FY14 Cooperative Research EM Plan:
Developing NPFMC Alternatives to Operationalize EM in North Pacific Fixed Gear Fisheries

The FY14 cooperative research program has been developed to be responsive to both the implementation of the NPFMC EM strategic plan and to the Senate language below. The goals of the project are to develop two lines of research: (1) a full EM system using stereo cameras with automated processing of imagery for species composition and length data; (2) a standard EM system with a reduced footprint using off-the-shelf digital cameras at the rail and for compliance monitoring. In addition, we will be developing electronic logbooks and evaluating their use in combination with EM to enable an integrated at sea monitoring system. Observers will be used to enable comparisons between information collected by EM and observers to evaluate efficacy of at-sea data collections. Dockside samplers could be used for evaluating retained catch. Performance metrics such as infrastructure, reliability, costs, and data precision and bias will be used to evaluate the tradeoff between costs and benefits of the systems. We will combine data across the lines of research where possible to add analytic power to this study (e.g., lessons learned on infrastructure and electronic reporting installation). Performance analysis will address critical agency management objectives, particularly species identification and length measurements of certain target species such as rockfish and key discard species such as skates, grenadiers and sharks.

This cooperative research project is intended to collect information which will help inform future Council alternatives for EM to enable catch estimation. We are committed to implementing this project as early in 2014 as possible, following Council and OAC feedback. The research should directly feed development of alternatives and analytical work leading to future Council action. The research will be funded in part with Agency funds and will be completed in collaboration with Pacific States Marine Fisheries Commission following standard procurement protocols.

The NMFS 2014 appropriations bill includes language which states:

"Electronic Logbooks -The agreement reiterates Senate language that NOAA shall maintain full funding for the continued installation of electronic logbooks and monitoring systems, which are both inherent to NOAA's core mission and essential to the implementation of current fishery regulations. The electronic monitoring systems shall be part of an integrated at sea monitoring program and shall serve as an alternative to observers for vessels carrying such electronic monitoring systems. The agreement clarifies that NMFS shall work in fiscal year 2014 with the small boat fixed gear fleet to implement a cooperative research program designed to test the functionality of available electronic monitoring systems. This cooperative research program shall address data quality, costs, species identification capabilities, and the reliability of hardware. NMFS shall ensure that this effort is adequately resourced for the fiscal year 2014 work program. Further, when evaluating requests by small boat fixed gear vessels seeking a release from the requirement to carry a human observer due to a lack of physical space or other operational constraint, NMFS is encouraged to exercise reasonable discretion in making such determinations."

Tools and Objectives	Stereo EM System	Standard EM System
E-logbook	Yes	?
Gear Sensors	Yes	Yes
Compliance Camera	Yes	?
Non-Stereo Rail Camera	Yes	Yes
Stereo Rail Camera	Yes	**No**
Stereo Chute camera	Yes	**No**
Rail Length Board	**No**	Yes
Observer	Yes	[Partial coverage]?
Study Timeframe	Target April 2014-June 2015	
Number of Vessels	5-10 vessels for each category depending on responsiveness to RFP and funding	
Type of Vessels	Hook and line vessels; primary focus vessels <57.5, but some of the testing might make sense on larger vessels.	
EM Description	This system would include a standard and stereo rail cameras and a stereo chute camera. Video data collection would be triggered by gear sensor data.	This system would include a standard rail camera and potentially a deck camera. Video data collection would be triggered by gear sensor data.
Evaluating the Efficacy of EM System to Estimate Discard		
Discard Estimation Objectives	1) Evaluate efficacy of species id of catch at rail 2) Evaluate efficacy of species id of drop-offs 3) Evaluate efficacy of catch disposition 3) Evaluate length estimation of catch and drop-offs 4) Evaluate sampling rates	1) Evaluate efficacy of species id of catch at rail 2) Evaluate efficacy of species id of drop-offs 3) Evaluate efficacy of catch disposition 3) Evaluate length estimation of catch and drop-offs 4) Evaluate sampling rates
Comparisons of Species Identification and Count Data	1) EM camera(s) retained and discard to observer 2) EM camera(s) drop-off to observer 3) EM disposition and drop-off to observer 4) Standard rail to stereo rail to stereo chute	1) EM camera retained and discard to observer 2) EM camera drop-off to observer 3) EM disposition and drop-off to observer
Evaluating the EM System Performance and Costs		
Logistical and Operational Objectives	1) Haul sensor control of instruments 2) beta-testing & improvement of E-logbook including auto generated lat/longs 3) Camera placement and operation 4) Interface camera operation and troubleshooting	1) Haul sensor control of instruments 2) beta-testing & improvement of E-logbook including auto generated lat/longs 3) Camera placement and operation 4) Interface camera operation and troubleshooting
Performance and Costs	1) Infrastructure installation costs 2) Infrastructure operation costs 3) Hardware reliability 4) Image processing costs 5) Time from collection to management use	1) Infrastructure installation costs 2) Infrastructure operation costs 3) Hardware reliability 4) Image processing costs 5) Time from collection to management use

Considerations	Stereo EM System	Standard EM System
Processing of video data	Stereo camera imagery will be processed in real time to gather single images of each catch piece and its length. Applications in development to sort and identify species are not ready at this time, so humans will make species identifications. Video data from rail and compliance cameras will be post processed using AFSC applications and humans for species identification.	Video data from the standard rail and compliance cameras will be post processed by humans for species identification and length.
Data Evaluation	All EM data sources will be compared to observer information for evaluation of EM systems efficacy to provide scientific data to estimate catch.	Observer data will be necessary to evaluate EM ability to gather data to estimate discard. Dockside samplers could be used to evaluate retained catch.
Utility	Aid development of a self contained EM monitoring tool to collect independent scientific data to use for catch estimation (Robot Observer). Will not require use of borrow information for expansion. Designed to support full automation of species ID and weight (video review will only be for compliance).	This system has been shown to be valuable as a compliance tool in an audit logbook based system (Canadian System).

System Applicability to Fishery Management Requirements	Stereo EM System	Standard EM System
Retained Catch - Requires id by species as well as count, weight & disposition	Electronic landing report generated by shore side processor. Could obtain haul specific catch data	Electronic landing report generated by shore side processor
Discarded Catch - Regulatory Discard (e.g. lingcod part of year, SR/RE in prohibit status) - requires id by species (or species groups?) as well as count & weight	Automated species id & length discard data with specific unidentified images marked and sequestered for manual processing of id; 100% length data. Compliance camera used to ensure all catch goes through the stereo camera chute and to determine disposition. Stereo rail camera video to be post-processed for length and ID drop-offs during sub sampling period. No inference from external data.	Video data reviewed manually for species identification and disposition; some length data might be possible. Unidentified fish will be sorted by fish category and data from observed boats in similar time and area stratum used infer species composition and length values for each category.

System Applicability to Fishery Management Requirements	Stereo EM System	Standard EM System
Discarded Catch (not required to be discarded)- requires id by species (or species groups?) as well as count & weight	Same as regulatory discard description above.	Same as regulatory discard description above.
Effort Information- set & retrieval dates, times, & location for all sets on fishing trip, & the number of hooks on each set.	eLogbook (under development) completed by captain; system would also use independent GPS & gear sensors	eLogbook (under development) completed by captain; system would also use independent GPS & gear sensors
Halibut Viability	Derived from observer data on similar vessel types	Derived from observer data on similar vessel types
Seabird Catch - requires id to species of threatened or endangered seabirds & id to species group for other seabirds.	??	??
Biological Data Collection- sex/length frequency data, otolith, stomach content collections	Obtained from observer data on similar vessel types	Obtained from observer data on similar vessel types.
Compliance Monitoring- verification of protocols such as: bird deterrent use, careful release of halibut, fishing in closed areas)	Human review of random segments of video from compliance camera. Review not time critical for in season management.	Deck compliance cameras could be used to determine deck activity related to discard events.
Transmission of data	Landings data transmitted through existing infrastructure. Method to transmit data from vessel not developed yet so several models may work. Once data extracted from video then haul & species composition data transmitted AFSC to AKRO via existing observer interface.	Not developed yet so several models may work. Once data extracted from video then haul & species composition data transmitted AFSC to AKRO via existing observer interface.
Integration into Catch Accounting System (CAS)	Would require changes to the catch accounting system. The scope of these changes will come out as part of the evaluation.	Would require changes to the catch accounting system. The scope of these changes will come out as part of the evaluation.

Linkages to the North Pacific EM/ER Strategic Plan

The cooperative study addresses Strategic Plan **Goal II, Objective 1**: Conduct scientific research to advance the science of monitoring and data integration. **Strategy C:** Evaluate EM technologies in the 2013-14 EM project on volunteer vessels in the <57.5 ft longline and pot vessels. **Action**: Evaluate species identification issues. **Action**: Identify data gaps and potential solutions for species weight estimates, biological samples and rare species interactions. **Action:** Assess the efficacy of using technology for capturing information that would quantify discard and provide spatial and temporal distribution of effort.

Analyses of the results from the cooperative study will be used to develop a suite of alternatives for the Council to choose from addressing Strategic Plan **Goal III, Objective 1**: Implement EM/ER technology where appropriate and cost effective to improve catch estimation and better inform stock assessments. **Strategy A:** Implement EM as appropriate based on scientific research from goal II. **Action:** Select EM approach. **Action:** Analyze EM approach, impacts, cost, and benefits. Following Council action, the next step will be to initiate Strategic Plan **Action:** Write implementing regulations, **Action:** Implementation, roll out, outreach.