Draft Report
Alaska Track 1:
Review of the 2014 Spring Season

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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 grouping suggested by the NOAA memo, testing the ability 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, experiment with different approaches, and develop procedures that inform program design and facilitate future scaling to other ports.

PSMFC will be analyzing 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 appendix 3 & 4). Data from the 2014 field work will continue to be evaluated and 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 that we see that breaks the surface, 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. Discard 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 makes it on 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 important to note that it is possible that some fish brought onboard and recorded as retained were later discarded out of view of the rail cameras. In those 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

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 include an engine oil pressure sleep 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. Video feed and system information were displayed on the user interface (typically installed in the wheelhouse) providing fishers 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.

Saltwater, Inc.

The on-board Saltwater system included a sensor for hydraulic pressure, a GPS for location data which was stamped on the video 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. The sensor and video data were not integrated and there was no time series recorded for the hydraulic sensor. The lack of a time series from a sensor 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 could ascertain if those hauls for which there was some amount of video were complete but not if video was captured for all hauls.

One vessel carrying a Saltwater system did not have GPS locations stamped on the video images for their first delivery. This issue was corrected for subsequent deliveries.

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 data entered 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.

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.

Logbook data are in the process of being entered, therefore video to logbook gear comparisons are not available for this report.

Review Rules

A subgroup of the ad-hoc 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

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.

Archipelago EM viewers 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 began sending data drives to PSMFC soon after drives were pulled from the vessel. Feedback was provided by the PSMFC video reviewers for one Saltwater vessel.

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 along with whether or not dockside monitoring was successfully completed. In the case of AMR vessels, the time series on the sensor and location data made us confident in our assessment of trips as having complete or incomplete video. For Saltwater vessels, as noted above, the lack of time series information on the sensor data 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 (Table 3).

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 9 of the total 48 hauls. The target species tended to be the species on deck at the time the video ended.

Testing Review Rate

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 from the beginning of the study. To date, data on review time without hooks has been

collected on only 7 of the 48 reviewed hauls. This sample size will increase as the remaining 92 hauls are reviewed.

Results

Data summary

To date, PSMFC has received EM data for 31 halibut trips and 17 sablefish trips containing 233 and 81 hauls respectively from 9 fishing vessels (Table 1). Eighteen of the halibut trips and nine of the sablefish trips had the landing monitored by a dockside monitor. Not included is one halibut trip where the skipper intentionally turned the system off due to someone onboard being uncomfortable with the cameras recording.

Table 2 describes the number of trips prescribed to each level of review based on the review rules, and the number of trips where review has been completed or remain to be reviewed. For all of the 6 halibut trips and 3 sablefish trips that have not been completed for catch annotation (review level 5), data has been collected through review level 4 (haul data).

For trips where video was assessed as incomplete, no pattern emerged for the reason of video failure. The reasons varied widely and in length for all of the failed trips (Table 3). In the halibut fishery, 6 of the 10 failed trips had technical problems on every haul of the trip (Table 4). One of the 4 failed sablefish fishery trips had every haul affected.

Rate of review

Rate of review is greatly increased by eliminating hook counting in the AMR data (Table 5). Hook counting slows the rate of review by 46% in the halibut fishery and 139% in the sablefish fishery. Review of the longline halibut fishery is slower than the sablefish fishery due to halibut condition assessment when halibut are discarded.

Catch summary

For the 10 trips with completed catch annotation, retained and discarded catch were also summarized to the target fishery level (Table 6). 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 given instruction to report thornyheads, and shortraker/rougheye rockfish at the grouping levels.

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 with more than one trip with a record of the rockfish between the two target fisheries (Figure 1). 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.

Discards were categorized as intentional or unintentional depending on the method of discard (Table 7). Any fish that dropped off of the gear with no visible shaking or intentionality by a crew member was defined as unintentional. All other discards were categorized as intentional. For most discarded species, the majority of discards were intentional. Thornyheads in the sablefish fishery were an exception with more unintentional discards than intentional. One quarter (28%) of the sablefish discards in the sablefish fishery were unintentional.

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 (Table 8). These release methods and condition ratings were identical to those used by the observer program. The majority of released P. halibut were released carefully (Hook twisting and shaking). The next largest release method 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 69 of the 358 “Unknown” fish released in the halibut fishery. In this instance however, the majority of fish in this category (289 of 358 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”.

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 a quarter (26%) of the discarded halibut in the halibut targeting fishery. 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 7% of the discarded halibut in the sablefish fishery were given an “unknown” release condition.

Tables and Figures

Table 1. Summary of data including: number of vessels, number of trips, number of hauls, haul level distribution of confidence in data from video, and reasons for low confidence or no confidence (unusable). Not included is one halibut trip where the skipper intentionally turned the system off due to someone onboard being uncomfortable with the cameras recording.

	Longling Halibut	Longline Sablefish
Number of Vessels		
Total	9	4
Trips		
Number of Trips		
Review Level Perscribed		
1-3	10	4
1-4	11	4
1-5	10	9
Total	31	17
Number of Trips with Dockside Monitoring		
Total	18	9
Sea Days		
Average Sea Days per Trip	4.42	4.12
Total Number of Sea Days	137	70
Hauls		
Number of Hauls		
Total	233	81
Number of Hauls Reviewed for Catch in This Report	28	20
Average Number of Hauls per **Sea Day**	1.70	1.16
Average Number of Hauls per **Trip**	7.52	4.76
Confidence in Data from Video (Number of Hauls)		
High	6	9
Medium	21	10
Low	1	1
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	1 / 1	
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	1 / 1	

Table 2. 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. 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 Trips (Hauls)

	Review Level Perscribed						
Review	Longline Halibut			Longline Sablefish			
Complete?	1-3	1-4	1-5	1-3	1-4	1-5	**Total**
No			6 (77)			3 (15)	**9 (92)**
Yes	10 (47)	11 (81)	4 (28)	4 (25)	4 (21)	6 (20)	**39 (222)**
Total	**10 (47)**	**11 (81)**	**10 (105)**	**4 (25)**	**4 (21)**	**9 (35)**	**48 (314)**

Table 3. 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. Not included is one halibut trip where the skipper intentionally turned the system off due to someone onboard being uncomfortable with the cameras recording.

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 4. 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. Not included is one halibut trip where the skipper intentionally turned the system off due to someone onboard being uncomfortable with the cameras recording.

		Longline Halibut			Longline Sablefish		
Proportion of hauls affected	Portion of System	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**

Table 5. Review rate by fishery, provider, and whether or not hooks were counted during catch assessment. Rate of review is greatly increased by eliminating hook counting. Review of the longline halibut fishery is slower than the sablefish fishery due to halibut condition assessment when halibut are discarded. Note: there were no Saltwater longline sablefish trips in this test.

	Longline Halibut			Longline Sablefish	
	AMR		Saltwater	AMR	
	With Hooks	No Hooks	With Hooks	With Hooks	No Hooks
Haul Count	10	2	16	15	5
Average Sort Min/Haul	136	177	143	180	190
Average Review Min/Haul	304	270	357	237	105
Average Review Min/Sort Min	2.24	1.53	2.50	1.32	0.55

Table 6. 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**	**Retained**	**Retained**	**Discarded**
Rockfish and Thornyheads						
Rockfish - unidentified		1			1	2
Rockfish, Canary				1	1	
Rockfish, Quillback				2	2	
Rockfish, Red Banded	72	70	4	3	3	
Rockfish, Rosethorn	3	3		1	1	
Rockfish, Rougheye	30			122		
Rockfish, Shortraker	195			116		
Rockfish, Shortraker/Rougheye		219	12		220	10
Rockfish, Silvergray				5	5	
Rockfish, Yelloweye	14	14		41	41	
Rockfish, Shortspine Thornyhead	346			512		
Rockfish, Thornyheads		345	88		561	73
Sablefish	9	1,068	39	NA	11,967	1,293
Pacific halibut	NA	2,292	1,944	NA	262	204
Pacific cod	199	536	335	NA	10	3
Lingcod	NA	27	2	4	6	
Flatfish						
Flatfish - unidentified	NA		55	NA	1	13
Flounder, Kamchatka/Arrowtooth	NA	11	444	NA	18	69
Sole, Dover	NA	1	1	NA		2
Sole, Flathead	NA		6	NA	1	1
Turbot, Greenland	NA		14	NA		
Other Fish						
Fish - unidentified	NA	2		NA		4
Fish head /lips or parts	NA		8	NA	2	36
Grenadier, (Rattail)	NA		27	NA	1	362
Pollock (Walleye Pollock)	NA		1	NA		
Ratfish, Spotted	NA			NA		3
Sculpin - unidentified	NA		109	NA		
Shark						
Shark, Spiny Dogfish	NA		216	NA	156	1,048
Skate						
Skate - Soft Snout unidentified	NA	1	68	NA	9	44
Skate, Big	NA		239	NA		3
Skate, Longnose	NA	1	326	NA	3	53
Coral						
Bryozoans/Coral Unid	NA	1	1	NA		3
Coral - unidentified	NA	1		NA		
Crab						
Crab, Hermit - unidentified	NA		5	NA		
Crab, Tanner	NA		1	NA		3
Invert						
Invertebrate - unidentified	NA	1	1	NA		
Octopus - unidentified	NA	6	2	NA	1	1
Oysters, Clams, Mussels, Scallops	NA		2	NA		
Sand Dollars, Sea Urchins	NA		1	NA		
Snail - unidentified	NA		9	NA		
Sponge - unidentified	NA		128	NA		
Starfish - unidentified	NA		16	NA		7
Starfish, Basket	NA	1	1	NA		
Starfish, Brittle	NA	1	2	NA		
Starfish, Sunstar	NA		6	NA		2
Miscellaneous - unidentified (rocks, mud, garbage, etc)	NA	1	28	NA		

Table 7. 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**
Rockfish, Red Banded	4		**4**			
Rockfish, Shortraker/Rougheye	10	2	**12**	1	9	**10**
Rockfish, Thornyheads	79	9	**88**	22	51	**73**
Sablefish	30	9	**39**	925	368	**1,293**
Pacific halibut	1,924	20	**1,944**	201	3	**204**
Pacific cod	324	11	**335**	3		**3**
Lingcod	2		**2**			
Flatfish						
Flatfish - unidentified	52	3	**55**	12	1	**13**
Flounder, Kamchatka/Arrowtooth	441	3	**444**	69		**69**
Sole, Dover	1		**1**	2		**2**
Sole, Flathead	6		**6**	1		**1**
Turbot, Greenland	14		**14**			
Other Fish						
Fish - unidentified				1	3	**4**
Fish head /lips or parts	8		**8**	35	1	**36**
Grenadier, (Rattail)	25	2	**27**	337	25	**362**
Pollock (Walleye Pollock)	1		**1**			
Ratfish, Spotted				3		**3**
Sculpin - unidentified	109		**109**			
Shark						
Shark, Spiny Dogfish	216		**216**	1,024	24	**1,048**
Skate						
Skate - Soft Snout unidentified	66	2	**68**	39	5	**44**
Skate, Big	231	9	**240**	3		**3**
Skate, Longnose	322	4	**326**	51	2	**53**
Coral						
Bryozoans/Coral Unid	1		**1**	3		**3**
Crab						
Crab, Hermit - unidentified	5		**5**			
Crab, Tanner	1		**1**	3		**3**
Invert						
Invertebrate - unidentified						
Octopus - unidentified	1	1	**2**	1		**1**
Oysters, Clams, Mussels, Scallops	2		**2**			
Sand Dollars, Sea Urchins	1		**1**			
Snail - unidentified	9		**9**			
Sponge - unidentified	127	1	**128**			
Starfish - unidentified	16		**16**	7		**7**
Starfish, Basket	1		**1**			
Starfish, Brittle	2		**2**			
Starfish, Sunstar	6		**6**	2		**2**
Miscellaneous - unidentified (rocks, mud, garbage, etc)	28		**28**			

Table 8. Pacific halibut counts for each type of discard, release method, and release condition for the two target fisheries. The second largest release method 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 69 of the 358 "Unknown" fish released in the halibut fishery. In this instance however, the majority of fish in this category (289 of 358 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".

Discard Type	Release Method	Release Condition	Longline Halibut	Longline Sablefish
General	Crucifying	Minor	16	
General	Crucifying	Moderate	21	
General	Crucifying	Severe	4	
General	Crucifying	Dead/Sand Fleas/Bleeding	2	
General	Crucifying	Unknown	11	
General	Cut the gangion	Minor	1	1
General	Gaff	Minor	4	
General	Gaff	Moderate	42	
General	Gaff	Severe	5	
General	Gaff	Dead/Sand Fleas/Bleeding	19	
General	Gaff	Unknown	8	
General	Hit the roller	Minor	25	3
General	Hit the roller	Moderate	6	1
General	Hit the roller	Severe	1	
General	Hit the roller	Dead/Sand Fleas/Bleeding	1	
General	Hit the roller	Unknown	28	1
General	Hook twisting and shaking	Minor	971	164
General	Hook twisting and shaking	Moderate	54	2
General	Hook twisting and shaking	Severe	1	
General	Hook twisting and shaking	Dead/Sand Fleas/Bleeding	33	2
General	Hook twisting and shaking	Unknown	309	6
General	Unknown	Minor	195	5
General	Unknown	Moderate	11	
General	Unknown	Severe	3	
General	Unknown	Dead/Sand Fleas/Bleeding	12	
General	Unknown	Unknown	137	5
Damaged	Crucifying	Dead/Sand Fleas/Bleeding	1	
Damaged	Gaff	Dead/Sand Fleas/Bleeding		1
Damaged	Hook twisting and shaking	Minor		1
Damaged	Hook twisting and shaking	Dead/Sand Fleas/Bleeding	3	7
Damaged	Unknown	Minor		1
Damaged	Unknown	Dead/Sand Fleas/Bleeding		1
Drop-off Above Water	Drop-off	Minor		1
Drop-off Above Water	Drop-off	Unknown	19	2
Drop-off Below Water	Drop-off	Unknown	1	

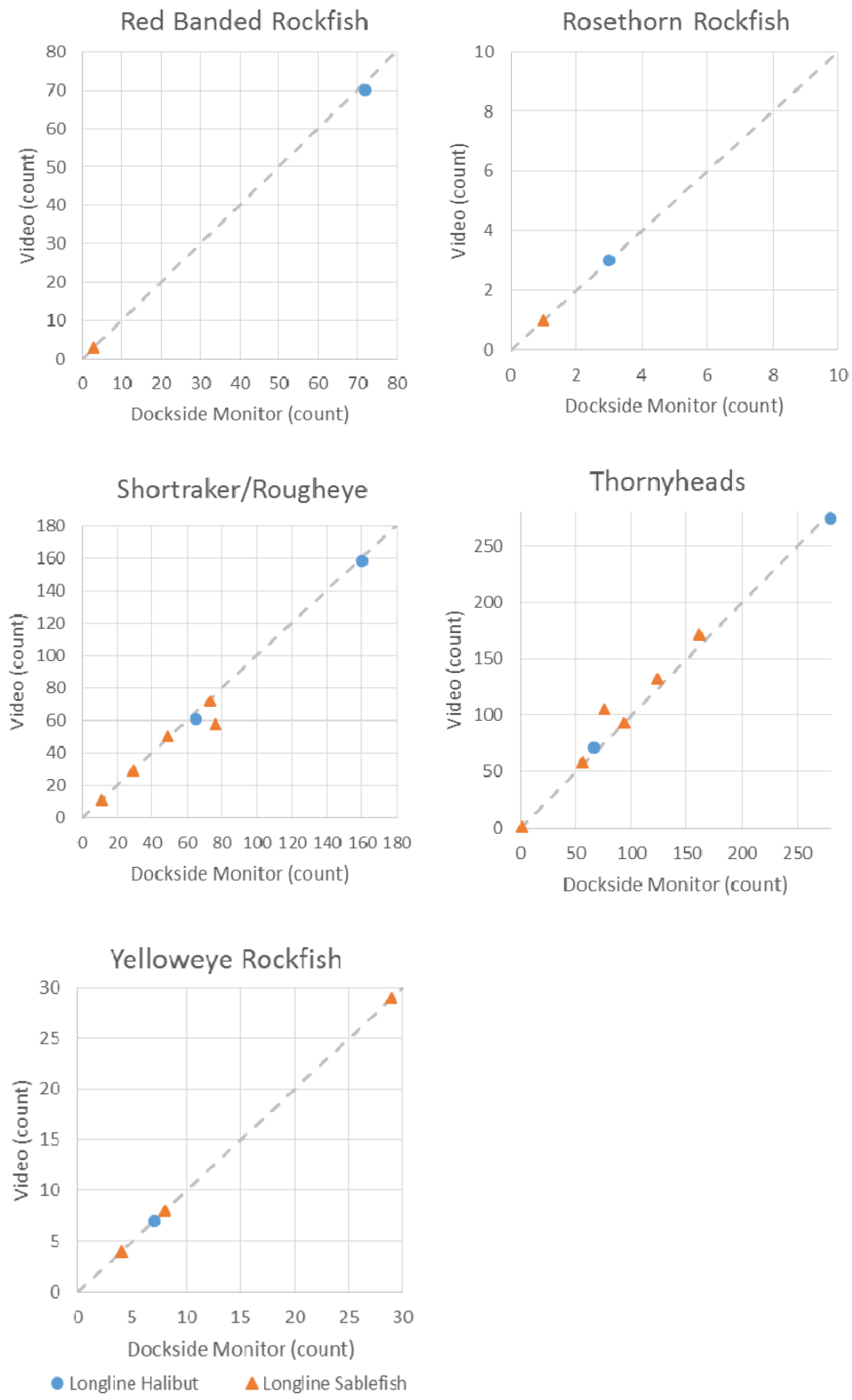

Figure 1. Comparison of dockside monitor and video retained rockfish counts aggregated to the trip level. The dashed grey line is the video = dockside monitor line. If video and dockside monitor counts agreed, the point would fall on the dashed line.

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

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EM Track 1 Field Work for 2014 (Draft)

North Pacific Cooperative Research Plan

Adam Batty, Howard McElderry, Kim Astle
Archipelago Marine Research Ltd.
October 3, 2014

1 Introduction

The North Pacific EM cooperative research program was developed to work with the Alaskan small boat fixed gear fleet to implement a program to test the functionality of available electronic monitoring systems.

This report summarizes the work involved in the operational components such as deploying EM systems, collecting EM data, fisher, and dockside monitor data for a component of the Track 1 of the cooperative research program in 2014. It also defines the data collection methods used on vessels to document fishing events, total catch and discards.

This work was intended to provide a better understanding of field operation requirements in an Alaskan setting, within a controlled setting for deployment of EM technology, thus enabling industry to gain familiarity with EM. With skilled technicians in place and EM systems deployed on vessels, the basic operational elements enabled technology-based monitoring on a limited scale, experiment with different approaches, and develop procedures that inform program design and facilitate future program scaling to other ports.

Project Team

The project team consisted of Archipelago, the Alaska Longline Fishermen's Association (ALFA), Pacific States Marine Fisheries Commission (PSMFC), and the Sitka Sound Science Center (SSSC).

2 Operational Components

Vessel Selection

The Alaska Longline Fishermen's Association (ALFA) selected the participating vessels based on availability and willingness to participate. All participating vessels were volunteers and were homeported in Sitka. Participation required carrying and EM system, discarding catch within camera view, retaining all rockfish, and completing an effort logbook for each trip. Participating vessels were removed from the observer selection pool for the season.

Management and Fleet Coordination

The planning component of the study was highly compressed, with the decision to involve Archipelago occurring at the February 17/18, 2014 EM Cooperative Research meetings in Juneau, and installation of equipment occurring about 10 days later. Over this period, vessels were selected, equipment was shipped to Sitka, outreach was conducted and installation was completed.

Archipelago had a central coordinating role and was responsible for ensuring the consistent delivery of services throughout the project. To support this, Archipelago, ALFA, and the SSSC maintained contact with and the captains regularly to provide the services. All participating vessels were proactive in contacting the technician via phone or SMS, however at times, it was difficult to schedule a data retrieval or dockside monitoring due to late notice or lack of cell phone coverage at-sea. Additionally, several landings occurred in distant ports and required services.

Lessons

A single communication channel would reduce the need for fishers to contact multiple parties, and ensure that all parties are informed on vessel activity and landings (i.e., port location). A process could be developed for the captain to contact a single entity (e.g. phone, email or SMS), which would then trigger notifications being sent to all parties that need to be aware of vessel activity.

Outreach and Scheduling

Outreach was conducted in person on the vessel during installation by Archipelago staff. At the time of installation, technicians and captains discussed the layout of the vessel, an installation plan, installation requirements, and any issues that may have complicated the installation process. Vessel operators received a briefing on the system operation, caretaking and procedures to follow when requiring assistance.

Vessel Monitoring Plans

Archipelago developed a Vessel Monitoring Plan (VMP) for each vessel (see Attachment 1 for an example). The VMP includes a summary of the fisher catch handling and system maintenance requirements, equipment location and rationale, camera placement and associated views, and a summary of software settings. The VMP is intended to be a communication tool, reference for fishers, viewers, and technicians, as well as the single source of information about the onboard installation and practices.

Due to the short sampling period, some vessels did not receive their VMP, so it could not be used as an operational tool during the study.

Lessons

The basis for the VMP and installation plan should be developed before the installation to ensure consistent data collection across all participating vessels. This generic VMP can then act as the at-sea data collection and installation plan. Only one of the vessels was equipped with a view across the deck, and feedback from PSFMC indicated that catch could not always be seen and assessed for retention or discarding. A complete overview

of the vessel deck would resolve this issue. It is important to note that fishers may be reluctant to participate with this requirement because a complete view of the vessel is commonly perceived as being an overly invasive monitoring method.

EM Equipment Provision

EM monitoring systems were shipped from Archipelago for installation on the participating vessels. EM Observer system consist of a control center, video cameras, sensors, GPS, wireless communications, and monitoring software, and has the capability to record video imagery from cameras placed in any part of the vessel, determine vessel location and route, and retrieve sensor data from onboard machinery such as winches, pumps, and lifts to identify fishing activity. The EM system collects sensor data at a 10-second interval while the vessel engine was operating, with corresponding video data during haul back of fishing gear. The system can be set to sleep when the engine in inactive in order to preserve vessel battery power.

Equipment Installation

Archipelago technicians set up the EM system based on discussions with fishers about catch handling and vessel details. The installation included the control center, GPS, engine sensor, and pressure sensors and at least two cameras to capture a close up of the hauling station for species identification (5 fps), and a wide view of the rail (5 fps). As well, two of the participating vessels had unique installations to test the use of higher video data capture rates and different views, including a deck view camera (3 fps), and a hauling station view (10 fps), and a high frame rate camera with hauling station view (15 fps).

The EM system was set to turn on with the main engine, sleep when the main engine was shut off, thus automatically resuming operation after periods of inactivity. This feature reduced power draw at night and when in port.

The fisher was responsible for installing the engine oil and hydraulic pressure sensors and given guidance on placement. At the end of the installation, technicians tested the EM system with the vessel in operation when possible.

Video recording was set to trigger when the hydraulic sensor detected pressure equal to or greater than a given threshold (typically 125 psi) or the drum sensor registered one or more turns. Video recording was set to continue for 30 minutes after fishing activity to capture any catch handling that occurred after hauling was complete.

Lessons

In some cases, vessels were not operable at the time of the EM system installation, and final confirmation of hydraulic pressure lines was not possible by the technician. In future work, we recommend that the vessel does not leave port until an EM technician has confirmed installation of hydraulics through an onboard test. This may require multiple trips to the vessel (one for installation, others for confirmation), but would greatly increase the data collection success on the first few trips.

Routine Service and Data Retrieval

The SSSC technicians performed data retrievals, with technical support from Archipelago as necessary. Archipelago provided training in Sitka on the EM technician work (data retrievals and minor trouble-shooting) and was not Level 1 technician training. Some retrievals were also performed in Seward and Homer by the Alaska Department of Fish & Game (ADF&G) and overseen by the SSSC and Archipelago.

Due to the unpredictable vessel schedules and landing outside of Sitka, data retrievals were conducted opportunistically (as needed and whenever possible) by the SSSC. Both SSSC staff and ALFA were in frequent communication with vessels to determine landing and fishing schedules.

At the service, the technician conducted initial data assessment and had discussions with the fisher to determine if there were any issues during the trip, as well as conducting an examination of the data for any timegaps. SSSC technicians collected the data and replaced hard drives. The data were then backed-up on an external hard drive, and the original hard drives were shipped to PSMFC offices in Portland near the end of the study period.

Lesson

The delivery of services in ports would be improved by involving port staff in planning as early as possible to ensure consistent service delivery. In addition, providing each staff member with extensive EM technology training (i.e. Level 1 Certification) on the technology and processes will enable them to address technical problems immediately with limited remote support.

Quality Control (feedback processes)

A feedback process was developed to evaluate the data quality and correct for any issues as soon as they were evident. The process for reviewing and providing feedback included an Archipelago viewer identifying any major issues (gaps, video quality, etc). Based on the review, an Archipelago technician would work with SSSC and captain to resolve issues.

Data were first shipped to PSMFC in July 2014, and as such, there was no opportunity for feedback from PSFMC viewers on camera placement, video quality or catch handling.

The types of problems addressed included three main categories:

- **Hydraulic pressure and trigger related**: several vessels exhibited issues related to video trigger and pressure threshold. Each vessel has a unique pressure signature, and some adjustments to the threshold were necessary to refine the data collection. The problem caused major issues on one vessels (four trips) when the pressure sensor did not correctly trigger recording (it was likely installed on return line, not supply line) resulting the trips being listed as incomplete in the PSMFC assessment

- **Imagery related:** resolved through trouble-shooting and adjusting settings. This occurred on three vessels did not result in any major data problems.
- **Power related**: One vessel was running on AC power, and the EM system lost power when the captain switched generators or turned off the inverter powering the EM system resulting in multiple unexpected timegaps in the sensor and video data for a few (<5) minutes.

These types of modifications are typical during the 'burn-in' period of using EM, and either were resolved quickly, or can be resolved under operational circumstances.

Lessons
PSMFC must be able to access the data quickly in order to provide feedback on camera placement and other system function. This would be supported by clearly defined timelines and protocols will assist in more quickly correcting any causes of poor data quality. As well, EM technicians should be trained in installation, trouble-shooting, maintenance and removal so that they are able to respond quickly to any issues.

Dockside Monitoring

Dockside monitoring was conducted by staff at the SSSC. The intent of dockside monitoring was to collect data on rockfish for comparison against EM review to determine the feasibility of determining rockfish species from video data. Dockside monitors were present for 18 of the offloads to count and weigh all of the landed rockfish.

SSSC staff had extensive experience with local fish identification, and did not require further training on identification, however, Archipelago provided forms to SSSC staff for recording landings. Dockside monitors were instructed to:

- Attend all offloads when possible,
- Document the total piece counts and weights (lbs) of landed rockfish by species,
- Collect logbooks from fishers and conduct a data retrieval when the drive is nearing full, and
- Discuss EM system use, any issues that arose during the trip, and future fishing plans with the fisher.

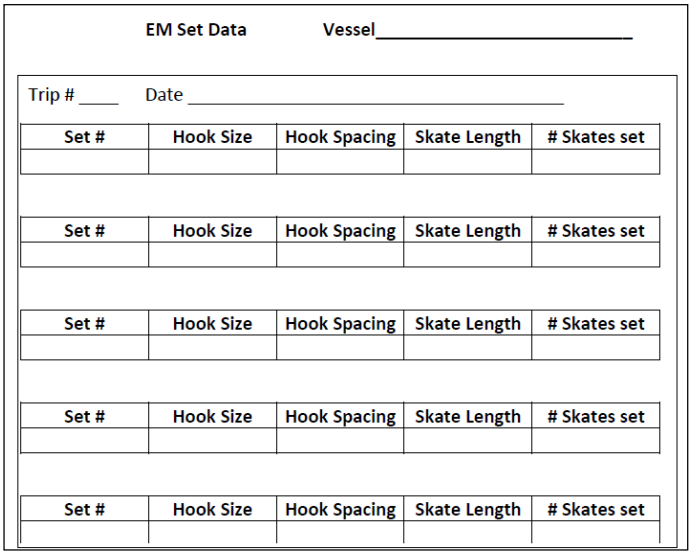
Three of the participating vessels had landings in areas other than Sitka, therefore it was necessary for some monitoring events to be performed by ADF&G staff overseen by the SSSC.

Lessons
The challenges related to providing dockside monitoring were similar to those for data retrievals, wherein landings occurred in ports other than Sitka (Kodiak, Seward, Homer, Yakutat, and Shushilna Island). This challenge requires a recognition that landings in ports that do not have the required infrastructure and staffing will not be able to be monitored in a cost effective way. This highlights the decision to either equip ports with trained staff to collect data, or remove landings outside of specific ports from the study.

Additionally, the dockside monitor should collect landings data on all landed non-target species to enhance the data collected for comparisons.

Fisher Effort Logbooks

During fishing trips, fishers completed simplified fishing logbooks to document fishing effort. These data included vessel name, trip start and end date, total sets, and skates per set. The dockside monitor or EM technician collected the logbooks and they were submitted to PSMFC.



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

Figure 1. Example of the simplified effort log that fishers completed for each trip.

Lessons

The prescribed logbook did not have any effort data related to timing and location of fishing activity, nor catch information. These additional data points could serve as a 'double-check' against EM system and dockside data.

Data Delivery

SSSC technicians collected the EM data, dockside data, and fisher logbooks, The EM data were backed up prior to shipment to ensure that no data were lost, and the removable hard drives were shipped to PSMFC for review in July, 2014.

Lessons

The delivery of data was delayed until near the end of the data collection, which eliminated the opportunity for PSMFC viewers to participate in the feedback process. This can be addressed in future field work to ensure feedback processes are complete.

3 Vessel Monitoring Results

Data collection ran from March 8, 2014 to July 29, 2014, with the majority of activity occurring in from March to May. The data that were collected during fishing on the five participating vessels resulted in 36 fishing trips, 202 hauls, and 18 dockside monitoring events. Half of the trips had dockside monitoring events largely due to the challenge of remote landings, and limited or no notice of landing despite the best communication efforts by captains and SSSC staff.

Table 1. Summary of data collected during the 2014 field season.

Vessel	Trips	Hauls	Dockside Monitoring	Sitka Landings	Other Port Landings
Vessel 1	7	32	4	5	2
Vessel 2	13	78	6	6	7
Vessel 3	6	19	4	6	0
Vessel 4	4	16	2	4	0
Vessel 5	6	57	2	2	4
Total	**36**	**202**	**18**	**23**	**13**

4 Recommendations for 2015

The lessons learned in the 2014 field season can be applied to the planning process for future field efforts and trials. The planning effort prior to the next fishing season should focus on the development of rigorous processes to ensure data quality is well defined, targets are set to meet data quality standards, and processes are in place to address any data that are not of sufficient quality.

Planning would also involve identifying ports that could support the EM project by having on-call EM technicians and dockside monitors available. To develop capacity in port, training should take place for EM technicians and dockside monitors to ensure that data are collected in a consistent format, and are held to the defined standards.

The planning stage should be followed by a communication effort linked with scheduling installations. In the 2014 field effort, all outreach was conducted on the vessel at the time of installation. Pre-installation outreach will help to ensure that captains and crew are familiar with the requirements and communication channels prior to installation of the equipment and data collection.

Communication planning should also examine the feasibility of a hail-in notification processes to give EM technicians and dockside monitors up-to-date information for planning services.

To ensure consistent data standards, next data collection effort should have a well-defined feedback processes that includes a standard trip summary to be completed by the EM technician at the time of retrieval, which should include at a minimum:

- Assessment of data quality, reasons and solutions for any gaps,

- Confirmation of proper function of video triggers and video quality as defined in the VMP
- Captain interview to determine any unexpected events during the retrieval,
- Confirmation of captain and crew adhering to catch handling practices (video review and interview)
- Documentation of any changes or modifications made to the system.

This process will enhance the feedback processes by providing detailed information to all parties involved with the retrieval and review of each data set.

Following the above stages, the equipment removal would occur, and vessels should be returned to their original state, or if desired, some sensors (e.g. engine oil pressure, hydraulic pressure) left in place for future EM work.

Attachment 1 - Vessel Monitoring Plan

Vessel Name: Reference Vessel

Vessel/License Number:

Gear Type: Longline

Port: Sitka

Project Background

This project is being conducted as part of a cooperative research program to evaluate the use of EM as an optional monitoring tool within the Alaska Longline Fishery. Participation in the study requires some modifications to the standard catch handling methods to ensure that the video is collecting the required information. This document defines the data collection methods used on this vessel to document fishing events, total catch and discards.

EM System Operation

The EM system has been set up to turn on when the main engine is on, and sleep when the main engine is shut off. Video recording is triggered whenever the hydraulic sensor detects pressure equal to or greater than 125 psi or the drum sensor registers 1 or more turns. The system continues to record video for 30 minutes after fishing activity, as indicated by the sensor readings dropping below the specified thresholds. Video does not record within designated port areas.

Operator Responsibilities

Start of every trip

- Check that you have the fishing logbooks for the project.
- Turn on main engine and confirm that the EM system has started and camera views appear. If the system does not start within 1 minute of turning on the main engine, press the green LED power button to re-start the system.
- Run a Function Test.
- Click on the Disk Storage icon to determine if the there is sufficient capacity on the hard drive. If there is not enough capacity, arrange a data retrieval and data drive swap with the EM technician.
- Check camera views against reference images below.

Before/during every haul

- Check camera views are clean and that nothing is blocking the views.
- Retain all rockfish caught during the fishing trip up to the legal bycatch.

Technical Support Contact: 1-250_____

Camera View Summary

Camera 1 is used to document total catch (piece counts), species identification.

Camera 2 is used to confirm species identification and discard methods.

Camera 1 – Hauling Station View

Full starboard view to observe all catch. Document total catch (piece counts, and estimated weight), species identification.

The camera records video at 5 fps.

Camera 2 – Hauling Station Close-up

Close-up view to confirm species identification. Count and identify retained catch as it is brought onboard.

The camera records video at 5 fps.

Fishing Activity Overview

Setting: Longlines are deployed off the stern of the vessel.

Hauling: Longlines are hauled onboard at the starboard side roller and moved onto bins.

Catch Sorting

Catch is sorted at the rail within camera view as it is brought up. Retained catch is brought onboard and placed into bins, then moved to the hold, and discarded catch is removed from the line and discarded immediately.

EM System Installation

Control Center

Controls all the sensors and cameras and stores all the EM data.

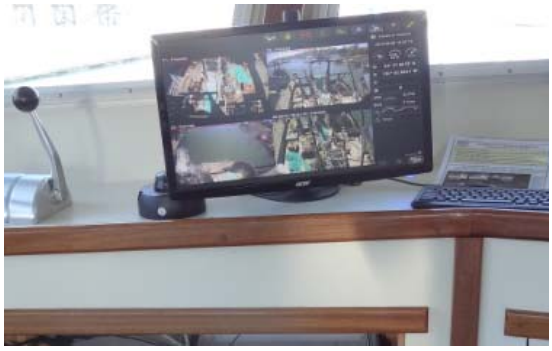
Located in wheelhouse.

GPS

Provides location, time, and speed information.

Located above the wheelhouse.

User Interface



Allows the skipper and the EM technician to interact with the Control Center to ensure the system is performing well and enter comments.

Located in the wheelhouse.

Hydraulic Pressure Sensor

Detects hydraulic activity to signal fishing activity.

Connected to high-pressure line of hydraulic system.

Engine Sleep Sensor

Engine oil pressure sensor installed on vessel engine. Located in the engine room.

Drum Rotation Sensor

Not used

Camera 1 – Hauling Station View

Aimed at the starboard rail from hauling station to stern to document total catch (piece counts, and estimated weight), species identification.

Located on starboard stabilizer pole.

3.6mm lens, 5FPS.

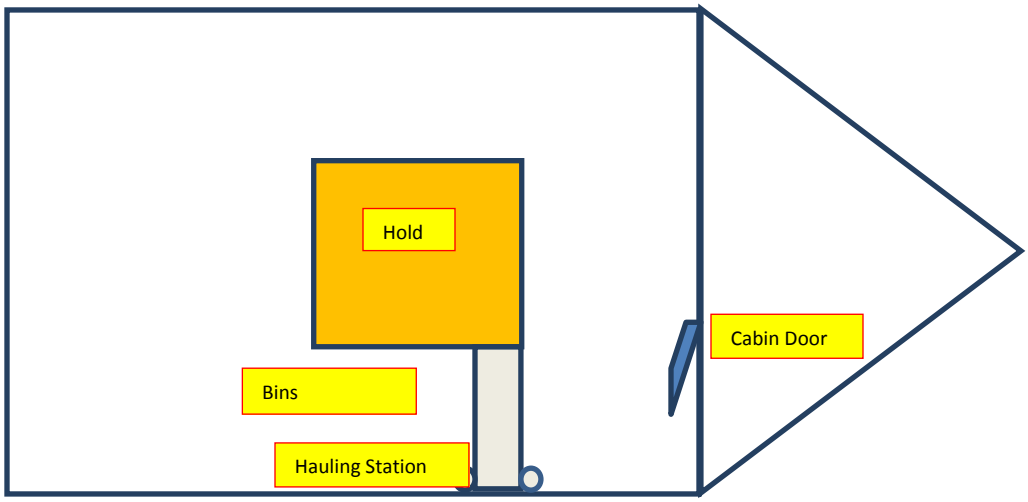
Camera 2 – Hauling Station Close-up

Aimed at the starboard hauling station to provide a close-up to confirm species identification.

Located on starboard stabilizer pole.

6.0mm lens, 5 FPS.

Vessel Layout and Dimensions



Software Configuration

- Sensor data sample rate: 10seconds
- Video run on time: 30 minutes
- Time zone: UTC -09:00
- Port boxes used: Yes
- Pressure trigger: 125 PSI
- Engine Sensor Sleep: Yes
- Video frame rate
- Camera 1: 5 fps
- Camera 2: 5 fps

North Pacific Cooperative Research Plan
Report on Field Work March-June, 2014

Saltwater Inc. was contracted by the Pacific States Marine Fisheries Commission (PSMFC) to assist with the implementation of Track 1 of the North Pacific Cooperative Research Plan (CRP). PSMFC notified Saltwater to "go ahead" with the work on March 25, 2014, and work was completed by June 30, 2014. The following is a summary of activities and lessons learned.

Project Objective (from PSMFC Statement of Work with Saltwater Inc.)
The overall objective is to test the Saltwater Inc. electronic monitoring system on longline halibut and sablefish fishing vessels fishing from or around Homer, Alaska to understand the potential of varying systems being deployed on vessels if EM is implemented.

TASKS

Task 1: Recruiting Vessels

Saltwater will coordinate deployment of Saltwater Inc.'s electronic monitoring system on up to five identified vessels fishing out of or around Homer, Alaska (proposed schedule March 7th through sometime in June).

Results:
The identification of volunteer vessels in Homer for this project proved to be a challenge. Because volunteer vessels had not been identified, Saltwater worked directly with industry and industry representatives to recruit volunteers to carry EM system. By leveraging existing working relationships with the industry, Saltwater successfully identified four vessels willing to participate in Track 1 of the CRP. Much of this recruitment effort had to take place after the halibut season had started, which diminished the pool of available volunteer vessels.

Since November 2013, Saltwater has had a part-time staff member, Stacey Buckelew, based in Homer, working on an ongoing National Fish and Wildlife Foundation (NFWF) grant with the North Pacific Fisheries Association (NPFA). Our work history with NPFA and the relationship that had been established with the fleet proved invaluable when it came time to find vessels to participate in Track 1 of the CRP. This was especially important given the context of considerable frustration among fishermen about what they felt were mixed messages regarding whether carrying an EM system would give them an exemption from carrying an observer.

Task 2: Installation of Equipment

Saltwater Inc. will coordinate deployment including but not limited to: communication with the fishing vessel, scheduling and completion of installations, and servicing. The system will record video imagery, GPS locations, time stamps, as well as any additional information available for the entirety of all trips the vessels complete.

Results:

Four installs were successfully completed between March 25 and April 11, 2014, which allowed for data collection during spring halibut fishing. The installs took place on the F/V Mislead on March 25, the F/V Defender on March 25, F/V Captain Cook on April 4, and the F/V Douglas River on April 11. The window for installing systems for this project was limited since the contract began after the halibut season had begun. Installations and system deployment were limited later in the contract period by fishermen switching gear for the summer salmon fishery.

Two of the vessels (the F/V Mislead and F/V Defender) are stern haulers. This is important because stern haulers have been identified by NMFS as vessels where EM may be particularly appropriate. Because of the setup of the vessel, there is no safe place for an observer to stand where they would be able to see the fish on the line coming out of the water and yet not be in the way of fishing operations. We were able to provide good quality footage from the stern haulers, which had proven difficult in past EM pilot projects.

Equipment installed on all vessels included two digital cameras (one hemispheric camera to provide a deck view and one with a narrower lens to provide a view of the waterline from the hauling station); a GPS sensor; a hydraulic sensor (to activate recording), and a ruggedized control box to provide onboard software and data storage capacity.

Task 3: Field Service of Equipment

Saltwater will be responsible for keeping the equipment maintained and operational for the entirety of the deployment. Vessel operators will be trained by Saltwater on basic operation of the equipment.

Results:

Saltwater provided initial training during installations to all vessel operators about the EM system and their duties of care. We also provided ongoing support to vessel operators during data retrieval. Each time data was retrieved, Saltwater's local coordinator solicited feedback using a standardized reporting form. Further, the coordinator did a coarse review of imagery collected during that trip and made any adjustments necessary to camera angles to ensure full framing of fishing operations. Saltwater staff were on call to troubleshoot and provide technical support as required.

There were technician call-outs on two of the four vessels. The first was required because of a system failure that resulted when a crewmember removed the ground of the plug for the control box and then used a short extension cord to connect the system to shore power. This destroyed the control box and all

data from the trip was lost. The control box and GPS units were replaced and data was successfully collected from subsequent trips.

The second call-out was in response to failure of the deck camera. The technician was able to determine that the failure was due to a corroded PoE switch on the control box, which likely resulted from saltwater entering the cabin via the camera cable. This did not occur until the end of the program, so the system was removed, not replaced.

Task 4: Data Retrieval

Saltwater will be responsible for data retrieval from participating vessels and data delivery to PSMFC every two weeks or as often as the fishing vessel returns to port if the vessel's trip length is expected to exceed two weeks.

Results:

Saltwater's local coordinator successfully coordinated data retrievals from all participating vessels and regularly submitted the data to PSMFC. Data retrieval included collecting hard drives of video imagery, fishing effort logs, and daily function logs completed by the skipper. During data retrieval, she solicited feedback from vessel operators, which was used to inform technicians of any issues or concerns.

Task 5: Initial Data Review

Carrying out an initial review of data to assess system function (e.g. completeness, general quality) and to identify any needed modifications to the installation. Work with the PSMFC staff to ensure the most useful and informative data are captured using efficient methods.

Results:

When data was retrieved from the vessels, copies of all datasets were given to Saltwater's data reviewers at the same time they were sent to PSMFC. Saltwater's initial review of the CRP data included a scan of entire video data to verify all reported hauls were recorded and mapping the GPS data to help locate the precise timing of each haul. Information from this initial review, specifically about haul times, was shared with PSMFC to facilitate their review of the video data.

Saltwater's reviewer also collected data from the first five minutes of each haul on video quality, species composition, catch retention, and halibut discard conditions. The results were summarized in a Trip Summary Report, which was shared with the skipper of the vessel after each trip. Sharing results with the skippers helped them better understand how the data collected on their vessels was being reviewed, similar to skippers seeing the data collected by human observers onboard their vessels.

A significant value of Saltwater's initial review was that it allowed Saltwater staff to identify, in a timely manner, any system performance issues, like camera placement or function, and make adjustments throughout the season as needed. We received feedback on collected data from PSMFC reviewers from one trip, but the in-house preliminary review allowed us to quickly respond to any system performance problems.

Task 6: Provide Trip Data to PSMFC
Provide raw video footage and trip data from each vessel to PSMFC.

Results:
Saltwater's local coordinator retrieved video and trip data from the four vessels and provided it to PSMFC. The data included video from two cameras of all hauls and GPS logs for the duration of the trip.

The following table summarizes the data collected from the four volunteer vessels fishing from Homer, AK:

	Days	Trips	Days/Trip	Hauls	Hauls/Day	Dockside
Vessel 1	21	6	3.5	53	2.52	4
Vessel 2	11	2	5.5	29	2.64	2
Vessel 3	7	2	3.5	20	2.86	1
Vessel 4	7	2	3.5	12	1.71	0

One of the things this table illustrates is the variation in fishing activity between vessels. Because this was an opportunistic sample, there was no minimum activity level set, so relatively little data was collected from some of the participants. When trying to assess the costs of deploying EM, this is a factor that needs to be taken into account. For future research efforts, it may be useful to have clear criteria for vessel selection to allow for more cost efficiency.

In addition to the data collected on board the vessel, Saltwater was tasked with arranging for dockside monitoring of retained rockfish to allow for comparison to data captured by EM. The requirement to provide dockside monitoring was outside the original SOW and was initially made known to Saltwater by Dan Falvey, an industry representative, at a chance meeting at the North Pacific Fisheries Management Council in April. Thankfully, because our local coordinator was aware of the dockside monitoring activities of the Alaska Department of Fish & Game (ADF&G), she was able to arrange for collection of this additional information and provide it to PSMFC in a timely manner. Adding this requirement mid-stream did get some negative reactions from volunteers because the expectation for the information they were required to provide changed without notification from NMFS.

Task 7: Skipper Feedback

Saltwater will provide feedback to vessel operators when data is retrieved. The purpose of the feedback is to inform the skippers on issues like changes to fishing behaviors, equipment functionality and maintenance that are needed to allow for better video review.

Results:

Saltwater's local coordinator provided feedback to vessel owners, and collected feedback from them, whenever data was retrieved. She developed a standardized survey that she used at each encounter. The post-trip vessel surveys were submitted to PSMFC via Survey Monkey together with the data.

LESSONS & *RECOMMENDATIONS*

- Recruiting volunteer participation in the EM pilot programs is an ongoing challenge.
- *Advance planning prior to fishing the season is needed to allow sufficient lead time to recruit volunteers, coordinate scheduling, and install EM systems before the start of the fishery.*

- The number of vessels interested in participating in this pilot program without incentive for observer exemption is limited.
- *Implementing observer exemptions for vessel participating in pilot programs is likely to increase volunteer vessel participation*.

- There is considerable variation in this fleet (eg. number of days fished, season fished, gear type, etc.) that will not be captured with an opportunistic sampling design.
- *The research design should consider criteria for vessel selection that maximizes the amount of data collected and gets representation from key sectors of the fleet (e.g. stern haulers)*

- Despite voluntary participation, there is still lingering skepticism among fishermen about the program and the data being collected. Saltwater developed written materials, which outlined the program, objectives, and expectations for participation. These proved useful in addressing the skepticism.
- *A succinct standardized written summary of the research plan, data to be collected, and expectations of volunteers should be provided by NMFS via the EM service providers and/or industry representatives at the onset of the program. The data needs should be more clearly defined and include a disclaimer that the requirements may change. Standardized data collection forms should be used in all ports and shared with vessel operators at the outset of the project. These may include: effort logs, checker measurements, bycatch retained, system performance, post-trip surveys, dockside monitoring reports, etc*.

- Fishermen may become frustrated with additional information requests that are not clearly explained and/or vary from the expectations set during the time of installation. For example, not all fishermen willingly participated in dockside sampling.
- *NMFS should have a clear communication plan to inform participants of any changes in research direction or information requirements. EM service providers are uniquely positioned to provide information from NMFS to vessel operators about the program and to collect and pass on feedback to NMFS. Developing systematic/standardized approaches to this communication is recommended.*

- Data confidentiality is a significant issue among the fleet. Saltwater Inc. developed a confidentiality agreement for vessel owners, which was important in allaying concerns.
- *Standardized data confidentially forms need to be signed by vessel owners, service providers, and the agenc(ies) carrying out data review. A clear data custody process should be established by NMFS and explained to participants.*

- Industry "buy-in" is vital to the success of an EM program. A tight feedback loop about the program and the data collected is an important element of this. Saltwater developed Trip Summary Reports for skippers, which described the data collected from their boat after each trip. These reports went a long way in reducing fishermen's concerns about the information being collected. They also increased the willingness of skippers to share information about their experience with the EM system and fishing practices.
- *Vessel operators should receive timely reports on the data collected from their vessels. Preliminary reviews by service providers make this possible and allow for timely in-season adjustments to EM systems (camera position, etc.). Service providers must have access to data for this to occur.*

- Vessels in this fishery have very unpredictable schedules, which makes scheduling installations and data retrievals challenging. Vessels in this fishery do not always deliver to the same port, which further complicates data retrieval.
- *EM service providers should be included on the "Prior Notification of Landing" list to give advance notification of a landing. This would help with arranging data retrieval and provide the lead time needed to coordinate dockside monitoring*. *This is only one example of the infrastructure needs that will be critical to the successful operationalization of an EM program in Alaska .*

- Vessels may deliver to distant ports, which precludes the opportunity for dockside sampling.
- *Vessel selection should consider this variable where dockside monitoring is a requirement.*

- Fishermen were uncomfortable with continuous recording and/or delayed power down of cameras. This was perceived as an invasion of privacy, particularly when needing to urinate. This was especially pronounced for vessels with an aft deck cover. In these cases, fishermen altered their fishing practice by removing their gear and entering the cabin to use the head, which was a hindrance to efficient fishing operations. On another vessel, the system was turned off when the vessel owner was fishing someone else's quota, who was not willing to be monitored. The issue of privacy was the single biggest complaint received from fishermen carrying EM systems.
- *Privacy concerns need to be addressed. Efforts should be made by NMFS to define data collection strategies and EM system configurations that do not require continuous recording.*

- The cost of EM program implementation is a concern among fishermen.
- *The pilot program design should include solid strategies to assess the cost of making EM an operational program, as well as a focused effort to identify strategies to reduce those costs. The long-term strategy to cover those costs should be discussed early and often.*