A METHOD TO REDUCE WINTER FLOUNDER RETENTION THROUGH THE USE OF AVOIDANCE GEAR ADAPTATIONS IN THE SMALL MESH TRAWL FISHERY WITHIN THE SOUTHERN NEW ENGLAND/MID-ATLANTIC WINTER FLOUNDER STOCK AREA

Project Team Members:

Cornell University Cooperative Extension
Marine Program
423 Griffing Avenue
Riverhead, N.Y. 11901

Emerson Hasbrouck, Project Leader
John Scotti
Tara Froehlich
Kristin Gerbino

Patrick Sullivan
Cornell University
Dept. of Natural Resources
214 Fernow Hall
Ithaca, NY 14853-3001
(607) 255-8213

Jonathan Knight
Superior Trawl
55 State Street
Narragansett, RI 02882
(401) 782-1171

Charles Weimar
F/V Rianda S
P.O. Box 2017
Montauk, NY 11954
(631) 668-9274

Bonnie Brady
LI Commercial Fishing Association
P.O. Box 191
Montauk, NY 11954
(516) 527-3099

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ABSTRACT

This project developed a trawl modification to reduce winter flounder bycatch in the longfin squid fishery. This project tested an avoidance gear adaptation (AGA) in order to reduce winter flounder bycatch ahead of capture in the net. A large mesh belly panel was made up of 2 meshes deep of 80cm (32") mesh 6mm poly webbing. With the 'saw-toothing' of the surrounding standard 16cm (6") mesh this yields an effective opening of 3 full meshes, a total of about 7' of large 32" mesh. The panel attaches five 16cm meshes (approximately 2.5') behind the footrope and goes from gore to gore (22 meshes wide and approximately 30') In order to take advantage of optimum conditions in the inshore summer directed longfin squid fishery, experimental sampling occurred from June to October 2010.

A single vessel was used in this study to conduct replicate tows comparing a control trawl to an AGA altered trawl (experimental trawl). The F/V Rianda S was chartered to conduct all sea sampling trips. The vessel operated with two identical trawls (one modified with the AGA). A control trawl was compared with the experimental trawl on a sequentially similar course for each tow. Comparisons of the control and experimental net were based on differences in winter flounder and longfin squid retention, and total catch. A total of 16 trips were conducted for the project. A total of 90 tows were completed, 45 tows each for the control and experimental nets.

The experimental large mesh belly panel has proven to be functionally effective in significantly reducing the quantity of winter flounder bycatch as well as other demersal species. Winter flounder showed a significant effect between the control and treatment tows and the overall percent reduction in winter flounder catch from the large mesh belly panel treatment was 87.9%. When all demersal species were pooled, we found a highly significant difference between the control and treatment that yielded an 83.3% reduction in catch by the large mesh belly panel treatment. There was no significant difference in squid catch between the control net and the net modified with the large mesh belly panel. In summary, results indicate that the large mesh belly panel is capable of effectively reducing winter flounder bycatch and the bycatch of other demersal species while retaining levels of longfin squid compared to the control net.

INTRODUCTION

Winter flounder (*Pseudopleuronectes americanus*) stocks have suffered severe declines according to recent stock assessments. The Southern New England/Mid-Atlantic (SNE/MA) winter flounder stock complex is overfished with overfishing occurring. Amendment 16 to the Northeast Multispecies Fishery Management Plan implemented management measures to reduce fishing mortality and achieve rebuilding goals on overfished stocks including SNE winter flounder. Under the regulations in place during this project, retention of winter flounder is prohibited throughout the SNE/MA winter flounder stock area. This area of prohibition extends from North Carolina to Massachusetts.

Avoidance of winter flounder during fishing activities is imperative at this time in order to reduce fishing mortality and assist rebuilding efforts. Through this project we tested an avoidance gear adaptation in order to reduce winter flounder bycatch ahead of capture in a trawl net. The gear modification used is a large mesh belly panel. While this approach was functionally and conceptually possible, it was necessary to determine in practice that this gear modification is effective in reducing winter flounder bycatch. This type of gear

modification can be easily retrofitted to pre-existing trawl gear. This presented an opportunity for pre-emptive research into the problem and allowed industry the opportunity to evaluate fishing methods which avoid winter flounder and can be adopted on a voluntary or required basis. It was equally important to seek avoidance gear adaptations which do not drastically impact fishermen economically. A successful design would not reduce harvest of target species to levels below economic viability. Because the experimental net modification focuses on the front end of the net, it may have a wider application than simply the small mesh squid fishery. The rationale for the inclusion of the approach tested was to broaden the prevailing discussion to evaluate a mesh management alternative to a drop chain sweep. There is a need for proven methods for bycatch reduction that will work within multiple fisheries. The project goal was to reduce winter flounder bycatch through the use of an avoidance gear adaptation in the small mesh trawl fishery in the SNE/MA winter flounder stock area. We evaluated a method to reduce winter flounder bycatch in the small mesh longfin squid trawl fishery.

STATEMENT OF RESEARCH QUESTION

Avoidance of winter flounder during commercial fishing activities is crucial at this time in order to reduce fishing mortality and assist rebuilding efforts of the SNE/MA stock. The research question we aim to answer is whether an avoidance gear adaptation, specially a large mesh belly panel, can successfully reduce winter flounder bycatch ahead of capture in the net without reducing the harvest of target species to levels below economic viability. While this approach is functionally and conceptually possible, it is necessary to determine in practice that this gear modification can effectively reduce winter flounder bycatch.

GOALS AND OBJECTIVES

Goal: This project goal was to evaluate a method to reduce winter flounder bycatch through the use of an avoidance gear adaptation in the inshore small mesh bottom trawl longfin squid fishery.

Objectives: Inherent and related objectives were:

1. Avoidance gear adaptation should result in at least a 85% retention of target species and a 50% reduction of non-target species as compared to the control net.
2. Avoidance gear adaptation must be compatible with existing small mesh bottom trawl gear.
3. To identify winter flounder reduction technology that is easily constructed while being manageable and enforceable.

METHODOLOGY

In this project CCE tested an avoidance gear adaptation (AGA) in order to reduce winter flounder bycatch ahead of capture in a small mesh longfin squid net. A large mesh belly panel was made up of 2 meshes deep of 80cm (32”) mesh 6mm poly webbing. With the ‘saw-toothing’ of the surrounding standard 16cm (6”) mesh this yields an effective opening of 3 full meshes, a total of about 7’ of large 32” mesh. The panel attaches five 16cm meshes (approximately 2.5’) behind the footrope and goes from gore to gore (22

meshes wide and approximately 30'). Please refer to Figure 1 in the Appendices for design of large mesh belly panel.

The vessel used in this project was the F/V Rianda S, homeport Montauk, NY. The F/V Rianda S is a 56 foot 65 gross tonnage steel stern trawler built in 1980. The vessel has 437 H.P., two hydraulic net reels and an ITI Trawl Monitoring System (door mounted sensors that report net spread). The net used for this project was a 400 X 12cm 4-seam 3-bridle standard otter trawl. This unaltered trawl was used as the control net for this project. This trawl is typical of a trawl used in the longfin squid fishery along the East Coast of the US (and is the trawl used by the NEFSC survey vessels and the NEAMAP survey). The 400 x 12cm refers to the fishing circle of the trawl. This size trawl is appropriate for vessels with horsepower in the range of 400hp to 550hp. This trawl has 12cm (full mesh) webbing in the wings, jibs, bunts and the 1st bottom belly. It has 6cm webbing in the square, side square and all the bellies except the 1st bottom belly. Flotation for this trawl is provided by 48 -8" floats mounted on the headrope. The sweep of the trawl consisted of 2-3/8" and 3" rubber discs on wire rope. The sweep is comprised of three pieces totaling 83 feet long. It was mounted to the bottom hanging line with the use of a traveler which allows the trawl to be adjusted. The sweep was hung to the traveler by 3 links of chain (approx. 5" long). The vessel towed 72-inch Tyberon doors.

Sixteen research trips were completed for this project during the period of June 24, 2010-October 13, 2010. A total of 90 tows (45 experimental and 45 control tows) were performed. The F/V Rianda S was chartered to conduct all sea sampling trips. The vessel operated with two identical trawls (one modified with the AGA). A control trawl was compared with the experimental trawl on a sequentially similar course for each tow. Comparisons of the control and experimental nets were based on differences in winter flounder and longfin squid retention and total catch. One hour tow durations were 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). The experimental sampling program consisted of multiple single day fishing trips. We used a repetitive ABBA protocol throughout each trip. To minimize any bias, the control and experimental nets were fished using the alternative paired method whereby the control and experimental nets were paired and the nets were switched according to ABBA protocol. The control net "A" was fished first and then the next tow used the experimental net "B". Then the next pair of sequential tows started with the experimental "B" net then followed by "A". If an even number of tows were completed in a day, on the subsequent day (or trip) the pairs were reversed (to BAAB sequence) to reduce any bias that could result from varying catches related to time-of-day differences. This method also reduced the number of net changes required thus maximizing at-sea time. The sequential tows covered the same ground, but in the opposite direction. After haul-back of one tow, the vessel turned around and made the same tow in the opposite direction with the next net in the ABBA sequence. This maximized the number of tows made per trip. The tow path or track was moved or changed only when necessary due to changes or movement of fish concentrations, at the end of a tow-block sequence.

Fishing took place in two different areas defined by analysis of NMFS Northeast Observer Program data from 2002-2008. These two areas delineate the locations of highest observed winter flounder discards in small mesh bottom trawl fisheries from May through Sept. 2002-2008. These areas were generally be defined as: 1- An area along the south shore of Long Island, NY from Smith Point to Bridgehampton and ranging from 12 fathoms to 25 fathoms; 2- An area within Block Island Sound approximately bordered by

Block Island, the Rhode Island coastal area and Montauk in depths ranging from 5 fathoms to 25 fathoms.

The onboard catch processing followed standard NMFS survey methods. However, the target was winter flounder relative to quantifying differences in winter flounder retention between control and experimental nets. As such, total winter flounder for each tow was accurately weighed and sampled for length frequency. The goal was, minimally, 100 random length measurements per tow. If fewer individuals were caught, all were measured. Since longfin squid occur with the winter flounder, and we were looking at bycatch in the longfin squid fishery, the total squid catch was also weighed on each tow and a length frequency sample was obtained. The weight of each individual species in each tow was obtained by separating the entire catch and direct weighing of each individual species. For large catches of a species or assemblage (i.e. skates), that species was placed in baskets and a sub-sample of the baskets were weighed.

DATA ANALYSIS AND RESULTS

Below is a quantitative evaluation and summary of the data analysis. Data were analyzed primarily to determine if a statistical difference exists in the catch of winter flounder and squid between the control and experimental nets, and to further quantify what the difference was. We further looked at the performance of the two nets relative to other species. A variety of statistical analyses were performed on the data generated from this project. Both parametric and nonparametric statistics are used. All statistics are at the $\alpha = .05$ level. Since the data are not normally distributed, the non parametric Wilcoxon results are more relevant.

First we looked at the difference in winter flounder catches and in squid catches between the control and experimental nets. Paired t- test results for winter flounder catch weights between control and experimental nets show a marginally significant difference ($t = 1.907$, $df = 43$, p-value = 0.0632). The experimental net caught less winter flounder. However, the winter flounder catches were relatively low in number and weight. Data analysis also included a nonparametric test for winter flounder catch weights. The Wilcoxon signed rank test with continuity correction resulted in a highly significant difference for winter flounder catch weights between the control and experimental nets ($V = 896$, p-value = <.0001). The experimental net caught significantly less winter flounder.

Paired t-test results for longfin squid catch weights between control and experimental nets show that the difference is not significant ($t = 1.1072$, $df = 43$, p-value = 0.2744). The nonparametric Wilcoxon signed rank test for squid catch weights showed that there was no significant difference between the control and experimental nets ($V = 501$, p-value = 0.9493). Thus the belly panel does not reduce squid catch.

In summary, statistical analysis indicates that there is a significant difference in catch of winter flounder, but not of squid between the control and the experimental nets (see Figures 1 and 2). The experimental net reduces the quantity of winter flounder bycatch. The overall percent reduction in winter flounder catch due to the large mesh belly panel treatment was 87.9% compared to the control net.

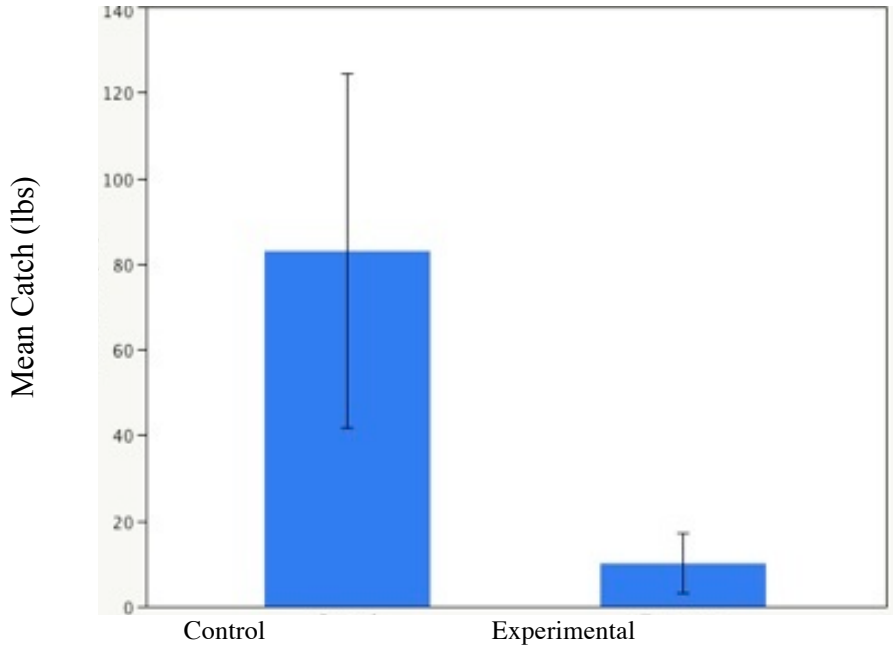


Figure 1. Mean Catches of Winter Flounder for All Tows in the Control Net Vs. Experimental Net

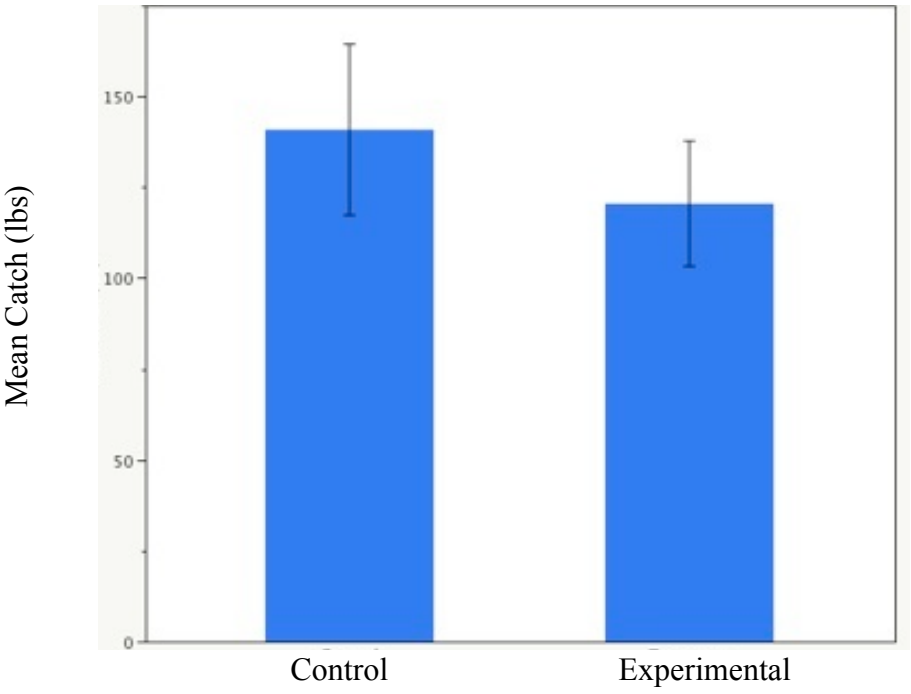


Figure 2. Mean Catches of Longfin Squid for All Tows in the Control Net Vs. Experimental Net

The data was also analyzed to determine if a statistical difference exists in the catch of combined demersals or in the total catch of all species between the control and experimental nets. Combined demersal species include all flounders (summer flounder, winter flounder, sand dab, four-spot flounder, Gulf Stream flounder), all skates, dogfish, monkfish and sea robins.

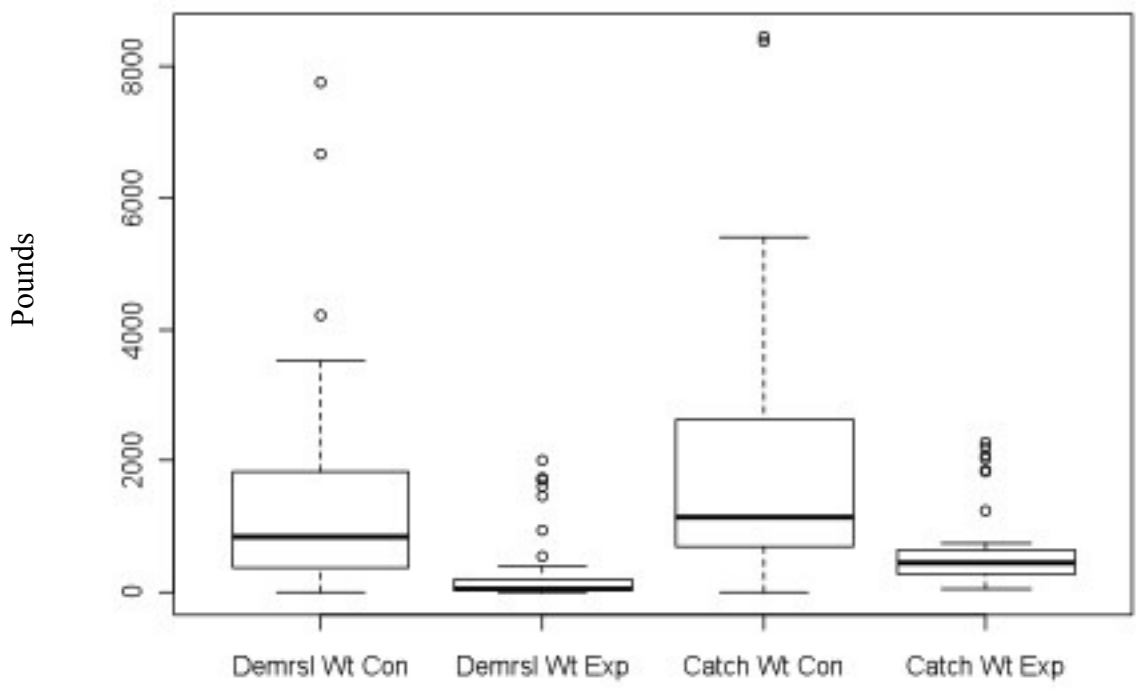


Figure 3. Boxplot distribution of demersal catch weights for the control (Con) and experimental (Exp) tows and total catch weights for the control and experimental tows.

As shown in Figure 3 there is a large reduction in total catch and combined demersal species in the experimental net compared to the control net. This reduction supports the efficiency of the large mesh belly panel in reducing bycatch of bottom dwelling species. There was an 83.3% reduction in catch by weight of combined demersal species in the experimental net with the large mesh belly panel.

Paired t- test results for the catch of combined demersals show a highly significant difference between control and experimental nets ($t = 5.3424$, $df = 43$, p-value = <.0001). The experimental net caught fewer combined demersals. Paired t-test results for total catch of all species show a highly significant difference between the control and experimental nets ($t=5.3958$, $df=43$, p-value = <0.0001). The experimental net caught less total catch.

The nonparametric Wilcoxon signed rank test also returned a highly significant result for both combined demersals and total catch weight differences between the control and experimental nets. (Demersals: $V = 953$, p-value = <.0001; Total Catch:$V = 957$, p-value = <.0001) Overall, both combined demersals and total catch were significantly lower in the experimental net using the large mesh belly panel.

Data analysis of winter flounder and squid lengths was also performed to look for differences in length selectivity between the nets. The average lengths for each tow were calculated for both winter flounder and squid. The paired differences in average length were then compared in the control and experimental nets.

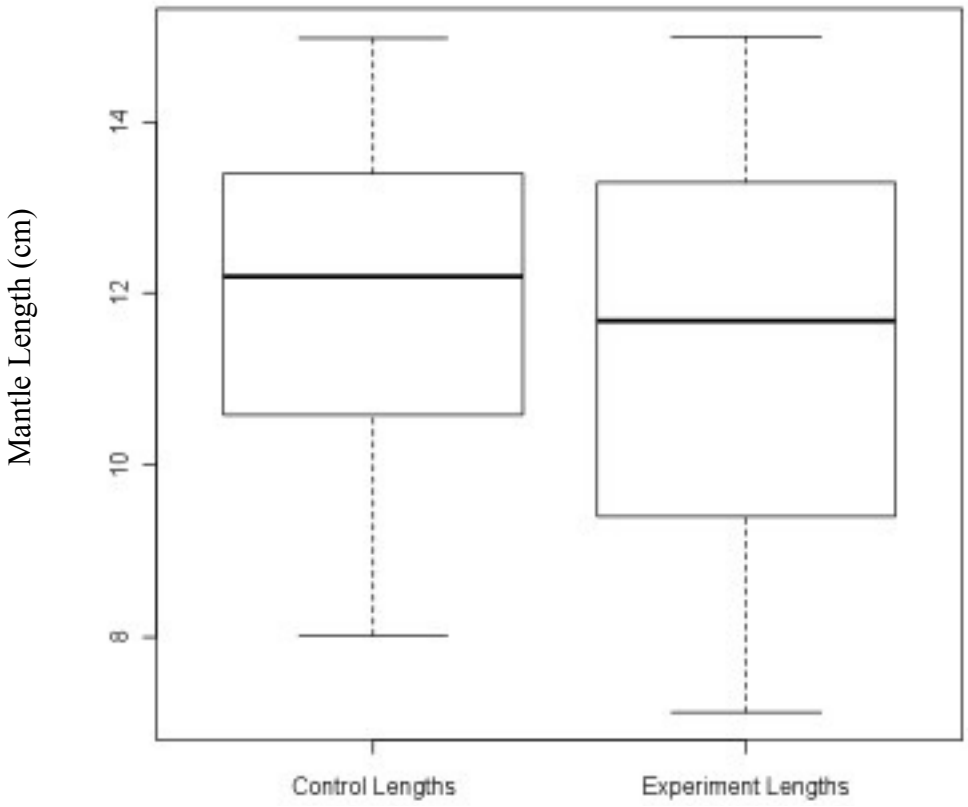


Figure 4. Boxplot of average squid lengths in the control and experimental nets.

Figure 4 shows the difference in average lengths for squid between the two nets. The average squid lengths for the experimental net are 0.5 cm smaller than squid in the control net (Figure 4). We are not sure what caused this difference in average size of squid. The mesh in the large mesh panel is so large that it likely did not have a selectivity effect on squid size. Further at-sea tests would have to be conducted to resolve this difference. Conducting the paired t-test and the Wilcoxon signed rank test shows that this difference in average squid lengths between the control and experimental nets is significant. (Paired t-test; $t = 2.3636$, $df = 43$, p-value = 0.0227; Wilcoxon signed rank test; $V = 688$, p-value = 0.0236)

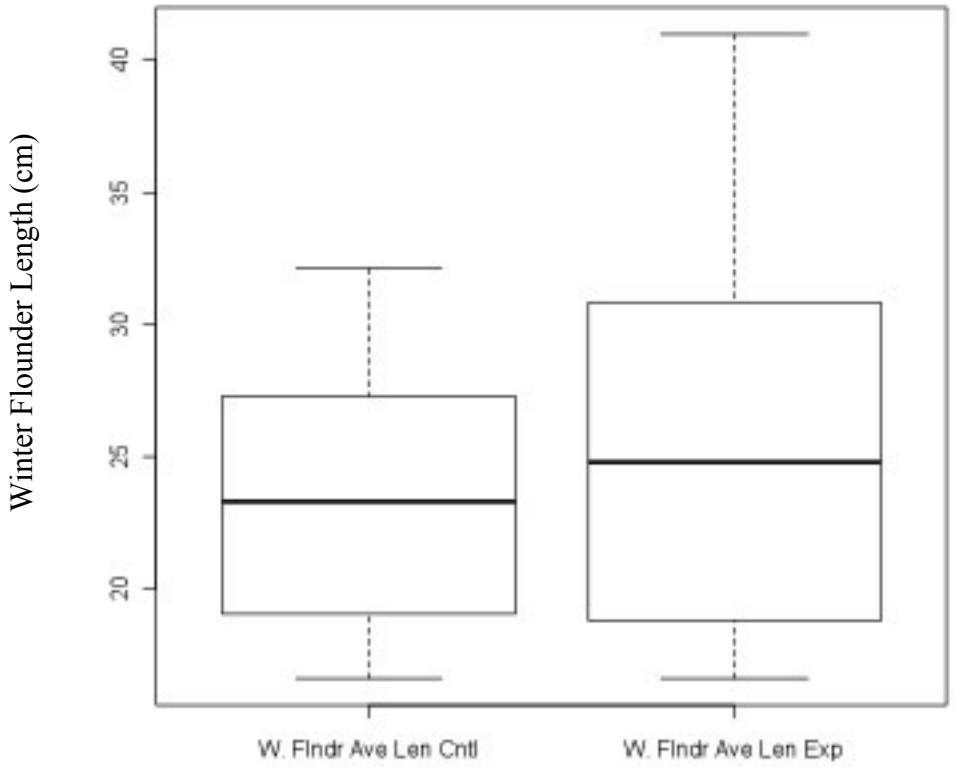


Figure 5. Boxplot of average winter flounder lengths in the control and experimental nets.

Figure 5 shows the average lengths for winter flounder for both control and experimental nets. Analysis shows that winter flounder in the experimental net are approximately 3 cm larger than those in the control net. This size difference indicates that small fish may escape better through the large mesh panel than larger fish do. This may be a result of the panel dimensions and placement. However this is speculative and we cannot definitively say without further testing. Statistical analysis using the paired t-test and the Wilcoxon signed rank test shows a significant difference in winter flounder lengths between the control and experimental nets. (Paired t-test; $t = -2.6872$, $df = 21$, p-value = 0.0138, Wilcoxon signed rank test; $V = 46$, p-value = 0.0074)

An additional goal of the data analysis was to compare winter flounder, longfin squid and combined demersal catch weights to total catch weight of all species combined. See Figures 6-8 below for plots of winter flounder, longfin squid, and combined demersal catch compared to total catch of all species combined. The solid lines in these figures are calculated loess curves – locally weighted moving averages, or a type of local regression on nonparametric data.

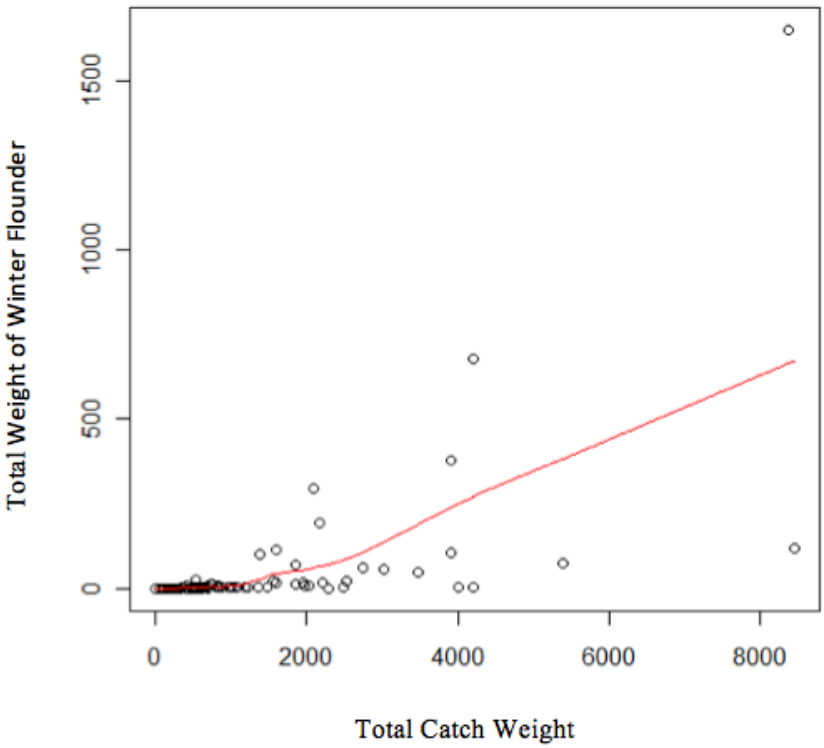


Figure 6. Total weight of winter flounder (lbs) caught per tow plotted against total catch weight (lbs) of all species caught per tow. Solid line is calculated loess curve.

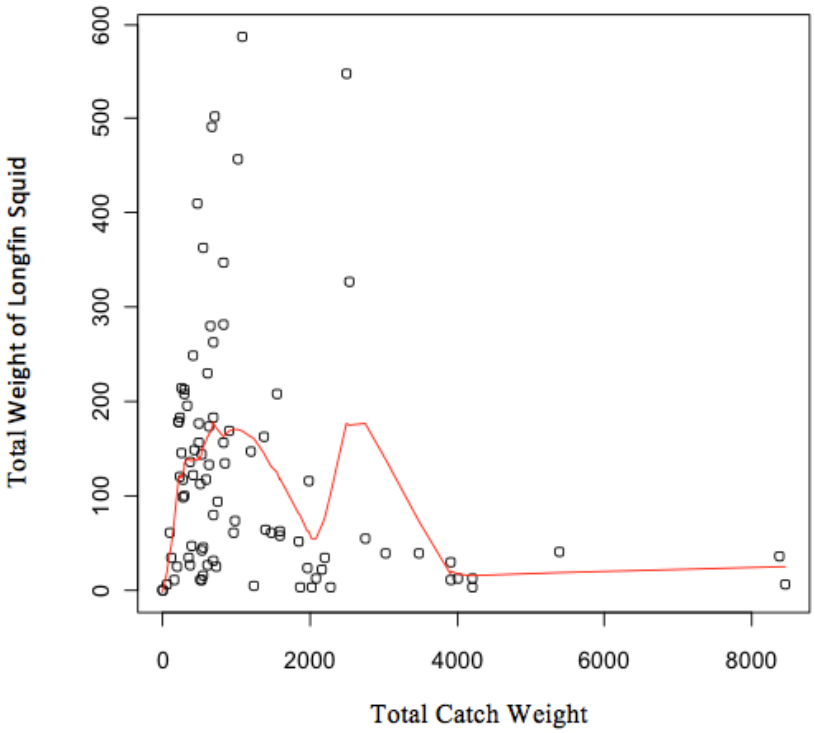


Figure 7. Total weight of longfin squid (lbs) caught per tow plotted against total catch weight (lbs) of all species caught per tow. Solid line is calculated loess curve.

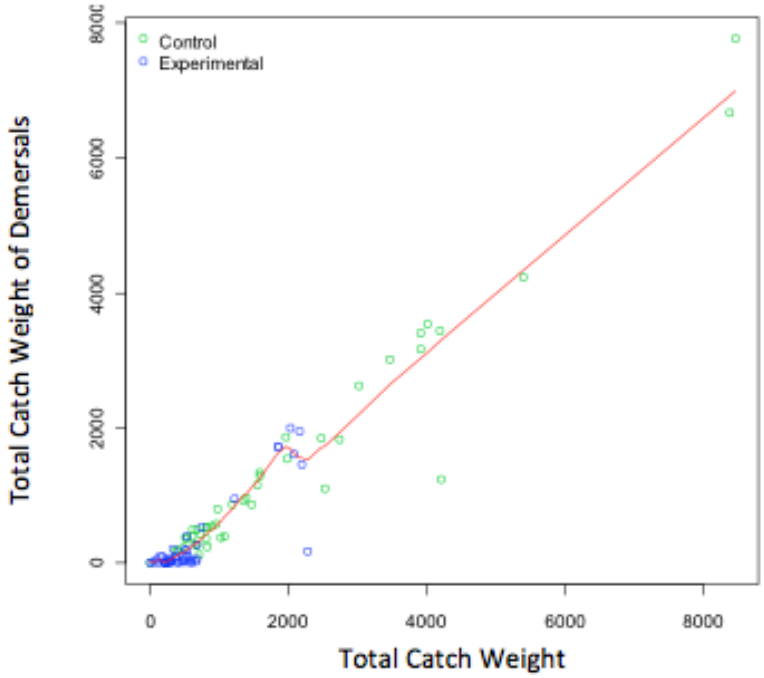


Figure 8. Total weight of all demersal species caught per tow (lbs) plotted against total catch weight (lbs) of all species caught per tow. Solid line is calculated loess curve.

As shown above, the experimental net has a significant effect on reducing total demersals and total catch. This effect is further detailed in Figure 8 where the experimental net results cluster in the lower left of the plot. In addition to maintaining the squid catch and reducing winter flounder bycatch, the large mesh belly panel has the additional desired effect of reducing the bycatch of other flounders, skates and dogfish.

The winter flounder and longfin squid relationship to total catch is a weak relationship so further analysis of the data is unnecessary. The total catch weight of demersal species is directly related to the total catch weight of all species combined. This results from demersal species comprising a large portion of the total catch. Total catch is thus being dominated by the catch of total demersals, particularly skates and dogfish. This is further evidenced by the linear relationship between the paired tow differences of the total catch and the paired tow differences of the demersal catch (Figure 9).

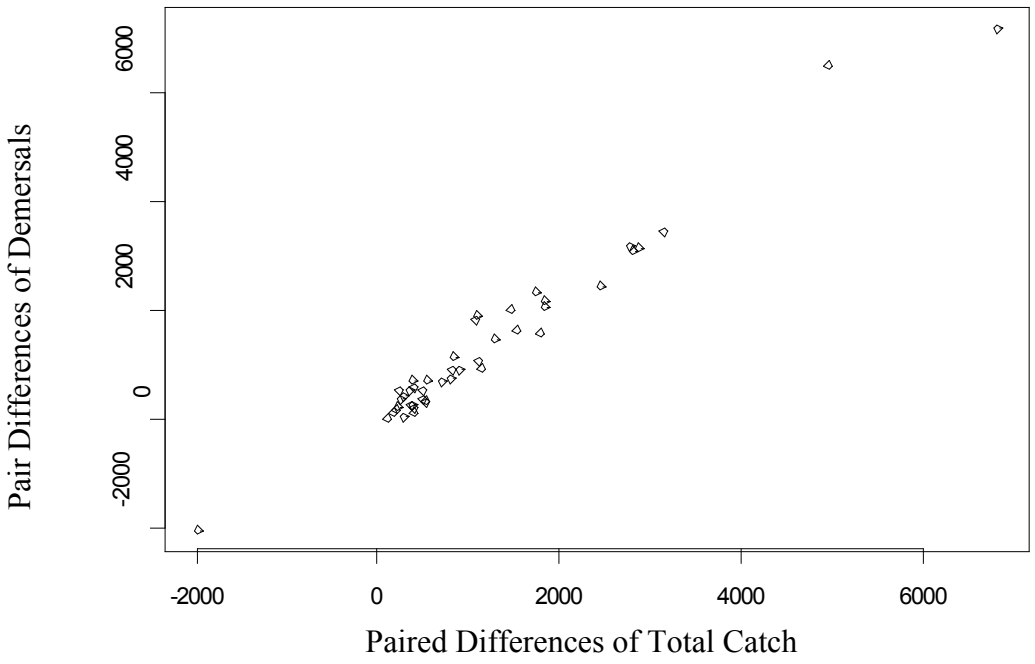
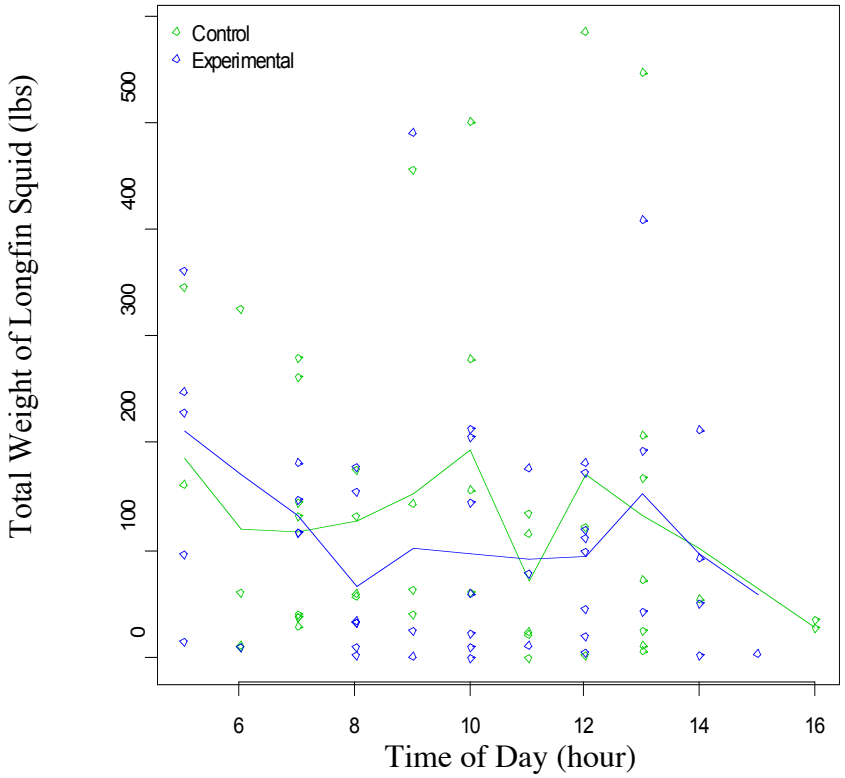


Figure 9. Paired differences in the total catch and paired differences in the demersal catch by trip and tow pairs.

The catch was also analyzed with time of day to determine if time of day and temporal changes occurring over the course of a day affect squid, winter flounder, demersal catch or catch differences for the control or experimental nets. The use of the alternating ABBA-BAAB protocol resulted in both control and experimental tows being randomized against time of day.

Figures 10-13 below show the catch of longfin squid, winter flounder, combined demersals, and total catch plotted against time of day. (Military time)



F**igure 10.** Total catch weight of longfin squid in the experimental and control nets at each time of day. Solid lines are calculated loess curves.

The graph above indicates that there is no apparent difference in the longfin squid catch by time of day. Squid catches were relatively steady over the course of the day.

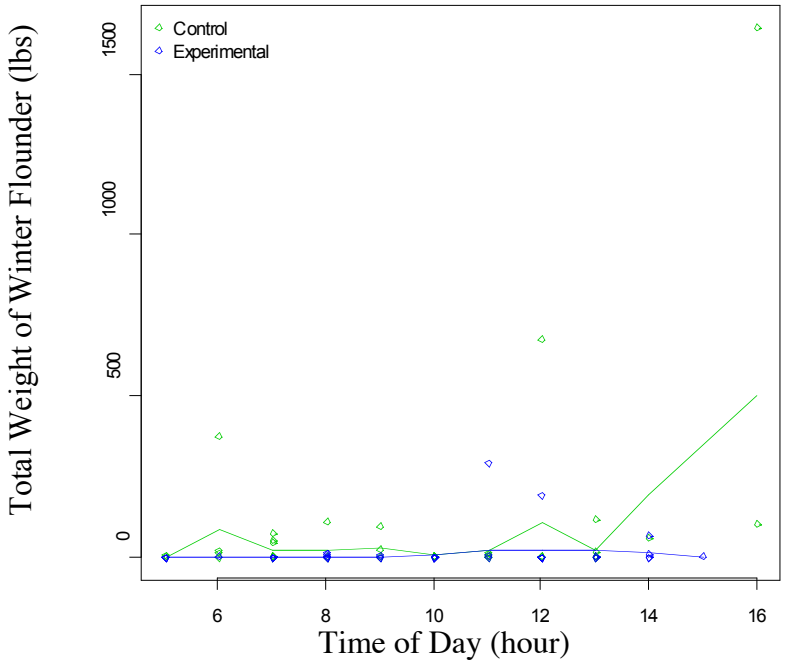


Figure 11. Total catch weight of winter flounder in the experimental and control nets at each time of day. Solid lines are calculated loess curves.

For most of the day there is no difference in the catch of winter flounder in the experimental net and the control net. There is one large tow in the control net influencing the plot and indicating a difference in the catch at the end of the day. Total catch of winter flounder was low in most tows. Overall, there is no difference in the catch of winter flounder between the two nets relative to time of day.

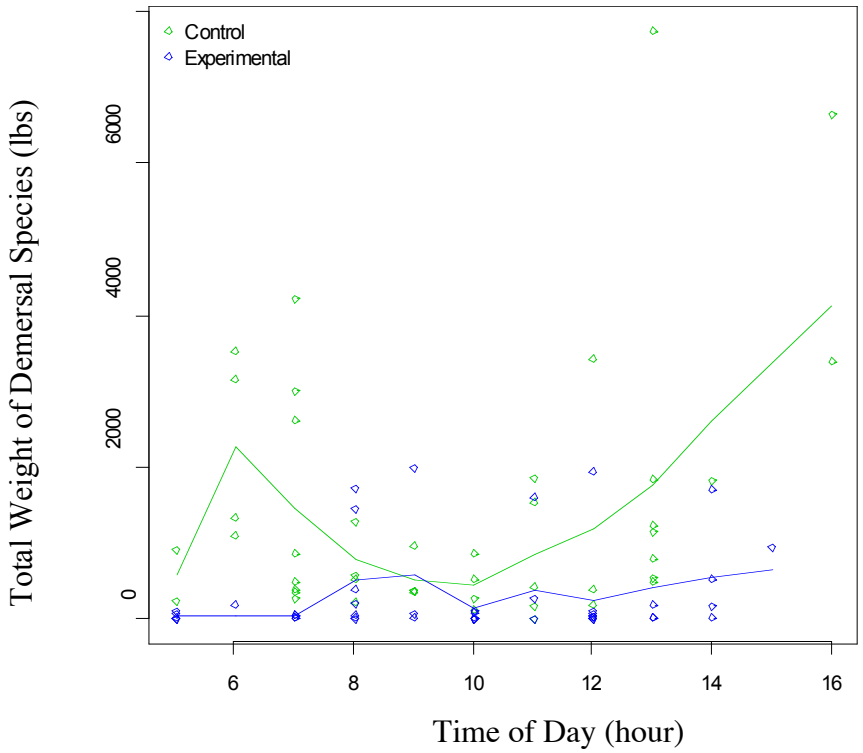


Figure 12. Total catch weight of all demersal species in the experimental and control nets at each time of day. Solid lines are calculated loess curves.

Figure 12 indicates that there is no apparent difference in the demersal catch by time of day in the experimental net. This is due to the 83.3 % bycatch reduction in total demersals thru the use of the large mesh panel. There is a difference in the demersal catch in the control net. More demersal species were caught in the control net in the earlier and later parts of the day.

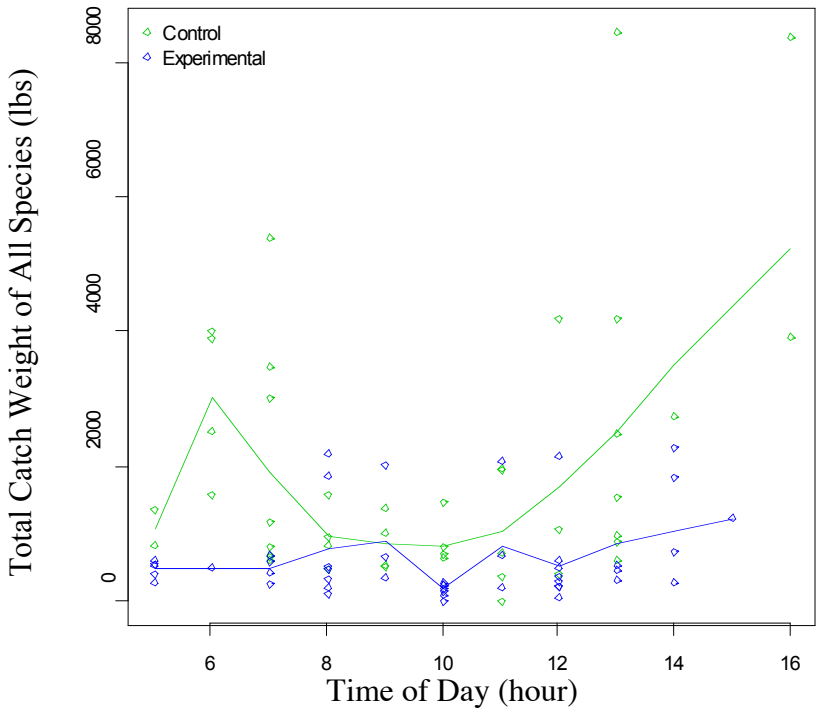


Figure 13. Total catch weight of all species combined in the experimental and control nets at each time of day. Solid lines are calculated loess curves.

In Figure 13 the total catch weight plot by time of day is similar to the demersal catch weight plot in Figure 12 above since demersal species made up a large portion of the catch. There is no apparent difference in the total catch by time of day in the experimental net. There is a difference in total catch with time in the control net with larger catches in the morning and later afternoon/evening.

Time of day has no effect on the catches of squid in the experimental or control nets. Time of day has no effect on winter flounder catch with the exception of one large tow in the control net which is considered an outlier. Time of day does have some influence on total catch and the catch of demersals in the control net but not the experimental net. Overall, the experimental net consistently results in lower total catches and lower demersal catches compared to the control net. This is due to bycatch reduction in the experimental net for flounders, total demersals (mostly skates and dog fish) and thus total catch.

VIDEO

An additional task of the project was to try to obtain underwater video recording of the function of the large mesh panel. However we were not able to obtain good useable video showing fish escapement through the panel. On the June 25, 2010 trip with the assistance of the University of New Hampshire equipment and personnel, underwater video was conducted to visually document fish behavior and escapement relative to the large mesh panel. Unfortunately the equipment malfunctioned and did not record video. During the two trips in October video equipment and personnel from the NEFSC were available to record the function of the panel and fish behavior. The underwater camera was attached to the headrope for a total of 8 tows for the two days. The

usefulness of this video was extremely poor due to the combination of muddy bottom type and poor visibility. Panel function and fish behavior were unable to be assessed using video technology. A copy of the video recording was provided to the CFRF as a supplement to this report.

DISCUSSION

The experimental large mesh belly panel has proven to be functionally effective in significantly reducing the quantity of winter flounder bycatch as well as other demersal species. Winter flounder showed a significant effect between the control and treatment tows and the overall percent reduction in winter flounder catch from the large mesh belly panel treatment was 87.9%. When all demersal species were pooled, we found a highly significant difference between the control and treatment that yielded an 83.3% reduction in catch by the large mesh belly panel treatment. There was no significant difference in squid catch between the control net and the net modified with the large mesh belly panel. In summary, results indicate that the large mesh belly panel is capable of effectively reducing winter flounder bycatch and the bycatch of other demersal species while retaining levels of longfin squid compared to the control net. This large mesh belly panel gear design worked as anticipated and offers a practical solution to the winter flounder bycatch problem in the longfin squid fishery.

The next step for this project is to have fishermen adopt this gear modification which is easily retrofitted to pre-existing gear. Future research goals for this gear modification include testing this proven method in other small mesh fisheries.

SUMMARY OF CONCLUSIONS

- The experimental large mesh belly panel has proven to be functionally effective in significantly reducing the quality of winter flounder bycatch as well as other demersal species.
- Winter flounder catch was significantly different between the control and treatment tows and the overall percent reduction in winter flounder catch from the large mesh belly panel treatment was 87.9%.
- When all demersal species were pooled, we found a highly significant difference between the control and treatment that yielded an 83.3% reduction in catch by the large mesh belly panel treatment.
- There was no significant difference in squid catch between the control net and the net modified with the large mesh belly panel.

	t-test	Wilcoxon signed rank test
Winter flounder	p=0.0632 MS	p=<0.0001
Longfin squid	p=0.2744 NS	p=0.9493 NS
Combined demersals	p=<0.0001	p=<0.0001
Total catch	p=<0.0001	p=<0.0001
Squid length	p=0.0227	p=0.0236
Winter flounder length	p=0.0138	p=0.0074

Figure 14. Statistical results comparing catches in the control net to catches in the experimental net. NS = not significant, MS = marginally significant

OUTREACH

Outreach to fishermen and industry members regarding project activities and preliminary results was an additional task scheduled that continuously occurred over the course of the project. CCE's website has been expanded to include a section dedicated to this project. The web page includes project activities, results, trip reports, photos, and video. The addition of this project and its results has also been posted on the Squid Trawl Network (STN) website. By including this project information on the STN website both industry members and managers involved in the squid fishery gain opportunity to be educated on avoidance gear adaptations to reduce winter flounder in the small mesh fishery.

A CCE Fisheries Program project presentation was held in Montauk at the Montauk Inlet Seafood Dock and Restaurant. This meeting was set up specifically for CCE to present results of our conservation gear technology programs to the fishing industry and to receive feedback from industry on these subjects. Multiple projects were presented at this meeting, on June 23, 2011, including the AGA large mesh belly panel project. Overall, 10 industry members attended and were updated on the positive results of the large mesh belly panel design in retaining squid while reducing winter flounder catch. This meeting was very interactive and allowed for open discussions relative to conservation gear technology. CCE distributed to all participants its project update video that was linked to the last progress report. This video was well received and is now being shown on a regular basis to customers at Inlet Seafood Restaurant in Montauk, NY.

The Squid Trawl Network Workshop was held in Rhode Island at the University of Rhode Island-Bay Campus on July 20-21, 2011. The main intention of the of the Squid Trawl Network is to establish a collaborative industry, science and management network approach to solving the bycatch challenges of the Northeast Squid Fishery. The purpose of this workshop was to evaluate past and current squid trawl projects, plan further studies, and establish research designs for current and future phases of network activities. This workshop was a great opportunity to demonstrate the positive bycatch reduction results of the large mesh belly panel to industry, scientists and fisheries management representatives. Thirty-five participants representing various perspectives of the northeast squid fishery attended this meeting.

CFRF Presentation

The Commercial Fisheries Research Foundation (CFRF) sponsored a series of research sessions in Pt. Judith, Rhode Island to promote the findings and results of funded projects relating to conservation engineering and collaborative research. These informational conferences were a great opportunity to demonstrate the positive bycatch reduction results of the large mesh belly panel to industry, scientists and fisheries management representatives. CCE presented the results of the AGA large mesh belly panel study at two of these sessions Nov. 3 and Nov.22, 2011. The research sessions were well attended, very interactive and allowed for open discussions relative to conservation gear technology. Presentations were posted on the CFRF website and all CCE related websites.

An article was published in the Commercial Fisheries News February 2012 edition. The article explains project activities and results. Coordination with publication editors to

supply information and photos was performed by CCE. An article was also published in The East Hampton Star, a Long Island local newspaper in the 8/19/10 edition. The article highlighted new fishing technologies used in avoiding winter flounder bycatch.

PROBLEMS ENCOUNTERED

Performing research with commercial fishing vessels, experimental gear and scientific equipment leaves many variables for problems to occur. This project overall went very well with only a few minor problems. The readings for door spread from the vessels door sensors were erratic due to battery power. Squid and winter flounder catches varied. We coordinated with the local fleet to determine fishing area based on squid movements in the area. We fished directly with the fleet and reported similar catches. We were not able to obtain any useable video documentation of fish escapement through the large mesh panel.

ACKNOWLEDGEMENTS

We would like to extend our sincere appreciation to Charles Weimer, Captain and owner of the Rianda S as well as the crew of the Rianda S. Their cooperation and fishing knowledge were key to the success of this project. We would also like to thank Henry Milliken and Eric Matzen, NMFS NEFSC, for their cooperation and equipment use for the video component of the project. We would also like to thank the Board of Directors and Executive Director of the CFRF not only for funding this project but also for providing guidance and assistance to help ensure the success of this project. We would also like to thank Jonathan Knight and the crew at Superior Trawl for their guidance and expertise with trawl gear. Finally the support of Bonnie Brady and the Long Island Commercial Fishing Association is also acknowledged.

Appendices

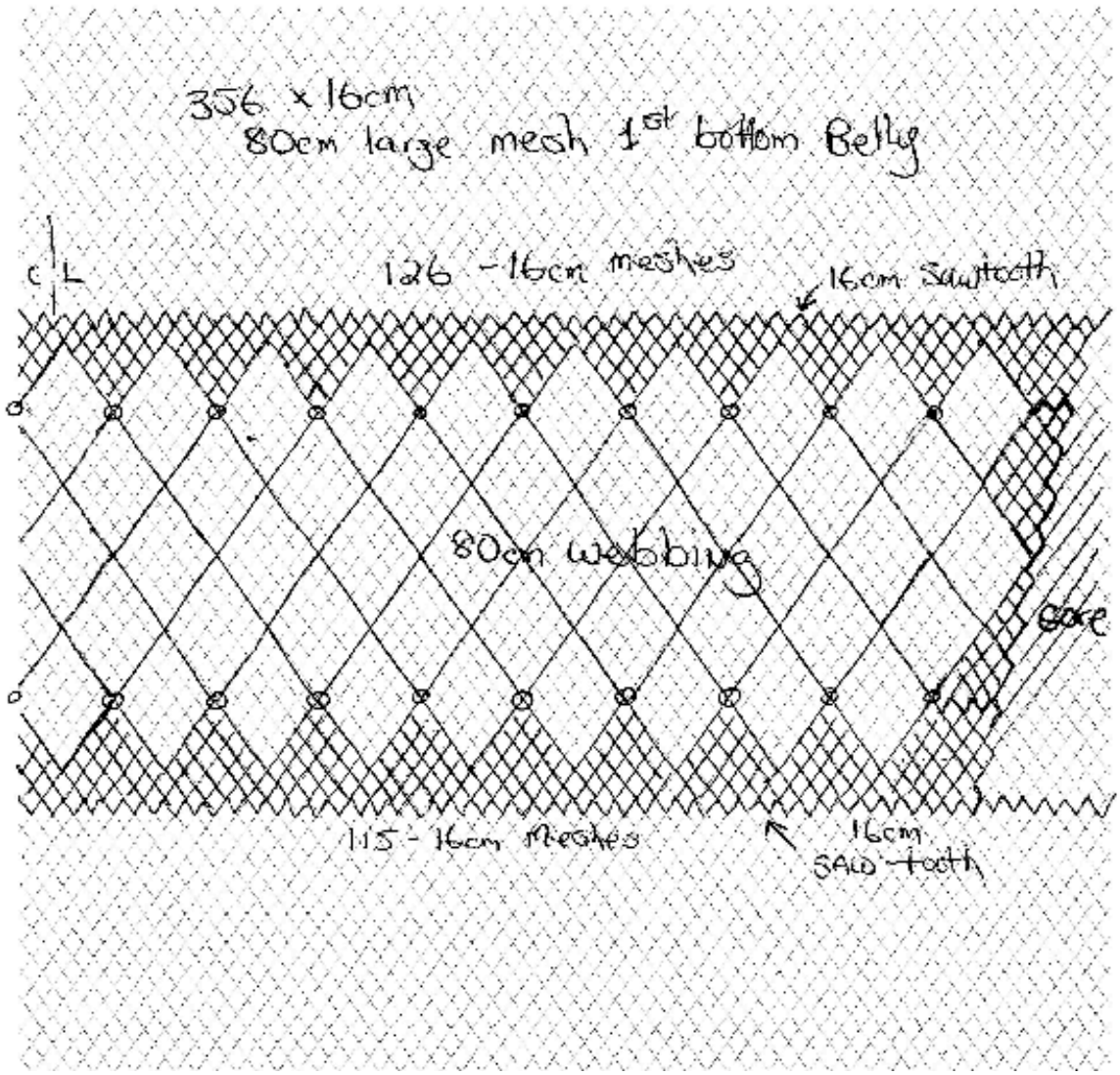


Figure 1. Sketch of Large Mesh Belly Panel Configuration

WINTER FLOUNDER AVOIDANCE GEAR ADAPTATION PROJECT 2010
TRIP LOG

TRIP DATE	
TRIP NUMBER	
VESSEL NAME	
HULL NUMBER	
CAPTAIN	
FOOD FISH NUMBER	
PORT	
VTR NUMBER	
DATA LOGGER 1 NUMBER (EXPERIMENTAL NET)	
DATA LOGGER 2 NUMBER (CONTROL NET)	

CCE STAFF
1
2
3
4
5

GEAR DESCRIPTION - CONTROL & EXPERIMENTAL TRAWL (FIRST TRIP ONLY)	
COD END MESH SIZE	
EXTENSION MESH SIZE	
MESH SIZE IN WINGS	
MESH SIZE IN JIBS	
MESH SIZE IN BUNTS	
MESH SIZE IN 1st BELLY BOTTOM (CONTROL)	
MESH SIZE IN 1st BELLY BOTTOM (EXPER.)	
MESH IN SQUARE	
MESH IN SIDE SQUARE	
MESH IN BELLIES (EXCEPT 1ST BELLY BOTTOM)	
TYPE OF FLOATS	
TYPE OF SWEEP	
SWEEP LENGTH	
HORSEPOWER	
TYPE OF DOORS	

EXACT PANEL LOCATION	
DESCRIPTION OF PANEL SIZE	
PANEL MODIFICATION	

COMMENTS

WINTER FLOUNDER AVOIDANCE GEAR ADAPTATION PROJECT 2010

TOW LOG

TRIP NUMBER		GROUND CABLE LENGTH	
TOW NUMBER		TOW CABLE LENGTH	
AGA (PANEL) OR CONTROL		TOW CABLE SCOPE	
TOW SEQUENCE (A OR B)		DOOR SPREAD @ TOW START	
TOW START TIME (24 HR)		DOOR SPREAD @ TOW END	
TOW END TIME (24 HR)		HEADROPE HEIGHT	
LATITUDE @ START		TOW DIRECTION (HEADING)	
LONGITUDE @ START		PANEL LOCATION	
LATITUDE @ END		WEATHER	
LONGITUDE @ END		WIND SPEED (KNOTS)	
STATISTICAL AREA		WIND DIRECTION	
WATER DEPTH @ START (FM)		WAVE HEIGHT (FT)	
WATER DEPTH @HAUL BACK (FM)		AIR TEMP(F)	
TOW SPEED (KNOTS)		SURFACE WATER TEMP (F)	
VIDEO? YES OR NO?		BOTTOM WATER TEMP (F)	
VIDEO LOCATION		DISSOLVED OXYGEN	
		SALINITY	

CATCH

SPECIES	TOTAL WEIGHT	TOTAL NUMBER*
WINTER FLOUNDER		
LOLIGO KEPT		
LOLIGO DISCARDS		
WHITING		

* Collect total number of winter flounder and Loligo. If time permits, collect total # for all commercially important species.

TOTAL CATCH	
COMMENTS	

WINTER FLOUNDER AVOIDANCE GEAR ADAPTATION PROJECT 2010
LENGTH FREQUENCY DATASHEET

TRIP NUMBER			
SPECIES		TOW #	
MARKET CATEGORY		EXPER. OR CONTROL	
COMMENTS		TOTAL POUNDS	

0 CM		0		0	
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
7		7		7	
8		8		8	
9		9		9	
0		0		0	
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
7		7		7	
8		8		8	
9		9		9	

SPECIES		TOW #	
MARKET CATEGORY		EXPER. OR CONTROL	
COMMENTS		TOTAL POUNDS	

0		0		0	
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
7		7		7	
8		8		8	
9		9		9	
0		0		0	
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
7		7		7	
8		8		8	
9		9		9	

WINTER FLOUNDER PROJECT CHECKLIST:

SAMPLING DAY

- Copies of all necessary permits
- Baskets
- Data sheets in aluminum case
- Waterproof notebook and pencils/pens
- Scale (Marel M1100) and 50 lb. calibration weight
- Backup scale
- Scale enclosure
- Panasonic Toughbook laptop
- Garmin handheld GPS
- Weather meter
- Hach meter with two 5 meter probes (DO probe and conductivity probe)
- Data loggers (activated)
- Camera
- Stopwatch/timers
- Calculator
- Cell phone
- Measuring boards/Yard sticks
- Scale packets
- Scale Knives and any other necessary knives
- Sharpening stone/Knife sharpener
- Forceps
- Tool bag/zip ties
- Extra batteries
- All necessary chargers for electronic equipment
- Manuals for all equipment
- All necessary clothing, foul weather gear, boots, and gloves
- Water and food
- Coolers
- Sea sickness medicine
- Sun block
- Zip lock bags

SAFETY EQUIPMENT:

- Float plan turned in
- Emergency plan sheet
- Survival Suits (5) w/strobe light attached
- Life jackets (5)
- Life raft
- First aid kit
- Emergency radio
- EPIRBS (registered to user)
- "Ditch bag" – including food rations, water, thermal protective aids, horn, strobe light, mirror, radar reflector, Dramamine

WINTER FLOUNDER
(Avoidance Gear Adaptation Project)
SAMPLING DAY PROCEDURE

DAY BEFORE TRIP

- Activate two data loggers

ONBOARD BEFORE DEPARTURE:

- Checklist complete
- All equipment, staff, paperwork and permits on boat
- Establish a float plan
- Call in for research trip

WHILE STEAMING OUT

- Attach data loggers to head rope of both the control net and experimental net
- Fill out vessel info data sheet
- Set up scale and calibrate
- Be aware that a minimum of 6 tows must be made and only during daylight hours and each tow should be 1 hour in length
- If the trip is to include video work, be sure the equipment is ready and properly located
- Conduct safety drills

IMMEDIATELY PRIOR TO EACH TRAWL

- Locate the GPS outside and turn it on so that it can record our track. **CHECK BATTERY LEVEL** – be sure the batteries will last the tow
- Take Hach reading and record data before net drops (repeat before each tow) – data should include salinity, DO, and surface water temperatures
- Be sure that tows are sequential – tows will cover the same ground but in the opposite direction (after the haul back of one tow the boat should turn around and make the same tow in the opposite direction with the correct net in the ABBA sequence)
- Remember to alternate/switch the net that is being fished according to the ABBA protocol
    1. "A" would equal the control net and "B" would equal the experimental net
    2. Be sure to record which net is being used, either the control or the experimental

DURING TRAWL

- Make sure that all the variables related to the tow pair remain as constant as possible. These variables include:
    1. Tow speed
    2. Tow cable length
    3. Tow cable scope
    4. Ground cable length
    5. Door spread

POST TRAWL – the following procedure occurs after all tows (1 hour duration with a minimum of 6 tows)

- Release fish on deck
- Sort catch – separate catch by species into baskets – priority being winter flounder and *Loligo squid*
- Record a total number for both winter flounder and *Loligo* (number of individual specimens for each species)
    1. Sub-sampling will occur for *Loligo* when there is **MORE THAN** one **FULL** basket (count the number of individuals in one full basket (70lbs) and extrapolate over the entire catch)
- Record weights for all species (for large catches, a sub-sample of basket weight will be used to extrapolate the weight of the total catch)
- If time permits, an actual total weight of whiting should be obtained (whiting is an additional priority species that may be impacted by winter flounder regulations)
- Collect length frequencies for winter flounder and *Loligo*(minimally 100 lengths but if less than 100 available measure all)
- Be sure the data sheets are filled out correctly with all the gathered data
- **All NON-LEGAL FISH OVERBOARD**

WHILE STEAMING HOME

- Determine if an even number of tows have been completed during the trip, if so the following trip the pairs will be reversed (ABBA – BAAB)
    1. This should be done to reduce any bias that could result from catch variability due to time of day differences

- Be sure ALL data sheets are filled out
- Clean all sampling equipment
- Pack up equipment and review checklist making sure everything is accounted for
- Remove data loggers
- Fill out VTR – include discards

BACK ON THE DOCK

- Unload boat
- Go over checklist again and make sure everything is accounted for
- Pack up truck and return to office

Scientific Research Reports: A trip report was completed for every research trip. Below are trip reports 1-16 covering all research days.

Cornell Marine Program
Scientific Research Trip Report
Trip # 1 (shakedown cruise) – Winter Flounder AGA Project

Early on the morning of June 24, 2010 the Cornell research team (See below) departed from Inlet Seafood in Montauk, NY aboard the F/V Rianda S., federal permit # 310378. The three Cornell scientists aboard were Tara Froehlich, Joe Costanzo, and Josh Clauss. After loading all the necessary equipment onto the boat, the Rianda S. left the dock at approximately 5:30 am. Travel time was near one hour to our location which was roughly mid-way between Montauk Point and Block Island in the Block Island Sound. The Rianda was equipped with two nets and would be so throughout this project. The first net is the control net which is a 400 X 12 cm., 4-seam, 3-bridle standard otter trawl (the specifics of which can be found in the full proposal). The second net is the experimental net. This net was the same as the control net except for one alteration. This alteration consisted of removing the first belly panel and installing a new one consisting of two rows of 32" mesh creating the avoidance gear adaptation (AGA). This first trip was to be one of two shakedown cruises to be sure all equipment and procedures were working correctly. The plan was to complete six one hour tows altering between the control and experimental nets following the ABBA AB protocol (A=control and B=experimental). The first tow began at 7:05 am and was followed by only three more tows as the Rianda crew and Cornell staff worked together to perfect procedure and ensure that six tows would be completed on ensuing trips. Initial outcome from the data collected from the completed four tows showed promising results for the effectiveness of the AGA. The two tows with the control net resulted in 42.9 lbs. of *Loligo* and 753 lbs. of winter flounder while the experimental net caught 45.8 lbs. of *Loligo* and 311.2 lbs of winter flounder. In regards to whiting the results were not as promising with the control net capturing a total of 738 lbs. and the experimental only 205.6 lbs. Another area that showed great promise for the success of the AGA was in regards to other less economical important species of bycatch. The numbers of skates was drastically reduced when using the experimental net. Also the numbers of dogfish, both spiny and smooth, were reduced when comparing the sequential tows of the control and experimental nets. Overall, trip # 1was a success. As a shakedown cruise it allowed the crew and staff to perfect procedure and the accumulation of initial data shows promising results for the effectiveness of the AGA's design.

Cornell Marine Program
Scientific Research Trip Report
Trip # 2 (shakedown cruise) – Winter Flounder AGA Project

June 25, 2010 signified the start of the Cornell research team's second shakedown cruise. This trip included video equipment and a videographer from the Gulf of Maine Research Institute with the intent of capturing underwater footage of fish behavior and fishing gear at work. In addition to the camera work, we also planned to change the size of the AGA panel by covering the center third of the large mesh (80 cm) panel with a smaller (12 cm) patch. This modification was done to see what effect it would have on the overall performance of the AGA panel. The location was again Block Island Sound

roughly mid-way between Montauk Point and Block Island. Installing the camera on the net initially proved to be tedious and time consuming, but the procedure was improved upon over the course of the day. The results of the camera work to date appear to be less than a success as the technician was unable to retrieve any images despite the fact that the camera was recording. The final result is still unclear as the images are still trying to be retrieved. The size of the AGA panel was altered during comparative tows 3 and 4 with the raw data showing that the panel is much more effective at its full, unaltered size. Initial observations and raw data show similar results relative to the effectiveness of the AGA panel to that of trip # 1. Bycatch was reduced significantly in comparative tows when using the net with the AGA panel. Retention of *Loligo*, according to raw data, was consistent with no obvious difference between the control and the experimental nets. On the other hand, the reduction in retention of winter flounder was significantly different with the experimental net retaining much smaller numbers.

Cornell Marine Program
Scientific Research Trip Report
Trip # 3 – Winter Flounder AGA Project

On June 28, 2010, with two shakedown cruises completed, Cornell's third research trip began. Three Cornell scientists boarded the Rianda S. early in the morning and began a long day fishing. Weather conditions and industry feedback from other commercial vessels as to the location of the squid led us to a new fishing area. Research would be conducted north and slightly west of Montauk Inlet in an area that included waters of both Gardiner's Bay and Block Island Sound. After the conclusion of the six tows and upon examination of the raw data the experimental net with the AGA panel appears to be functioning well. Retention of squid by the experimental net initially appears to be slightly less than the goal of 85% but the retention of non-target species, including winter flounder, is greatly exceeding the goal of 50%.

Cornell Marine Program
Scientific Research Trip Report
Trip # 4 – Winter Flounder AGA Project

The Cornell researchers boarded the Rianda S. early on June 29, 2010 for the commencement of trip # 4. The area fished today was the same as that of trip # 3. This locale is referred to by the fishermen as "the bay", and it appeared as if the squid were still here as the majority of the Montauk, NY fishing fleet was in this area. Upon conclusion of the sixth tow and examination of the collected data the AGA panel seems to be providing results that would verify its success. The control net resulted in roughly 946 lbs. of *Loligo* while the experimental net retained 743 lbs. This equates to nearly an 80% retention rate. The experimental net is proving to be even more successful at reducing bycatch, with the retention of winter flounder by the experimental net at near zero (.32 lbs.) and the control net at just over 25 lbs. Other species of bycatch were also reduced, most notably were skates and windowpane flounder.

Cornell Marine Program
Scientific Research Trip Report
Trip # 5 – Winter Flounder AGA Project

Trip # 5 occurred on July 7, 2010 and the research team included a videographer from Cornell who was there to film the work and also assist in the collection of data. The short

film that will be created will hopefully be offered to those that are interested via the internet including the Cornell Cooperative website. Trip 5 continued in the same area as the previous two trips as the Montauk fleet continued to have success catching *Loligo* at this locale. The Cornell researchers were once again on the F/V Rianda S. early in the morning. The first research tow began at 5:30 am and the sixth tow was completed at 2:00 pm. The raw data from this trip reflects similar results to the previous trips. Winter flounder and other species of bycatch continue to show significant reductions in retention when using the experimental net. The success of the experimental net in retaining squid, when compared to the control net, waivered slightly on this trip. The combined totals for *Loligo* in each of the two nets were approximately 763 lbs. in the control net and 479 lbs. in the experimental net.

Cornell Marine Program
Scientific Research Trip Report
Trip # 6 – Winter Flounder AGA Project

The F/V Rianda S. continued to find squid in the calm waters of Gardiner's Bay on July 8, 2010. Trip # 6 started much the same as the previous cruises with an early rise for the Cornell researchers and a quick start to the fishing. Much of the Montauk fleet also continued to fish this area which served to bolster our confidence in the decision to stay at this locale. At the conclusion of the day the raw data showed that during this trip, for the first time the experimental net had outperformed the control net in regards to the retention of *Loligo*. Preliminary totals had the experimental net with 622 lbs. of squid compared to 561 lbs. with the control net. The bycatch of winter flounder was non-existent with the experimental net, 0 lbs. were caught, while the control net resulted in 11lbs. of winter flounder for the day. The experimental net continued to show promising results with the bycatch of other species, in particular skates whose reduction is most drastic.

Cornell Marine Program
Scientific Research Trip Report
Trip # 7 – Winter Flounder AGA Project

July 14, 2010 was the date of the seventh trip for the Cornell research team. We continued to fish the sheltered waters north of Montauk Inlet that bordered both Block Island Sound and Gardiner's Bay. The Montauk fleet was making its presence less felt as the number of boats in the area had noticeably declined. At the end of the day, the combined total of retained *Loligo* would reflect the fact that the squid had started to move and were no longer present in the abundance that they had been. Again, the data collected throughout the day remained consistent with that from previous trips indicating that the AGA panel was performing well and demonstrating the qualities it was designed to have. As was the case in trip # 6, the combined total of retained squid in the experimental net exceeded that of the control net. To its credit, the experimental net with the AGA panel once again retained 0 lbs. of winter flounder while the control net captured slightly more than a combined 12 lbs. Other species of bycatch continued to show declined numbers in the experimental net as compared to the control net.

Cornell Marine Program
Scientific Research Trip Report

Trip # 8 – Winter Flounder AGA Project

Trip # 8 took place on July 15, 2010 with the fishing continuing in Gardiner's Bay and the surrounding waters. Several other commercial vessels continued to fish this location but it was obvious that the fleet was less represented. The day progressed smoothly as protocol and procedure were by this time perfected and second nature. At day's end, the data collected continued to be consistent with that of previous trips. The experimental net and AGA panel once again resulted in zero retention of winter flounder while the control net landed slightly over 7 lbs. for the day. The totals for *Loligo* favored the control net on this trip with approximately 449 lbs. for the control and 270 lbs. for the experimental. Bycatch continued to be significantly reduced when using the experimental net especially relative to skates, windowpanes, and fluke.

Cornell Marine Program
Scientific Research Trip Report
Trip # 9 – Winter Flounder AGA Project

Cornell's 9th research trip took place on July 21, 2010 and included a new fishing area in an effort to locate a spot that would include both *Loligo* and winter flounder. The new location was an area south and east of Montauk Point along the east end of Long Island's Atlantic coast. All of the fishing on this trip occurred in approximately 23 fathoms of water and the new location provided changes compared to previous trips. There was an abundance of winter flounder caught on this trip but minimal amounts of *Loligo.* Spiny dogfish dominated the species of bycatch and on tow # 4 were so abundant (amount estimated at between 8,000 – 12,000 lbs.) that the net (control) could not be hauled onto the boat for fear of damaging the gear. This in turn nullified the data collected from tow # 3 since there would be nothing to compare it to. Using the remaining four tows winter flounder totals were reduced significantly in the experimental net (14 lbs.) as compared to the control net (494 lbs.). *Loligo* totals were low across the board with the control net capturing more than the experimental. Finally, relative to other species of bycatch, the quantities caught were lower with the experimental net compared to the control net.

Cornell Marine Program
Scientific Research Trip Report
Trip # 10 – Winter Flounder AGA Project

Research trip # 10 occurred on July 22, 2010. Fishing location was a concern on this trip because of the abundance of dogfish at our trip # 9 location and the lack of knowledge as to the location of the squid. The rest of the commercial fleet were also having problems locating the squid so our only logical choice was to return to the waters of Gardiner's Bay and Block Island Sound to avoid the dogfish and hope there was still some squid lingering in the vicinity. At day's end, the data collected reflected results that were consistent with previous trips. Winter flounder numbers were greatly reduced in the experimental net as compared to the control net. This was also the case with other species of bycatch. The control net outperformed the experimental net relative to *Loligo* retention during this trip. Preliminary totals for winter flounder and *Loligo* were as follows: control net retained 97 lbs. of squid and 32 lbs. of flounder and the experimental net caught 32 lbs. of squid and 1 lb. of flounder.

Cornell Marine Program
Scientific Research Trip Report

Trip # 11 – Winter Flounder AGA Project

The Cornell team began trip # 11 from a new port on July 27, 2010. Information gathered from within the commercial fishing industry suggested that there was some squid located further west along the south shore of Long Island's Atlantic coast. The previous night the Rianda S. had steamed from Montauk, NY to the new port of Shinnecock located in Hampton Bays, NY. The day progressed smoothly and was mostly uneventful except for the capture of an extremely large roughtail stingray (250 + lbs.) during tow # 3 (experimental net). The captain informed us that when you catch one of these rays that the quantity of other species is often reduced. Upon examining the raw data at the end of the day it was obvious that we had indeed located more squid. Also preliminary results seemed to be consistent with those from previous trips. Winter flounder bycatch was greatly reduced when using the experimental net as was the bycatch of other species including fluke, windowpanes, and skates. The experimental net retained less squid than the control net and appeared to be well below the goal of 85% retention when comparing the two nets during this trip.

Cornell Marine Program
Scientific Research Trip Report
Trip # 12 – Winter Flounder AGA Project

Trip # 12 occurred on July 28, 2010 and began in Hampton Bays, NY with the hopes of staying with the squid that had been located yesterday between Moriches Inlet to the west and Shinnecock Inlet to the east on Long Island's Atlantic coast. With beautiful weather and procedure and protocol becoming second nature the day of fishing passed with no problems or significant events. At the conclusion of the day the raw data relative to bycatch continued to be consistent with other trips. The experimental net resulted in zero retention of winter flounder and reduced the quantity of other bycatch such as fluke, windowpanes, and skates. Additionally, the experimental net retained more *Loligo* during this trip than the control net. The total squid caught during the three tows with the experimental net was 514 lbs. while the three tows with the control resulted in 350 lbs.

Cornell Marine Program
Scientific Research Trip Report
Trip # 13 – Winter Flounder AGA Project

The Cornell team began trip # 13 back in Montauk, NY on October 6, 2010. The Rianda S. steamed to an area south of Montauk Point generally known as Block Canyon. Accompanying the Cornell team on this trip was a videographer from the New England Fisheries Science Center whose goal was to get some footage of both the control and experimental nets while actively fishing. This footage could then be used to more accurately assess fish behavior relative to capture and also to analyze the effectiveness of the AGA panel. The work involved in installing and removing the camera from the nets reduced the fishing effort from six tows to only four tows. Additionally tow # 2 had to be repeated because the first attempt resulted in a bag filled with an estimated 12,000 lbs. of scup. The Rianda S. was not capable of winching a catch that large aboard so the fish were released from the net while still in tow. Upon examining the raw data at the end of the day, preliminary results seemed to be consistent with those from previous trips. Winter flounder bycatch was greatly reduced when comparing the experimental net (16 lbs.) to the control net (157.6 lbs.). The experimental net exceeded expectations on this

trip and retained more squid than the control net with the numbers being 137.8 lbs. in the experimental and 67 lbs. in the control.

Cornell Marine Program
Scientific Research Trip Report
Trip # 14 – Winter Flounder AGA Project

Trip # 14 was conducted on October 7, 2010 and again left from the port of Montauk, NY. The video work continued on this trip which again, due to the effort of installing and removing the camera, resulted in only four tows being completed rather than the desired six tows. The fishing was conducted in relatively shallow water south and west of Montauk Point along the south shore of Long Island. The driving reason for this location was increased visibility in hopes of improving the results of the video work. The four tows were completed without any issues other than those related to the camera. Preliminary observation of the data collected during this trip continues with the trend of results from previous trips. The experimental net retained zero pounds of winter flounder compared to the 3.6 pounds caught in the control net. The experimental net continued to exceed expectations relative to squid retention. The experimental net caught 217.3 pounds of Loligo and the control net resulted in 121.4 pounds.

Cornell Marine Program
Scientific Research Trip Report
Trip # 15 – Winter Flounder AGA Project

The Cornell team left from Montauk, NY for research trip # 15 on October 12, 2010. The Rianda S. had only a short steam to today's location. The fishing for this trip was conducted a short distance from Montauk Inlet in Block Island Sound between Block Island and Montauk Point. The trip progressed smoothly. There were no problems encountered and all six tows were completed in a timely fashion. A quick evaluation of the data collected seemed to follow suit with the results from previous trips. Once again the preliminary numbers showed that winter flounder bycatch was significantly reduced in the experimental net. There was a total of 3.7 lbs. of winter flounder in the experimental net and 64.6 lbs. in the control net. There was also significant reduction in other species including skates, fluke, and scup. The control net did capture more squid than the experimental net during this trip. The total quantity for each net was 75.2 lbs. (control) versus 60.4 lbs. (experimental) which equates to approximately an 80% retention rate for the experimental net.

Cornell Marine Program
Scientific Research Trip Report
Trip # 16 – Winter Flounder AGA Project

Trip # 16, the final trip for this project, was conducted on October 13, 2010. Travel time for the Cornell team aboard the Rianda S. was short with the fishing locale just north and east of the Montauk Inlet, specifically Block Island Sound/Gardiner's Bay. By now procedure and protocol had become second nature and the Cornell team and Rianda S. crew progressed through the day without encountering a problem. The desired six tows were all completed and all the accompanying data was recorded in the appropriate data sheets. During this trip the experimental net again exceeded expectations in winter flounder bycatch reduction by retaining only 13.2 lbs. of winter flounder as compared to 272.2 lbs. in the control net. Reduction of most other potential bycatch species was also

reduced when towing the experimental net during this trip. Most notable among the other species was skates, spiny dogfish, fluke, and scup. The control net was more effective at retaining squid during this final cruise. The numbers relative to this aspect were 176.8 lbs. of *Loligo* over three tows for the control net, compared to 135.5 lbs. for the three tows made by the experimental net. This equates to about a 77% retention rate for the experimental net. On a final note, we would like to thank the captain/owner and crew of the F/V Rianda S. for their tremendous cooperation and generous amount of help in bringing this project to what we feel was a very promising and successful conclusion.

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Nature Notes

What's New in Old Fishing

By Larry Penny
(August 19, 2010)

In 1376 King Edward III was presented with a petition to ban the beam trawl, known as the "wondyrchoum" because it took "such a great abundance of small fish . . . to the great damage of the whole commons of the Kingdom and the destruction of the fisheries."

Fishing is much older than farming, on a par with hunting and gathering in terms of primeval occupations. Before humans, bears, bats, birds, and all sorts of animals, including whales, dolphins, and fish — yes, fish — fished. Fishing techniques among animals became sophisticated: Dolphins and cormorants evolved group fishing techniques and learned independently to round up fish the way cowboys in the Old West rounded up cattle.

Emerson Hasbrouck

Joe Costanzo and Tara Froelich of the Cornell Cooperative Extension have been helping out with a study of ecologically sensitive trawling.

As fishing techniques developed in humans, types of fishing gear for different fishing operations — seines, traps, pots and trawls, and hook-and-line — came into use. Later, boats were employed.

The fishhook has come a long way since it caught its first fish. It is still the basic tool of recreational fishing. It probably predates the net, but not by much. Before there was string, there were nets fashioned from reeds and other vegetation. Nets were used by aboriginals in America long before they were used here by settlers from the Old World.

Fishing gear hasn't changed much in the last 200 years; electronics came along to help find fish underwater, but hooks and nets are still used the same ways as in the past. Fishing gear was designed to catch fish, pretty much all fish, the marketable ones and those that were returned overboard. But there was even a market for the latter; they were used to make fish meal as feed for pets and livestock, or used as fertilizer, a trick, anthropologists say, the Native Americans taught us.

Along came the era of endangered and threatened species in the 1950s, and it was discovered that while fishing gear was very effective in catching almost anything that swam or crawled on the sea bottom, it was also equally effective in catching species in serious decline, such as sea turtles, manatees, dolphins, and seals, as well as unpopulous fish species such as sturgeons.

In America, since the Nixon administration put into effect the Endangered and Threatened Species Act passed by Congress, fishing gear has been going through another set of changes — it has become more selective. The objective now is to catch only target species and avoid those that are in danger of becoming extinct. Shrimp trawlers had to incorporate exits in their nets for trapped turtles, and trawls were made with different mesh sizes to selectively catch only those fish above the legal size.

"Avoidance" of endangered and threat-ened species or those on the way to earning that status became the new buzzword in the industry. The industry has come a long way in a short time. Very few sea turtles now die in American nets, very few dolphins are captured in Pacific Ocean purse-seining for tuna, and a new emphasis is on net pass-throughs for bottom fish, such as cod, the numbers of which in the world's oceans have become critically low.

One of the latest efforts to design an ecologically sensitive trawl is a local one spearheaded by the Cooperative Extension of Suffolk County, Cornell University, the Long Island Commercial Fishing Association, and a leading manufacturer of commercial fishing trawls, Superior Trawls of Narragansett. Bonnie Brady of Montauk heads the commercial fishing association, and Emerson Hasbrouck leads the Cornell Cooperative Extension team.

Two Montauk fishing boats, the Rianda, captained by Charles Weimer, and the Catlin and Mairead, captained by Dave Aripotch, are the boats pulling the specially designed trawls, and the fish the trawls are trying to

avoid — you guessed it — is the winter, or blackback, flounder, once a mainstay of the commercial and recreational fishery, now almost as uncommon as sturgeons, cod, and blowfish. Unless drastic measures are initiated, such as not catching it or stocking it, it may become a thing of the past.

Understanding the behavior of the fish one is trying to avoid is crucial to developing fishing methods that avoid it. It turns out that flounders tend to dive down when approached by a would-be predator, in this case a fishing trawl. A net that takes such an escape strategy into account is on the right track.

Two different nets have been designed by Superior Trawls for this purpose: One employs what are called drop chains, the other, large mesh paneling in the bottom part of the trawl at its front. Drop chains keep the bulk of the bottom of the trawl, or "foot-line," off the bottom; the large mesh paneling allows the flounder to dive through it so that the rest of the trawl passes above.

Throughout July and August, the two boats involved in the experiment have been pulling these avoidance trawls, alternating them with conventional trawls of the same size used as controls in waters off Long Island's South Shore and those north and east of Montauk Point. These two areas recorded the most "bycatch" of winter flounder over the recent past. Bycatch cannot be kept and marketed. It is thrown overboard after each trawl, and the mortality of those discarded fish is very high, more than 50 percent. In other words, the fish are wasted.

The two boats are trawling for Loligo squid, a main source of calamari in restaurants. Why squid? Well, squid are an important fishery object; they are captured with a trawl having a small mesh size and they tend to go up, not down, in the water column when first contacted by the trawl.

So far, according to Emerson Hasbrouck, results have been encouraging. Both experimental trawl designs have been catching very few flounders when compared with the controls, while the squid catches have been similar for both. The sale of the squid helps defray the cost of the project. Skates and dogfish sharks are less frequently caught by the avoidance trawls, as well.

The collaborative effort is heading in the right direction, providing not just an ounce, but a pound of optimism on the commercial fishing horizon. But we have a long way to go. Once the most popular rod-and-reel fish along our coast because of its early showing each year, the winter flounder is yet very far from being out of the woods.

The work is partially underwritten by the Commercial Fisheries Research Foundation.

Squid net belly panel cuts blackback bycatch

RIVERHEAD, NY – Making the diamond mesh in the belly panel of a squid net large enough for winter flounder to slip through can reduce blackback bycatch by 88%.

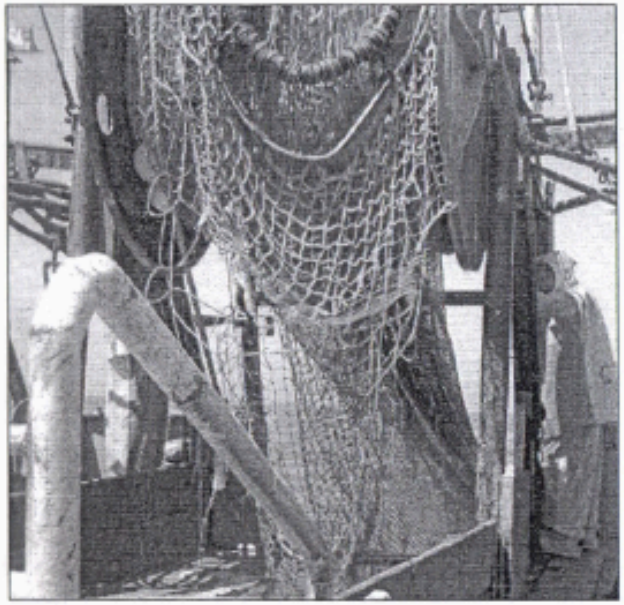
That's what Cornell University researchers are reporting after testing a new net modification on inshore fishing grounds between Long Island, NY and Block Island, RI.

This is potentially good news for Southern New England/Mid-Atlantic small-mesh squid trawl fishermen looking at ways to maximize their *Loligo* squid catch while reducing bycatch of winter flounder and other groundfish species.

Currently, retention of winter flounder is prohibited from Massachusetts to North Carolina in the commercial fishery, forcing fishermen to discard blackbacks or find ways to avoid them.

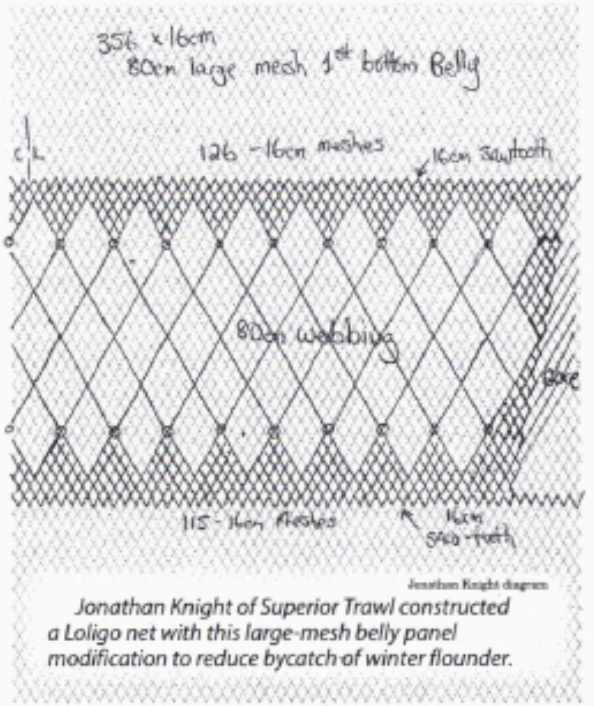
Emerson Hasbrouck, director of Cornell's Cooperative Extension Marine Program, headed up a study to test gear modifications intended to reduce winter flounder bycatch by at least 50% while retaining enough *Loligo* squid to allow commercial fishing vessels to remain economically viable.

The study was funded by the Commercial Fisheries Research Foundation (CFRF), a Kingston, RI-based nonprofit organization established by fishermen in 2004 to administer federal and private funds in support of collaborative research on issues affecting members of the commercial fishing industry based in Southern New England.



Tara Froehlich/Cornell Cooperative Extension Marine Program photo

Testing of a squid net modified with a large-mesh belly panel was conducted in June and August of 2010 aboard Chuck Weimar's Montauk, NY-based Rianda S.



Jonathan Knight of Superior Trawl constructed a Loligo net with this large-mesh belly panel modification to reduce bycatch of winter flounder.

Using 2002-2008 National Marine Fisheries Service (NMFS) Northeast Fishery Observer Program data, Hasbrouck's team planned experimental tows with the modified gear in areas that experienced the highest levels of winter flounder discards in small-mesh bottom trawl fisheries.

The testing was conducted in June and August of 2010 aboard Chuck Weimar's Montauk, NY-based Rianda S. Tows were made between Smith Point and Bridgehampton in 12-to-25 fathoms and between Block Island, RI and Montauk in 5-to-25 fathoms. The trawl test area was modified during the trials to include locations where the fleet was finding squid in large quantities.

After 45 tows each with the experimental net and with a small-mesh control net for a total of 90 tows, the experimental net was found to have consistently reduced winter flounder bycatch by as much as 88%.

An unexpected benefit of the large-mesh panel was an 83% reduction in demersal species such as spiny dogfish, skates, sea robins, and other flounders that also dropped out through the modified belly panel along with the blackbacks.

At the same time, *Loligo* squid retention results were encouraging. According to Hasbrouck, the average difference in squid catches between the standard and experimental nets was only 20 pounds, which was considered statistically insignificant.

"It's a great modification that will release winter flounder without affecting squid," Hasbrouck said. "It's inexpensive and easy to install. It's another tool the fishing industry can use to reduce winter flounder bycatch."

How it works

Researchers involved in this project capitalized on the fact that winter flounder flip up as a trawl net sweep approaches and then drop back down after the sweep passes under them.

By inserting a wide-mesh belly panel in the net, the flounder can swim out through the wide mesh and return to the sea floor, while the *Loligo*, which are further up in the water column, remain in the net rather than head to the belly panel at the bottom.

Jonathan Knight of Superior Trawl in Point Judith, RI constructed the net. He explained that typical small mesh in the squid fishery usually measures 4-3/4"-to-6" on the knot.

The belly panel of the experimental trawl net was modified with 32" diamond mesh in an area beginning about 2-1/2' behind the footrope. The panel is essentially 7' front to back and 30' wide.

from NMFS through a competitive award process.

The CFRF also administers a challenge grant program for conservation engineering projects that is funding additional studies focused on the winter flounder problem.

"CFRF has been funding conservation engineering research targeting winter flounder bycatch because that is an important limiting species down here," said CFRF Executive Director Peg Parker.

If the end results are as good as the Cornell Cooperative Extension study suggests, CFRF plans on supporting a future phase that will implement the research by setting up a gear modification fund for fishermen. The idea is to enable more fishermen to test the gear on their own vessels and for scientists to further track the results among a larger group of users.

"The data that came in were very promising," said Parker. "We've possibly uncovered new tools that our fishermen can use."

Cornell Cooperative Extension is working on a related CFRF-funded winter flounder avoidance project using a drop chain strategy. Tests are underway this winter with results expected in the spring.

More information on the large-mesh belly panel study and related research work is available on the Squid Trawl Network website at <http://squidtrawlnetwork>. The network, which is made up of university researchers, other scientists, and fishermen, was established last year to coordinate collaborative research projects aimed at solving bycatch problems in the squid fishery. Interested fishermen are encouraged to join and can do so on the website.

More information on CFRF-funded research projects is available at <www.cfrfoundation.org>.

Joyce Rowley

And the modification was inexpensive to install. The amount of webbing needed to make the redesigned mesh costs less than $100 and fishermen can install it themselves, Knight said.

Using the large-mesh belly panel also allows fishermen to make longer tows, he added. And the quality of the catch will be better if the squid aren't mixed in with skates and dogfish.

"It's the difference between pulling aboard 3,000 pounds of clean squid vs. pulling aboard a bag of 10,000 pounds to get 3,000 pounds of damaged squid," said Knight.

CFRF role

The study was funded by CFRF through a $182,000 Southern New England Collaborative Research Initiative (SNECRI) grant. Approximately $2 million in SNECRI funds have been used so far to support 18 projects. Originally funded by Congress through the efforts of US Sen. Jack Reed (D-RI) in 2008, SNECRI has since been supplemented by funding