2015 Cooperative Research Program

Introduction

The overall goal of integrating EM in the North Pacific Research Program (NPRP) is to improve fisheries dependent data collection by providing an alternative on vessels where accommodating a human observer may be problematic, and in circumstances where EM may be more cost effective thus allowing optimization of resources. The integration of EM data is intended to improve data quality by providing a census or direct estimate of catch composition from vessels currently not able to carry an observer, by increasing the number of boats able to provide fisheries dependent data thus reducing non-sampling errors, and by reducing potential bias caused by non-representative fishing behavior on vessels where carrying a human observer is problematic.

The technology to be deployed during the initial stages of EM integration is also a consideration. Electronic monitoring technology is continuously evolving and improving. However, before adopting any technology for operational purposes, several steps are required. First it must undergo pilot testing to understand the basic performance, costs, support requirements, and information outputs associated with the technology. Second, it must under-go extensive testing in an operational environment to determine data quality and system reliability under a variety of operational conditions and vessel configurations. Finally crew and operator responsibilities when using the new technologies must be clearly defined and tested for vessel compatibility to ensure expected outcomes are realized before the technology can be operationalized. Field work in 2015 and pre-implementation work in 2016 are premised on using current technologies and incorporating new technologies as they undergo these developmental steps.

The fixed gear sector has been identified as a priority for EM integration by the Council with specific emphasis on the 40' to 57.5' LOA hook and line vessels in the GOA. The SSC has recommended consideration of EM on vessels less than 40'LOA. The Council has also endorsed consideration of EM integration on groundfish vessels fishing pot gear as well. The initial management objective for vessels carrying EM systems identified by the Council is to estimate discarded catch. Recently, the Council also identified validating deployment of seabird avoidance gear on hook and line vessels as an EM management objective.

As envisioned, cooperative research to develop the capacity to deploy EM systems and inform decision points and regulation development is to be conducted in 2014 and 2015. 2016 has been identified as the target for a pre-implementation year where procedures for full scale integration of EM data into the NPRP are tested. In June 2014, NMFS sent a letter out to fixed gear vessels 40-57.5' LOA asking if they wanted to participate in EM testing in return for a release from observer coverage while carrying the EM systems. Of the 20+ responses, NMFS notified 10 vessels that they are EM candidate vessels.

Discussion at the November EMWG and December Council meeting to clarify how the EM stratum will be defined and the data used will aid in identify field work targets for 2015 and 2106. Follow this discussion, NMFS could consider adding vessels to the 2015 field work or an additional round of solicitation.

Decision Points:

- What scale EM program is envisioned for 2015 and the 2016 pre-implementation year?
- What regulatory vehicle will be used for the 2016 pre-implementation year?

Field Work

Goal: Carry out a field program to develop operational infrastructure in key landing ports, continue to socialize EM with the fleet and collect data for evaluation of EM alternatives.

Target Fleet: 40-57 vessel size group, including hook and line vessels from halibut, sablefish and cod target trips. Lower in priority are the <40' vessels and the 40-57' vessels fishing for Pcod with pot gear.

Scope: EM services will be provided in the ports of Kodiak, Sitka, Seward and Homer. These ports represent 50% total landings from the 40-57' fleet. Within each port 4-6 EM systems will be available for deployment on 8-10 vessels during the study period (32 to 40 vessels total). The logic for this level of activity is based on:

1. Selecting the main ports of activity for the fishery to build support capacity,
2. Conducting enough EM deployments to meet minimal capacity levels for the set up effort,
3. Acquiring data of sufficient sample size and operational diversity to inform decision points and evaluate cost factors and data quality achievable under an operational EM program.

Alternatives: Each vessel will complete alternative 2 for first trip, then subsequent trips hauls will be randomly assigned alternative 2, 3, 4 or 5.

Deployment: Based on fishery demographic research on the target vessel class, the following deployment scheme is envisioned:

Table 1. Proposed number of EM systems deployed on vessels in each season and port.

Port	Jan -Mar	Mar-May	June- Sept
Sitka		4 – Hal/Sab	4 Hal/Sab
Homer		2 – Pcod 2 – Hal/Sab	4 Hal/Sab
Seward		2- Pcod 2 – Hal/Sab	4 Hal/Sab
Kodiak	4 - Pcod	2 – Pcod 2-Hal/Sab	4 Hal/Sab

Table 2. Estimated data collection (trips and hauls) by port based on proposed deployment.

Port	Sitka	Homer	Seward	Kodiak	Total
Port-Months	6	6	6	9	27
EM Systems	64	64	64	64	256
Vessels	8 to 10	8 to 10	8 to 10	12 to 14	36 to 44
Pcod Trips	0	8	8	24	40
Pcod Hauls	0	64	64	192	320
Halibut Trips	20	16	16	16	68
Halibut Hauls	160	128	128	128	544
Sablefish Trips	12	8	8	8	36
Sablefish Hauls	96	64	64	64	288
Total Trips	32	32	32	48	144
Total Hauls	256	256	256	384	1152

* assumes 4 trips per vessel per quarter and 8, 5 and 8 hauls per trip for halibut target, sablefish target and pcod target, respectively.

Data Analysis

The data will be retrieved by the service provider, and shipped immediately to PSMFC on the removable hard drive for review. This process will follow a defined protocol to ensure timeliness of delivery, and confidentiality of data.

Each data set will undergo a procedure for assessing data quality and system performance on the vessel. The service provider will access this information to ensure that any issues are addressed immediately. Total review time for each alternative will be tracked under each alternative to answer the research questions outlined below, however, there is no set timeline for data review turnaround (as there would in an operational program).

Key Research Areas

1) EM Deployment strategies:

Current Status: EM based monitoring requires advance effort to install the EM system on a vessel and ensure that all aspects of the vessel monitoring plan are being followed. Single trip sampling with EM is costly and ineffective. The challenges are both technical (equipment installation and set up) and operational (crew responsibilities) to ensure that data collection objectives are met. Vessel selection strategies and the deployment duration will be important considerations for an operational EM program.

Currently two options for vessels selection have been proposed: an "opt-in" approach where vessels owners who cannot accommodate an observer pre-register, and a NMFS selection approach where NMFS determines which vessels cannot take observer and moves those vessels into EM strata on annual basis. Suggestions for deployment duration from the September EMWG meeting were 2 month, 6 month, annual.

Decision Points:

- How to define EM stratum:
  - Vessels opt into EM strata on annual basis, based on fisherman's assessment of their situation relative to observer coverage and/or electronic monitoring. Random selection of vessels that opt in;
  - NMFS determines which vessels cannot take observer and moves those vessels into EM strata on annual basis
- Duration of EM deployment--vessels carry EM for some time period (Duration of time carrying EM: 2-month, 6-months, annual)

Deployment Strategies Research Questions:

- **What is the potential size of the EM stratum and appropriate vessel selection criteria?**
  - **Methods:** Send out a survey to all under 57' vessels owners to identify need and interested in an EM alternative. Survey will also gather information on crew size, bunk space, home ports, and fishing schedule.

- **Is it feasible and desirable to use EM on <40 ft boats to improve precision of estimates for discards (currently not sampled)? What are operational, data quality, and cost factors to consider when deploying EM systems on vessels under 40' LOA in Alaska?**
  - Methods: Desktop study to further characterize impact on discard estimation by exclusion by fishery of under 40' vessels.

- **What are the performance standards, costs, support requirements, and information outputs associated with the stereo cameras and discard chutes.**
  - Methods: NPRB Study
  - Methods: September EMWG study plan Appendix C for pot/ll gear testing of discard chute

- **What are the management objectives when deploying EM systems on groundfish pot vessels in Alaska, and the related operational, data quality, and cost factors to consider?**
  - Methods: September EMWG study plan Appendix C for pot/ll gear testing of discard chute.

2) Monitoring:

Current Status: The stated goal of 'complete catch accounting for all managed species' suggests a requirement for species identification of all catch items. As shown in Exhibits 5a to 5e, there are many instances of species group assignments to catch items made by observers. In fact, preliminary analysis of 2014 EM data shows similar identification level ability between EM reviewers and Observer data. It is therefore important to define identification goals for EM. Based on the Feb. 2014 AFSC letter, and the September 2014 EMWG strawman proposal, all catch will be identified to the lowest taxonomic level when possible, then identified at the group level as outlined in the AFSC memo. Special handling procedures to aid in species ID will be focused on those priority species identified in the ASFC memo.

Converting EM piece counts into weight is an important consideration in program design. Catch accounting is based on weights of species, not pieces. The method for weight determination is usually based on applying an average piece weight to the number of pieces. None of the EM alternatives involve direct measurement of piece weights. Alternative 4 involves weight conversion of length based on published species growth curves.

The Council has identified the management objective for vessels carrying EM systems as discard estimation. Documenting the disposition of catch will therefore be important in meeting this objective. Earlier in the document a distinction was made between discarding that occurs at the time of catch retrieval and PRD that occurs later on the trip. With the primary sampling unit established as a retrieval event, PRD represents disposal of catch that was previously classified as retained. This represents a potential weakness in the catch assessment method. If significant for management purposes, this would require a more complex monitoring approach to address (nb – how is PRD handled by observers?).

Effort data is also necessary for catch accounting estimation. Current field work is focused on developing data sheets to capture effort information and the pilot testing of e-logs.

Decision Points

- Need to distinguish between policy goals and reasonable strategic objectives for species identification.
- Need to distinguish between primary and secondary species categories.
- Is the improvement in accuracy worth the added data collection costs to populate the most important strata?

Monitoring Research Question:

- **For each alternative, what level of species identifications is achievable using current EM systems under operational conditions?**

- Methods: Video Review of XXX sets from each fishery, halibut, sablefish, P. Cod. Compare actual results to *a priori* assessment.

- **For each alternative, what approaches can be used for cases when catch identifications can only be achieved at the group level?**
  - Methods:
    - Evaluate utility of observer data or survey data to provide estimates of species proportions within EM groupings?
    - Evaluate full retention of selected groups to assist in identification of cryptic species (eg. rockfish in BC)?
    - Evaluate utility of extended presentation to camera for identification of skate species.
- **How does each alternative compare in terms of species identification ability?**
  - Methods:
    - Determine frequency at which reviewer identify to species and group (flatfish, rockfish, etc.) level.
    - Compare frequency of use of species and group level identification between EM review and observer data
- **How can observations on weight/length be gathered (tactical deployment of observers, survey etc., or "negotiated value)?**
  - How much is the accuracy improved using different weight estimators
    - Methods: Identify and evaluate the accuracy of different approaches for conversion of piece counts using observer, research or other data sources?
      - **Method 1:** desk top study based on stratifying the available w/l observations by time and space vs. using one global value. (written study from Sept EMWG)
      - **Method 2:** Track **3 study design.**
- **For each alternative, what operational procedures and equipment are necessary to reliably document seabird avoidance gear use while setting?**
  - Methods: TBD

3) Data Review Logistics

Current status: Data review logistics are an important consideration in EM program design. Factors to consider are the overall level of sampling required to meet desired precision targets, the protocols to use when reviewing the EM data, the required data turn-around time for management uses, and the frequency and cost of collecting the EM data from the vessel.

Following the observer approach, the primary sampling unit is assumed to be a fishing event (haul). The use of EM provides more data, and therefore the ability to modify sampling rates as necessary. Under these alternatives, it is necessary to consider the best approach for selection of a sample. There are instances where the full trip may be a sample unit, particularly if PRD is considered to be an issue. Related to this is non-sample error – How well does the observed portion of the fishery represent the non observed portion.

One approach is to determine how much imagery review (# of events) and the allocation (#of events from # of trips) would equal precision generated by 12% observer coverage (50% or 100% of events observed within the trip).

Decision Points:

- Video review protocols necessary to meet management objectives.
- Timeliness required for catch accounting
- Efficiency of local vs. central data review.

Data Review Research Question:

- **What is the best method for selection of recorded fishing events to analyze? Should analysis be carried out for all monitored fishing events on a trip or a sample of fishing events across multiple trips?**
  - Methods: TBD

- **What are the trade-offs between various data review protocols?**
  - Methods:
    - Document review time/set for:
      - species ID of all catch (retained and discarded) and only discards
      - hook count vs. non-hook count review
      - deck validation camera
      - seabird camera
    - Document review time for sub sample by haul time vs. # hauls
    - Document data entry time for paper effort logs vs. e log

- **What data turnaround times can be achieved with local vs. central data services**
  - Methods: Estimate turnaround times based on documented review times, expected data delivery, and staffing levels.

4) Operational Elements

Current Status: Field Services

In 2014, EM cooperative research focused on establishing EM support capacity in 2 Alaskan communities, Sitka and Homer. Technicians were trained and EM systems were deployed on vessels as part of the 2014 field testing. Therefore the basic operational elements are in place tpo carry out technology based monitoring, on a limited scale in those ports. Maintaining this capacity and future scaling to other ports will be necessary to support an integrated EM component.

As noted previously, collectively the fixed gear fleet makes over 10,000 landings at about 50 ports. Among the 40-57′ group, landings occur at 33 ports with 50% from four ports, 75% from eight ports and 90% from 14 ports. The top five ports for each vessel size group are:

- **<40′ group:** St. Paul, Kodiak, Homer, Sitka and Yakutat (52% of landings).
- **40-57′ group:** Kodiak, Sitka, Seward, Homer and Juneau (60%).
- **>58′ group:** Kodiak, Sitka, Seward, Homer and Dutch Harbor (54%).

The greatest activity (all landings) is the Southcentral (42%), followed by Southeast (26%), Aleutian (23%) and Western region (9%). Among the 40-57′ fleet, the greatest activity is the Southcentral (45%), followed by Southeast (32%), Aleutian (22%) and Western region (1%). Aleutian region is distinctly summer, mostly (95%) by the <40′ vessel group. Southeast landings are mostly March to November period, while Southcentral and Aleutian have landings year round. The early season landings in the latter regions are due to the cod fishery.

Halibut target trips represent 46% of total landings, followed by cod (34%) and sablefish (20%). About 70% of the cod landings occur in the first quarter of the year and landings occur in all months. The majority (60%) of cod fishing is by the >58′ fleet, followed by 40-57′ sector (26%). Half the halibut trips are by <40′ sector, followed by 40-57′ (30%) and >58′ (20%). Conversely, about half (47%) the sablefish trips are by >58′ sector, followed by 40-57′ (43%) and <40′ (10%). Landing patterns in the <40′ halibut fleet are distinctly seasonal, most active June to August, while the other fleet groups are distributed more evenly between the months of April to October. Sablefish landing patterns are similar to the > 40′ vessel halibut landing patterns.

Current Status: Vessel responsibilities

The types of obligations on the fisher differ among the proposal alternatives. The following table summarizes the types of obligations, and how they relate to each alternative.

Table 3. Summary of obligations associated with each alternative.

Obligation	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Effort logbooks			X	X	X
Catch logbooks					X
Standard duty of care	X	X	X	X	X
Catch control points	X	X	X	X	X
Restricted discard location		X	X	X	X
Discard measurement grid				X	

Logbooks

Effort logs could be used to collect:

- Gear setting date, time, and location
- Gear hauling date, time, and location

Catch logs could be used to collect:

- Discarded catch by haul – species and estimated weight

Vessel Monitoring Plan

Vessel Monitoring Plans (VMPs) are a communication tool used to ensure that captains, EM field technicians, EM data reviewers and project coordination staff understand their roles and data collection protocols within an EM program.

The VMPs outline vessel-specific catch handling protocols and EM system configurations. Field and data technicians can work with fishers to document initial catch handling protocols, and later propose adjustments in catch handling procedures as needed to enhance the data review.

A VMP typically includes a description of:

- Vessel details:
  - Name, number
  - Port
  - Contact
- EM technical details:
  - EMR settings
  - Power source
  - Camera location and views
  - Sensor location
- Fisher obligations
  - Catch control points
  - Camera cleaning standards
  - Function test / processes
  - Other maintenance and reporting

The use of a feedback process involves the data reviewers completing a feedback form and submitting it to the field technician whenever a technician change is

required, or a change to catch handling protocols on the vessel would improve the data review (e.g. changing position to show catch handling, discarding in a specific location, etc). This process is a way to document any change request to the components described in the VMP.

Current status: Dockside Monitoring

None of the alternatives specifically require independent monitoring of vessel offloads and the present system is assumed to be accurate to meet science and management needs. There are a few reasons to consider dockside monitoring within the EM sampled fleet or with the fishery as a whole:

- Need for biological sampling of landed catch
- Concerns about accuracy of existing programs
- Improved resolution of difficult to ID species.

The addition of a dockside monitoring program (DMP) conducted by a third-party may be desirable for several reasons. A DMP can be conducted using a census or random sample approach.

A DMP would require the development of specific reporting format and processes that would parallel the existing trip ticket system of reporting landed catch by dealers.

Table 4. Summary of additional landings requirements associated with each alternative.

Landed Catch Data	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Status quo landings	X	X	X	X	X
Difficult to ID species			X	X	X

Operational Elements Decision Points:

- Which ports should EM services be established in (e.g. top 50% of landing events, 75%)?
- What is a cost effective number of EM vessels to service/port?
- What are the advantages/disadvantages of a rotational deployment strategy vs. and an annual deployment?
- Catch handling procedures to support EM systems
- What happens if there is an EM system failure.

Operational Elements Research Questions:

- **What EM hardware configurations, sensors, and performance standards best meet management objectives.**
  - **Methods**: Deploy current EM systems on XX vessels to evaluate optimum system configuration, reliability, and data quality, under operational conditions.
- **Duration of EM deployment: What is the "burn in" period necessary to get consistent quality data from vessels?**

- Methods: 10 vessels will be those currently participating in EM program, XX will be new vessels randomly selected from "opt in" requests. New vessels will be further stratified into 2 groups: one carries EM stems whole season, 2nd carries EM for 3 month period (original proposal). Installation costs, System reliability, record keeping, and image quality will be assessed between the 2 groups after 1 trip, 4 trips, whole season.

5) Cost Factors:

The four EM alternatives differ in the level of complexity with impacts on the program (operations and cost) and level of participation required of participating vessels. A method to evaluate cost factors is needed to relate the incremental improvements in data quality with the increased cost and complexity of the program. As noted previously under the objectives, there are two aspects to costs which must be considered

- Economic
- Vessel compatibility

Research Question:

- **For each alternative, what are the cost and EM program operational impacts associated with various decision points including:**
  - **Methods: Field services:**
    1. Document the installation and removal costs.
    2. Document the time/cost required for dockside QA/QC follow-up (touch time during burn in).
    3. Document the time/cost required for dockside monitoring of unload (from 2014 work).
    4. Determine the cost of rotating EM systems.
    5. Evaluate the costs of various data retrieval methods (e.g. technician pick-up, skipper mail in etc.)
  - **Methods: Data review costs**
    1. Costs of data turnaround time of 1 week, 1 month, 3 months, end of season various methods (local vs. central review)
    2. Data review cost/set when EM reviewers ID all catch vs. just count discards
    3. Sub sample data review costs (30% of sets/trip vs. 30% of each set; also test 30% sample by skate vs. haul time)
    4. Cost of EM reviewer counting hooks to determine effort, vs. using logbook/data sheet

5. Cost of deck camera installation and review to validate full retention and discard control point.
6. Cost of seabird camera installation and review to ensure avoidance gear deployment.

- **What is the incremental improvement in data quality associated with the four EM alternatives?**
    - **Methods:** compared the data outputs from each of the tested alternatives to determine they result in significantly different data (eg, percentage of species to group, percentage of catch unknown).
- **What are the incremental vessel and crew impacts associated with the four EM alternatives?**
    - Methods: Collect feedback from vessels through participant surveys.
- **What is the best way to achieve fleet sampling objectives across the vessel size, area, fishery strata, recognizing needs to optimize EM deployment costs?**
    - Methods: TBD