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Standards and Protocols for Surveys

NOAA FISHERIES PROTOCOLS FOR SHRIMP TRAWL SURVEYS

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NOAA Protocols for Shrimp Trawl Surveys

December 31, 2003

Prepared by:
Members of NOAA Fisheries Science Centers

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

Table of Contents

Introduction

A National Trawl Survey Standardization Workshop was convened 13-15 November 2002 with the directive to "review current protocols and directives regarding trawl survey operation, determine what changes are needed, and publish a new protocol." The objective of this effort was "to ensure that all aspects of preparation for trawl survey and trawl survey procedures are consistent and in keeping with the highest quality standards to provide for survey data accuracy and consistency from one survey to the next." At the original meeting it was recognized that a variety of surveys and gears were used in the regions, but in the interests of time, the scope of the workshop was limited to trawl surveys using twin warps. A later mandate expanded the development of national protocols to all types of surveys and all gears from which data collected were used for stock assessment. This document has been prepared in response to the latest mandate and deals with shrimp trawling survey protocol. Of all the regions, only the SEFSC and NEFSC conduct annual shrimp trawl surveys used primarily for stock assessment.

The protocols contained in this document closely follow, and are often identical to, those listed in the original "NOAA Protocols for groundfish bottom trawl surveys of the Nation's Fishery Resources." Rather than drafting slightly different protocols to address very similar problems, we decided for clarity purposes to use protocols already drafted as a standard for groundfish trawling. Regional differences in procedures or protocols are identified in the Appendices.

NOAA Fisheries Shrimp Trawl Survey Protocols

Length measurement of trawl warps

Problem Statement
For trawls using two warps (cables), it is important to ensure that each warp is measured correctly and that marks on each warp are equidistant from the cable end. Marks on the warps are used while setting the nets to determine the correct scope, and more importantly, to ensure that the doors are equal distances behind the vessel. If measurements are incorrect, one door could be ahead of the other resulting in a skewed configuration of the net and inefficiency of the trawl.

Current NOAA Fisheries procedures for measurement of trawl warp involve periodic measurement and marking of warps at fixed increments prior to a cruise. As a secondary check of the measurements, surveys include some real-time measuring device that verifies the amount of cable deployed. If the measured cable out and the static measurements do not match, it is often difficult to decide which measurement is correct. Differential warp length can result from improper measurement before the survey begins, from stretching of the cable or cables during trawling, or from inaccuracy and slippage of metering devices. To protect against measurement errors, the proposed protocol uses redundant measuring systems to detect differences in warp length.

The protocols for shrimp trawl surveys are identical to those proposed for NOAA trawl surveys for groundfish. The importance of accurate warp measurements is greater for the NEFSC because they use a two warp system. The SEFSC uses a single warp and bridle system, so the only impact of improper measurement is potential error in the scope of the cable.

Protocol 1
For two warp trawling systems, two independently-calibrated measuring methods or devices shall be used on each warp, one of which will measure the warp in real time.

If the difference between the two measured distances, summed over both warps, becomes greater than 4% (or another value specified by each program and justified by independent research) of the door-to-door cable distance (ie., sum of bridle lengths and the footrope), operations must be suspended until a cause is found and resolved.

When chartering vessels for survey, programs will clearly specify and verify use of the same wire type and size consistently among vessels and years.

Specification of the warp measurement system used on each survey will be included in an Operations Plan provided by the Science Center to the officers and crew of the survey vessel.

Sub-protocols for specific warp measurement technologies

Sub-protocol 1a: Physical warp markings
Physical marking of trawl warps generally involves spooling the wires off the drums and onto a flat surface to measure the wire relative to standard lengths. The NOAA standard for such measurements will be that both port and starboard wires will be measured and marked side-by-side to assure that the relative warp measurements between wires are exact. The spacing of such marks, details of marking method (fiber marks interwoven in wire rope strands or painting of marks), and degree of tension on the wires will be specific to the application. These marks will be checked and re-calibrated at least annually and rechecked after a survey or whenever irreconcilable discrepancies between warp marks and the redundant measurement system persist.

Sub-protocol 1b: In-line wire meters
In-line wire meters measure wire lengths directly using running line tensiometers or instrumented blocks over which the warp travels as it is payed out or retrieved. Such systems deflect the running wire by a known amount to facilitate measuring under tension and may be subject to deviations from true measurements due to wire slippage. These devices should be calibrated using known lengths of wire at least annually, using manufacturer recommended procedures, with moving parts (bushings, sheaves, etc.) inspected and replaced, as required. Since some in- line meters are relatively small and portable, they may be provided to the vessels by the Science Centers provided they are appropriately calibrated.

Sub-protocol 1c: Block wire counters
Block wire counters measure the length of wire passing over a trawl block or another wheel of known circumference, which is equipped with a proximity counter to enumerate the number of revolutions of the sheave. Length of the wire is thus calculated by multiplying the number of block revolutions by the circumference of the sheave. These devices may be subject to deviations from true measurements due to wire slippage. Block counters should be calibrated at least annually with a known length of wire after assuring the proper functioning of the proximity counter and measuring sheave.

Sub-protocol 1d: Geometric wire counters
Geometric wire counters (used as stand-alone wire measuring method or as a component of autotrawl systems) utilize the number of winch turns, diameter and width of the winch drum, diameter of wire and other parameters to compute the absolute amount of wire off each winch. These systems may lose calibration if the wire diameter decreases due to stretch or if the wires do not wrap properly on the winches. The counter can be re-calibrated by using a known length of wire wrapped on the winches. These calibrations should be performed at least annually, or more frequently if there are changes in wire diameter or the performance of wire wrapping on the winches.

Discussion
The protocols for length measurement of trawl warps are of greater significance to NEFSC because they use a two warp system. The SEFSC uses a single warp system with a bridle. This makes measurement of the trawl warps a lesser problem for SEFSC because use of the single warp and bridle system ensures symmetry of the net regardless of the amount of line deployed. Despite the fact that improper measurement of trawl warps is not a critical issue for SEFSC, we

have adopted the above protocol as a national standard because it can only improve the accuracy of our surveys.

Survey operational procedures

Problem Statement
Standardization of procedures, gear, and protocol is necessary to maintain survey consistency over time. Any number of factors such as tow speed, tow duration, net size, net type, sea state, tow distance, etc., can have large effects on gear performance and catchability of species. Written unambiguous protocols addressing these factors ensure that scientists and crew maintain continuity in procedures as personnel and vessels change over time.

Protocol 2
Each Science Center will provide a written Operations Plan to their staff and the crew of the survey vessels that provides clear and unambiguous definitions of all procedures required to properly conduct trawl sampling. The Chief Scientist and the vessel crew at the start of each survey will discuss the Operations Plan and again when crew changes occur. The Operations Plan may include, but is not limited to, the following issues:

a. Scope ratio
b. Speed of tow
c. Duration or distance of a tow
d. Direction of tow
e. Location of sampling sites, and procedures to use if stations are not suitable for towing.
f. Criteria for determining the success of a tow and procedures to use if a tow was unsuccessful.
g. Vessels and winch operation during trawl deployment and retrieval.
h. Methodology for warp measurement and verification.
i. Trawl construction plans, at-sea repair instructions and repair verification check-list.
j. Defining responsibility (ie. Survey scientists or vessel crew) for decisions regarding various aspects of the operations.

Discussion
All NOAA Fishery trawl surveys provide some form of an operations plan to their staff and the officers and crew of the survey vessels. Unfortunately, some of these plans can be general in nature and may not provide sufficient detail to avoid individual interpretation. Also, these plans may not be regularly updated, and any changes in procedures may not be adequately documented. By increasing the level of detail and formalizing the communication of procedures, we should make operations more consistent among members of the scientific staff and vessel crew, and the surveys operations more consistent between cruises and years.

Trawl Construction and Repair

Problem Statement
Once a specific trawl and trawl design have been selected for a survey, it is critical that this gear operates with the same efficiency every time it is deployed. The operations procedures ensure that the deployment, towing and retrieval processes are consistent over tows and years, but it is also essential that the sampling gear be standardized. Science Centers should ensure that detailed drawing of the nets, including tolerances of all materials, be available for each survey and the nets should be inspected by the Field Party Chief prior to every survey. It is also important to constantly inspect nets throughout the survey, to repair minor tears in the net, and to replace the nets when damage is significant. Because NOAA trawls are scientific sampling instruments, the protocols considered in this section are designed so that survey trawls are constructed and repaired with a level of detail needed to ensure, within specified tolerances, that the identical trawl is used at every sampling sit on every cruise.

Protocol 3
Construction plans for each survey trawl design will be maintained by each Science Center and included in an Operation Plan. The plans must include engineering drawings of the net, doors and rigging with a level of detail at least as specific as that in the ICES recommended standard (ICES C.M. 1989/B:44 Report of the Study Group on Net Drawing). In addition, each plan must contain a description of all materials used, and the qualities of these materials considered important for proper trawl function.

A check list will be developed for each trawl design specifying the dimensions, and their tolerances, or other design features considered important for proper trawl function. The check list will be used to verify that each newly constructed or repaired trawl is within operational tolerances before use.

Members of the scientific staff of each Science Center who are trained in trawl construction and repair verification will conduct verification that trawls are within operational tolerances.

Methodology for at-sea trawl repairs will be specified in an Operations Plan and communicated by the Chief Scientist to the crew of the vessel at the start of each cruise. A trawl repair check list will be included in the Operations Plan and used by a member of the scientific staff to verify that repaired trawls are with operational tolerances.

Regional Protocols

Survey protocols are dictated by objectives of the individual project and logistics. Therefore, it was deemed impractical to develop detailed national protocols that could be applied to surveys conducted across regions. Broad national protocols were selected in this document because they apply to shrimp trawl surveys, in general. To successfully conduct surveys, it is clear that gear must be standardized and procedures by which the sample is taken must be the same over all stations and years. This, however, does not imply that all parties conducting shrimp trawl surveys must use the same gear and procedures.

The appendices to this document provide a brief description of how each region conducts their shrimp trawl surveys. We did not go into the detail of a complete "Operational Plan," because such a plan is identified as a National protocol. Anyone seeking additional detail on shrimp trawl surveys can request a copy of the Regional operational plan for the survey of interest.

Appendix 1

Southeast Fisheries Science Center
Standard Operating Protocols for
Shrimp Trawl surveys

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center

Table of Contents

Introduction

Recent Data Collection

The modern era of fisheries research in the Gulf began when the OREGON II commenced operations in late 1967. However, for the first five years of OREGON II operations, as in the earlier cruises, sampling was primarily exploratory in nature and little quantitative information can be obtained from these records. Methods of collecting fisheries resource data changed significantly in the early 1970's. These changes reflected a growing awareness of the need to quantify data for purposes of managing fisheries. The Magnuson Fishery Conservation and Management Act of 1976 provided further impetus for a quantitative approach to management of fisheries resources.

The adoption in 1972 of a stratified random sampling design for groundfish surveys marked the beginning of current sampling strategy. Although revisions and improvements to the original sampling scheme have occurred over the years, this long-term quantitative and qualitative data base lends itself well to assessment of changes in species composition, abundance and distribution over time. All groundfish and shrimp data collected since 1972 have been entered in computers and are available to the research community upon request.

SEAMAP - Sampling design and standardized data collection procedures

Cruises in support of the Texas shrimp closure began in June 1981, and came under SEAMAP beginning in 1982. The sampling design for these cruises was somewhat different from the traditional groundfish protocol. Details of this design are given by Nichols in the 1982 SEAMAP Atlas (Stuntz, et al, 1985). The major difference was elimination of a block and grid design, which was replaced by a design that towed across depth strata at randomly selected locations. A station consisted of a 1 fm depth stratum inside of 25 fms, a 2.5 fm stratum in depths from 25 - 30 fms, and a 5 fm stratum between 30 and 60 fms. Tow duration depended upon the width of the depth stratum, although a single tow could last no longer than 30 minutes. If 30 minutes was not a sufficient amount of time to trawl across the entire stratum, multiple tows were used. In some areas where the bottom was very flat, five or six tows were needed to cross a one fm depth stratum. In a few areas the depth stratum was covered very quickly. In such cases the vessel turned to run obliquely across the stratum to allow a tow of at least 10 minutes duration. This sample design has been used consistently for summer shrimp cruises. The sampling area now extends from the Florida Panhandle to the Mexican border. While most of the sampling effort using trawls has been in the 5 - 60 fm depth range, another set of cruises designed to map the distribution and then determine abundance of small pelagic fishes operates in the depth range of 20 to 300 fm, with the majority of effort in the 20 - 200 fm range.

Initially trawling was only conducted at night during the SEAMAP cruises, due primarily to the nocturnal behavior of certain shrimp species. Beginning in 1987, day and night sampling of an equal number of stations was instituted. This sampling design was also extended to groundfish cruises as well.

At each trawl station, standardized sampling procedures are employed. At the culmination of each tow, the catch is brought aboard and weighed. If the total weight of the catch is greater than 22.7 kg (50 lbs.), the catch is subsampled. Catches smaller than 22.7 kg are worked up in their entirety. The only exception to this rule is in situations where very high species diversity exists. Under such circumstances, the watch leader may exercise the option of subsampling a catch of less than 22.7 kg. The entire catch or subsample is sorted to the lowest possible taxon, counted, weighed, measured and sexed where possible. Sexing individuals is frequently dependent on the size of the individual.

Collection of length frequency data began as a part of the groundfish cruises where it has long been policy to measure a sample of the sciaenids. Beginning in 1987, this practice was changed to require measurement of all species captured on all cruises. During the June-July and October-November SEAMAP cruises, measurements have been taken of over 40,000 specimens per cruise.

Sporadically before, but regularly beginning about 1981, environmental data including temperature, salinity, chlorophyll and dissolved oxygen have been collected at all stations where a biological sample is taken. For those cruises that fall under the auspices of SEAMAP, an atlas of biological and environmental data is published annually. SEAMAP Atlases now cover data from 1982 through 2002.

During the years there have been a number of special studies in which trawls were used. In most, data were collected in a manner similar to that employed during standardized trawl surveys. These studies have included shrimp bycatch aboard commercial shrimp fishing vessels, studies of turtle excluder devices (TEDs) in which one net was a standard net while the other was equipped with an excluder, studies of bycatch reduction devices (BRDs) using a standard net versus a net with a BRD, and so on. These data sets, while limited in duration, can often be used to complement the longer term data sets especially if aerial coverage coincides. Also, these special studies are often conducted aboard commercial trawlers thus providing fishery-dependent indices of species composition and abundance for comparison with fishery-independent resource surveys information.

Protocol 1: Warp measurement standardization.

NOAA Protocol 1 for shrimp trawl surveys requires two independently calibrated measuring methods or devices for each trawl warp. The SEFSC summer and fall shrimp surveys will use physical marking of the warps by spooling the wires off the drums and onto a flat surface where wires are marked side-by-side, as the first measure. The second measure used by SEFSC will be wire meters on the warp. Calibration of the in-line wire meters will occur during annual maintenance. At least once per year, the meter blocks will be returned to the manufacturer where broken and worn parts will be replaced and the units cleaned and lubricated.

Since the SEFSC uses a single warp and bridle system, side-by-side comparisons of warps are not as critical as with two warp systems. Stretching or other changes in measurements of the warp can affect the warp angle and scope, but not the configuration of the net. Thus, even extensive stretching of the warp is not expected to have much influence on the efficiency of the net.

Protocol 2: Operations protocols.

Since the inception of SEAMAP in the early 1980's, the SEFSC has maintained a SEAMAP Operational Manual describing the procedures and gear used in all surveys. This document is constantly being updated as changes in procedures and new technological advances are introduced into the at-sea sampling. The Manual includes information regarding the objectives of the survey, the survey design, and the detailed procedures that should be followed at every station. Some of the more obvious issues addressed in the operational plan are listed below, but the full plan attempts to address these and other contingencies that may affect the sampling efficiency of the survey.

Sub-protocol 2a: Measure survey gear
Survey gear is either manufactured by professional net makers or constructed by Mississippi Laboratory personnel. In both cases, nets are inspected by Harvesting Team members using a standard inspection sheet to verify that nets meet design specifications. Nets are rigged by research vessel personnel under the supervision of Harvesting Team members to assure that otter boards are properly set, the tickler chain is the correct length, and bridle length is appropriate. Once assembled, the gear remains in use until fouled by bottom obstructions, at which time it is replaced. Only very minor net repairs are conducted at sea

Sub-protocol 2b: Length measurement of trawl warps
Towing warp is measured by two techniques, marking the cable at known length intervals (25 fathoms apart) and block wire counters. Wire counters are calibrated during each tow by verifying the length of a 30-fathom towing bridle. Prior to the summer and fall surveys scheduled for this year, in-line wire meters will be purchased to replace the block wire counters. The effects of wire stretching with a single warp bridle system would be a change in the warp angle but not the configuration of the net. Thus, net stretching of one or two fathoms is believed to have little or no effect on the efficiency of the nets.

Sub-protocol 2c: Scope Ratio

Scope ratio varies according to sampling depth and is provided to bridge officers in the following table. FPC's discuss this table with vessel Captains to ensure that guidelines are adhered to. In some cases these ratios may be altered due to currents or adverse weather conditions.

Water Depth (fathoms)	Scope Ratio	Warp Length (fathoms)	Water Depth (fathoms)	Scope Ratio	Warp Length (fathoms)
5	7.0	35	28	4.1	116
6	5.8	35	29	4.1	118
7	5.0	35	30	4.0	120
8	5.0	40	31	4.0	124
9	5.0	45	32	4.0	128
10	5.0	50	33	4.0	132
11	5.0	55	34	4.0	136
12	5.0	60	35	4.0	140
13	5.0	65	36	4.0	144
14	5.0	70	37	4.0	148
15	5.0	75	38	4.0	152
16	5.0	80	39	4.0	156
17	5.0	85	40	4.0	160
18	5.0	90	41	4.0	164
19	5.0	95	42	4.0	168
20	5.0	100	43	4.0	172
21	4.9	102	44	4.0	176
22	4.7	104	45	4.0	180
23	4.6	106	46	4.0	184
24	4.5	108	47	4.0	188
25	4.4	110	48	4.0	192
26	4.3	112	49	4.0	196
27	4.2	114	50	4.0	200

Sub-protocol 2d: Speed of tow

Targeted towing speed is 4.6 kilometers hour-1 (2.5 knots) and is determined by the bridge officer considering the speed over ground provided by GPS and Doppler Speed Log. Towing speed is recorded every 5 seconds throughout the tow by the ship's Scientific Computing System, and an average speed calculated at the end of the tow. Four different sensors monitor speed, and any one, or combination of sensors, can be used to calculate speed of the vessel over the course of a tow. Interestingly, each of the sensors give slightly different readings, and we are continuing to compare these sensors to determine which one, or combination, should be used as the standard. Fortunately with SCS, data from all sensors and cruises can be recovered when a standard has been selected.

Sub-protocol 2e: Duration or distance of tow

Sampling design dictates that tow durations are the amount of time required to traverse defined depth strata (strata supplied by the Chief Scientist). Tow durations will not be less than 10

minutes nor greater than 55 minutes (in observance of marine turtle conservation requirements). The distance of the tow is a function of stratum width, and more than one tow may be required to traverse the area. Towing occurs on a 24-hour basis with night and day stations preselected prior to the survey.

Sub-protocol 2f: Direction of tow
Choice of towing direction is limited by the requirements of the sampling design and is restricted to towing perpendicular to depth contours. Because of bathymetry, tows are generally along a north/south axis in the northern Gulf of Mexico and along an east/west axis in the western Gulf.

Sub-protocol 2g: Bottom topography
Bottom relief is evaluated by a SIMRAD EQ50 color scope fathometer. In cases where high relief or obstructions are detected, the vessel moves in the direction of the next station while remaining in the correct depth strata. When trawlable bottom within the strata is located, the tow is conducted. If suitable bottom is not detected before reaching the next station, the original station is dropped.

Sub-protocol 2h: Location of sampling sites, and procedures to use if station is untrawlable
Two source are used to anticipate bad bottom, consultation of historical hang data (locations where nets were torn on previous surveys) and inspection of bottom information provided on navigational charts. When there is concern over untrawlable bottom, the sampling location is surveyed and the bottom is inspected for relief or obstructions using the ship's color fathometer. A joint decision is then made by the Chief Scientist or Watch Leader, and Bridge Officer.

Sub-protocol 2i: Gear damage and repeat criteria
Minor gear damage (torn webbing of less than a meter area) is repaired by the ship's Deck Department with the Chief Scientists approval. If damage to a net is extensive (more than a meter or in multiple locations), repairs are not attempted and the net is replaced.

Sub-protocol 2j: Criteria for determining the success of a tow and procedures to use if a tow was unsuccessful
A tow is deemed successful if established protocols were followed throughout the tow, and there were no indications of damage or fouling of the net, doors or tickler chain. Catch magnitude provides insight to tow acceptability during the Fall Survey, however this technique can not be used during the Summer Survey due to hypoxic conditions in the northcentral Gulf where water hauls are common. If the tow is deemed unsuccessful due to known causes and the gear remains undamaged, the tow is repeated. If the gear is damaged over the course of a tow, the station is dropped.

Sub-protocol 2k: Vessel and winch operation during trawl deployment and retrieval
Vessel speed while setting is 9.2 km hr-1 (5 kts). The winch operator informs the bridge when about 36.6m (20 fms) of towing warp remains to be deployed, and the Bridge Officer adjusts the throttle and pitch to achieve towing speed. Towing speed is maintained during haul-back with no pulsing as is commonly done with larger nets sampling pelagic species.

Sub-protocol 2l: Methodology for warp measurement and verification

Warps are marked prior to the cruise as part of the OMAO measurement process. Meter blocks verify warp measurements. Meter blocks will be replaced in future cruises with in-line wire meters for verification of warp measurements.

Sub-protocol 2m: Trawl construction plans. at-sea repair instructions and repair verification check-list

Trawl construction plans are attached. At-sea repairs are limited to sewing minor tears in the nets. If significant damage is noted, the nets are replaced.

Sub-protocol 2n: Defining responsibility (i.e. survey scientists or vessel crew) for decisions regarding various aspects of the operation

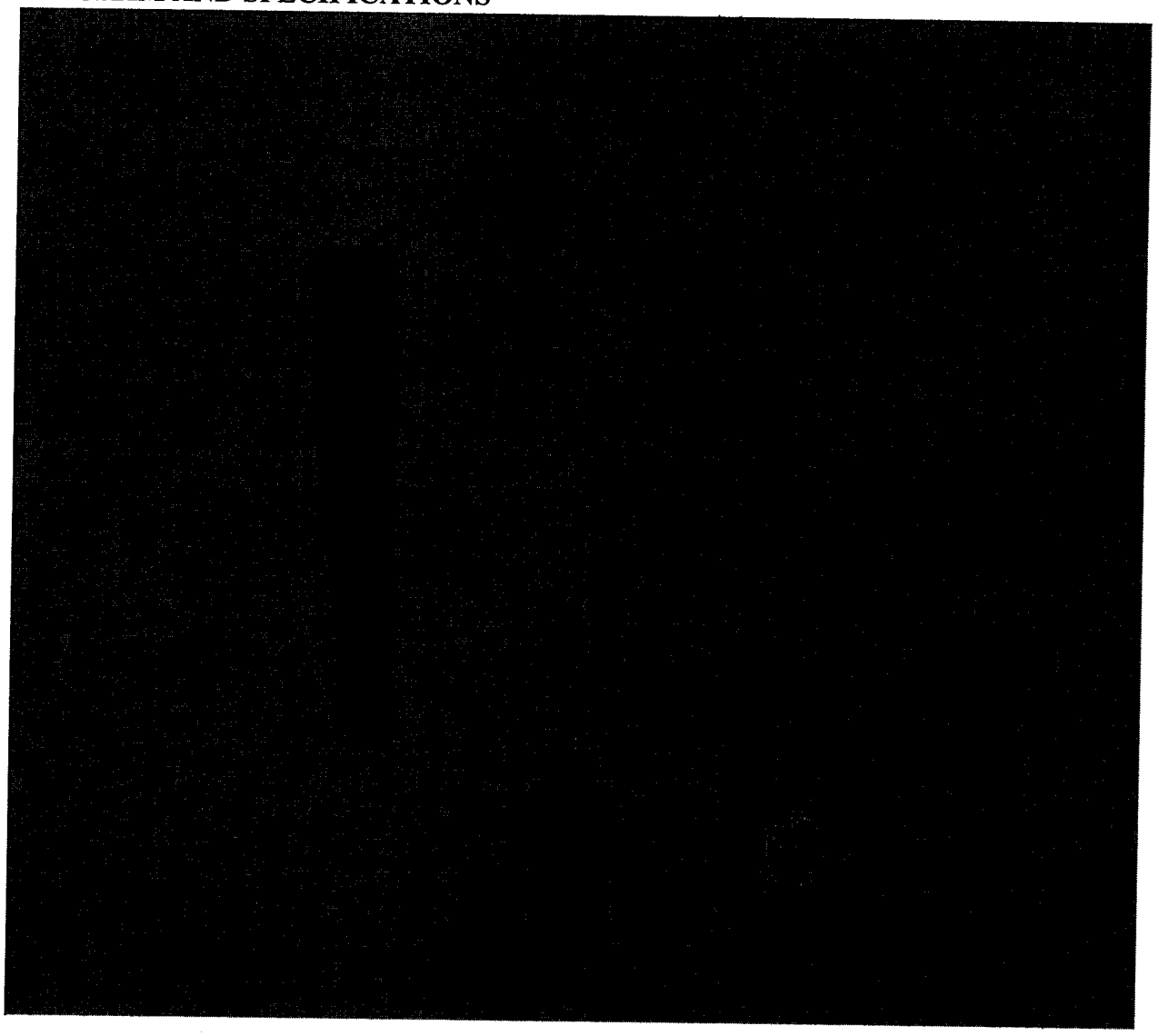
The field party chief is responsible for all decisions regarding scientific aspects of the operation. The Captain of the vessel has ultimate responsibility for the safety of the ship, crew and scientific party.

Protocol 3: Trawl construction and repair.

The trawl used in the SEFSC for shrimp and groundfish surveys is a 42 foot semi-balloon shrimp trawl. This trawl has been the standard employed for SEAMAP surveys since the early 1980s. The SEFSC trawls are constructed in-house by FMES gear specialists, and rigorous quality control measures are used to ensure uniformity of materials and construction measurements. With the exception of minor on-board repairs, nets are replaced by new nets when gear is retrieved and found to be damaged. A detailed description of the nets and construction procedures is provided below.

42 FT SEAMAP TRAWL

DIAGRAM AND SPECIFICATIONS



Trawl Specifications

A. Webbing- Twisted Nylon:
   1. Body, wings, corners, and jibs- 2" stretched x no. 18 twine.
   2. Intermediate- 1 _" stretched x no. 24 twine.
   3. Codend- 1 5/8" stretched x no.42 twine.
   4. Twine area- 240.27 sq. ft.

B. Hanging Cable:
   1. Headrope and footrope- 9/16" diameter (6x6) polyethylene covered stainless steel combination net rope.

2. Leglines- 6ft with heavy duty wire rope thimbles.
3. Wing lines- 3/8" polydacron, hang 3 meshes on 3.25".

C. Weight:
1. Loop chain- 50 loops of 1/4" galvanized standard link, 16 links per loop, tied every foot. Weight- 48 lbs.

D. Mud Rollers:
1. 17 mud rollers on separate line (_" polypropylene) tied every 3ft., with 3" of space between top of mud roller and footrope.

E. Flotation:
1. Floats- (6) 3" x 4" spongex floats spaced 5ft. across the center of the headrope and 5ft. apart.

F. Lazyline:
1. 18 fathoms of 3/4" polydacron.

G. Net Treatment:
1. Green plastic net coat.

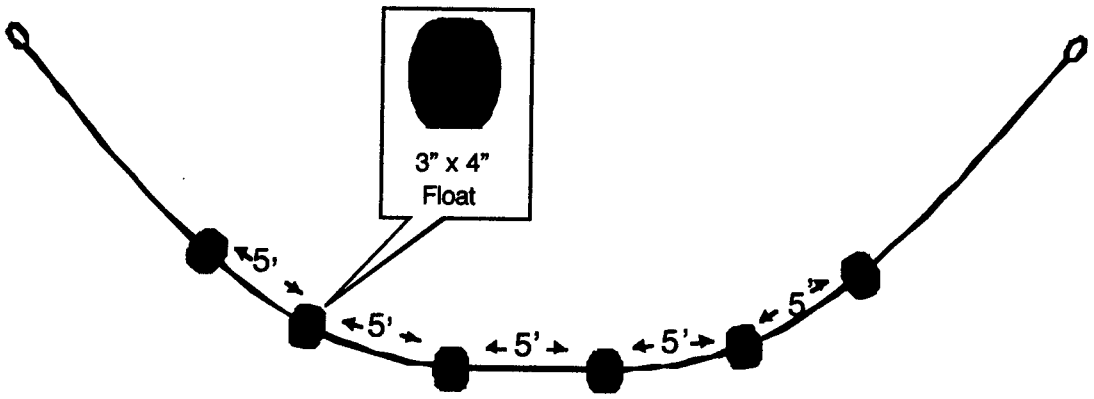
H. Door Specifications:
1. Door Type- Rectangular flat wooden otter boards
2. Length and Height- 8' long x 40" high
3. Chains- _" G4 proof coil chain
4. Swivels- 5/8" galvanized
5. Bolts- 5/16" cadmium plated
6. Planking- 5/4" yellow pine, Grade 1
7. Stiffeners- 4" x 4" yellow pine
8. Uprights- 2" x 10" yellow pine
9. Shoe- 1" x 6" flat stock
10. Doors have 23 _" bridles (tow point to door face)
11. Door Surface Area- 53.2 sq. ft. per set
12. Door weight- 450lbs.

I. Tickler Chain Specifications:
1. Type- Standard free tickler
2. Size- 1/4" standard link galvanized proof coil chain
3. Length- 58.7'
4. Weight- 41.6lbs.

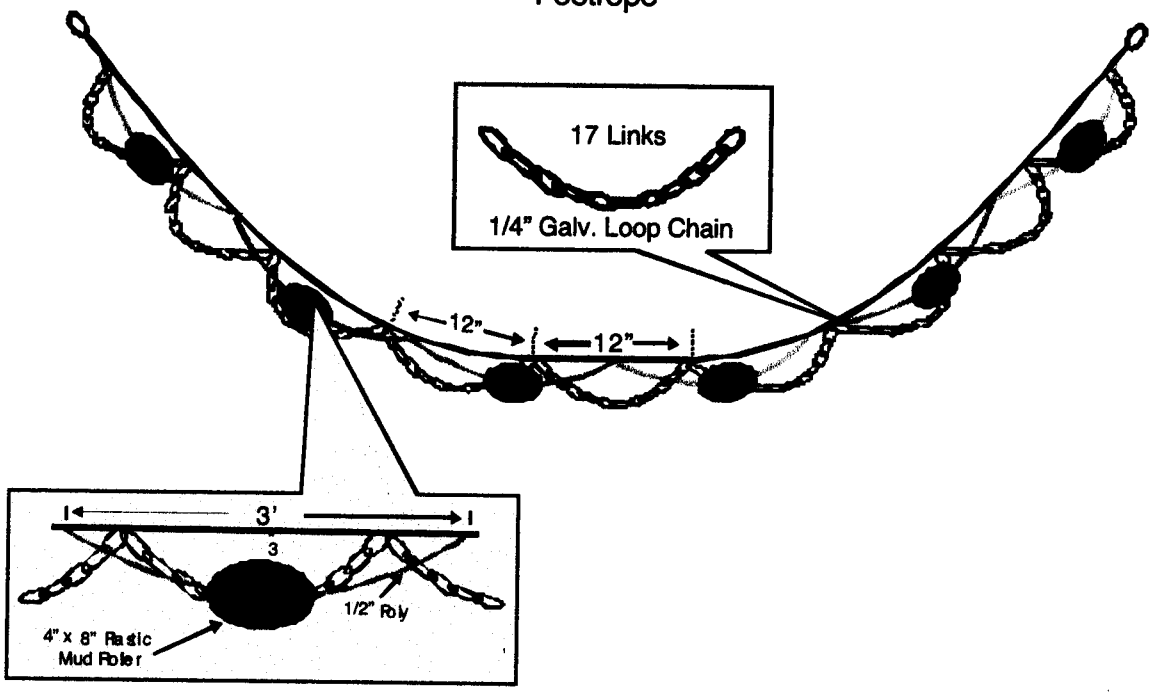
J. Bridle Specifications:
1. Type- Split Bridle Single Warp
2. Wire Type- 6x19 Stainless Steel IWRC
3. Wire Diameter- _"
4. Length/Leg- 180'

42' SEAMAP Trawl

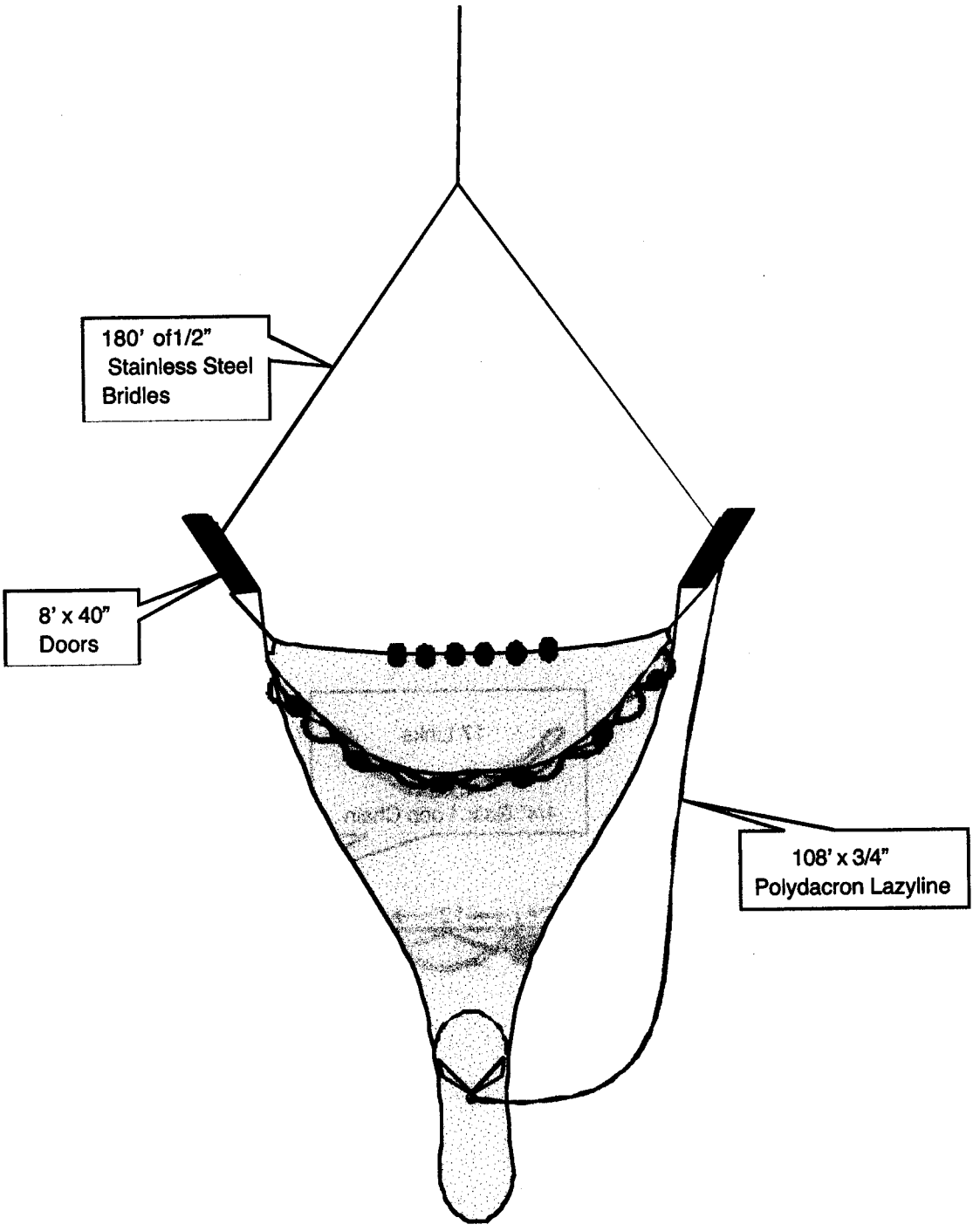
Headrope



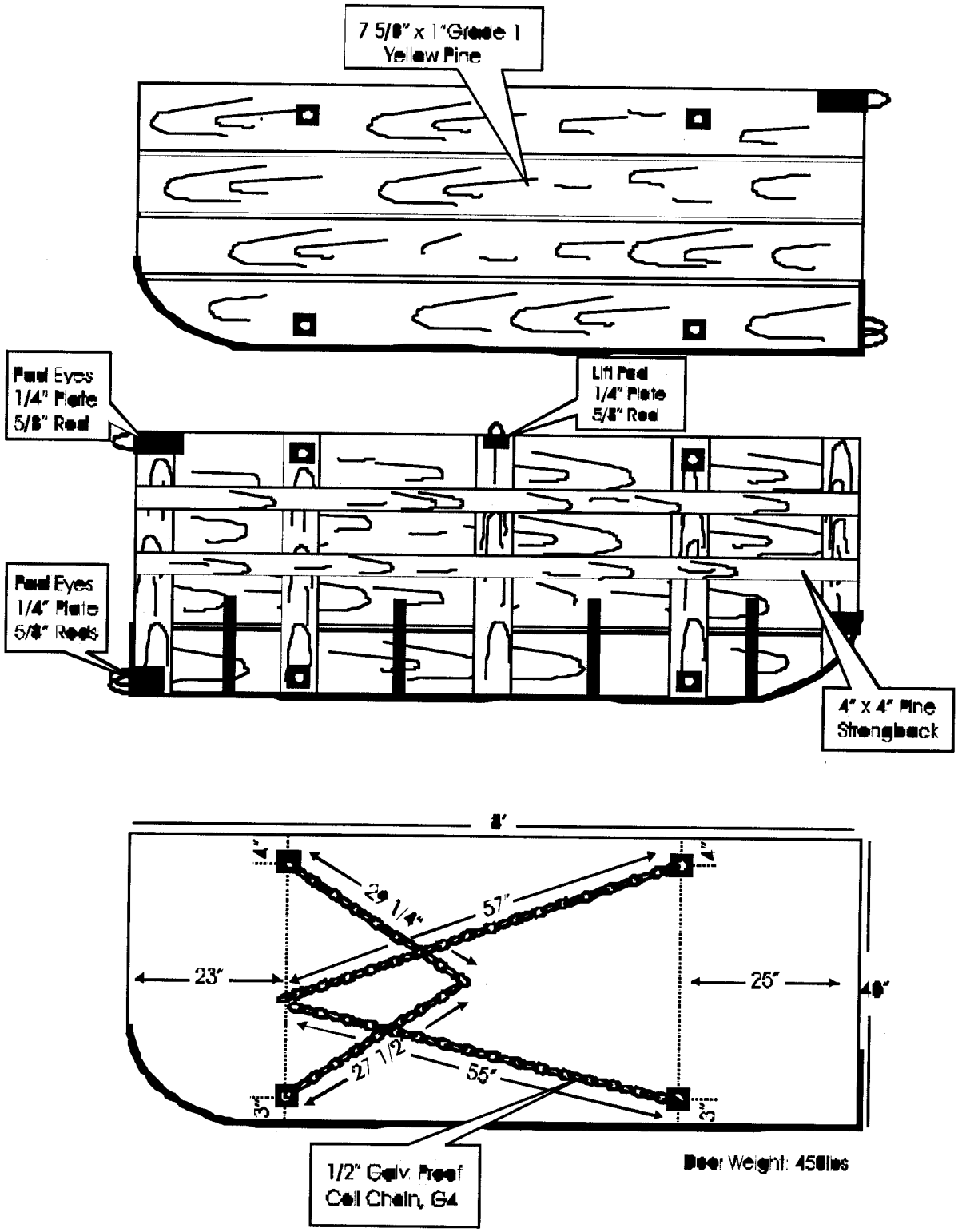
Footrope



42ft SEAMAP Trawl



8' x 48" Rectangular Flat Doors



SEAMAP Trawl Checklist

Inspector- _____ Date- _____ Trawl No.- _____

Description/ Tolerance	Measurement
A. Webbing/ +-3%	
Top Body- 33.4ft	
Top Left Corner- 12.5ft.	
Top Left Jib- 3.25ft.	
Top Right Corner- 33.4ft.	
Top Right Jib- 3.25ft.	
Left Wing- 48.5ft.	
Bottom Body- 27.66ft.	
Bottom Left Corner- 16.33ft.	
Bottom Left Jib- 3.25ft.	
Bottom Right Corner- 16.33ft.	
Bottom Right Jib- 3.25ft.	
Intermediate- 8.18ft.	
Codend- 16.31ft.	
B. Hanging Cable/ +-2%	
Diameter- .625in.	
Headrope- 53.91ft.	
Footrope- 62.2ft.	
Leglines- 6ft	
Wing lines diameter- 3/8in.	
Wingline length- 71.5in.	
C. Footrope Weight/ +-2%	
Chain Size- 1/4in.	
Chain Length- 67.8ft.	
Total Chain Weight- 48lbs.	
Number of Loops- 50	
D. Mud Rollers/ +-2%	
Size- 6in. X 8in.	
Number- 16	
Spacing- 3ft.	
Clearance from Footrope- 3in.	

E. Flotation/ +-5%

Size- 3in. X 4in.	
Number- 6	
Spacing- 5ft.	

F. Lazyline/ +-3%

Size- .75in.	
Length- 108ft.	

G. Net Treatment/ +-0%

Type- Plastic Coat	
Color- Green	

H. Doors/ +-2%

Door Type- Rectangular Flat Wooden	
Length- 8ft.	
Height- 40in.	
Chain Size- 1/2in.	
Chain Type- G4 Galvanized	
Top Front Chain- 29.25in.	
Bottom Front Chain- 27.5in.	
Top Back Chain- 57in.	
Bottom Back Chain- 55in.	
Swivels- 5/8in. Galvanized	
Bolts- 5/16in. Cadmium Plated	
Planking- 5/4in. Grade1 Pine	
Stiffeners- 4in. X 4in. Pine	
Uprights- 2in. X 10in. Pine	
Door Shoe- 1in. X 6in. Flat Stock	
Door Bridle- 23.5in. (Tow point to door face)	
Weight- 450lbs.	

I. Tickler Chain/ +-2%

Size- !/4in. Standard Link	
Length- 58.7ft.	
Weight- 41.6lbs	

J. Bridles/ +-2%

Wire Type- 6x19 IWRC Stainless Steel	
Wire Diameter- 1/2in	
Length- 180ft.	

Appendix 2

Northeast Fisheries Science Center Standard Operating Protocols For Shrimp Trawl Surveys

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center

Table of Contents

Introduction

The Gulf of Maine Northern shrimp survey was initiated in 1983 and has since been conducted annually aboard the R/V Gloria Michelle, a 65 foot, 96 GT stern trawler. It is a standardized survey conducted during July and August that employs a stratified random design and standard field data collection procedures similar to those used in NEFSC multispecies bottom trawl surveys. This survey, which was initially developed and implemented with support from the Atlantic States Marine Fisheries Commission (ASMFC), provides the primary fishery-independent data source for the assessment and management of the Gulf of Maine Northern shrimp stock. The NEFSC has held lead responsibility for conducting this survey and for processing and archiving the resulting data. The Northern Shrimp Technical Committee (NSTC) of the ASMFC plays an important role in staffing this survey.

The objectives of the Gulf of Maine Northern Shrimp Survey are to (1) determine the distribution and relative abundance of Northern shrimp (*Pandalus borealis*) in the western Gulf of Maine; (2) collect biological specimens and data relating to the age and size composition of Gulf of Maine Northern Shrimp stock; and (3) collect biological data for other Gulf of Maine invertebrate and finfish species in support of NEFSC research objectives.

Sampling is conducted using a NEFSC modified 4 seam commercial shrimp trawl with 350 kg Portuguese polyvalent doors (complete description and diagram shown in Appendices A and B of this document). Nor'Eastern Trawl Systems Inc. of Bainbridge Island, WA, manufactures the net specifically for this survey and Euronette manufactures the doors. In recent years the Massachusetts Division of Marine Fisheries has supplied a Net Mind mensuration system to obtain readings on net geometry during trawl operations and the NEFSC has supplied an inclinometer to evaluate bottom contact. The environment (temperature and depth) is usually monitored through mini-logger sensors attached to the net, though has at times been obtained using Seabird temperature/pressure sensors.

The shrimp trawl is towed for 15 minutes at each station. Catches are sorted to species, weighed, and length frequency data are recorded as appropriate. Biological samples and data are collected for sex and maturity stage determinations for Northern Shrimp. Both station and biological data are recorded on standard trawl logs. Shrimp and finfish data are both collected but shrimp sampling is the highest priority.

Protocol 1: Length measurement of trawl warps

Responsibility for procurement, installation, and maintenance of trawl warps currently resides with the crew of the R/V Gloria Michelle. The Gloria Michelle utilizes 5/8" 6X19 galvanized fiber core wire for trawling operations.

Upon initial installation, trawl wires will be measured and marked in 25 fathom increments. These marks will be checked and recalibrated before and after each seasonal shrimp survey, and whenever wire marks indicate that wire measurements fall outside of established standards. The Gloria Michelle will be outfitted with block wire counters to be used as a redundant measuring system. These counters will be calibrated before and after each seasonal survey, and once during the mid-point of the survey. Protocol 1 states that starboard and port wire measurements should not deviate from the redundant measuring system by more than 4% of the door to door distance measured along the bridles and head rope of the net. On the NEFSC standard shrimp net there is a 235.3' door to door measurement, 4% of which is 9.4'. We have established a maximum deviation of 2M (6.56') for this measurement. If this value is exceeded and it is determined that there were no measurement errors, the survey will be suspended until the problem is resolved. Calibration should be conducted more frequently if significant differences in warp length are detected, as might be expected following the initial installation of wire. Frequency of warp measurements may be reduced when an understanding of the variability in measurements is achieved and NEFSC and NMAO personnel determine that differences in measurements are primarily due to measurement error, temperature or other factors.

It is critical that marks on the starboard and port wires are paired and even with each other to ensure that equal lengths of wire are deployed at any depth or warp deployment. The following procedures should be employed during measurement or remarking operations:

- Wires may be measured from existing eye splices (as wire is unwound from the vessel's winches) or from a fixed existing mark in each wire (i.e., 325 fathom mark, as wire is wound back onto the vessel's winches).
- If wire is measured or remarked as wire is wound back onto the vessel's winches, remaining wire at the terminal end should be cut at even distance intervals on both wires.
- During marking, measurement, or remarking operations, the starboard and port wires should be laid next to each other and measured, marked, or remarked simultaneously. Slight and equal tension on the wires is necessary to ensure that wires are straight when measured or compared.
- Measurement of wire should employ a measurement device not prone to measurement error, such as pre-marked length of thin diameter wire.
- During measurement or remarking operations, if differences between existing and true marks are detected, wire shall be remarked at correct distance intervals
- During measurement or remarking operations, a representative of the NEFSC or a designee shall record differences between existing marks and newly measured distance intervals.

The NEFSC and NMAO continue to investigate the properties of wire rope utilized on NEFSC trawl surveys and methodology available to calibrate distance of wire rope deployed during trawling operations. As new information is obtained, methods used to calibrate wire rope will be updated in future revisions of these protocols.

Protocol 2: Survey Operational Protocols

Listed below are brief overviews of the more important operational protocols for the Northern Shrimp Survey. These protocols standardize the gear and operating procedures used during the survey, which is necessary to maintain consistency over time. This is not a complete list of operational procedures and there are no details included on biological sampling, survey design, or pre and post cruise procedures. A complete description of all operational procedures can be found in the Operations Manual for the Northern Shrimp Survey. See Attachment C for a chart of the Northern Shrimp Survey strata.

Sub-protocol 2a: Wire Monitoring

On the Gloria Michelle marks on each wire (warp) and block wire counters will measure the wire. If there is a discrepancy of 2 meters or more between these two measuring devices, operations shall be suspended until a cause is found and resolved. Protocol 1 states that the difference between the primary and redundant measuring device must not be greater than 4% of the door-to-door cable length. In our case, this measurement is 9.4', so implementing a maximum difference of 2M (6.56') is lower than what is called for in Protocol 1. Marks are placed at fixed distances along the warp to allow for consistent deployment of known lengths of wire in 25-fathom increments along the warp. As the trawl is being set, the marks must be counted on the trawl wire. When the proper length has been deployed, a member of the deck crew must visually inspect the marks to insure that the final marks on both port and starboard cables come to rest parallel to one another. If the difference between the marks and the metering system are greater than the above tolerances, the following must occur:

- The net must be hauled back and the gear reset to determine if the problem was a result of slippage of the wire metering system.

If this does not resolve the problem then the following procedures must be followed to ascertain where the problem originates:

- The marks should be visually compared as the net is retrieved and notes taken that can be used to indicate where the discrepancies appear.
- A separately marked cable should be used to verify the marks on the wire. When the wire marks are different than the pre measured cable, the wires should be remarked or otherwise accounted for so that we can be certain that the above tolerances are not exceeded.

Sub-protocol 2b: Captain/OOD and Chief Scientist Responsibilities
The OOD (Officer on Deck) is the Captain's designated representative on the bridge whose principal responsibility is the safe navigation of the vessel. This implicitly means that the ship, its people, its machinery, and other vessels shall not be put in peril. Safety always takes precedence over the ship's mission.

The Captain/OOD shall:
- Conduct mission operations that are consistent with the safe navigation of the vessel.
- Work closely with the Chief Scientist to determine the most efficient track line.

Only the Chief Scientist may:
- Change planned track-lines
- Change mission priorities (e.g., request change of course or speed to meet other objectives)
- Cancel stations
- Direct the work of the scientific party
- Relocate stations more than 1.0 nautical mile from the original target

The Chief Scientist may not:
- Direct or interfere with the work of the ship's crew

Both the Captain and the Chief Scientist have the authority to stop operations due to inclement weather; the Captain because of potential danger to the ship or its people, the Chief Scientist because of compromised data quality. Neither person will override a decision to cancel operations made by the other.

Sub-protocol 2c: Trawl Monitoring Systems
Two systems are currently used on the trawl during the Northern Shrimp Survey for quality assurance. They are the "Net Mind System" used to monitor headrope height, wing spread, and door spread, and an inclinometer to record bottom contact. The trawl monitoring systems are used to indicate if something is dramatically wrong during the tow (i.e. crossed doors) and to allow the end users of the data to evaluate the quality of each tow after the survey is completed. If an end user determines that the bottom contact time or net configuration indicates a non-standard tow, it will not be used for assessment purposes. The data collected by these instruments is not otherwise analyzed at sea. After each tow, a "haul and gear" code is assigned by the scientific watch chief to indicate the overall success of the tow (see the section on "when to repeat a tow" for more details on these codes). If a 15-minute tow is completed without any damage to the net and there was no interference with fixed gear, the tow is considered to be successful. Along with the net mind system and inclinometer, a temperature/depth minilogger is attached to the wing of the net inside a mesh bag during each tow to obtain temperature and depth readings. The data is downloaded after each tow.

1) The "Net Mind" system is used to evaluate net geometry during the Northern Shrimp Survey. It is deployed on the net during each tow to obtain readings of headrope height, wing spread,

and door spread. If readings during the tow indicate that the doors are crossed or any other significant malfunction is occurring, the tow will be aborted. Readings of all measurements are recorded 3 times during each tow. This data is available to data users after the survey is completed so that it can be used to determine tow quality. The Massachusetts Division of Marine Fisheries (DMF) provides the Net Mind System. Permission for the use of the system must be given by the DMF prior to the survey.

2) An inclinometer is attached with chain to the center of the footrope on each tow. The inclinometer is used to evaluate bottom contact of the trawl gear. Data is downloaded after each tow and reviewed to ensure that the instrument is functioning properly. The data is saved into a directory and is distributed to end users after the survey so that they can determine the quality of each tow. If an end user determines that a tow was not standard due to the length of time that the net made contact with the bottom, that particular tow will not be used for assessment purposes.

Sub-protocol 2d: Setting the net

The vessel is not to be turned during this phase of deployment. After the ship has steadied up on course and speed, the depth is noted from the sounder. Using this depth, the proper "wire-out" length is selected using the appropriate scope ratio. A speed of 3 to 4 knots will be maintained during setting to ensure adequate door spread. When the winch operator has paid out all but the last 25 fathoms of wire for the tow, he will instruct the OOD to slow down. Vessel speed should then be reduced to 2.0 knots.

The port and starboard marks will be aligned at either the winch or the blocks. The amount of wire set should never be less than that indicated by the scope ratio. Therefore, when the amount of wire has reached its predetermined length as dictated by the scope ratio, additional wire will be let out until the marks are aligned at either the blocks or the winch. Aligning the marks at a fixed point on the vessel will ensure that the marks are evenly set.

Sub-protocol 2e: Wire-out and scope ratio

The wire-out length for a tow is based on the depth as read from the sounder. The scope ratio used will be 3:1 in depths up to and including 85 fathoms; 250 fathoms of wire will be used in depths from 86 – 100 fathoms; and a scope ratio of 2.5:1 will be used in depths greater than 100 fathoms.

Sub-protocol 2f: Simplified trawling rules

- An "official tow" starts when the trawl winch brakes are locked after paying out the designated trawl warp length, and ends when the trawl winch brakes are released and the trawl warps are engaged.
- The vessel is to stay within stratum boundaries during the entire tow
- Tow shall start at the marked location and the direction of the tow should be into the current
- Tows shall be 15 minutes long from the time the winch brakes are set to the initiation of haul back
- Towing speed is 2.0 knots

- The tow locations should not be moved more than 1-mile from the marked station location without permission of the Chief Scientist
- The amount of wire deployed will never change after the tow has started

Sub-protocol 2g: Tow Direction
Tow direction should be into the current unless any of the following situations exist:

- If towing into the current would put you out of the stratum and into another.
- Bad bottom, wreck, cables or obstructions.
- Fixed gear in the tow path.
- Traffic in the area.
- Moderate to heavy seas.

Sub-protocol 2h: Tow duration
Northern Shrimp Survey trawls are 15-minutes in duration. It is the NEFSC policy that a tow should not be shortened if there is a 50% chance or better of successfully completing a full 15-minute tow. Time starts when the trawl winch brakes are locked. Time stops when the trawl winch brakes are released for haul-back. Intentional or planned reductions in tow duration shall be avoided and only done after consultation with the Chief Scientist. If unexpected obstacles are encountered, tows will be aborted.

Sub-protocol 2i: Summary of tow speeds
- When streaming the net over the stern, the ships speed through the water is between 1-knot and 3-knots, adjusted for weather conditions and current. This is necessary to provide sufficient tension to pull the net over the roller without so much tension to hinder or endanger the deck force while connecting the doors.
- When initially placing the doors into the water and while shooting the net, the ship's speed is 3 to 4 knots through the water in order to insure proper door spread, prevent the likelihood of crossing the doors, and to provide sufficient tension to pull the net and wire off the trawl winch drums.
- The official standardized trawling speed for the Northern Shrimp Survey is a constant 2.0 knots over the bottom (not through the water).
- During haulback, the ship's speed is kept close to the 2.0 knot trawling speed but the speed may be adjusted depending on weather, current, and weight of the net.
- Once the doors have cleared the water, the ship's speed is reduced to minimize tension while bringing the net aboard. Again, the OOD must correct for the speed and direction of the current.

Sub-protocol 2j: Hauling Back
The OOD notifies the winch operator when there is 1 minute remaining in the tow, then again when 30 seconds remain, and the OOD will count down the last 5 seconds. The winch operator then begins haulback. The vessel speed remains close to 2 knots during haulback but is not necessarily maintained. The speed will vary depending on current, weather conditions, and the weight of the net. The ship will not change course during haulback. Once the doors have

cleared the water, the ship's speed is reduced to minimize tension while bringing the net aboard. Again, the OOD must correct for the speed and direction of the current. Before the net is hauled aboard it is inspected to ensure that there are no fish escaping and to assess any damage to the net.

Sub-protocol 2k: Determining if a tow was successful and when to repeat a tow

If a 15-minute tow is completed without any damage to the net and there was no interference with fixed gear, the tow is considered to be successful. Occasionally it is necessary to repeat a trawl haul because of malfunction or damage to the trawl. In cases of severe malfunction (crossed doors) or severe damage (whole sections torn out such as a wing or belly), the tow will not be counted as a standard haul and must be repeated, although it may be sampled for biological data, which is independent of abundance and biomass information. For recording purposes, the tow is recorded as a valid station, but the coding for Station-Haul-Gear (SHG) value shall be greater than 1-3-6, indicating a non-valid catch for assessment purposes. Descriptions of the types of damage that constitute an SHG value of greater than 1-3-6 are given in the coding details – see Attachment E.

In some cases, it may be difficult to determine how to properly code a haul that has encountered problems. The following guidelines should be used:

- It is essential to indicate a minimum of 2 for haul value, which flags data auditors that something abnormal occurred during the tow.
- If in doubt about SHG coding consult with the Chief Scientist
- Ensure that the catch is worked up at least to the point of weights and lengths
- An accurate and complete account of what occurred to the gear must be given on the log; the lead fisherman should be interviewed to determine details on gear condition.
- When significant gear damage occurs, the Chief Scientist should be informed, and the decision to re-tow must be made based on the severity of the damage.

The decision to repeat a tow is made by the Chief Scientist and is based on a coded SHG value greater than 1-3-6. The following factors may override this decision:

- The probability of the same or greater damage to the net occurring; in this case, the station location should be moved
- The current progress of the cruise as a whole (when time remaining in the cruise threatens the completion of the entire survey area)
- The status of shipboard gear inventory, i.e. how many undamaged nets are left

The following factors must be weighed with every decision to override a retow:

- The overall progress of the cruise (does time in the context of the entire survey permit extended effort on any one station)
- The number of stations completed in the stratum in question (higher priority would be placed on a station that represents the sole tow in the stratum, lower priority would be placed on a station that would represent the 8th successful tow in the stratum)

- The current relative importance of the stratum in question (is it a critical stratum for assessment purposes)
- The geographic coverage within stratum that the tow represents

Sub-protocol 2l: Repairing gear damage at sea
When net damage requires more than 20% repair of any trawl mesh section or significant damage to any other trawl component i.e. broken headrope or footrope, the net will be set aside for proper repair at the NEFSC warehouse. NEFSC staff at the warehouse will repair the net to the manufacturer's specifications. A "trawl checklist" with specific mesh measurements for use at sea is in the process of being made. Damage to less than 20% of any trawl mesh section may be fixed at sea by the lead fisherman with the Chief Scientists' consent.

Sub-protocol 2m: Factors that may determine a station to be untrawlable
Stations may be postponed, moved, or skipped (if they are not of highest priority) for the following reasons:

- Sea State. Survey tow direction (or the ability to tow at all) may be determined by sea state. If the conditions are as severe as to pose a safety or data quality issue operations may be affected. For the Gloria Michelle a maximum sea state of 6' has been established. If seas are greater than 6', operations will be postponed until the conditions are again trawlable. Other safety related decisions may be made by either the vessel Command or the Chief Scientist. The Chief Scientist will make data quality decisions.

- Bottom Topography. Bathymetry may become a factor in tow site location. If the alteration will result in a more than 1.0 nm relocation of the station from the original station location the Chief Scientist must be consulted. Areas of "bad bottom" may be determined to be untowable. This determination will be made after scouting the area, using all available navigation and scientific resources (including historical trawls), and consultation between the Chief Scientist, the Officer of the Deck or Commanding Officer, and the Lead Fisherman. Involving the OOD in this decision will ensure that the determination is consistent between Chief Scientists.

- Traffic. Tow direction and tow site may be altered by marine traffic. With regard to traffic as it affects the survey operations, the OOD will notify the Chief Scientist if there is going to be a delay of more than 15 minutes due to other vessels in the area or if the alteration will result in more than a 1.0 nm relocation of the station. The OOD is primarily responsible for the safe navigation of the ship. Delays of this nature should be rare as tow direction may be changed to avoid any close quarters situations.

- Fixed Gear. Fixed gear may become a factor in tow site location. If the alteration will result in more than 1.0 nm relocation, the Chief Scientist must be consulted. Areas of fixed gear may be determined to be untowable. This determination will be made after scouting the area, using all available navigation and scientific resources, and consultation between the Chief Scientist, the Officer of the Deck or Commanding Officer, and the Lead Fisherman. Barring safety issues, the Chief Scientist will make the final decision.

The mere presence of fixed gear in an area is not a sufficient condition to abandon attempts to complete a tow. Often, scouting and/or communication with local fishery operators results in identification of a towable area, even when fixed gear is present. Efforts to locate towable area will be made for a period of up to one hour.

Sub-protocol 2n: Fixed gear retrieved from trawl
When lobster traps or fishing gear is captured in the trawl, the following procedures shall take place:

Chief Scientist records on the trawl log:
- Trap or buoy number(s)
- Contents (count and measure lobsters –these data are not included in the trawl catch)
- Location
- Presence or absence of buoys
- Condition of the gear (i.e. ghost gear, new traps)

If it is determined that it is ghost gear, the crew may cut it apart to facilitate removing it from the net.

Sub-protocol 2o: Gear condition report
Upon arrival in Woods Hole, the Chief Scientist will confer with the Lead Fisherman and record the condition of all trawl gear and report this information to both Survey's Gear Specialist and the Gear Warehouse. The form for this information is provided in Attachment D.

Protocol 3: Trawl construction and repair

Sub-protocol 3a: Trawl nets
The Northern Shrimp Survey utilizes a NEFSC modified commercial shrimp net. Nor'Eastern Trawl Systems Inc. of Bainbridge Island, WA manufactures the net specifically for this survey. A complete description and diagram with dimensions are included in Attachments A and B. Nets are certified by trained NEFSC personnel prior to deployment on the vessel. Only minor repairs are done at sea.

Sub-protocol 3b: Trawl Doors
Trawl doors are critical to the performance of bottom trawl gear. Doors function to spread the trawl net and have a direct effect on net wingspread, head rope height, bottom tending, and mud cloud. The Northern Shrimp Survey utilizes 350-kg, Portuguese polyvalent (Euronette) doors (Attachment B). Doors shall be purchased in pairs and immediately numbered in a permanent manner to allow tracking during use and maintenance.

Trawl doors shall be maintained in a fashion to ensure proper paired functioning. Door pairs shall be certified by NEFSC personnel prior to deployment. Door pairs must have shoes that are

in good condition, be free of dents and other significant changes in shape, and have brackets welded in a manner to eliminate shifting.

Door spread resulting from deployment of specific sets of doors will be measured using trawl mensuration equipment upon initial deployment and at intervals of a minimum of every 50 tows. When door spread is determined in successive tows to fall outside of target ranges, the corresponding door pair shall be removed from the trawling system until proper performance can be verified. The specified target and acceptable range for door spread values are in the process of being evaluated experimentally.

Backstrap chains shall be paired, measured for length and maintained to the specifications shown in the diagram under Attachment B. Backstraps will be attached to the doors in the hole closest to the back end of the door. Pairs of backstrap chains shall remain associated with a specific door pair during transport to and from fishery research vessels, and during deployment during trawling operations. If backstrap chains are removed from doors during trawl operations due to damage or determination that measured lengths are no longer within specifications, removed backstrap chains shall be tagged with information including the door pair number, the date of removal, and reason for removal from the door pair. Removed backstrap chains shall be returned to NEFSC gear personnel for inspection.

Sub-protocol 3c: Gear certification / inspection

Prior to being placed on the vessel, the trawl gear and equipment will be certified by two NEFSC personnel who are trained in the specifications of the net. A detailed checklist for the trawl design specifying the dimensions for each section is in the process of being made. This checklist will enable the Chief Scientist and Lead Fisherman to verify that trawls are within operational tolerances while at sea. Until then, repairs at sea will be limited to a maximum of 20% damage to any mesh section. If the damage exceeds 20% in any section, the net will be set aside and replaced with a newly inspected net. The trawl gear is described in detail in Attachment A. A condition report form (Attachment D) will be forwarded to the Lead Fisherman prior to the survey. When the gear is returned, the Lead fisherman and the Chief Scientist are requested to fill out this gear condition report form, return it with the gear, and supply a copy to the Branch Chief of the Ecosystems Surveys Branch.

Attachment A

Specifications for Construction of NEFSC Standard Shrimp Net

Body of the Net

Dimensions of the sections are shown on the attached net plan and cutting diagram. Mesh size is 1 3/8 stretched mesh (knot to knot) throughout top, side pieces, bottom, and wings and constructed from #21 (R1626tex) 1.6 mm black twisted nylon twine.

Extensions

The first extension is 1 _" stretched mesh (knot to knot) constructed from #21 twisted nylon twine. It measures 224 meshes across by 200 deep. The second extension is 1 _" stretched mesh (knot to knot) constructed from #21 (R1626tex) twisted nylon twine. It measures 210 meshes across by 200 deep.

Codend

The codend is constructed from 1 _" stretched mesh (knot to knot) #24 braided nylon twine (R1984tex). It measures 165 across by 100 meshes deep.

Chaffer

The chaffer is constructed from orange 4" double 4-mm polyethylene twine and measure 100 meshes deep x 100 meshes around. The chaffer encircles the entire codend and is attached to the first extension piece 50 meshes up from the aft end of the first extension. Therefore, the chaffer covers the codend, second extension and 50 meshes of the first extension.

Gore Lines

Gore lines are constructed from 3/8" polyethylene. The four gore lines run the length of the four seams of the net up to the first extension.

Footrope

The footrope is 78' total length and is a continuous 5/8" diameter wire wrapped with _" polypropylene line.

Headrope

The headrope is made of _" diameter wire wrapped with _" polypropylene line. It measures 70'8" and is constructed from one continuous piece. The square is hung 12 foot (2 fathom) and the wings are hung in 24-foot (4 fathom) lengths.

Breastline

The breastline (up and down) measures 21'6" and is constructed from _" diameter wire wrapped with _" polypropylene line.

Floats

There are 27 eight-inch spherical center hole UBE plastic floats evenly spaced every 28" beginning 28" from the wing end.

Sweep

The sweep is made up of three lengths of 5/8" diameter combination rope with eyes spliced in each end without thimbles and joined with 5/8" hammerlocks. There are two wing sections that are 34 _ feet long and a center section of 9 feet. Combination rope is a combination of nylon or polypropylene strands and steel wire with a fiber core. There are six 36 cm (14 inch) diameter rubber discs in the 2.7 m (9-foot) center section spaced 18 inches apart (on center). The disks are one to one and a half inches wide and have a center hole and a top hole for the bolch line. The wing sections have fourteen 25 cm (9.8 inch) diameter discs in each 8.7 m (28.5 foot) wing section. At each wing end, there was a 1.5m (5-foot) section equipped with 7.6 cm (3-inch) diameter rubber "cookies".

Bolch line

78-foot bolch line is passed through a hole at the top of each rubber disc. The bolch line is constructed from 9/16" combination (wire / rope) rope. (See attached diagram)

Liners

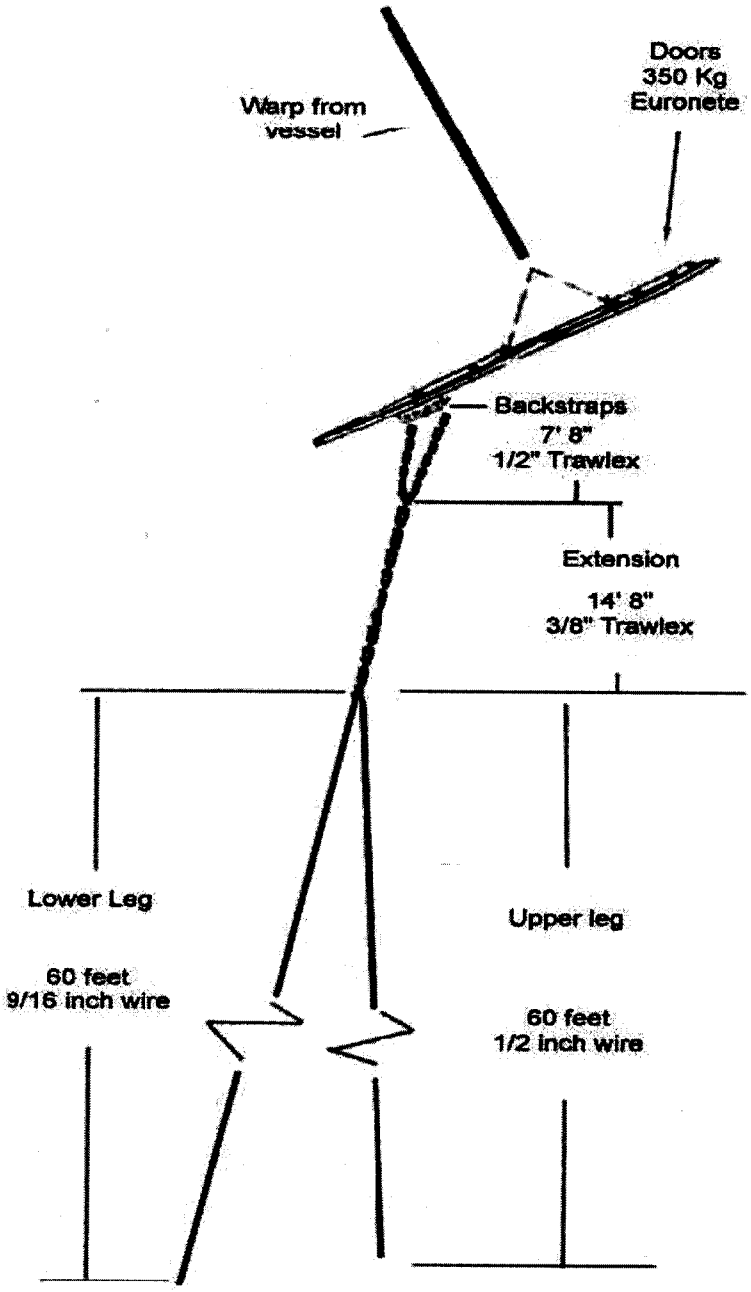
No liners are used in this net

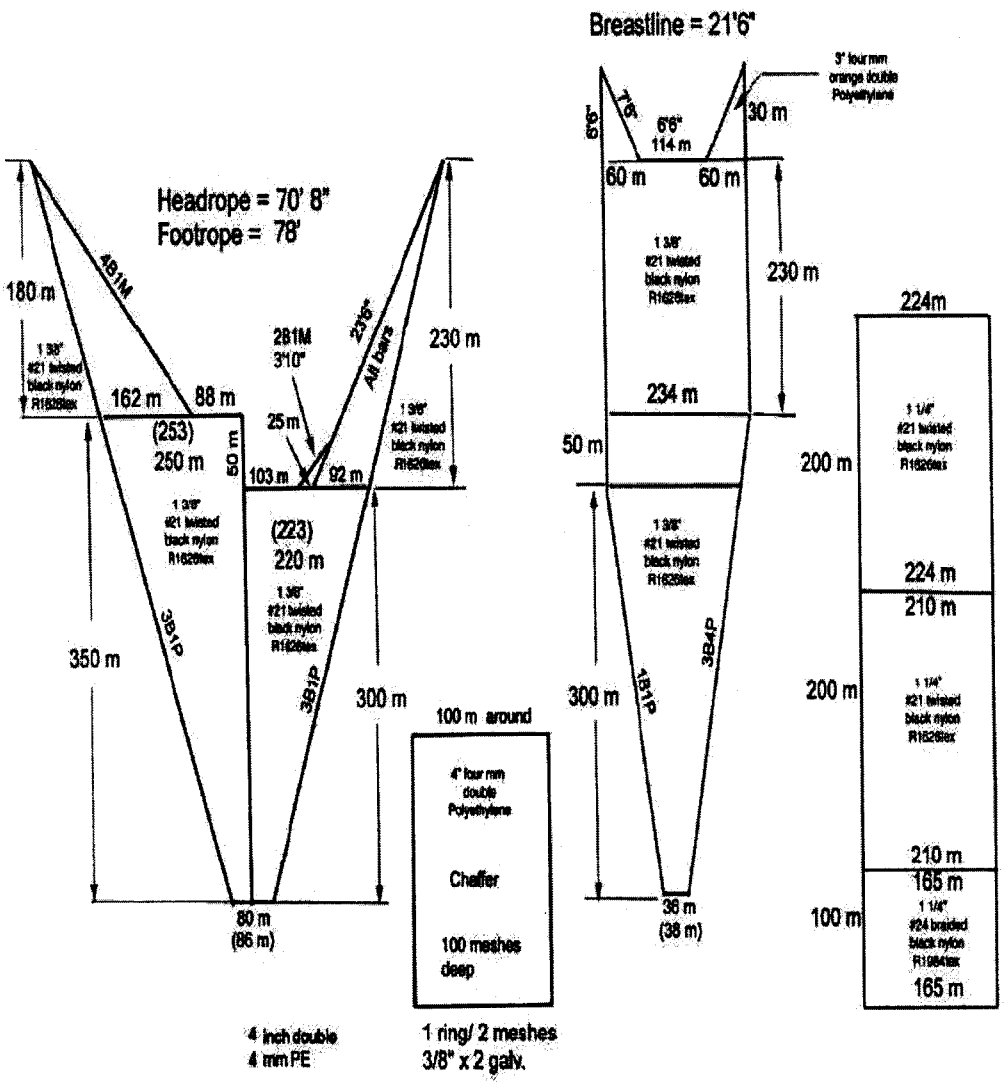
Doors

The doors are 350 kg Portuguese polyvalent doors manufactured by Euronette.

Attachment B

Diagrams of NEFSC Standard Shrimp Door and Net

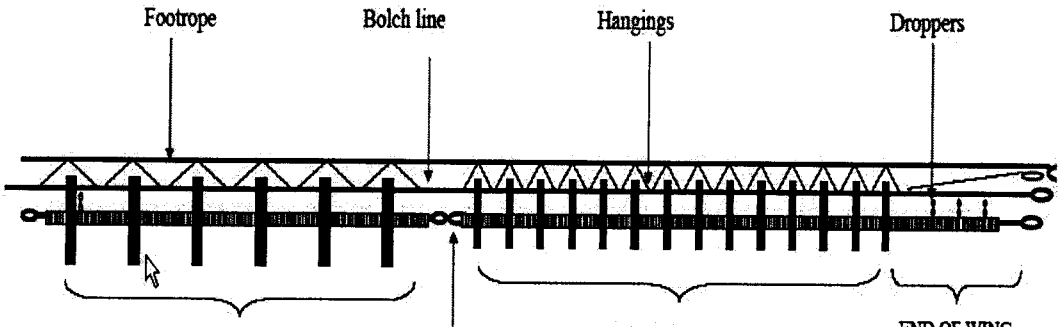




Numbers in parentheses (##) are the actual number of meshes in the section. The additional meshes are wrapped in the gore.

Mesh sizes are knot center to knot center

Shrimp Net Sweep



CENTER SECTION

- Six – 14 inch rockhoppers spaced 18 inches apart
- 3-inch cookies between rockhoppers
- center section is 9 feet long

5/8 inch hammerlock

WING SECTION

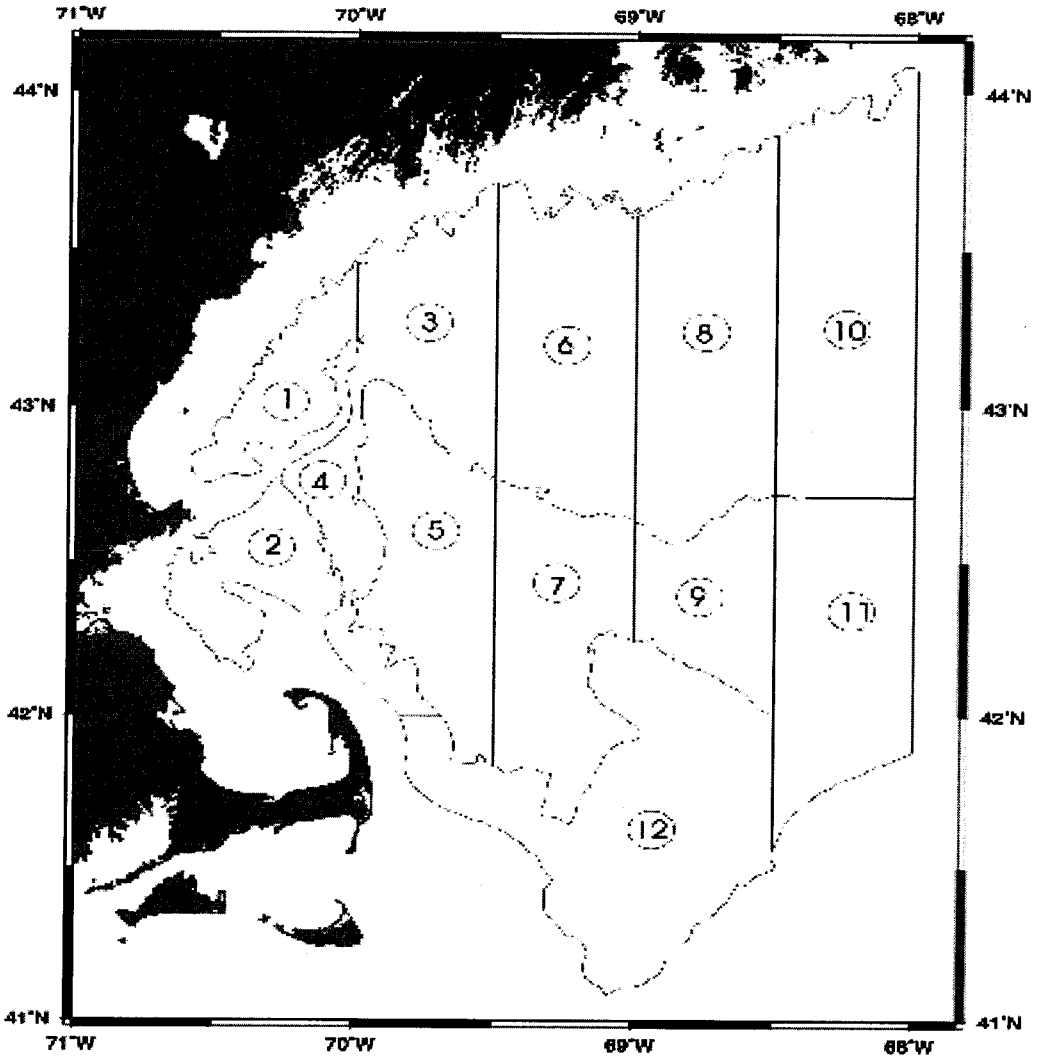
- Fourteen – 10 inch rockhoppers
- 3-inch cookies between rockhoppers
- section is 29.5 feet long

END OF WING

5-foot wing end section covered in 3-inch cookies

Attachment C

NEFSC Northern Shrimp Survey Strata



Stratum	Sq. Nm	Depth(m)
1	427	51 - 100
2	508	< 50
3	861	51 - 100
4	427	51 - 100
5	1053	> 100
6	1289	51 - 100
7	1065	> 100
8	1466	51 - 100
9	667	> 100
10	1691	51 - 100
11	1234	> 100
12	1926	51 - 100

Attachment D

Survey Trawl Condition Report

[redacted]

Received Condition

Work / Repairs

Bundled Condition

[redacted]

Received Condition

Work / Repairs

Bundled Condition

[redacted]

Received Condition

Work / Repairs

Bundled Condition

[redacted]

Received Condition

Returned Condition

[redacted]

Received Condition

Returned Condition

[redacted]

Please return this form to Ace Nelson with a copy to Henry Millikan at the conclusion of each leg

Attachment E

(**Note**: This is version of the SHG coding details does not contain all coding criteria)

STATION VALUE - STATION TYPE CODE:

1=Survey haul (random-stratified)
2=Non-random haul
3=Special random add-on station haul
4=Comparison haul
5=No trawl haul (e.g., bongo, CTD or XBT)
6=Site-specific
7=Systematic grid
8=Depletion site
9=Systematic parallel transects
0=Systematic zig zag transects

HAUL VALUE - CODE FOR RELATIVE SUCCESS OF HAUL:

1=Good tow. No gear or tow duration problem.
2=Representative, but some problem encountered due to gear or tow duration.
3=Problem tow. May or may not be representative due to gear or tow duration.
4=Not representative, due to gear or tow duration.
5=No bottom trawl (e.g., bongo, CTD or XBT ONLY).

GEAR CONDITION - CODE FOR GEAR CONDITION: (ALL GEAR PROBLEMS MUST BE NOTED ON TRAWL LOG OR IN FSCS WC COMMENTS SECTION)

1=No damage or insignificant damage.
2=Wing twisted or tears in upper or lower wings not exceeding 10 ft; tear in square not exceeding 5 ft; tears not exceeding 3 ft in upper belly, or 6 ft in lower belly; cod-end or liner with tears not exceeding 2 ft; parted idler; liner hanging out of cod-end; 1-2 floats missing, bottom falls out for a few minutes.
3=Hung up with no to minor damage or due to sand waves.
4=Parted legs, sweep or head-rope; cod-end liner untied; wire out slippage; floats, rope or buoys hung up on door, loss of a few cookies.
5=Tear-up exceeding limits for code 2, but not a total failure.
6=Significant obstruction in trawl, such as fixed gear, large rocks, mud, coral, tires, old anchors, timbers etc. Problem with third wire; unmatched doors; strong current throughout tow.
7=Crossed doors. Net was not on bottom or did not perform due to currents or other factors.
8=Open gear.
9=Hung up with major damage; total tear-up, rim-rack; loss of all gear; loss of trawl; loss of one or both doors.