Improving the Size Selectivity for Northern Shrimp Through Use of a Combination of a Modified Nordmore Grate and Square Mesh Cod End: shrimp catch data, from the F/V Jeanne C. NEC-KP2003-1 from the Gulf of Maine, 2003-2004 (NEC-CoopRes project)

Website: https://www.bco-dmo.org/dataset/2999
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Project
» Northeast Consortium: Cooperative Research (NEC-CoopRes)

Program
» NorthEast Consortium (NEC)

Contributors	Affiliation	Role
Pinkham, Kelo		Principal Investigator
Schick, Daniel	Maine Department of Marine Resources (Maine DMR)	Co-Principal Investigator
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Improving the Size Selectivity for Northern Shrimp Through Use of a Combination of a Modified Nordmore Grate and Square Mesh Cod End

final report, by Daniel Schick, Kelo Pinkham and Lessie White.

This dataset pertains to the large and small shrimp catch data for the various trawl modifications. See also:
*shrimp_nord_tows - listing of all trawl modifications and dates
*shrimp_nord_sumry - summarizes the test results for the various trawl modifications, with statistical analysis.

gear code	description of gear
qtr_grate	1/4-length small bar space section
half_grate	1/2-length small bar space section
std	standard Nordmore grate with a diamond mesh cod end
mbbg	with small mesh bag attached behind the small bar space grate
mbeh	with small mesh bag over escape hole
no_grate	no grate
StdDD	standard Nordmore grate/cod end
716DD	7/16" bent grate Diamond lengthener, Diamond mesh cod end
716DS	7/16" bent grate Diamond lengthener, Square mesh cod end
716SD	7/16" bent grate Square mesh lengthener, Diamond mesh cod end
716SS	7/16" bent grate Square mesh lengthener, Square mesh cod end
TapDD	Tapered, bent grate was placed in a diamond lengthening piece and fished with a Diamond mesh cod end
TapDS	Tapered, bent grate was placed in a diamond lengthening piece and fished with a Square mesh cod end
TapSD	Tapered bent grate Square mesh lengthener, Diamond mesh cod end
TapSS	Tapered bent grate Square mesh lengthener, Square mesh cod end

Abstract

Comparative tows with a trouser trawl were conducted to test improved release of small shrimp and fish and retention of large shrimp using various configurations of a compound Nordmore grate and diamond or square mesh in the lengthening piece and cod end. The forward (upper) grate section had small bar spacing (7/16") sized to allow small shrimp to flow between the bars and escape. The aft (lower) section had ¾" bar spacing to allow large shrimp to flow between the bars and into the cod end mounted behind this section. Two sizes of small bar space section, ½ and ¼ of the total length were tested. The ½ length section released more small shrimp but also retained less large shrimp than the ¼ length section compared to a standard Nordmore grate/cod end. The large shrimp were flowing out the escape hole at the bottom of the compound grate. The aft section was lengthened for better retention of large shrimp and the small bar space section was tilted (bent) another 10 degrees to improve small shrimp release. A small bar space section with tapered openings was added to the test series as was square mesh in the lengthener and/or cod end. The two modified compound grates with the four mesh combinations produced eight test series where each gear type was judged for finfish release, shrimp weight retained, small shrimp release and large shrimp retention. The best combination was the 7/16" bar space bent grate with diamond lengthener and square mesh cod end.

Methods & Sampling

Methods

The research spanned two years. In the first year's study, the compound grate tested was mounted in the net upside down so that the small bar spacing was at the top of the grate and the larger bar spacing was at the bottom of the net with the escape hole in the bottom. The upper edge of the cod end is attached to the grate at the juncture between the small bar spaces and the larger bar spaces. All shrimp and finfish were directed to the top of the grate where the small shrimp and finfish were able to pass through the small bar spacing (7/16") and exit the net. The larger fish and marketable shrimp worked their way down to the larger bar spacing (3/4") where the shrimp and some fish would pass through into the cod end and lobsters and remaining fish worked their way down and out through the escape hole. Two different grate surface areas of small bar spacing were tested. One of the compound grates had one quarter of the grate small bar spacing (10" of the 40" grate were spaced 7/16" apart) while the other compound grate was comprised of half the grate with small bar spacing (20" of the 40" grate were spaced 7/16" apart). A second cod end of smaller mesh was constructed to fit behind the small bar space panel to collect what was escaping through these bars on over the escape hole to determine if shrimp were being lost out through this hole.

The compound grate was tested using a trouser trawl, a dual cod end trawl split vertically down the middle (Figure 1). One lengthener/cod end held the experimental device while the other cod end was used as the control in a series of experiments. As there is always a question concerning bias in a split trawl as to weather the two halves fish equally, both lengtheners and both cod ends were attached to the trawl with a quick release zipper so that they could be switched between sides.

Each of the panel sizes (1/4 small bar spaces and 1/2 small bar spaces) was tested by a series of tows against a standard Nordmore grate and each side had a standard 1 3/4" diamond mesh cod end. Each panel size was also towed with and without the small mesh cod end behind the small bar space panel. The species weights and length frequencies in the cod ends were compared to determine any differences in the catch. The length frequency in the regular cod end was also compared to the length frequency in the small mesh cod end to test against the possibility of back pressure affecting the flow through the bars of the small bar space panel. The tow series to conduct these tests switched the standard and experimental units between sides to reduce any possible side effect with the trouser trawl (Table 1).

In the second series of tests the next year the study built upon the results of the first year and modified the grate structure to improve loss of finfish and small shrimp and retention of large shrimp. We used the half grate configuration, elongated the grate and tipped the upper, small bar space half about 10 degrees more towards the front of the net to improve movement of shrimp and fish down that portion of the grate. With this change, two bar space widths were tested in the upper, small bar space section, a straight 7/16" grid and a trapezoidal grid with tapered bar spacing increasing from 5/16" to 1/2" front to back. Each of these bar space configurations were tested with diamond mesh in both the lengthener around the grate and the cod end, with square mesh in the cod end only, with square mesh in the lengthener only and with square mesh in both the lengthener and cod end to see which combination resulted in the best separation of fish and small shrimp from the market shrimp. The extra sets of tow with the small mesh bag behind the small bar space grate and with small mesh bags behind the small bar space grate and over the escape hole were not conducted in the second year due to time and funding constraints. The tow series to conduct the second years' tests switched the standard and experimental units between sides to reduce any possible side effect with the trouser trawl (Table 2).

In looking at the boat procedure there were a couple of things that had to be determined. The first was the total time to tow the net. The average tow time for the Maine shrimp fishery from 2001 through 2004 was 2.1 hours per tow with fishermen getting in about 3 or 4 tows a day. The other factor in determining the duration of the tow was to get as many replications as possible with the budget and time we had. One hour tows were chosen in order to remain as close as possible to realistic fishing conditions while getting in 3 or 4 extra replications per day. The tow time started at the started. The date, starting time, ending time, starting latitude, ending latitude, starting longitude, ending longitude, starting depth, ending depth, tow speed, wire out and gear type on the starboard and port sides of the trouser trawl were all recorded for each tow. Once the cod ends came on board the boat the starboard cod end was emptied onto the sorting table. The port cod end was emptied into fish trays. The shrimp were then separated from the fish in the starboard catch. The fish were separated further by species and a total weight by species was recorded along with the individual lengths of each fish. In the cases where there were quite a few fish a weighed sub-sample was taken. The total shrimp catch was then weighed and a 1-kilogram sub-sample of shrimp was brought back to the lab for further analysis. Once done with the starboard side the process was repeated for the port side catch. The catch from the mesh bags behind the small bar space grate, or over the escape hole, when employed, was sorted and measured in a similar fashion.

During the lab analysis of the 1-kilogram sub-sample the shrimp are sorted by species and the Pandalus borealis are sorted by sexual stage. For the non Pandalus borealis species total weights for each species are obtained along with individual carapace lengths. For Pandalus borealis the total weights for each sexual stage is recorded. Then for each sexual stage the individual carapace lengths are recorded. This information is used to generate sex-specific length frequency distributions, thus providing information on the size and age composition of each of the catches.

Data Processing Description

The data obtained for this research are the trawl haul logs and laboratory measurements of the shrimp for each sample. The trawl haul logs contain the typical information on location, date, time, depth, at the beginning and end of the tow. They also contain the catch information in weight and numbers by species for all finfish and the shrimp aggregate weight. From the subsample of shrimp brought to the lab, species weights and numbers at size for all shrimp and for Northern shrimp, Pandalus borealis, weights and numbers at size for

each sex.

test code name	description of test
std_v_nograte	standard vs. no Nordmore grate
std_v_half_grate_port_stbd	standard vs. 1/2 length grate on either port or starboard side of trouser trawl
std_v_mbeh	standard vs. mesh bag over escape hole
std_v_qtr_grate	standard vs. 1/4 length grate
std_v_qtr_grate_v_mbbg	standard vs. 1/4 length grate vs. mesh bag behind grate
std_v_qtr_grate_v_mbbg_v_mbeh	standard vs. 1/4 length grate vs. mesh bag behind grate vs. mesh bag over escape hole
std_v_half_grate	standard vs. 1/2 length grate
std_v_half_grate_v_mbbg	standard vs. 1/2 length grate vs. mesh bag behind grate
std_v_half_grate_v_mbbg_v_mbeh	standard vs. 1/2 length grate vs. mesh bag behind grate vs. mesh bag over escape hole
std_port_v_std_stbd	standard on port vs. starboard side of trouser trawl
std_v_716DD_v_tapSS	standard vs. 7/16" small bar space grate with diamond lengthener and diamond cod end vs. tapered small bar space grate with square lengthener and square mesh cod end.
std_v_716DD_v_716DS	standard vs. 7/16" small bar space grate with diamond lengthener and diamond cod end vs. 7/16" small bar space grate with diamond lengthener and square mesh cod end.
std_v_716SD_v_716SS	standard vs. 7/16" small bar space grate with square lengthener and diamond cod end vs. 7/16" small bar space grate with square lengthener and square mesh cod end.
std_v_tapDD_v_tapDS	standard vs. tapered small bar space grate with diamond lengthener and diamond cod end vs. tapered small bar space grate with diamond lengthener and square mesh cod end.
std_v_tapSD_v_tapSS	standard vs. tapered small bar space grate with square lengthener and diamond cod end vs. tapered small bar space grate with square lengthener and square mesh cod end.

Normore grate *(Photo: Ken La Valley)*

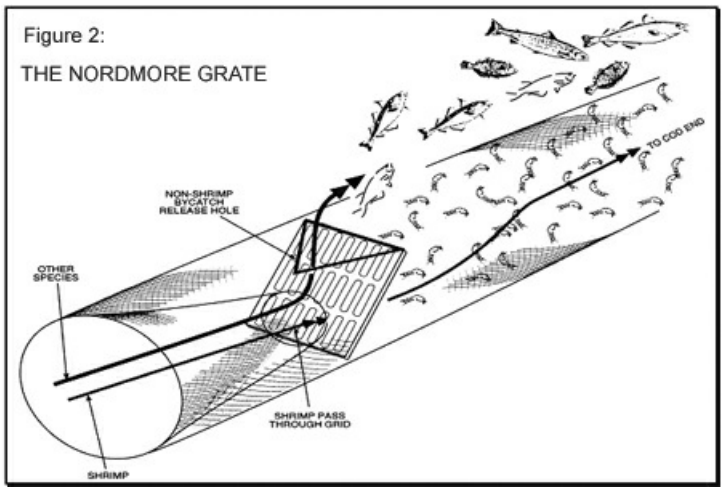

Diagram of Nordmore grate

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Data Files

File
shrimp_nordgrate.csv (Comma Separated Values (.csv), 34.55 KB) MD5:5acd1763ddedfe33f67bb39fd0fc12ad Primary data file for dataset ID 2999

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Parameters

Parameter	Description	Units
test	description of the modifications to the trawl that was tested. see description above.	
gear	configuration of trawl (see above)	
tow	sequential tow number	
count_shrimp_sm	number of shrimp less than 21.5 mm in length	
count_shrimp_lg	number of shrimp greater than 22 mm in length	
count_shrimp_total	total number of shrimp in sample	
tow_duration	duration of tow	hours
position	position of modification of gear, port or starboard side of trouser trawl.	

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Instruments

Dataset-specific Instrument Name	Trawl
Generic Instrument Name	Beam Trawl
Dataset-specific Description	trouser trawl using various configurations of a compound Nordmore grate and diamond or square mesh in the lengthening piece and cod end.
Generic Instrument Description	A beam trawl consists of a cone-shaped body ending in a bag or codend, which retains the catch. In these trawls the horizontal opening of the net is provided by a beam, made of wood or metal, which is up to 12 m long. The vertical opening is provided by two hoop-like trawl shoes mostly made from steel. No hydrodynamic forces are needed to keep a beam trawl open. The beam trawl is normally towed on outriggers, one trawl on each side. While fishing for flatfish the beam trawl is often equipped with tickler chains to disturb the fish from the seabed. For operations on very rough fishing grounds they can be equipped with chain matrices. Chain matrices are rigged between the beam and the groundrope and prevent boulders/stones from being caught by the trawl. Shrimp beam trawls are not so heavy and have smaller mesh sizes. A bobbin of groundrope with rubber bobbins keeps the shrimp beam trawl in contact with the bottom and gives flatfish the opportunity to escape. Close bottom contact is necessary for successful operation. To avoid bycatch of most juvenile fishes selectivity devices are assembled (sieve nets, sorting grids, escape holes). While targeting flatfish the beam trawls are towed up to seven knots, therefore the gear is very heavy; the largest gears weighs up to 10 ton. The towing speed for shrimp is between 2.5 and 3 knots. (from: http://www.fao.org/fishery/geartype/305/en)

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Deployments

NEC-KP2003-1

Website	https://www.bco-dmo.org/deployment/57951
Platform	F/V Jeanne C.
Report	http://northeastconsortium.org/ProjectFileDownload.pm?report_id=708&table=project_report
Start Date	2003-12-14
End Date	2004-04-27

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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)	unknown NEC-CoopRes NOAA

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