.

	Longling Halibut Discards			Longline Sablefish Discards		
Species	**Intentional**	**Unintentional**	**Total**	**Intentional**	**Unintentional**	**Total**
Rockfish and Thornyheads						
Rockfish - unidentified	2		**2**	4	1	**5**
Rockfish, Black		1	**1**			
Rockfish, Quillback	1		**1**			
Rockfish, Red Banded	6	1	**7**	16		**16**
Rockfish, Rougheye				9		**9**
Rockfish, Shortraker		1	**1**	19		**19**
Rockfish, Shortraker/Rougheye	40	4	**44**	19	9	**28**
Rockfish, Widow	1		**1**			
Rockfish, Yelloweye	15	2	**17**			
Rockfish, Shortspine Thornyhead				30	1	**31**
Rockfish, Thornyheads	85	10	**95**	842	63	**905**
Sablefish	208	13	**221**	1,067	390	**1,457**
Pacific halibut	8,271	57	**8,328**	678	6	**684**
Pacific cod	547	35	**582**	14	3	**17**
Lingcod	152	4	**156**			
Flatfish						
Flatfish - unidentified	52	3	**55**	17	2	**19**
Flounder, Arrowtooth	3		**3**			
Flounder, Kamchatka	5	1	**6**			
Flounder, Kamchatka/Arrowtooth	1,122	10	**1,132**	243		**243**
Sole, Dover	1		**1**	17	1	**18**
Sole, Flathead	6		**6**	4		**4**
Turbot, Greenland	14		**14**	1		**1**
Other Fish						
Fish - unidentified	22	2	**24**	1	4	**5**
Fish head /lips or parts	27		**27**	37	1	**38**
Flatnose, Pacific (Codling)				1		**1**
Grenadier (Rattail), Giant	116	13	**129**	6		**6**
Grenadier, (Rattail)	26	2	**28**	3,383	86	**3,469**
Pollock (Walleye Pollock)	3		**3**			
Ratfish, Spotted				3		**3**
Roundfish - unidentified	2		**2**			
Sculpin - unidentified	1,662		**1,662**			
Sculpin, Great	235	1	**236**			
Wolffish, Bering	1		**1**			

Table 9, cont. Counts of discarded catch divided as intentional or unintentional discards.

Species	Longling Halibut Discards			Longline Sablefish Discards		
	Intentional	Unintentional	Total	Intentional	Unintentional	Total
Shark						
Shark, Blue	1		**1**			
Shark, Pacific Sleeper (Mud)	26	6	**32**			
Shark, Spiny Dogfish	516	1	**517**	1,030	24	**1,054**
Skate						
Egg Case, Skate	4		**4**			
Skate - Soft Snout unidentified	94	2	**96**	95	5	**100**
Skate, Alaska	1		**1**			
Skate, Aleutian	484	5	**489**	12		**12**
Skate, Big	438	12	**450**	4		**4**
Skate, Longnose	1,038	14	**1,052**	194	2	**196**
Ray, (Skate) - unidentified	20		**20**	1		**1**
Coral						
Bryozoans/Coral Unid	5		**5**	7		**7**
Crab						
Crab, Hermit - unidentified	5		**5**			
Crab, Paralomis verrilli				1		**1**
Crab, Tanner - Unidentified	1		**1**	6		**6**
Invert						
Crinoids - unidentified				26		**26**
Invertebrate - unidentified	1		**1**	4		**4**
Jellyfish - unidentified				3		**3**
Octopus - unidentified	16	43	**59**	1		**1**
Oysters, Clams, Mussels, Scallops	2		**2**			
Sand Dollars, Sea Urchins	1		**1**	1		**1**
Sea Anemone - unidentified	2		**2**			
Snail - unidentified	9		**9**	2		**2**
Sponge - unidentified	127	1	**128**	11		**11**
Starfish - unidentified	307	18	**325**	10		**10**
Starfish, Basket	2		**2**	77		**77**
Starfish, Brittle	2		**2**	54		**54**
Starfish, Sunstar	9		**9**	18		**18**
Bird						
Albatross, Black-footed	1		**1**	2		**2**
Miscellaneous - unidentified (rocks, mud, garbage, etc)	28		**28**	2		**2**
Waste -- Decomposed Fish				1		**1**

Pacific halibut

The data collected for track 1 included Pacific halibut release information. Data collected included the method of release and the condition of each individual fish at time of release. These release methods and condition ratings were identical to those used by the observer program. The majority (89%) of released P. halibut were released carefully using the Hook twisting and shaking method (Table 10). The next largest release methods (5%) was recorded as "Unknown". Typically this method would be used to identify an unknown release method either due to the fish coming on board and going out of camera view and later released, or the video reviewer not getting a good view of the halibut as it is being removed from the hook. That accounts for 144 of the 433 "Unknown" release method fish in the halibut fishery. In this instance however, the majority of fish in this category (289 of 433 fish in the halibut fishery) were carefully released by manually removing the hook by hand, but the hook was not twisted and shaken. This release method was not provided on the list of options given by the observer program and consequently were captured as "Unknown". A new release method has been added for the 2015 season after consulting with the observer program to account for this new method of release ("Hand release") along with "Other careful release" and "Other non-careful release" to avoid this issue in the future.

Table 10. Pacific halibut counts for each type release method for the two target fisheries.

Release Method	Longline Halibut		Longline Sablefish		Total	% of total
Hook twisting and shaking	7380	89%	619	90%	7999	89%
Unknown	433		12		445	5%
Unknown	*144*	*2%*	*12*	*2%*	*156*	*2%*
Hand release	*289*	*3%*	*0*	*0%*	*289*	*3%*
Hit the roller	249	3%	37	5%	286	3%
Gaff	105	1%	4	1%	109	1%
Crucifying	102	1%	5	1%	107	1%
Drop-off	57	1%	6	1%	63	1%
Cut the gangion	2	0%	1	0%	3	0%
Grand Total	**8328**	**100%**	**684**	**100%**	**9013**	**100%**

Although it is not possible to assess the accuracy of the ability to assess halibut release condition from EM data due to a lack of corresponding data from onboard the vessel, a release condition was not possible to capture for 7% of the discarded halibut in the halibut targeting fishery (Table 11). A halibut would be given a release condition of unknown if the video reviewer could not observe both sides of the fish and the injuries could not be observed clearly at point of release. Conversely, only 4% of the discarded halibut in the sablefish fishery were given an "unknown" release condition.

Table 11. Pacific halibut counts for each type release condition for the two target fisheries.

Release Condition	Longline Halibut		Longline Sablefish		Total	% of total
Minor	7233	87%	625	91%	7858	87%
Moderate	168	2%	21	3%	189	2%
Severe	19	0%		0%	19	0%
Dead/Sand Fleas/Bleeding	284	3%	14	2%	298	3%
Unknown	624	7%	24	4%	648	7%
Grand Total	**8328**	**100%**	**684**	**100%**	**9013**	**100%**

Table 12. Pacific halibut counts for each type of discard, release method, and release condition for the two target fisheries.

Discard Type	Release Method	Release Condition	Longline Halibut	Longline Sablefish
General	Crucifying	Minor	19	1
General	Crucifying	Moderate	23	1
General	Crucifying	Severe	4	
General	Crucifying	Dead/Sand Fleas/Bleeding	42	
General	Crucifying	Unknown	12	1
General	Cut the gangion	Minor	1	1
General	Cut the gangion	Unknown	1	
General	Gaff	Minor	6	
General	Gaff	Moderate	48	3
General	Gaff	Severe	6	
General	Gaff	Dead/Sand Fleas/Bleeding	32	
General	Gaff	Unknown	13	
General	Hit the roller	Minor	199	30
General	Hit the roller	Moderate	10	4
General	Hit the roller	Severe	1	
General	Hit the roller	Dead/Sand Fleas/Bleeding	10	
General	Hit the roller	Unknown	29	3
General	Hook twisting and shaking	Minor	6803	585
General	Hook twisting and shaking	Moderate	75	13
General	Hook twisting and shaking	Severe	3	
General	Hook twisting and shaking	Dead/Sand Fleas/Bleeding	157	3
General	Hook twisting and shaking	Unknown	318	10
General	Unknown	Minor	195	5
General	Unknown	Moderate	12	
General	Unknown	Severe	5	
General	Unknown	Dead/Sand Fleas/Bleeding	14	
General	Unknown	Unknown	207	5
Damaged	Crucifying	Dead/Sand Fleas/Bleeding	2	2
Damaged	Gaff	Dead/Sand Fleas/Bleeding		1
Damaged	Hook twisting and shaking	Minor		1
Damaged	Hook twisting and shaking	Dead/Sand Fleas/Bleeding	24	7
Damaged	Unknown	Minor		1
Damaged	Unknown	Dead/Sand Fleas/Bleeding		1
Drop-off Above Water	Drop-off	Minor	10	1
Drop-off Above Water	Drop-off	Dead/Sand Fleas/Bleeding	3	
Drop-off Above Water	Drop-off	Unknown	43	5
Drop-off Below Water	Drop-off	Unknown	1	
		Total	**8328**	**684**

References

National Marine Fisheries Service. 2014. Electronic Monitoring Cooperative Research and Implementation Program. http://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/Observer/EM/EMCoopResearchPlan614.pdf

Appendix

Appendix 1. Archipelago Marine Research vessel logbook

EM Set Data **Vessel**_____

Trip # ____ Date _____

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Trip # ____ Date _____

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Appendix 2. Saltwater vessel logbook

EM Fishing Effort Form **Vessel**_____

Port departure date/time_____ **Port return date/time**_____

Trip # ____ Date _____

Fishing start time _____ Fishing end time _____

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Trip # ____ Date _____

Fishing start time _____ Fishing end time _____

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set

Set #	Hook Size	Hook Spacing	Skate Length	# Skates set