**Terms of Reference for the Peer Review**

**Methodology for Sampling and Estimating Bycatch of the Hawaii Deep-Set Longline Fishery**

**Project Description:** Quantifying bycatch in the Hawaii deep-set longline fishery is required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA), Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), and Migratory Bird Treaty Act (MBTA) and their implementing regulations. As over a hundred species, some of them listed as endangered or threatened, have been recorded as being caught in the Hawaii deep-set longline fishery, reliable bycatch estimates need to be computed in a relatively quick manner on a yearly basis. Since mid-year 2002, a unique complex sampling design has been used to select deep-set longline trips for observer placement. While aboard a selected longline trip, NMFS trained observers collect information on bycatch and ancillary variables for each longline fishing operation. Based on the sampling design, bycatch estimates are computed for all marine mammals, protected species, sharks, and fish that have been observed at least once in the fishery or are of special interest. What estimators are used depends on the observed frequency distribution of bycatch events for the species of interest. Interval estimators have been developed for commonly, seldom, and very rarely bycaught species. Methods for estimating bycatch within political geographical areas within the fishing grounds and the total number of marine mammal bycatch events resulting in a death or serious injury (DSI) have also been developed as the MMPA requires estimates of DSI within and outside the Economic Exclusive Zones (EEZ) of the United States.

These annual bycatch estimates of sea turtles, seabirds, and marine mammals are used to monitor takes within the deep-set longline fishery. These estimates have a large potential impact on endangered species and the valuable longline commercial fishery in Hawaii. Additionally, bycatch estimates of all species are provided for inclusion in the National Bycatch Report, seabird and sea turtle estimates are submitted annually to the IATTC (Inter-American Tropical Tuna Commission) per Resolution C-11-02 and C-04-05, and marine mammal, seabird, and sea turtle estimates are provided for inclusion in the annual WCPFC (Western and Central Pacific Fisheries Commission) National report. The methods to be reviewed have not undergone independent peer review and there is a need to evaluate the methods to improve the scientific basis for management.

Terms of Reference

1. Review the sampling design used to select trips for observer placement and determine if it is a preferred design for estimating bycatch considering constraints and reporting requirements.
2. Evaluate the point estimators and determine if they are good estimators given the sample design, observed frequency distribution of bycatch events, and constraints.
3. Evaluate the interval estimators and determine if they are good estimators given the sample design, observed frequency distribution of bycatch events, and constraints.
4. Evaluate estimators of total bycatch events resulting in a death or serious injury (DSI) classification and determine if they are good estimators given the sample design, observed frequency distribution of injury classifications (non-serious or DSI), and constraints.

5. Evaluate the subpopulation estimators being applied to estimate bycatch within a political geographical boundary and determine if they are good estimators given the sample design, reporting requirements under the MMPA, and constraints.
6. Suggest future research priorities to improve methods for estimating bycatch with increased efficiency given the current data structure. Suggest future research priorities for improving the sampling design for the purposes of estimating bycatch, with efficient use of sampling resources as a consideration.

*Note – CIE reviewers typically address scientific subjects, hence ToRs usually do not involve CIE reviewers with regulatory and management issues unless this expertise is specifically requested in the SoW.*