**Gear Trials Program**

**Summary of Research Protocols**

**Quantitative Data Collection**

To expand on the knowledge and achievements made in the proof of concept and full proposal research done under the Challenge Grant Program for Conservation Engineering Projects, Cornell Cooperative Extension (CCE) will conduct an at-sea experimental fishing component to the Gear Trials Program. This portion of the work will be approached as a Proof of Concept experimental fishery phase. The goal of the at-sea research component is: To demonstrate what the potential is, for two different conservation gear modifications, to reduce winter flounder bycatch in the small mesh trawl fishery for whiting in the southern New England winter flounder inshore stock area. The two gear types to be tested are the 12” drop chain sweep and the large mesh belly panel.

Data will be collected onboard two commercial fishing vessels targeting whiting. Paired tows will be conducted using the large mesh belly panel and the 12” drop chain sweep (experimental) against a standard small mesh trawl (control). A detailed description of this evaluation follows.

*Research Design:*

The experimental design proposed is intended to test the large mesh belly panel and 12” drop chain sweep with a 24” headrope adjustment in the commercial small mesh whiting fishery using existing gear and typical fishing practices. The team will test for differences in both the target species catch and protected winter flounder species of concern. The team will test across appropriate identified strata of time, depth, area, fishing practices and fishing vessel size and power. Two, similar size and horsepower vessels (60-70’ vessels; 450-600 HP with identical fishing nets, doors, legs, ground cable) will be chosen by the CFRF from a pool of applicants to work with CCE on the quantitative data collection portion of the project. These vessels with enter into direct Work Agreements with the CFRF and receive compensation for their participation separately through the CFRF. These vessels will be representative of the small mesh whiting trawl fleet and chartered as a research platform to compare the experimental nets to a control net.

The unaltered trawl nets (control nets) will be identical on both vessel and will be typical of the small mesh nets used in the whiting fishery along the east coast of the US. The two participating captains will have extensive experience fishing for whiting in the project areas and will work cooperatively to accomplish all project goals. CCE will work with the vessel boat captains and the CFRF Board of Directors to confirm that the study area at the time of the fieldwork will be the best geographic location for testing the two types of gear. The geographic area will be chosen based on confirmed empirical fisherman knowledge that winter founder and whiting will likely both be present during the designated study time. The tentative general fishing area will likely be the “Deep Hole” area – east of Block Island. (Note: This area has a history of a concentration of whiting in the late summer months (August – September).

Tow procedure will have each vessel essentially fish as it would in a standard commercial fishing trip, with the exception that all tows will be 1 hour in length. The standard control net is the one that the vessel would normally use in its standard commercial whiting trip. The two fishing vessels will have identical nets, and will each have just one net that they will make adjustments to in order to move from a control to an experimental design. The drop chains in the control net are to be 2 links plus a shackle connected to the traveler with 4 chain links hanging – this will be switched to an experimental design by changing the links to 6 links plus a shackle connected to the traveler (= 12”drop chain length). Both vessels will use the ‘2 links plus the shackle connected to the traveler with 4 hanging” as the control net in order to provide consistency of the sweep between the control net on each vessel. For the large mesh belly panel design, the large panels will be sewn in place with 5” mesh laced over the large mesh area for the control. For the experimental design the 5” mesh will be removed leaving the 32” mesh panel exposed as the experimental design.

The two vessels will tow the gear side by side in the designated study area while fishing for whiting. Each vessel will have just one test gear type onboard (12” drop chain or the large mesh belly panel) incorporated within the control net as described above, and will follow an alternating testing pattern. Comparison tows will be accomplished as the vessels fish side by side as the vessels switch from control to experimental nets. One vessel will use the control and one vessel will use the experimental on each tow as described below.

Test Design

Vessel 1 and Vessel 2 (towing side by side)

A= Control fishing net

B=Experimental net

Vessel 1– Testing 12” Drop Chain Vessel 2- Testing Large Mesh Panel

A B

Comparison tows

B Variable A Variable

B A

A B

A B

B A

Tows will be made oriented along slope. We will use the coupled ABBA-BAAB protocol described above throughout each trip. To minimize any bias, the control and experimental nets will be fished using the alternative paired method whereby the control and experimental nets are paired and the nets are switched according to an ABBA protocol (DeAlteris and Castro 1991, King et al. 2009). The coupled ABBA-BAAB protocol will have 1 vessel use the ABBA sequence and the other use the BAAB sequence. That way on every tow one vessel will be fishing a control net to which the other vessel’s experimental net will be compared. We can also compare the alternate hauls of each vessel by individual vessel. On the next fishing day the sequence will be reversed where the vessel that had the ABBA sequence will next use the BAAB sequence. If an even number of tows are completed in a day, on the subsequent day (or trip) the pairs will be reversed to reduce any bias that could result from varying catches related to time-of-day differences. This method will also reduce the number of net changes required thus maximizing at-sea time. The coupled ABBA sequence is the best approach to use. The paired tows will fish side by side within a half-mile of each other. After haul-back of one tow, the vessel will turn around and make the same tow in the opposite direction with the next net in the ABBA sequence. This will maximize the number of tows to be made per trip. Also by using the ABBA protocol tows over the same ground, depth (and temperature) within each trip (and over the experiment) will be randomized and will thus normalize the data relative to depth (and temperature). Since the team does not know how fish are oriented relative to any depth gradient that may exist along the tow, depth affect will be randomized. The towpath or track will be moved or changed only if necessary due to changes or movement of fish concentrations, at the end of a tow-block sequence.

*Number of trips and tows:*

The team will conduct 6 scientific trips. Each scientific trip is defined as one day at sea for 2 vessels. This will result in a total of 12 scientific trips. Each vessel will make 6 tows per day consisting of 1 hour in duration per day. Six tows per scientific trip will equal a total of 72 tows (36 with the control net and 36 total experimental nets (18 per treatment)). This research design maximizes the quantitative data collection component of this program.

*Timing:*

The proposed experimental sampling will focus on the Fall of 2012. This time period coincides with the normal activities of the small mesh fisheries for whiting and (highest likely) co-occurrences with winter flounder. CCE will conduct research trips in the fall targeting whiting in the SNE winter flounder inshore stock area.

*Area and Fishing Practice:*

The operational plan will be based on information from the active fishermen, NEFSC trawl surveys, observer data and landings reports. The vessels will operate with one net switching back and forth between the chosen modifications. Evaluation of the control and experimental tows will be based on differences in catch of winter flounder with scup or whiting retention and total catch. Catch levels for all species will be collected. One-hour tow durations will be used during this study to maximize the number of tows conducted per trip and still remain within the range of commercial tow durations (1-3 hours). Specific fishing practice adjustments will be discussed and agreed upon by project partners and will be as follows: tow speed of 3 knots and a 2.5-3.0:1 wire to depth ratio scope range for inshore tows. The headrope for both the control net and the experimental net with the belly panel will be set on even. The headrope will be lengthened 24” only on the experimental net with the 12” drop chain sweep. The experimental 12” drop chain sweep is in three pieces consisting of the two wings and center sections. The sweep will be lengthened by 2 feet (one foot per side) to get the sweep to fall behind the bottom hanging line. The two-foot extension will be removed when using the net as the control. The actual scope will be determined and coordinated by the vessel captains based on the area fished and the normal tow warp used at that depth of water. The team has offered a standard range used by inshore vessels. CCE will coordinate with captains prior to gear deployment in order to keep the scope similar from tow to tow. These fishing practice adjustments will be consistent between vessels.

The study vessels will depart from commercial ports of chartered vessels in NY and RI. During the fall whiting will be targeted in depths of 20-30 fathoms. Fish movements, captain’s knowledge and normal fishing activity will determine specific areas as described above.

*On Board Catch Processing:*

The onboard catch processing procedure will follow standard NMFS survey methods as described below (NEFSC, 1988). The target is winter flounder catch relative to quantifying differences in the retention between control and experimental nets. As such, total catch of winter flounder for each tow of both nets will be accurately weighed. Winter flounder will also be sampled for length frequency. The goal will be minimally 100 random length measurements per tow. If fewer individuals are caught, all will be measured. The team will also quantify the catch of winter flounder in terms of numbers as well as weights. This will be accomplished by actually counting the fish (if the catch is small) or by utilizing the number of individuals in our length frequency and the weight of that sample extrapolated over the entire winter flounder catch. Since The team also wants to quantify if the catch of whiting is influenced by the experimental net modifications, the total whiting catch will also be weighed on each tow and a length sample of at least 100 individuals will be obtained. The total weight of all additional species in each tow will also be obtained either by direct weighing or by catch estimations. Catch estimations will be based on basket or tote counts. Catch estimations will be made by separating individual species into baskets or totes. An average weight will be determined by weighing a minimum of 3 baskets or totes. Next, a count of the number of baskets or totes will be made for the particular species and this number will be multiplied by the average weight. This number will then be recorded as the estimated total catch weight. This procedure for catch estimations, based on basket or tote counts, follows the NMFS At Sea Monitoring Program and the Observer Program Biological Sampling protocols as outlined in the NEFSC 2010 sampling manuals.

*Statistical Analysis:*

Statistical analysis will rely on GLM and GAM regression approaches to model bycatch rates and will determine if the avoidance gear 12” drop chain sweep with a 24” headrope adjustment and the large mesh belly panel significantly reduces retention of winter flounder relative to the standard control net. The team anticipates that our data may be non-normal and so we will consider other distributions for the fit as necessary. Dependent variables will be catch weight of winter flounder per tow and the percentiles (25th, 50th, 75th) of the size-frequency distribution. Main effect variables will be net (control and each experimental). The team will also analyze time of day, recognizing that catches of whiting (and thus perhaps winter flounder exclusion) could be affected by time-of-day. Since the objectives are also to evaluate a proportional decrease in winter flounder retention relative to the catch of whiting, and to determine if the avoidance gear adaptations have any effect on target species catch or size selectivity, whiting catch weight per tow and the percentiles (25th, 50th, 75th) of the target species size-frequency distribution will also be used as dependent variables in the analysis. Total catch of all species will be used as a covariate. Total catch used as a covariate allows us to isolate the difference in our dependent variables (winter flounder and whiting catch and length frequency) that are due to the main effects of net, and not due to the change in total catch from one tow to the next. Where necessary, binomial tests will be used to evaluate the likelihood of achieving observed significant differences by chance. Response variables will all be in weights. Counts are useful however in comparing length frequencies as the focus is on individual fish, so numbers of fish will also be used in the analysis. Also, since both the control and experimental nets are the same (with the exception of the 12” drop chain sweep and the 24” headrope slack or large mesh belly panel) and fished the same, the gear effect is only related to the gear modification. As described above, depth (and temperature) will be randomized and thus the effect should be accounted for.

*Underwater Video Recording:*

Videotape recordings will be made during as many tows as possible and where conditions permit. A self-contained underwater video camera and recording system will be attached to the net. The video camera and equipment will be loaned to CCE for use in this project by the NEFSC when available. A qualified video technician will train CCE staff on camera use, maintenance and positioning in the net. The technician will be onboard the vessel when available. Due to these variables, The team can not specify the number of tows that will be recorded with video.