Low-Profile, Low-Bycatch Gillnets, Gulf of Maine, Stellwagon Bank, 2000-2002: catch data from F/V Lady Irene NEC-MP2000-1 in the the Gulf of Maine from 2000-2002 (NEC-CoopRes project)

Website: https://www.bco-dmo.org/dataset/2789
Version: final
Version Date: 2005-09-01

Project
» Northeast Consortium: Cooperative Research (NEC-CoopRes)

Program
» NorthEast Consortium (NEC)

Contributors	Affiliation	Role
Pol, Michael		Principal Investigator

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Dataset Description

Testing of Low-Profile, Low-Bycatch Gillnets

Project Leader:
Michael Pol, Massachusetts Division of Marine Fisheries
Additional Project Participants:
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Robert MacKinnon, Massachusetts Gillnetters' Association

"Two experimental gillnets were tested that are designed to reduce or eliminate the bycatch of cod while targeting flatfish species. Both experimental designs reduce the vertical profile of the nets in the water. One experimental design modifies a foam-core floatline by adding lead every few feet; the other net replaces the gillnet's floatline with another leadline so that the net lies nearly completely on the bottom. Both are 8 meshes deep (MD) and have different floatation and hanging ratios. The nets were quantitatively compared to standard gillnets (25 MD) to determine their effectiveness in reducing cod bycatch. The nets with lower vertical profiles have been shown to reduce the catch of legal cod, but not discarded cod. Catch rates of flatfish could not be compared, due to low catch numbers. Filming with an underwater camera indicated that the orientation of the nets was different than anticipated. Research has continued on these gillnets with additional funding the Northeast Consortium in FY2001." *extracted from: Summary of Completed Cooperative Research Projects Funded by the Northeast Consortium, January 2006*

Parameter names and Descriptions each with a different form of flotation on the headline.
A: had floats
B: had foamcore and lead
C: had foamcore only
D: second leadline in place of floatline "NK" indicates species "not known".

Related data objects:
Total weights from all net configurations
Gillnet bottom temperatures

Methods & Sampling

Several important conclusions can be drawn from these results. First, we confirm that the traditional industry-developed cod and flatfish gillnets are each effective at targeting cod and flatfish; the cod gillnet was especially selective for legal-sized cod, with a small bycatch of spiny dogfish. The relatively small bycatch of spiny dogfish differs from He's (2006) similar study, although this difference may be due to densities of dogfish rather than gear design. Secondly, the experimental designs reduced cod catches in the flatfish gillnet by 49% and 58%, demonstrating that the floatline modifications were effective in avoiding cod. Catches of cod below MLS, following removal of one anomalous set, were reduced at levels approaching the 0.05 significance level. Catches of legal-sized yellowtail and winter flounder in experimental nets were not different from catches in the standard flatfish gillnet. Further, catches of undersized winter flounder were also significantly lower in the experimental designs. These results Testing of Low-Profile, Low Cod-Bycatch Gillnets 16 indicate that adoption, mandated or voluntary, of the modified gillnet designs would lead to reductions in cod bycatch compared to standard flatfish gillnets.

The lengths of flatfish caught in the experimental gillnets, as reflected in lengthfrequency distributions, were not different from the standard flatfish gillnet. This result indicates that adoption of these designs would not lead to any reduction in the landed value of flatfish catches due to size differences. In short, evidence was found to reject the first null hypothesis and, with the caveats of one anomalous set and p-values close to 0.05 in the case of sublegal cod, that the experimental designs do catch cod (above and below MLS) at a lower rate than the standard flatfish net (Hypothesis 1). No evidence was found to refute the null hypothesis for cod length that all flatfish designs would catch cod of similar lengths (Hypothesis 2). No evidence was found to refute Hypothesis 3 (All flatfish designs, experimental and standard, would catch flatfish at similar rates) for yellowtail above and below MLS, and winter flounder above MLS. It was rejected for winter flounder below MLS. Lastly, no evidence was found to reject Hypothesis 4. All flatfish nets caught similar lengths of flatfish. The experimental nets therefore performed as hoped, improving the standard flatfish design by reducing cod bycatch, while also reducing winter flounder below MLS, too.

Data Processing Description

Four types of gillnets were constructed for this study. Each gillnet was 91 m (300 ft) long. Two complete sets of nets (48 nets) were constructed. All reported gillnet characteristics are nominal. The standard flatfish, lead-added, and dual leadline nets were identically designed except for the construction of the floatline. Each type was constructed of light green (mesh size: 178 mm (7 in)), monofilament mesh webbing with a diameter of 0.47 mm, twenty-five meshes deep. The leadline was 91 m (50 fm) of 23 kg/183 m (50 lb/100 fm) leadline. The floatline of the standard flatfish net consisted of 91 m (50 fm) of 13 mm (0.5 in) diameter foamcore float line with built-in floatation (1.7 oz./yd (52.5 g/m)). The leadadded design was made with a floatline the same as the standard flatfish net, but with flat pieces of lead weight wrapped around the floatline every 9 m (5 fm). The dual leadline net was made with the floatline and leadline consisting of 91 m (50 fm) of 23 kg/ 183 m (50 lb/100 fm) leadline. This net had no floatline as it is normally defined. The standard cod net was used to determine if cod were present in the study area. It was designed following industry practice, and differed from the other three nets in color, twine diameter, leadline weight, and hanging ratio. It was constructed of light green monofilament mesh webbing (mesh size: 178 mm (7 in)) with a diameter of 0.57 mm, twenty-five meshes deep. The floatline was 91 m (50 fm) of 9.5 mm (0.375 in) twisted polyethylene (PE) floatline with one deepwater gillnet float every fathom, or fifty floats per net. Each float provided approx. 3 oz. (85 g) of flotation. The leadline was 91 m (50 fm) of 29 kg/ 183 m (65 lb/100 fm) leadline. Eight nets of the same design were tied into a string; one string of each design was set in the same general location. The geographical arrangement of the strings was changed each time the nets were hauled, based on a modified Latin square design to reduce bias. In general, strings were set and hauled following normal commercial fishing practice. However, soak times were limited to overnight (~24 h), shorter than standard when targeting flatfish. This shorter soak time was selected to allow more rapid testing and to increase survival of discarded fish. A 'set' was defined as each instance of a net being hauled and its catch quantified. Strings were fished on consecutive days whenever possible.

Testing was halted for safety reasons and scientific validity when weather conditions were poor. Bottom temperatures were collected by probes attached to nets during the May 2001 and February 2002 testing periods. Soak durations were defined as the difference between the time when the setting of the nets began until the end of the hauling of the nets. On trips where the gear was set and not hauled, set times were recorded by the vessel captain. When only the time that setting ended was recorded, an estimate of the begin time was made by using other set durations for that vessel. When no set time was recorded, soak times were estimated using water temperatures collected by sensors attached to three of the four nets, if available. Durations were used to normalize catches to lb/hr.

Modified box-and-whisker plots were constructed for catch rates (lb/hr) of cod and yellowtail flounder separately above and below minimum landing size (MLS) and for winter flounder above MLS. Box-and-whisker plots give a visual representation of the distribution of the catch rates for each net by set. The box ends are defined as the first and third quartile of all observed catch rates for that net. The median is a solid line through the box. The mean is represented by a plus sign. The whiskers at either end extend to the most extreme data point, except where those points exceed 1.5 times the length of the quartile box. More extreme points are shown as solid dots. Box-and-whisker plots typically cannot be used for hypothesis testing.

To determine the appropriate statistical test, Bartlett's test for homogeneity of variance (Sokal and Rohlf 1995) was first employed; catch rates (lb/hr) were found to be heteroscedastic, making use of ANOVA or t-tests for catch comparisons inadvisable unless transformed. As an alternative to transforming data, the non-parametric randomization test (Sokal and Rohlf 1995, Rago 2004) was chosen to compare the catch of several species and size groups in each experimental net (lead-added and dual leadline) against the control, the standard flatfish net. Using this method, mean differences in catch rates were compared set-by-set for cod, yellowtail and winter flounders above and below MLS. Sets that had zero catches in all four designs were excluded from analysis.

The observed mean difference between the catch rate in each experimental string and the standard flatfish string for each set was compared to a distribution of 1000 or more differences determined from random assortments of the pool of catch data. The p-value was defined as the percentage of the mean differences more extreme than the observed difference. Length-frequencies of target species were pooled and compared between the standard net and each of the control nets using the Kolmogorov-Smirnov test (Sprent 1989). Sample sizes were adjusted for cluster effects following the methods of Pennington et al. (2001). One day of filming was conducted with an underwater remotely-operated vehicle (ROV) to examine the underwater profile of individual nets.

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Data Files

File
lolo_gillnets.csv (Comma Separated Values (.csv), 743.46 KB) MD5:a94e849b32579242120050c45939e357 Primary data file for dataset ID 2789

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Parameters

Parameter	Description	Units
haul_group	sampling phases -- hauls grouped by time of the year	
year_start	the year the sampling started for each sampling interval	
ship	name of ship setting haul	
trip_id	unique identifier for each ship/vessel trip	
month_local	month of year, local time, (from date_local)	
day_local	day of month, local time, (from date_local)	
year	year local time (from date_local)	
date_local	date the net was hauled up and the fish were removed, local time, reported as mo/day/yr.	
lat	latitude associated with trip_id	
lon	longitude associated with trip_id, negative = West	
net_config	"treatment" -- Four strings of eight nets each were set, each with a different form of flotation on the headline. A: had floats B: had foamcore and lead C: had foamcore only D: second leadline in place of floatline	
haul	the order in which the four gillnet strings were recovered	
set_begin_date	date when nets were set	
set_begin_hr	time when nets were set	
haul_end_date	when hauling of endline begins	
haul_end_hr	time when hauling of endline begins	
duration	how long did the set last in hours	
total_species_caught	includes both those kept and those discarded	
species	common name of fauna caught "NK" indicates species "not known".	
kd_flag	disposition of the fish: (K)ept or (D)iscarded	
weight	total weight of all fish caught, in pounds	

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Instruments

Dataset-specific Instrument Name	Gillnet
Generic Instrument Name	Gillnet
Dataset-specific Description	Two experimental gillnets were tested that are designed to reduce or eliminate the bycatch of cod while targeting flatfish species. Both experimental designs reduce the vertical profile of the nets in the water. One experimental design modifies a foam-core floatline by adding lead every few feet; the other net replaces the gillnet's floatline with another leadline so that the net lies nearly completely on the bottom. Both are 8 meshes deep (MD) and have different floatation and hanging ratios. The nets were quantitatively compared to standard gillnets (25 MD) to determine their effectiveness in reducing cod bycatch.
Generic Instrument Description	Gillnetting uses curtains of netting that are suspended by a system of floats and weights; they can be anchored to the sea floor or allowed to float at the surface. A gillnet catches fish by their gills because the twine of the netting is very thin, and either the fish does not see the net or the net is set so that it traps the fish.

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Deployments

NEC-MP2000-1

Website	https://www.bco-dmo.org/deployment/57762
Platform	F/V Lady Irene
Report	http://northeastconsortium.org/ProjectFileDownload.pm?report_id=564&table=project_report
Start Date	2000-12-03
End Date	2002-02-25
Description	**Methods & Sampling** Several important conclusions can be drawn from these results. First, we confirm that the traditional industry-developed cod and flatfish gillnets are each effective at targeting cod and flatfish; the cod gillnet was especially selective for legal-sized cod, with a small bycatch of spiny dogfish. The relatively small bycatch of spiny dogfish differs from He's (2006) similar study, although this difference may be due to densities of dogfish rather than gear design. Secondly, the experimental designs reduced cod catches in the flatfish gillnet by 49% and 58%, demonstrating that the floatline modifications were effective in avoiding cod. Catches of cod below MLS, following removal of one anomalous set, were reduced at levels approaching the 0.05 significance level. Catches of legal-sized yellowtail and winter flounder in experimental nets were not different from catches in the standard flatfish gillnet. Further, catches of undersized winter flounder were also significantly lower in the experimental designs. These results Testing of Low-Profile, Low Cod-Bycatch Gillnets 16 indicate that adoption, mandated or voluntary, of the modified gillnet designs would lead to reductions in cod bycatch compared to standard flatfish gillnets. The lengths of flatfish caught in the experimental gillnets, as reflected in lengthfrequency distributions, were not different from the standard flatfish gillnet. This result indicates that adoption of these designs would not lead to any reduction in the landed value of flatfish catches due to size differences. In short, evidence was found to reject the first null hypothesis and, with the caveats of one anomalous set and p-values close to 0.05 in the case of sublegal cod, that the experimental designs do catch cod (above and below MLS) at a lower rate than the standard flatfish net (Hypothesis 1). No evidence was found to refute the null hypothesis for cod length that all flatfish designs would catch cod of similar lengths (Hypothesis 2). No evidence was found to refute Hypothesis 3 (All flatfish designs, experimental and standard, would catch flatfish at similar rates) for yellowtail above and below MLS, and winter flounder above MLS. It was rejected for winter flounder below MLS. Lastly, no evidence was found to reject Hypothesis 4. All flatfish nets caught similar lengths of flatfish. The experimental nets therefore performed as hoped, improving the standard flatfish design by reducing cod bycatch, while also reducing winter flounder below MLS, too. **Processing Description** Four types of gillnets were constructed for this study. Each gillnet was 91 m (300 ft) long. Two complete sets of nets (48 nets) were constructed. All reported gillnet characteristics are nominal. The standard flatfish, lead-added, and dual leadline nets were identically designed except for the construction of the floatline. Each type was constructed of light green (mesh size: 178 mm (7 in)), monofilament mesh webbing with a diameter of 0.47 mm, twenty-five meshes deep. The leadline was 91 m (50 fm) of 23 kg/183 m (50 lb/100 fm) leadline. The floatline of the standard flatfish net consisted of 91 m (50 fm) of 13 mm (0.5 in) diameter foamcore float line with built-in floatation (1.7 oz./yd (52.5 g/m)). The leadadded design was made with a floatline the same as the standard flatfish net, but with flat pieces of lead weight wrapped around the floatline every 9 m (5 fm). The dual leadline net was made with the floatline and leadline consisting of 91 m (50 fm) of 23 kg/ 183 m (50 lb/100 fm) leadline. This net had no floatline as it is normally defined. The standard cod net was used to determine if cod were present in the study area. It was designed following industry practice, and differed from the other three nets in color, twine diameter, leadline weight, and hanging ratio. It was constructed of light green monofilament mesh webbing (mesh size: 178 mm (7 in)) with a diameter of 0.57 mm, twenty-five meshes deep. The floatline was 91 m (50 fm) of 9.5 mm (0.375 in) twisted

polyethylene (PE) floatline with one deepwater gillnet float every fathom, or fifty floats per net. Each float provided approx. 3 oz. (85 g) of flotation. The leadline was 91 m (50 fm) of 29 kg/ 183 m (65 lb/100 fm) leadline. Eight nets of the same design were tied into a string; one string of each design was set in the same general location. The geographical arrangement of the strings was changed each time the nets were hauled, based on a modified Latin square design to reduce bias. In general, strings were set and hauled following normal commercial fishing practice. However, soak times were limited to overnight (~24 h), shorter than standard when targeting flatfish. This shorter soak time was selected to allow more rapid testing and to increase survival of discarded fish. A “set” was defined as each instance of a net being hauled and its catch quantified. Strings were fished on consecutive days whenever possible. Testing was halted for safety reasons and scientific validity when weather conditions were poor. Bottom temperatures were collected by probes attached to nets during the May 2001 and February 2002 testing periods. Soak durations were defined as the difference between the time when the setting of the nets began until the end of the hauling of the nets. On trips where the gear was set and not hauled, set times were recorded by the vessel captain. When only the time that setting ended was recorded, an estimate of the begin time was made by using other set durations for that vessel. When no set time was recorded, soak times were estimated using water temperatures collected by sensors attached to three of the four nets, if available. Durations were used to normalize catches to lb/hr. Modified box-and-whisker plots were constructed for catch rates (lb/hr) of cod and yellowtail flounder separately above and below minimum landing size (MLS) and for winter flounder above MLS. Box-and-whisker plots give a visual representation of the distribution of the catch rates for each net by set. The box ends are defined as the first and third quartile of all observed catch rates for that net. The median is a solid line through the box. The mean is represented by a plus sign. The whiskers at either end extend to the most extreme data point, except where those points exceed 1.5 times the length of the quartile box. More extreme points are shown as solid dots. Box-and-whisker plots typically cannot be used for hypothesis testing. To determine the appropriate statistical test, Bartlett’s test for homogeneity of variance (Sokal and Rohlf 1995) was first employed; catch rates (lb/hr) were found to be heteroscedastic, making use of ANOVA or t-tests for catch comparisons inadvisable unless transformed. As an alternative to transforming data, the non-parametric randomization test (Sokal and Rohlf 1995, Rago 2004) was chosen to compare the catch of several species and size groups in each experimental net (lead-added and dual leadline) against the control, the standard flatfish net. Using this method, mean differences in catch rates were compared set-by-set for cod, yellowtail and winter flounders above and below MLS. Sets that had zero catches in all four designs were excluded from analysis. The observed mean difference between the catch rate in each experimental string and the standard flatfish string for each set was compared to a distribution of 1000 or more differences determined from random assortments of the pool of catch data. The p-value was defined as the percentage of the mean differences more extreme than the observed difference. Length-frequencies of target species were pooled and compared between the standard net and each of the control nets using the Kolmogorov-Smirnov test (Sprent 1989). Sample sizes were adjusted for cluster effects following the methods of Pennington et al. (2001). One day of filming was conducted with an underwater remotely-operated vehicle (ROV) to examine the underwater profile of individual nets.

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Project Information

Northeast Consortium: Cooperative Research (NEC-CoopRes)

Website: http://northeastconsortium.org/

Coverage: Georges Bank, Gulf of Maine

The Northeast Consortium encourages and funds cooperative research and monitoring projects in the Gulf of Maine and Georges Bank that have effective, equal partnerships among fishermen, scientists, educators, and marine resource managers.

The Northeast Consortium seeks to fund projects that will be conducted in a responsible manner. Cooperative research projects are designed to minimize any negative impacts to ecosystems or marine organisms, and be consistent with accepted ethical research practices, including the use of animals and human subjects in research, scrutiny of research protocols by an institutional board of review, etc.

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Program Information

NorthEast Consortium (NEC)

Website: http://northeastconsortium.org/

Coverage: Georges Bank, Gulf of Maine

The Northeast Consortium encourages and funds **cooperative research** and monitoring projects in the Gulf of Maine and Georges Bank that have effective, **equal partnerships** among fishermen, scientists, educators, and marine resource managers.

At the 2008 Maine Fisheremen's Forum, the Northeast Consortium organized a session on data collection and availability. Participants included several key organizations in the Gulf of Maine area, sharing what data are out there and how you can find them.

The Northeast Consortium has joined the Gulf of Maine Ocean Data Partnership. The purpose of the GoMODP is to promote and coordinate the sharing, linking, electronic dissemination, and use of data on the Gulf of Maine region.

The Northeast Consortium was created in 1999 to encourage and fund effective, equal partnerships among commercial fishermen, scientists, and other stakeholders to engage in cooperative research and monitoring projects in the Gulf of Maine and Georges Bank. The Northeast Consortium consists of four research institutions (University of New Hampshire, University of Maine, Massachusetts Institute of Technology, and Woods Hole Oceanographic Institution), which are working together to foster this initiative.

The Northeast Consortium administers nearly $5M annually from the National Oceanic and Atmospheric Administration for cooperative research on a broad range of topics including gear selectivity, fish habitat, stock assessments, and socioeconomics. The funding is appropriated to the National Marine Fisheries Service and administered by the University of New Hampshire on behalf of the Northeast Consortium. Funds are distributed through an annual open competition, which is announced via a Request for Proposals (RFP). All projects must involve partnership between commercial fishermen and scientists.

The Northeast Consortium seeks to fund projects that will be conducted in a responsible manner. Cooperative research projects should be designed to minimize any negative impacts to ecosystems or marine organisms, and be consistent with accepted ethical research practices, including the use of animals and human subjects in research, scrutiny of research protocols by an institutional board of review, etc.

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Funding

Funding Source	Award
National Oceanic and Atmospheric Administration (NOAA)	ZZ-487

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