SCIENTIFIC AND STATISTICAL COMMITTEE
Draft report to the
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
June 6th – 8th, 2016

The SSC met from June 6th through 8th at the Best Western Inn, Kodiak, AK.

Members present were:

Farron Wallace, Chair *NOAA Fisheries—AFSC*	Robert Clark, Vice Chair *Alaska Department of Fish and Game*	Chris Anderson *University of Washington*
Jennifer Burns *University of Alaska Anchorage*	Sherri Dressel *Alaska Department of Fish and Game*	Kari Fenske *Washington Dept. of Fish and Wildlife*
Jason Gasper *NOAA Fisheries—Alaska Region*	Brad Harris *Alaska Pacific University*	Anne Hollowed *NOAA Fisheries—AFSC*
George Hunt *University of Washington*	Gordon Kruse *University of Alaska Fairbanks*	Terry Quinn *University of Alaska Fairbanks*
Seth Macinko *University of Rhode Island*	Franz Mueter *University of Alaska Fairbanks*	Kate Reedy *Idaho State University Pocatello*
Matt Reimer *University of Alaska Anchorage*	Ian Stewart *Intl. Pacific Halibut Commission*	Alison Whitman *Oregon Dept. of Fish and Wildlife*

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D-2 Review EM Analysis

The SSC received presentations from Diana Evans (NPFMC) and Jennifer Mondragon (NMFS-AKRO) on the fixed gear Electronic Monitoring Work Group's (EMWG) progress as described in three documents: *Analysis to Integrate Electronic Monitori ng into t he North Pacific Observer P rogram*, *Catch Estimation Process for E lectronic Monitoring*, and Pacific States Marine Fisheries Commission (PSMFC) fieldwork

reports from 2015 and early 2016. The SSC was asked to comment on the integration plan and proposed catch estimation methods. There was no public testimony.

Analysis to Integrate Electronic Monitoring into North Pacific Observer Program Discussion Paper
The Council intends to integrate electronic monitoring (EM) tools into the North Pacific Groundfish and Halibut Observer Program (Observer Program) for vessels using fixed gear. As such, staff began preparing an analysis to integrate EM as a tool in the Observer Program. The discussion paper includes the Council's adopted purpose and need statement and alternatives, as well as a preliminary description of the components of an EM program, and was developed and refined by the EMWG. Further, the document highlights some questions that will be evaluated in the EM integration analysis, and provides the proposed timeline for this amendment action.

The SSC commends the EMWG for its efforts in developing an integration plan and putting forward a catch estimation process and notes that these both interact closely with the processes for the current Observer Program. The document provides an outline of steps to integrate EM into the Observer Program and the SSC looks forward to seeing additional detail in the initial review draft in October 2016.

Owing to the highly technical nature of EM and the associated requirements to develop, deploy and retrieve EM hardware, the integration process involves a suite of complex interactions between the agency, industry, and EM service providers. **The SSC is optimistic about the role of EM for catch estimation in the future but considers the EMWG's proposed implementation timeline to be extremely optimistic and is concerned that there may not be sufficient opportunity for review.**

Generally, the SSC notes that there are many suitable configurations that can lead to successful EM implementation and we encourage the EMWG to continue to consider the impacts of implementation approach on, 1) quality of scientific data products, 2) burden on vessels, and 3) impacts on the policy process. At this stage of development of the integration plan, it is clear that the EMWG is considering these things, but is still in the planning phase. We recommend that these aspects be addressed specifically in the future EM initial review.

No specific analyses of the alternatives were presented (only Alternative 2 was discussed). Moving forward for initial review, the SSC recommends that specific worked examples be used to demonstrate key decision points and associated impacts. Specifically, examples are needed that demonstrate the performance of a given level of sampling coverage and image quality on the quantification of frequently encountered and abundant species as well as rare and hard to identify species. This would provide a range of potential data products that bookend species of interest giving valuable perspective on associated processing time and costs.

The SSC reiterates the comments we made in February 2015 during our review of the Cooperative Research Plan for deploying EM systems on 13 vessels in the Gulf of Alaska. During that review, we acknowledged the importance of the Council's program goals and noted that EM technology appears to be capable of enumerating catches directly, but expected that a substantial amount of work would be required before a vetted EM catch accounting system would be operational. The SSC recommends that prior to implementation of EM, the Council clearly articulate quantifiable program goals for implementation such that appropriate EM coverage rates can be determined. Once quantifiable program goals are developed, the SSC recommended a time and motion study to assess efficiencies and inefficiencies of the program (e.g., estimate the time required to analyze the video and produce an estimate of catch and the associated uncertainty).

A key issue that needs to be addressed in the initial review analysis is ensuring that data are collected using reliable and verifiable methods. The overview in section 5 (Quality of monitoring data) provides metrics

for measuring data quality. However, this list is not inclusive of methods to verify information in the effort logbook, which is to be used for catch estimation. In situations where haul data is incomplete, video auditing of the effort logbook is likely required to verify the information needed for estimation at the haul-level under both a ratio and simple mean design-based scenarios. While the SSC looks forward to the evaluation of whether the length of the groundline is a reliable proxy for haul size, this approach likely has a number of problems as noted in the catch estimation analysis. **Unverifiable haul-size information poses a serious data quality issue for catch estimation.** Given that EM development is in the early stages, we encourage the EMWG to consider the development and use of a combined effort logbook and partial video audit method to validate the effort information.

The SSC finds the EM image analysis work to date by the PSMFC very informative (Alaska Track 1, 2015 and 2016). Importantly, the time-frame for the current workflow to produce catch estimates takes between 0.5 and 0.9 minutes of analysis time for each minute of observed fishing time, depending on the fishery being observed. Generally, halibut longline fishing review times were shorter and Pacific cod longline fishing review took longest. In addition, the 2015 Observer Annual Report stated that when image processing costs are included, the EM deployment and workflow costs as much as a human observer in the partial coverage category (Observer Program 2015 Annual Report, page 31). We also note that these costs did not appear to include the required image processing QA/QC costs. The SSC requests a thorough discussion of the costs of the program during the initial review analysis.

The SSC notes that previously the EM program was focused on vessels in the no-selection pool (<40ft, Jig), but in the Integration Analysis, emphasis is placed on >40 – 57 ft vessels. The SSC notes that EM may be an appropriate tool to gain some understanding of the catch and discards of this unobserved portion of the fixed gear fleet. The integration analysis emphasized 40-57.5 ft vessels and the analyst noted that they are bringing a few vessels <40 ft into the program. The initial review should explicitly consider this component of the fleet for future EM development and deployment given it is an important data gap.

Catch Estimation Process for Electronic Monitoring
In 2016, NMFS and the Council initiated pre-implementation of EM in the small boat (40-57.5 feet length overall) longline fleet, focusing on vessels that had trouble carrying an observer in the past. Along with the pre-implementation of EM onto vessels in 2016, NMFS is developing estimation methods so that data collected from those vessels can eventually be used in the NMFS Catch Accounting System (CAS) to generate catch, bycatch, and PSC estimates for the EM stratum.

The purpose of the Catch Estimation discussion paper was to describe the potential estimation methods and outline tradeoffs that NMFS is considering between the different estimation approaches. Once the estimation methods have been developed, the infrastructure needs to be put into place to move data from the video reviewers (currently occurring at PSMFC) to the Observer Program at the Alaska Fisheries Science Center and NMFS Alaska Region.

There are three sampling strata (small-vessel trip selection, large-vessel trip selection, and full coverage) in the sample design used by the Observer Program in 2015. Within each stratum, the sampling and associated catch, bycatch, and prohibited species catch (PSC) estimation are hierarchical. Catch, bycatch, and PSC estimation follows the sampling hierarchy by expanding sample data to the haul, haul data to the trip, and the trip data to the fishery within each stratum. Strata estimates are then combined to produce overall estimates. As with estimation based on observer data, the EM stratum methods will depend of the sample design used to collect the data and the estimation needs.

The SSC appreciates the analysts' efforts to explore and explain the term "design-based", which we recommend calling "simple random sampling" (SRS) estimator, and "ratio estimator". Put simply, the ratio estimator calculates the average per-haul rate of bycatch and PSC relative to total landed groundfish catch

and multiplies this by total catch over the trip to get estimate of trip-level bycatch and PSC. The SRS estimator takes the average bycatch and PSC per haul for a trip and multiplies this by the number of hauls on the trip to get trip-level bycatch and PSC. As the analysts correctly point out, these two approaches have different implicit assumptions and performances. The SRS estimator is unbiased if data are collected in an unbiased (e.g. randomized) fashion, but weights each sample unit (e.g. haul on a trip) equally such that each "haul" would contribute equally to the overall estimate, regardless of how much catch occurred. As such, estimates can suffer from higher variance than the ratio estimators. Ratio estimators take into account the size of the sample unit (hauls or trips) so that larger sample units (longer or larger hauls) contribute more to the overall estimate than smaller sample units. For example, the amount of discard per unit of haul-size (e.g. foot of groundline) is multiplied by the total size of the set (length of groundline). Ratio estimators can have lower variance if, 1) the size of hauls fished varies greatly, and 2) there is a relationship between the amount of discard and the size of the haul. However, in their scientific publication exploring these estimators (Cahalan et al. 2015) the analysts suggest the mean amount of catch per haul using the SRS estimator performed better in terms of bias and precision when scaling up haul level data to trips and/or fishery totals when a given species' catches were rare or at low percentages, as opposed to using the ratio estimator.

The SSC notes that the analysts had a clear preference for the ratio estimator, primarily due to the large variability in haul-level effort, and because currently the EM fleet is voluntary and as such does not provide a random sample of trips. The SSC pointed out that, while this makes sense statistically, the ratio estimator requires substantially more information than the SRS estimator, critical components of which may not be suitable to collection via EM. Specifically, catch estimates derived from EM observations need to be "weighted" by fishing effort (this assumes effort is correlated with catch) or by actual catch in weight. Attempts to determine effort (e.g. long line hooks, skate length) with EM imagery have not been successful to date, require substantially more image review time (increasing costs), and the degree to which these factors may be used to predict catch is poorly understood. In either situation, haul size must be recorded in a logbook. The analysts indicated they are conducting research to evaluate whether length of the groundline is a useful proxy for haul size. In addition, the analysts also pointed out that obtaining catch weight information at the haul-level requires using logbooks, which to date have not been validated. **The SSC recommends the analysts continue to explore these estimators and looks forward to further development and detail on their use and tradeoffs in the upcoming initial review.**

For the following reasons the SSC suggests the analysts consider targeting data collection methods focused on validating logbook data as a requirement to developing data collection methods for implementing catch estimation. Consideration should be given to situations where audits would improve the catch estimation process, such as situations where statistical expansion is needed because EM captures only part of a haul. The SSC also notes having an electronic catcher vessel logbook would provide another source of verification on discards as well as some of the same information contained in the electronic effort logbook, without duplicating reporting requirements. This may also provide the necessary information to evaluate whether a ratio estimator using haul-specific catch total is appropriate.

Finally, the SSC noted the high failure rate of EM on the first trip. Further analysis evaluating methods to reduce this rate, how to address it in estimation, as well as the potential magnitude of the problem relative to the EM fleet should be included in the initial review document.

D-3 Pacific cod Models

We received a presentation from Grant Thompson (AFSC), who reviewed last year's assessment models, summarized recommendations from a recent CIE review of the EBS and AI Pacific cod assessments, and presented recommendations from the Joint Team Subcommittee (JTS). As in previous years, the JTS met with the assessment author to recommend a suite of models to explore in this year's stock assessment. Public testimony was provided by Chad See and Gerry Merrigan (Freezer Longline Coalition).