UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

APR 8 2011

To All Interested Government Agencies and Public Groups:

Under the National Environmental Policy Act (NEPA), an environmental review has been performed on the following action.

TITLE: Environmental Assessment for Proposed Data Collection Analysis in Support of Single and Multispecies Stock Assessment in the Mid-Atlantic: Northeast Area Monitoring and Assessment Program Near Shore Trawl Program (NEAMAP), NOAA Grant #NA11NMF4540005

LOCATION: The proposed project would conduct surveys in waters at approximate 20 to 60 foot depth contours between Cape Hatteras, NC and Montauk, NY. Stations will also be sampled between 60 and 120 foot contours in Rhode Island Sound and Block Island Sound.

SUMMARY: The purpose of this project is to conduct surveys to collect data on the living marine resources in the designated area for the NEAMAP Near Shore Trawl Program, a complement to the NEFSC bottom trawl surveys that are conducted from the Gulf of Maine to Cape Hatteras. A pilot survey was successfully conducted in the autumn of 2006. Full-scale regular surveys were conducted in the spring and fall of 2007-2009. This project will continue the biennial sampling in these waters. In addition to providing assessment-related data for a number of managed species, it is anticipated that successful completion of this project will make a significant contribution to several of the specific research priorities and species of interest outlined in the Request for Proposals (black sea bass, scup, and bluefish).

The project is for two years and will be funded under NOAA Grant #NA11NMF4540005, Virginia Institute of Marine Science, Gloucester Point, Virginia. The Co-Principal Investigators (PI) are Christopher Bonzek and Robert Latour.

RESPONSIBLE OFFICIAL: Nancy B. Thompson, Ph.D.
Science and Research Director
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543

The environmental review process led us to conclude that this action will not have a significant effect on the human environment. Therefore, an environmental impact statement will not be prepared. A copy of the finding of no significant impact (FONSI) including the supporting environmental assessment (EA) is enclosed for your information.

Although NOAA is not soliciting comments on this completed EA/FONSI we will consider any comments submitted that would assist us in preparing future NEPA documents. Please submit any written comments to the responsible official named above.

Sincerely,

Paul Doremus
NOAA NEPA Coordinator

Enclosure

Data Collection and Analysis in Support of Single and Multispecies Stock Assessments in the Mid-Atlantic: Northeast Area Monitoring and Assessment Program (NEAMAP) Near Shore Trawl Program 2011 – 2012

2011-2012 Environmental Assessment

Grant Funding Provided by:
Mid-Atlantic Fisheries Management Council, Research Set-Aside Program & Commercial Fisheries Research Foundation, Southern New England Cooperative Research Initiative

Prepared for:
National Marine Fisheries Service
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NEAMAP Near Shore Trawl Program
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Gloucester Point, Virginia 23062

December 2010

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1.0 INTRODUCTION

This Supplemental Environmental Assessment (EA) describes, and evaluates the impacts of, the proposed research activities during 2011 and 2012 for a coastal ocean bottom-trawling program in the Mid-Atlantic and Southern New England waters of the United States, the Northeast Area Monitoring and Assessment Program (NEAMAP) Near Shore Trawl Survey. The Atlantic States Marine Fisheries Commission (ASMFC) administers NEAMAP, and the Virginia Institute of Marine Science (VIMS) executes the field sampling, laboratory processing, and data analysis components of this survey. The proposed work for the 2011–2012 period would follow the successful completion by VIMS of the survey's first three-and-a-half years of sampling (i.e., fall 2007 cruise, and spring and fall cruises in 2008, 2009, & 2010). This Supplemental EA has been prepared in an effort to update the information regarding sea turtle interactions experienced by this trawl survey as well as the potential impacts on these turtle populations by this program.

Designed to improve the quality of resource and habitat assessment and management, as well as to complement existing trawl surveys, the proposed study is in the process of establishing a coordinated, long-term collection and analysis of fisheries-independent data on the trawl-caught living marine resources of the Mid-Atlantic and Southern New England regions.

With respect to the funding of this survey, it is anticipated that the project discussed below will be supported with monies derived from awards granted by the Mid-Atlantic Fisheries Management Council via the Research Set-Aside Program in both 2011 and 2012. The Commercial Fisheries Research Foundation will also provide additional funding through the Southern New England Cooperative Research Initiative. Funds resulting from these awards should be sufficient to cover both the spring and fall NEAMAP cruises, as well as all supporting operations (e.g., laboratory sample processing, data analysis, etc.), for each respective year.

2.0 PURPOSE AND NEED FOR PROPOSED STUDY

The Northeast Fisheries Science Center (NEFSC) Bottom Trawl Surveys have been conducted from the Gulf of Maine to Cape Hatteras since 1963. Currently, these surveys sample in the spring and fall of each year in waters less than approximately 300 fm (1800 ft). Beginning in 2009, waters less than 10 fm (60 ft) are no longer surveyed by the NEFSC. Specifically, the NEFSC abandoned this portion of their survey area because of the draft restrictions of their new vessel, the *FSV Henry B. Bigelow* (R. Brown, NMFS, pers. comm.). Moreover, from New York south to North Carolina, only one state (i.e., New Jersey) currently conducts routine near shore ocean monitoring with trawl gear. Survey coverage in Block Island Sound and Rhode Island Sound has also been perceived to be less than adequate, both in terms of the geographic coverage and sampling intensity, in the past. These gaps in survey coverage by fisheries-independent monitoring programs have the potential to result in significant bias and may impede timely stock assessments for managed species. The need of the proposed study is to address these recognized gaps in sampling coverage.

The purposes of this study are to collect data on the diversity, biomass, relative abundance, and distribution of living marine resources; to record biological information including size, age, sex, reproductive condition, and diet composition for species of management interest; to collect environmental data coincident with living marine resource monitoring activities; to provide biological specimens to cooperating agencies and other investigators upon request, subject to time and space limitations; and to manage and disseminate data collected by the survey.

3.0 PROPOSED STUDY AND ALTERNATIVES

The NEAMAP Near Shore Trawl Program proposes to continue survey operations in 2011 and 2012. Specifically, NEAMAP would sample along the coast of the Mid-Atlantic Bight in an area bounded by Montauk, New York, Cape Hatteras, North Carolina, and the 3.3 fm and 10 fm depth contours. Sampling would also occur in Block Island Sound and Rhode Island Sound between the 10 fm and 20 fm lines. In accordance with the survey design, two cruises would be conducted each calendar year, one in the spring and one in the fall. The duration of each cruise would be approximately 30 days, with the spring survey occurring during April/May and the fall cruise taking place during the September/October timeframe. A total of 150 sites would be sampled using a bottom trawl during each of these cruises. Sampling locations would be selected prior to cruises using a stratified random design. As a result, the exact locations of the sites would vary slightly from survey-to-survey, but sampling coverage of the entire survey area would be achieved for each cruise.

The alternative to the NEAMAP Trawl Survey (alternative required by the National Environmental Policy Act [NEPA]) is a no action alternative, meaning that these research surveys would not be conducted. Under this alternative, NEAMAP survey data for 2011 and 2012 could not be provided to support stock assessment and fishery management activities as outlined above; scientists and managers would need to rely on other data sources for the inshore waters of the Mid-Atlantic Bight and Southern New England, such as fishery-dependent data and information from the few state-supported, fishery-independent surveys that are in existence.

3.1 Alternative 1 (Proposed Study)

<u>Study location</u>

The proposed sampling area includes coastal ocean waters extending from Montauk, New York to Cape Hatteras, North Carolina (Figure 1a), at depths from 3.3 to 10 fm (20-60 ft). The NEAMAP Survey also plans to sample both Block Island and Rhode Island Sounds at the request of the NEFSC (Figure 1b). To select the sampling stations for each cruise, a 1.5 nm x 1.5 nm grid was overlaid on the entire sampling area (i.e., coastal ocean and

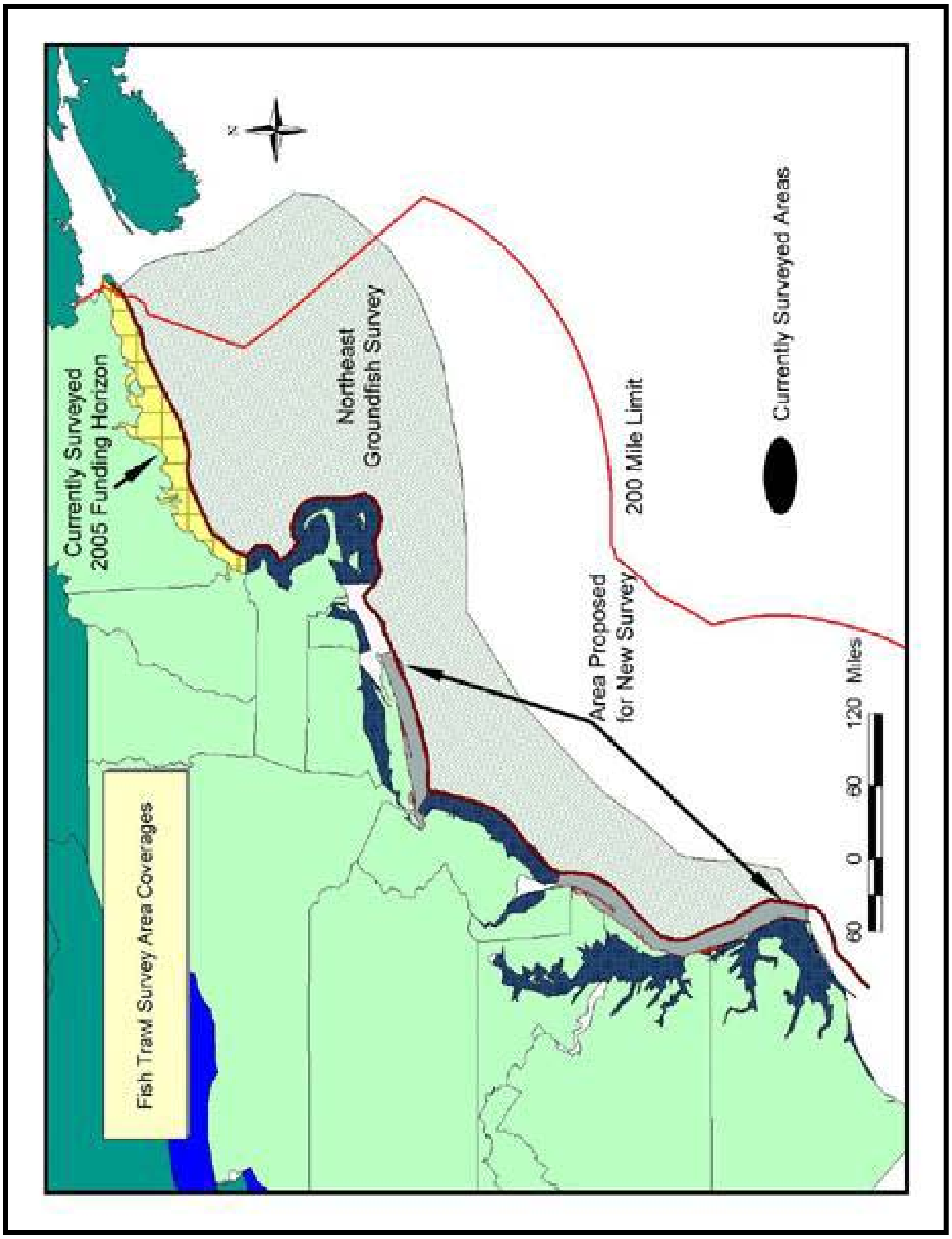


Figure 1a. Spatial extent of the NEAMAP Near Shore Trawl Survey sampling area in the coastal ocean of the Mid Atlantic Bight. The coastal portion of the NEAMAP survey area is bounded to the north and south by Montauk, NY and Cape Hatteras, NC, respectively. The offshore boundary of this survey is given by the bold, dark red line (i.e., 10 fm depth contour), and the inshore boundary coincides with the 3.3 fm depth contour.

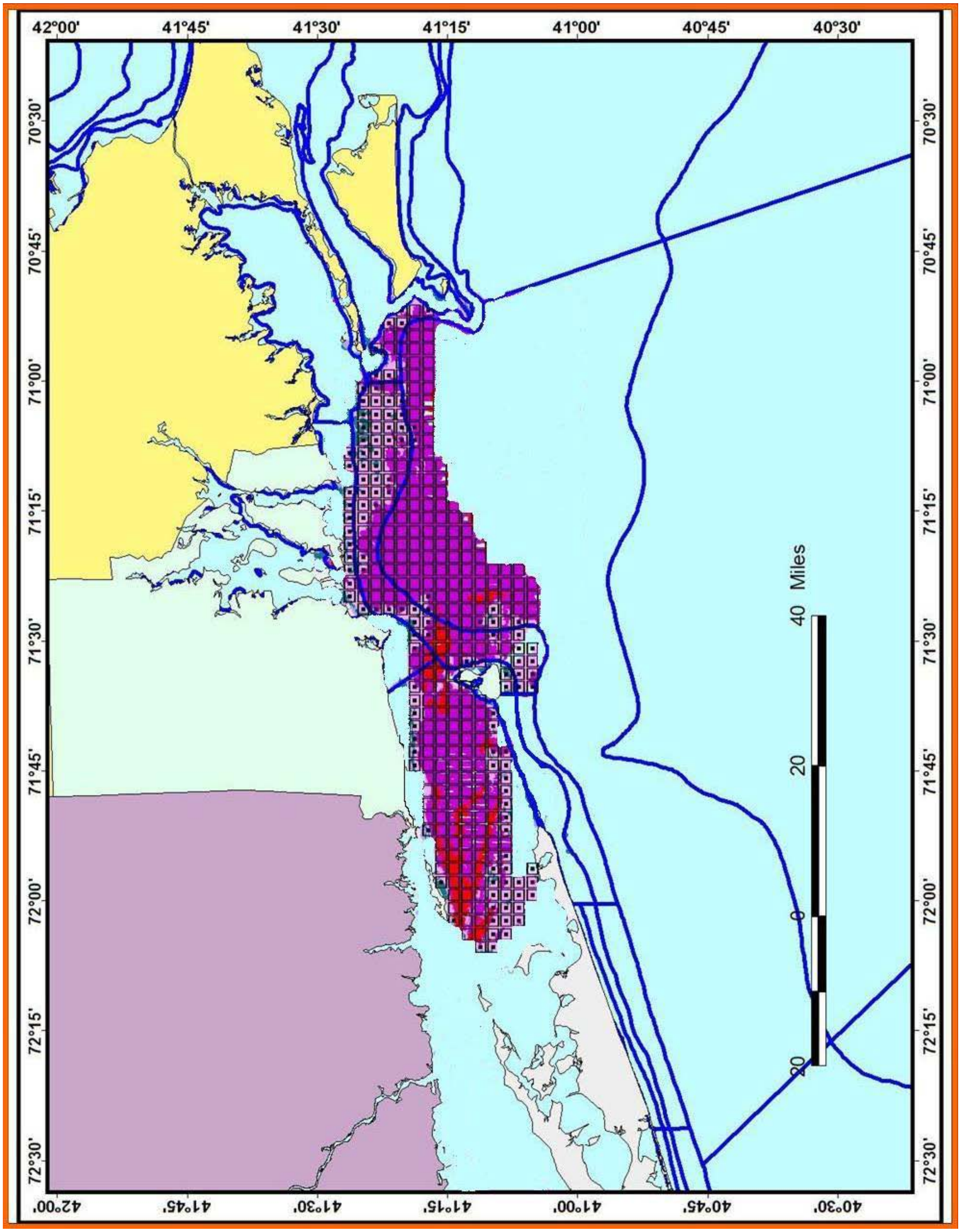


Figure 1b. Spatial extent of NEAMAP Near Shore Trawl Survey sampling area in Block Island Sound and Rhode Island Sound. Boxes correspond to all possible sampling sites within each body of water, from which 10 are selected using a stratified random design from Block Island Sound and 17 are selected using a stratified random design from Rhode Island Sound for each cruise.

sounds), with each 1.5 nm x 1.5 nm cell representing a potential sampling site. This yielded 1,958 cells. A total of 150 of these cells are sampled along the coast and in the sounds during each cruise, and these sites are selected using a stratified random design (stratification based on latitude/longitude and water depth – see Methods section below). The exact coordinates (i.e., latitude and longitude at the four corners of each selected cell) for the sites to be sampled during each of the proposed cruises in 2011 and 2012 are given in Appendix I (spring 2011 [Appendix Ia], fall 2011 [Appendix Ib], spring 2012 [Appendix Ic], and fall 2012 [Appendix Id]).

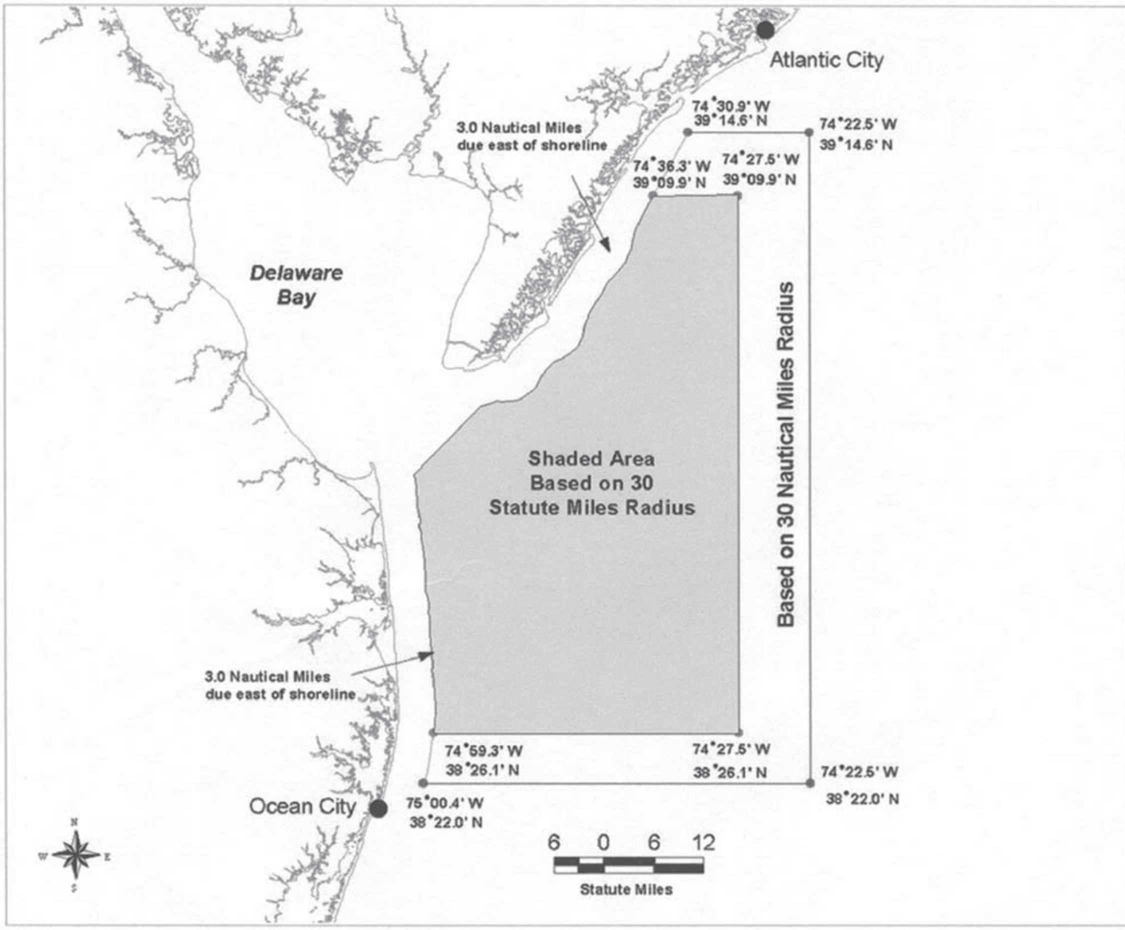
Some of these research tows will occur in the Dr. Carl N. Shuster, Jr. Horseshoe Crab Reserve (Figure 2), which encompasses almost 1,500 square miles and is located in Federal waters adjacent to Delaware Bay (ASMFC 2004). Within this reserve, the retention of horseshoe crabs (*Limulus polyphemus*) is prohibited. Approximately 20 stations will be sampled in the reserve during the spring 2011 cruise, and 18 will be sampled during the 2011 fall survey (different numbers to be sampled within the reserve during each cruise as a result of random selection of sampling sites). A total of 18 sites will be sampled within the reserve during the spring 2012 survey, and 19 will be sampled during the fall 2012 cruise. For each of the survey cruises, the majority of the sites are found along the inshore boundary of the reserve because the overlap between the offshore extent of the NEAMAP Survey and the inshore extent of the reserve is relatively minor (Figure 2, Appendices Ia-Id). If horseshoe crabs are encountered, they will be measured and returned to the water immediately. Refer to Section 5.1.1 for more details.

<u>Timeframe</u>

Surveys are conducted twice per year, once in the spring and once in the fall. For the proposed study, each spring survey would occur over about a 30-day consecutive period beginning approximately in mid-April and would likely coincide with substantial south-to-north and offshore-to-inshore migrations of marine fishes along the U.S. Atlantic Coast. Therefore, the proposed spring surveys would begin by sampling the southernmost stations and work generally northward. While exact dates are difficult to provide at this time (November 2010) as schedules may shift due to weather and/or mechanical issues with the vessel, start dates of 18 April 2011 and 16 April 2012 are tentatively scheduled.

Similarly, each fall survey also would be conducted over about a 30-day consecutive period. It is anticipated that each cruise would begin in mid-September, likely coinciding with north-to-south and inshore-to-offshore migrations of marine fishes along the U.S. Atlantic Coast. Thus, the fall surveys would be conducted starting in the northeast region of the survey area (i.e., Rhode Island Sound) and progress generally southward. Again, the exact dates for the fall surveys are difficult to provide as the cruises may need to be shifted either earlier or later by days to a week due to weather (e.g., hurricanes) and or boat issues (e.g., mechanical problems). Nevertheless, start dates of 19 September 2011 and 17 September 2012 are tentatively scheduled.

Figure 2. Geographical extent of the Dr. Carl N. Shuster, Jr. Horseshoe Crab Reserve. Source: Walls et al. (2002)



Methods

A single vessel, to be determined through an annual contract, would be used to perform the survey. All fishing operations would be conducted during daylight hours. Each tow would be 20 minutes in duration with a target tow speed of approximately 3.1 knots.

Examination of the present NEFSC survey strata revealed that the major divisions among survey areas (i.e., latitudinal divisions from New Jersey to the south; longitudinal divisions off Long Island and in Block Island Sound and Rhode Island Sound) generally correspond well with major estuarine outflows. These boundary definitions were therefore adopted by the proposed study. The NEAMAP survey area along the coast is bounded by the 10 fm depth contour offshore, which represents the inshore extent of the NEFSC Bottom Trawl Survey, and the 3.3 fm depth contour inshore. As a result, only two depth strata (shallow - 3.3 fm to 6.6 fm, and deep - 6.6 fm to 10 fm) were defined by NEAMAP for this portion of the survey area. For the sounds, the survey area is bounded by the 10 fm and 20 fm contours, and again two depth strata (shallow – 10 fm to 15 fm, and deep – 15 fm to 20 fm) were defined. As mentioned previously, a 1.5 nm x 1.5 nm grid was overlaid on the entire sampling area (i.e., coastal ocean and sounds), each 1.5 nm x 1.5 nm cell represents a potential sampling site, and this yielded 1,958 cells. A total of 150 of these cells are sampled along the coast and in the sounds during each cruise and are selected using a stratified random design. The number of sampling sites allocated to each latitudinal/depth or longitudinal/depth stratum is based on proportional allocation according to the amount of surface area within each stratum. For statistical purposes, a minimum of two stations are allocated to each stratum for each cruise. This scheme results in a sampling intensity of approximately one station per 30 square miles from Montauk to Cape Hatteras as well as in Block Island Sound and Rhode Island Sound.

A number of standard parameters would be recorded at each station, including, but not limited to:

- *station identification parameters* - date, station number, stratum, depth, tidal stage, and current direction
- *tow parameters* - beginning and ending tow location, vessel speed and direction, engine RPMs, and duration of tow
- *gear parameters* - net type code & number, door type code & numbers, warp lengths, trawl door spread, trawl wing spread, and trawl headline height
- *atmospheric and weather data* - air temperature, wind speed & direction, relative humidity, sea state, barometric pressure
- *hydrographic data* - water temperature, salinity, dissolved oxygen, percent dissolved oxygen saturation, and pH

At each sampling site, the catch would be sorted by species. If modal size groups are present within a species (e.g., really large and really small specimens of a species present in a catch), then that species would be sorted by size group as well. Total weight (0.01 kg) would be recorded for each size group of each species, and the individual length measurements (mm) would be recorded for all or a subsample of specimens from each species/size group. Subsampling methodology is described in Appendix II.

Additional information would be collected from a number of priority species (Table 1). These species have been grouped into three categories. Species in the "A" list would be sampled for 'full processing' from every tow in which they are collected. Those from the "B" list would be sampled if time permits following the processing of the "A" list, and those from the "C" list would be sampled after those on the "A" and "B" lists have been processed. A subsample of five specimens of each size class of each of these priority species would be taken for 'full processing' at each sampling site. The data collected from each of these subsampled specimens would include length (mm), weight (0.001 kg), and macroscopic sex and maturity stage (mature, immature, unknown) determination. Eviscerated weight (0.001 kg) would also be recorded to facilitate the calculation of condition indices. The stomach of each specimen would be removed, and those containing prey would be preserved onboard. These samples would be processed post-cruise at VIMS. Empty stomachs would be noted and discarded at sea. Otoliths (or other appropriate ageing structures) would also be removed from each of these specimens for age determination.

All extraneous materials (mud, detritus, etc.) sampled in the trawl net would be identified and categorized on a relative abundance scale.

The data resulting from the survey would be extensive. Within weeks of the conclusion of each cruise, the set of available data summaries for each species or subset of species (as appropriate) collected during that cruise would include:

- Biomass estimates, expressed in a variety of possible units including, but not limited to, biomass per area swept, minimum trawlable biomass in the total survey area, biomass per standard tow or per standard tow-minute.
- Abundance estimates, expressed in a variety of possible units including, but not limited to, number per area swept, minimum trawlable number in the total survey area, and number per standard tow or per standard tow-minute.
- Distribution maps, prepared using Geographic Information System programs, showing relative abundance distribution over the survey area.
- Length distribution graphs (by geographic region, by sex, etc.).
- Length-weight relationships (by geographic region, by sex, etc.).
- Length-at-maturity analyses by sex.
- Sex ratios.

Table 1. Priority species to be sampled for complete processing.

Priority Species	
A LIST	
Atlantic Cod	*Gadus morhua*
Black Sea Bass	*Centropristis striata*
Bluefish	*Pomatomus saltatrix*
Haddock	*Melanogrammus aeglefinus*
Pollock	*Pollachius virens*
Scup	*Stenotomus chrysops*
Striped Bass	*Morone saxatilis*
Summer Flounder	*Paralychthys dentatus*
Weakfish	*Cynoscion regalis*
Winter Founder	*Pseudopleuronectes americanus*
B LIST	
American Shad	*Alosa sapidissima*
Atlantic Menhaden	*Brevoortia tyrannus*
Atlantic Croaker	*Micropogonias undulatus*
Spot	*Leiostomus xanthurus*
Monkfish	*Lophius americanus*
Yellowtail Flounder	*Limanda ferruginea*
Smooth Dogfish	*Mustelus canis*
Spiny Dogfish	*Squalus acanthias*
Skate and Ray Species	
C LIST	
Alewife	*Alosa pseudoharengus*
Atlantic Herring	*Clupea harengus*
Blueback Herring	*Alosa aestivalis*
Atlantic Mackerel	*Scomber scombrus*
Black Drum	*Pogonias cromis*
Red Drum	*Sciaenops ocellatus*
Speckled Trout	*Cynoscion nebulosus*

Within six months of the conclusion of a given cruise, age and stomach analyses associated with that cruise would be completed, allowing the production of an additional set of data summaries for each species or subset of species (as appropriate), including:

- Age distribution graphs and associated catch curves
- Growth curves
- Maturity proportions by age class
- Diet composition, expressed as percent by weight and by number, and percent frequency of occurrence.

Note that sample size issues (i.e., small sample size) may preclude the generation of some of these analyses for some species.

Survey gear

All specimens would be collected using a 77-foot (headrope length), four-seam, three-bridle bottom trawl (400 x 12cm fishing circle). This net has a 2.4" stretch mesh in the body, a 4.8" stretch mesh in the wings, and a 1" stretch mesh cod end liner. A full net design description, along with technical design plans, is given (Appendix III). Note that only the "cookie" (or "flat") sweep is used by NEAMAP. No modifications to the gear are expected prior to the 2011 or 2012 NEAMAP cruises. In the event of a change, however, the National Marine Fisheries Service (NMFS), Northeast Regional Office (NERO) would be informed and the analyses in this document may need to be supplemented, accordingly.

The survey gear that the NEAMAP Near Shore Trawl Survey has used in the past and plans to use for the 2011-2012 period was developed by the joint Mid-Atlantic/New England Fishery Management Council Trawl Survey Advisory Panel for use by the NEFSC Bottom Trawl Survey when sampling from the *Bigelow*. By using this gear, comparability between the NEAMAP Near Shore Trawl Survey and the NEFSC Bottom Trawl Surveys is possible. Theoretically, only relative fishing power (i.e., differences between survey vessels) and minor differences in trawl rigging remain as gear-related variables that may affect catch rates between these surveys.

Species expected to be harvested and/or discarded

The biological diversity documented by the survey would likely be great. It is difficult to predict the precise species that would be captured during the 2011 & 2012 survey operations, as a myriad of variables affect catch compositions and amounts. The species composition observed during recent NEFSC Spring Bottom Trawl Surveys and that documented from the 2009 & 2010 spring NEAMAP cruises may be similar to that expected for the 2011 & 2012 spring surveys of the proposed study. Therefore, principal species captured by weight during trawls for three consecutive spring seasons from the NEFSC (Table 2a) as well as the 2009 (Table 2b) and 2010 (Table 2c) spring NEAMAP catches are provided for comparative purposes. Additional information related to the NEFSC surveys is available at http://www.nefsc.noaa.gov/esb/Resource_Survey_Reports.htm. With respect to the species diversity expected during the fall 2011 and fall 2012 surveys, principal species captured by weight on NEFSC Bottom Trawl Survey cruises are provided for three consecutive fall seasons (Table 3a), and catch compositions from the fall 2009 (Table 3b) and fall 2010 (Table 3c) NEAMAP surveys are also given for comparisons.

Again, a subset of these species would be subject to the complete processing procedure described above (Table 1). All other fishes would be enumerated, and the individual length of each of the specimens, or an appreciable subsample, would be measured. Aggregate weights would be recorded at each sampling site by species/size class.

With respect to invertebrates, those of management interest (i.e., blue crab [*Callinectes sapidus*], horseshoe crab, American lobster [*Homarus americanus*], long-finned squid [*Loligo pealeii*], and short-finned squid [*Illex illecbrosus*]) would be enumerated, measured, weighed, and examined for sex determination. Aggregate weight and individual length measurements would be recorded for the southern commercial shrimps (i.e., brown [*Penaeus aztecus*], pink [*P. duorarum*], and white shrimp [*P. setiferus*]). Also, at a minimum, the presence and aggregate weight (recorded by species) of the other invertebrates would be recorded for each tow. For many of these species, individual length measurements would also be taken.

Since information for all fish and invertebrate species collected would be recorded, no species captured would be considered as incidental, with the exception of Federally-listed protected species.

3.2 Alternative 2 (No Action Alternative)

This alternative is required by the NEPA. The no action alternative would mean that the NEAMAP research cruises would not be conducted. Data provided by the surveys would not be collected to support the scientific and management purposes as outlined in Section 2.0. Instead, scientists and managers would need to rely on other data sources for the inshore waters of the Mid-Atlantic Bight and Southern New England, such as fishery-dependent data (i.e., harvest data) and the few existing state-supported, fishery-independent data collection surveys.

Table 2a. Catch and effort values for some of the predominant fish and invertebrate species captured during three consecutive years of the NEFSC Spring Bottom Trawl Survey (Cape Hatteras to Gulf of Maine). Derived from NEFSC (2008a; 2009a; 2010).

Species	**Catch weights (kilograms)**		
AMERICAN LOBSTER	570	1169	961
AMERICAN PLACE	289	530	598
ATLANTIC COD	1648	2821	2463
ATLANTIC HERRING	595	3993	5125
ATLANTIC MACKEREL	1705	2078	1829
BLACK SEA BASS	11	57	488
BUTTERFISH	349	952	3417
GOOSEFISH	181	1242	927
HADDOCK	3447	3195	3618
LITTLE SKATE	5496	6669	9616
LONG-FINNED SQUID	378	1197	867
POLLOCK	684	371	194
REDFISH	2486	4614	2603
SCUP	140	371	2418
SILVER HAKE	424	4092	5631
SPINY DOGFISH	27616	38977	62109
SUMMER FLOUNDER	162	571	986
WHITE HAKE	328	1002	1114
WINDOWPANE	99	169	242
WINTER FLOUNDER	772	845	1049
WINTER SKATE	2101	8368	6126
WITCH FLOUNDER	86	268	237
YELLOWTAIL FLOUNDER	459	1231	1537
# of stations sampled	**344**	**437**	**403**
temporal extent of survey	**Mar 6 - May 1, 2008**	**Feb 27 - May 9, 2009**	**Feb 27 - May 3, 2010**

Table 2b. Total biomass collected, by species, during the spring 2009 NEAMAP Near Shore Trawl Survey cruise. This survey was conducted between 21 April and 15 May, 2009, and 160 sites were sampled during this cruise.

COMMON NAME	CATCH WEIGHTS (KG)
Alewife	232.969
American lobster	89.853
American sand lance	0.004
American shad	33.217
Atlantic brief squid	0.109
Atlantic cod	2.288
Atlantic croaker	1004.283
Atlantic cutlassfish	0.904
Atlantic herring	196.530
Atlantic mackerel	4.556
Atlantic menhaden	786.014
Atlantic rock crab	35.201
Atlantic thread herring	0.046
Banded drum	3.085
Banded gunnel	0.048
Bay anchovy	145.917
Black seabass	67.463
Blackcheek tonguefish	1.459
Blue crab	1.908
Blueback herring	160.280
Bluefish	91.204
Bluntnose stingray	490.750
Brown shrimp	0.092
Bullnose ray	42.500
Butterfish	816.467
Channeled whelk	1.940
Clearnose skate	3382.138
Common spider crab	47.526
Cownose ray	11.410
Cunner	4.468
Etropus spp.	0.270
Fawn cusk-eel	0.168
Fourspot flounder	23.315
Goosefish	70.954
Gulf Stream flounder	0.110
Harvestfish	1.100
Hickory shad	0.248
Hogchoker	5.266
Horseshoe crab	2702.063
Jonah crab	2.450
Kingfish	207.755
Knobbed whelk	2.327
Lady crab	0.267

Leucoraja spp.	594.364
Little skate	12463.583
Long-finned squid	501.625
Longhorn sculpin	23.517
Mantis shrimp	0.075
Moon snail	5.720
Northern puffer	16.705
Northern searobin	13.401
Short-finned squid	0.557
Northern stargazer	6.845
Ocean pout	59.779
Pigfish	2.434
Pinfish	0.171
Quahog clam	1.700
Red hake	27.712
Round herring	0.554
Scup	2820.124
Sea raven	9.783
Sea scallop	4.959
Silver hake	105.665
Silver perch	41.096
Smallmouth flounder	0.069
Smooth butterfly ray	4.540
Smooth dogfish	2741.449
Southern stingray	2.480
Spiny dogfish	3562.660
Spot	824.862
Spotted hake	116.738
Striped anchovy	1.480
Striped bass	388.935
Striped searobin	332.017
Summer flounder	518.255
Tautog	30.988
Weakfish	339.293
White shrimp	0.743
Windowpane	268.210
Winter flounder	628.235
Winter skate	6843.009
Yellowtail flounder	21.267

Table 2c. Total biomass collected, by species, during the spring 2010 NEAMAP Near Shore Trawl Survey cruise. This survey was conducted between 22 April and 15 May, 2010, and 150 sites were sampled during this cruise.

COMMON NAME	CATCH WEIGHTS (KG)
Alewife	209.708
American lobster	24.035
American sand lance	0.090
American shad	43.795
Atlantic brief squid	1.625
Atlantic croaker	1656.180
Atlantic cutlassfish	183.257
Atlantic herring	103.376
Atlantic mackerel	5.398
Atlantic menhaden	446.114
Atlantic rock crab	8.419
Atlantic sturgeon	209.580
Atlantic surfclam	0.292
Banded drum	0.637
Bay anchovy	175.642
Black seabass	54.688
Blackcheek tonguefish	0.069
Blue crab	0.350
Blueback herring	86.622
Bluefish	21.445
Bluntnose stingray	183.515
Bullnose ray	1.550
Butterfish	2136.207
Channeled whelk	2.457
Clearnose skate	2516.422
Common spider crab	15.237
Cunner	0.835
Fawn cusk-eel	0.143
Fourspot flounder	23.133
Goosefish	37.377
Harvestfish	0.638
Hickory shad	25.749
Hogchoker	2.206
Horseshoe crab	1220.697
Kingfishes	1230.882
Knobbed whelk	10.406
Lady crab	4.683
Little skate	4262.212
Loggerhead turtle	*No weight

Longfin inshore squid	316.162
Longhorn sculpin	29.130
Moon snail	5.030
Northern puffer	6.154
Northern sand lance	0.012
Northern searobin	8.194
Northern shortfin squid	0.330
Northern stargazer	13.860
Ocean pout	44.010
Pigfish	126.809
Pink shrimp	0.002
Pollock	0.040
Red hake	24.856
Rough scad	0.010
Roughtail stingray	3.894
Sand dollar	1.845
Sand shrimp	1.086
Sand tiger shark	14.800
Sandbar shark	7.260
Scup	928.520
Sea raven	8.919
Sea scallop	12.422
Sheepshead	16.700
Silver hake	155.252
Silver perch	58.848
Silver seatrout	0.750
Six spine spider crab	1.398
Smallmouth flounder	0.050
Smooth butterfly ray	4.704
Smooth dogfish	1232.603
Spiny dogfish	804.131
Spot	822.140
Spotted hake	67.179
Striped anchovy	0.121
Striped bass	143.178
Striped searobin	21.391
Summer flounder	386.757
Tautog	15.630
Thresher shark	220.000
Weakfish	864.900
Windowpane	237.072
Winter flounder	574.658
Winter skate	3985.636
Yellowtail flounder	19.329

Table 3a. Catch and effort values for some of the predominant fish and invertebrate species captured during three consecutive years of the NEFSC Fall Bottom Trawl Survey (Cape Hatteras to Gulf of Maine). Derived from NEFSC (2007; 2008b; 2009b). Data from 2010 were not available at the time when this document was prepared and were therefore excluded from this table.

Species	**Catch weights (kilograms)**		
ATLANTIC COD	420	854	2540
HADDOCK	6862	3088	4390
POLLOCK	185	288	49
WHITE HAKE	521	509	959
SILVER HAKE	711	799	4354
REDFISH	2976	3344	6014
GOOSEFISH	180	146	835
SPINY DOGFISH	32930	20288	19219
YELLOWTAIL FLOUNDER	828	671	1648
WINTER FLOUNDER	458	820	1552
AMERICAN PLAICE	273	324	375
WITCH FLOUNDER	41	48	180
WINDOWPANE FLOUNDER	62	97	289
SUMMER FLOUNDER	551	405	638
BLUEFISH	311	473	462
WEAKFISH	1201	490	91
SCUP	1665	1237	1858
BLACK SEA BASS	14	48	207
SPOT	1204	1326	4572
CROAKER	5354	3872	1708
BUTTERFISH	613	772	4451
AMERICAN LOBSTER	469	728	1306
LONG-FINNED SQUID	1862	1586	2623
SHORT-FINNED SQUID	555	302	1000
# of stations sampled	**349**	**346**	**381**
temporal extent of survey	**Sept 7 - Nov 1, 2007**	**Sept 3 - Nov 8, 2008**	**Sept 12 - Nov 19, 2009**

Table 3b. Total biomass collected, by species, during the fall 2009 NEAMAP Near Shore Trawl Survey cruise. This survey was conducted between 24 September and 31 October, 2009, and 160 sites were sampled during this cruise.

COMMON NAME	TOTAL WEIGHT (KG)
African pompano	1.015
Alewife	3.922
American eel	0.469
American lobster	29.116
American sand lance	0.035
American shad	3.142
Atlantic angel shark	75.482
Atlantic brief squid	10.043
Atlantic croaker	5685.325
Atlantic cutlassfish	19.959
Atlantic herring	12.400
Atlantic mackerel	0.260
Atlantic menhaden	11.915
Atlantic moonfish	32.963
Atlantic rock crab	2.426
Atlantic sharpnose shark	7.180
Atlantic spadefish	0.160
Atlantic stingray	1.740
Atlantic sturgeon	200.960
Atlantic surfclam	0.525
Atlantic thread herring	0.588
Atlantic threadfin	0.015
Atlantic torpedo	123.900
Banded drum	5.136
Banded rudderfish	0.550
Bay anchovy	194.338
Bigeye scad	1.645
Black drum	8.504
Black seabass	94.463
Blackcheek tonguefish	7.250
Blue crab	2.095
Blue runner	1.310
Blueback herring	0.642
Bluefish	910.688
Bluespotted cornetfish	0.135
Bluntnose stingray	3.095
Brown shrimp	0.880
Bullnose ray	78.537
Butterfish	8677.548

Clearnose skate	1352.117
Common spider crab	4.830
Cownose ray	66.470
Crevalle jack	0.174
Fawn cusk-eel	1.000
Fourspot flounder	15.165
Goosefish	0.630
Gray triggerfish	4.875
Great white shark	42.000
Green sea turtle	*No weight
Gulf Stream flounder	0.845
Harvestfish	34.823
Hogchoker	51.501
Horseshoe crab	2164.444
Inshore lizardfish	4.055
Jonah crab	1.250
Kemp's ridley sea turtle	*No weight
Kingfishes	888.922
Knobbed whelk	2.305
Lady crab	3.701
Etropus flounders	0.269
Little skate	4964.388
Longfin inshore squid	3406.394
Lookdown	0.317
Mantis shrimp	0.490
Northern puffer	22.778
Northern searobin	28.495
Northern sennet	10.895
Northern stargazer	19.715
Pigfish	30.814
Pinfish	0.095
Planehead filefish	0.075
Purple sea urchin	0.160
Quahog clam	0.485
Red drum	73.452
Red goatfish	0.015
Red hake	7.749
Rough scad	9.213
Roughtail stingray	57.910
Round herring	0.844
Round scad	6.105
Sand tiger shark	139.400
Sandbar shark	10.753
Scup	2577.783

Sea raven	3.265
Sea scallop	30.035
Sheepshead	10.720
Short bigeye	0.053
Silver anchovy	0.130
Silver hake	17.302
Silver perch	542.150
Silver seatrout	0.145
Six spine spider crab	0.585
Smallmouth flounder	0.461
Smooth butterfly ray	132.200
Smooth dogfish	843.490
Southern stingray	9.065
Spanish mackerel	3.893
Spanish sardine	0.155
Spiny butterfly ray	414.310
Spiny dogfish	1749.982
Spot	592.972
Spotfin butterflyfish	0.008
Spotted hake	343.502
Spotted seatrout	3.320
Striped anchovy	113.371
Striped bass	1523.675
Striped burrfish	8.244
Striped cusk-eel	0.220
Striped searobin	243.580
Summer flounder	545.790
Tautog	42.994
Thresher shark	190.250
Weakfish	5556.935
White mullet	0.020
White shrimp	6.643
Windowpane	211.184
Winter flounder	127.415
Winter skate	4040.342
Yellowtail flounder	0.214

Table 3c. Total biomass collected, by species, during the fall 2010 NEAMAP Near Shore Trawl Survey cruise. This survey was conducted between 21 September and 25 October, 2010, and 150 sites were sampled during this cruise.

COMMON NAME	TOTAL WEIGHT (KG)
Alewife	13.745
American eel	0.162
American lobster	19.371
American sand lance	0.280
American shad	1.121
Atlantic angel shark	99.895
Atlantic brief squid	46.125
Atlantic bumper	0.815
Atlantic croaker	5715.050
Atlantic cutlassfish	28.542
Atlantic herring	34.495
Atlantic mackerel	0.082
Atlantic menhaden	29.291
Atlantic moonfish	65.503
Atlantic rock crab	1.230
Atlantic sharpnose shark	25.470
Atlantic spadefish	20.181
Atlantic stingray	3.010
Atlantic sturgeon	225.800
Atlantic thread herring	17.155
Atlantic torpedo	21.160
Banded drum	16.501
Bay anchovy	124.664
Bigeye	0.055
Bigeye scad	0.055
Black drum	2.258
Black seabass	42.775
Blackcheek tonguefish	0.150
Blue crab	1.929
Blue mussel	0.448
Blue runner	3.021
Blueback herring	0.563
Bluefish	271.638
Bluespotted cornetfish	0.115
Bluntnose stingray	292.259
Brown shrimp	8.596
Bullnose ray	853.852
Butterfish	4957.310
Cannonball jelly	95.686

Cero	1.160
Channeled whelk	0.795
Clearnose skate	1056.730
Common spider crab	4.226
Cownose ray	2627.848
Crevalle jack	0.470
Fawn cusk-eel	0.375
Fourbeard rockling	0.503
Fourspot flounder	8.922
Gulf Stream flounder	0.012
Harvestfish	47.707
Hogchoker	14.594
Horseshoe crab	862.169
Inshore lizardfish	11.872
Jonah crab	0.345
Kemp's ridley sea turtle	*No weight
Kingfishes	2479.425
Knobbed whelk	0.804
Lady crab	1.383
Etropus flounders	0.192
Little skate	3739.090
Loggerhead turtle	*No weight
Longfin inshore squid	962.836
Lookdown	1.023
Mantis shrimp	0.040
Moon jelly	13.295
Moon snail	0.525
Northern puffer	16.081
Northern searobin	12.714
Northern sennet	6.752
Northern stargazer	16.462
Orange filefish	0.495
Permit	0.335
Pigfish	38.688
Pinfish	3.686
Purple sea urchin	0.065
Quahog clam	12.357
Red drum	78.670
Red goatfish	0.015
Red hake	1.178
Rough scad	9.702
Roughtail stingray	246.150
Round herring	9.203
Round scad	7.911

Sand dollar	0.015
Sand tiger shark	407.150
Sandbar shark	202.160
Scup	3959.235
Sea raven	2.020
Sheepshead	66.302
Silver anchovy	1.749
Silver hake	18.167
Silver perch	573.886
Six spine spider crab	0.460
Smallmouth flounder	0.054
Smooth butterfly ray	581.395
Smooth dogfish	691.148
Southern stingray	18.485
Spanish mackerel	9.591
Spanish sardine	0.158
Spiny butterfly ray	1080.680
Spiny dogfish	11.736
Spot	5060.007
Spotfin mojarra	1.157
Spotted hake	442.559
Spotted seatrout	0.378
Striped anchovy	849.830
Striped bass	2853.223
Striped burrfish	12.969
Striped cusk-eel	0.485
Striped searobin	74.918
Summer flounder	400.096
Tautog	24.348
Thresher shark	120.400
Weakfish	5795.707
White mullet	1.120
White shrimp	87.170
Windowpane	172.902
Winter flounder	72.304
Winter skate	2169.606

4.0 AFFECTED ENVIRONMENT

This section contains information on the various ecosystem components impacted by the proposed action and the no action alternative. A description of the protected species that could potentially be affected is also included.

4.1 Biological Environment/Fisheries Resources

There are thousands of species of finfish, elasmobranchs, and invertebrates that occur within the area sampled by the NEAMAP Near Shore Trawl Survey. During the two-and-a-half years that this program has been in operation, over 160 species have been collected and identified. A list of these species is provided (Appendix IV). The data have been sorted by total weight of individuals caught.

The NMFS and the New England and Mid-Atlantic Fishery Management Councils manage the following stocks/species in the Northeast region through thirteen Fishery Management Plans (FMPs): Atlantic Sea Scallop; Northeast Multispecies; Northeast Skate; Atlantic Herring; Red Crab; Monkfish; Spiny Dogfish; Summer Flounder, Scup and Black Sea Bass; Atlantic Bluefish; Atlantic Surf Clam and Ocean Quahog; Atlantic Mackerel, Squid (*Illex* and *Loligo*), and Butterfish; Tilefish; and Atlantic Salmon. The species managed under the Northeast Multispecies FMP include: Atlantic cod (*Gadus morhua*), witch flounder (*Glyptocephalus cynoglossus*), American plaice (*Hippoglossoides platessoides*), yellowtail flounder (*Pleuronectes ferruginea*), ocean pout (*Macrozoarces americanus*), Atlantic haddock (*Melanogrammus aeglefinus*), silver hake (*Merluccius bilinearis*), pollock (*Pollachius virens*), winter flounder (*Pleuronectes americanus*), windowpane flounder (*Scophthalmus aquosus*), redfish (*Sebastes faciatus*), red hake (*Urophycis chuss*), white hake (*Urophycis tenuis*), Atlantic halibut (*Hippoglossus hippoglossus*), and offshore hake (*Merluccius albidus*).

The ASMFC also manages a number of species, namely: American eel (*Anguilla rostrata*), American lobster, American shad (*Alosa sapidissima*), Atlantic croaker (*Micropogonias undulatus*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic sturgeon (*Ancipenser oxyrinchus*), horseshoe crab, northern shrimp (*Pandalus borealis*), red drum (*Sciaenops ocellatus*), river herrings, Spanish mackerel (*Scomberomorus maculatus*), spot (*Leiostomus xanthurus*), spotted seatrout (*Cynoscion nebulosus*), striped bass (*Morone saxatilis*), tautog (*Tautoga onitis*), and weakfish (*Cynoscion regalis*). The Commission manages black sea bass (*Centropristis striata*), bluefish (*Pomatomus saltatrix*), coastal sharks, scup (*Stenotomus chrysops*), spiny dogfish (*Squalus acanthias*), summer flounder (*Paralichthys dentatus*), and winter flounder in conjunction with NMFS.

Overfished is defined as “stock size that is below a prescribed biomass threshold,” whereas overfishing is defined as “harvesting at a rate above a prescribed fishing mortality threshold” (NMFS 2005). According to the NMFS Annual Report to Congress on the Status of U.S. Fisheries for 2009 (available at http://www.nmfs.noaa.gov/sfa/sfweb) regarding FMPs in the Northeast region, “8 [of the above] stocks are subject to overfishing, 17 stocks are overfished, and no stocks are approaching an overfished condition" (Table 4; NMFS 2010). Although it is unknown if non-groundfish commercial stocks such as horseshoe crab and American lobster stocks are overfished, the presence of overfishing is indicated for lobster (ASMFC 2010).

For the purposes of this EA, a brief life history of 52 species that are Federally or state- (i.e., ASMFC) managed and that have been or could potentially be (based on known distribution) captured by the NEAMAP survey are presented. Species synopses are also provided for 17 non-managed species due to significant past catch (by weight) by this bottom trawl survey.

The following species descriptions are presented in alphabetical order within each category (i.e., managed & non-managed). Several of these life history summaries are taken directly from an EA submitted by the NEFSC (NEFSC 2008c). More detailed information about these species can be obtained at: http://www.nefsc.noaa.gov/sos/.

Life History Summaries – Managed Species

American Eel: American eels, *Anguilla rostrata*, are distributed in the Atlantic Ocean from Greenland to Brazil. Along the Atlantic coast of the U.S., eels between Maine and Florida are considered part of a single management unit. American eels are members of the family *Anguillidae* and are closely related to the European eel, *Anguilla anguilla*. Both species spawn in the Sargasso Sea, a warm water area in the middle of the North Atlantic between the Azores and West Indies. American eel larvae spend 9 to 12 months as leptocephali during which time they are transported by the Gulf Stream into coastal U.S. waters. At approximately 6 cm in length, the larvae develop into the first juvenile phase, called glass eels, and migrate into coastal estuaries. As the glass eels grow and become pigmented, they develop into elvers. Elvers may migrate upstream to freshwater or remain in marine estuaries but subsequently develop into sexually immature adults, known as yellow eels. Yellow eels remain in this stage of maturity for as few as 3 or as many as 20-plus years.

Maturity appears to be a function of size rather than age, therefore faster growing individuals mature earlier. Maximum size is approximately 130 cm for females but only 60 cm for males. Although American eels were classified as the only catadromous species in North America, the species is now considered to exhibit facultative catadromy as individuals move into freshwater systems only under favorable conditions. The freshwater distribution of eels is influenced by sex as males tend to remain in estuaries while females migrate upriver. Upon reaching maturity, eels migrate out of the freshwater or estuary systems and return to the Sargasso Sea to spawn. Prior to their long ocean return migration to the spawning grounds, eels undergo significant physical changes, such as enlargement of the eyes and pectoral fins, changes in visual pigmentation and changes in body coloration (to what is known as the silver phase). Additionally, eels cease feeding and the gut begins to degenerate. Although spawning has never been observed, eels are believed to die after spawning.

American Lobster: The American lobster, *Homarus americanus*, is distributed in the northwest Atlantic from Labrador to Cape Hatteras, from coastal waters out to depths of 700 m. Lobsters are locally abundant in coastal regions within the Gulf of Maine as well as in Southern New England. Coastal lobsters are concentrated in rocky areas where shelter is readily available, although occasional high densities occur in mud substrates suitable for burrowing. Offshore populations are most abundant along the continental shelf edge in the vicinity of submarine canyons. Lobsters exhibit a complex life cycle in which mating occurs following molting of the female. Eggs (7,000 to 80,000) are extruded and carried under the female's abdomen during a 9 to 11 month incubation period. The eggs hatch during late spring or early summer and the pelagic larvae undergo 4 molts before attaining adult characteristics and settling to the bottom. Lobsters molt approximately 20 times (over a 5 to 8 year period) before reaching minimum legal size.

Tagging experiments in coastal waters suggest that small lobsters undertake rather limited movement, although larger individuals may travel extensively. In contrast, offshore lobsters show well-defined shoalward migrations during the spring, regularly 80 km, and often as much as 300 km. Lateral movements along the shelf edge occur as well. For assessment purposes, based on differences in biological attributes and exploitation patterns, 3 stock areas are recognized: Gulf of Maine, George's Bank and Southern New England. The NEAMAP Near Shore Trawl Survey frequently collects American lobster. Catches are typically concentrated in Block Island and Rhode Island Sounds, and specimens range in size between 3 cm and 11 cm (carapace length).

American Plaice: The American plaice or dab**,** *Hippoglossoides platessoides*, is a large mouthed, "right- handed" flounder, distributed along the northwest Atlantic continental shelf from southern Labrador to Rhode Island in relatively deep waters. Off the U.S. coast, American plaice are managed as a single stock in the Gulf of Maine/George's Bank region. The greatest commercial concentrations exist between 90 m and 182 m. Maturation begins between ages 2 and 3, but most individuals do not reach sexual maturity until age 4. Spawning occurs in spring, generally during March through May. Growth is rather slow; 3 year old fish are normally between 22 cm and 28 cm in length, and weigh between 90 g and 190 g. After age 4, females grow faster than males. American plaice from George's Bank have faster growth at age than fish from the Gulf of Maine.

American Shad: American shad, *Alosa sapidissima*, is an anadromous species distributed along the Atlantic coast from southern Labrador to northern Florida. An introduced stock occurs along the Pacific coast. American shad undergo extensive seasonal migrations, moving into rivers for spawning beginning in January in southern rivers, and continuing until July in the northernmost portion of their range. After spawning, shad migrate north along the coast to Canada where they feed during the summer. A southward migration occurs later along the continental shelf where the fish overwinter prior to spring spawning migrations to their natal rivers.

Life history patterns of shad vary depending on the latitudinal location of their natal rivers. Most shad remain in the ocean for 4 years before returning for their first spawn, although the mean age at first spawning is age 5 for the more northern fish. Fecundity also changes with latitude, ranging from 300,000 to 400,000 eggs per mature female in southern rivers and decreasing to 125,000 for fish in northern rivers. After spawning, American shad north of Cape Hatteras move offshore to feed and overwinter and may return to their natal rivers to spawn in several subsequent years; however, southern members of the species usually die after spawning.

Atlantic Cod: The Atlantic cod, *Gadus morhua*, is a demersal gadoid species found on both sides of the north Atlantic. In the northwest Atlantic, cod occur from Greenland to North Carolina. In U.S. waters, cod are assessed and managed as two stocks: Gulf of Maine, and George's Bank and Southward. Both stocks support important commercial and recreational fisheries. Commercial fisheries are conducted year round, primarily with otter trawls and gill nets. Recreational fishing also occurs year round; peak activity occurs during the late summer in the lower Gulf of Maine and during late autumn to early spring from Massachusetts southward.

Cod may attain lengths of up to 130 cm and weights of 25 kg to 35 kg. Maximum age is in excess of 20 years, although young fish (ages 2 to 5) generally constitute the bulk of the catch. Sexual maturity is attained between ages 2 to 4; spawning occurs during winter and early spring.

Cod are omnivorous, feeding on a variety of invertebrates and fish species. Growth rates differ between the stocks although each is exploited by the same gear types with similar selection characteristics. Cod growth in the Gulf of Maine has historically been slower than on George's Bank, but appears to have increased in recent years. Differences in growth rate by sex have also become less pronounced in both stocks.

Atlantic Croaker: The Atlantic croaker, *Micropogonias undulates*, is a demersal, shallow water member of the drum family, *Sciaenidae*. They range from the Gulf of Mexico north to Massachusetts. They are one of the most abundant inshore bottom-dwelling fish along the U.S. Atlantic coast, and large recreational and commercial fisheries exist for this species. From North Carolina to the northern extent of their range, Atlantic croaker are found from the littoral zone in open beaches and embayments out to approximately 50 m depth, with the center of abundance around 20 m, based on NEFSC spring and fall trawl surveys. Atlantic croaker have been recorded to reach as much as 66 cm standard length, but are usually much smaller, averaging around 24 cm in the northern part of their range according to NEFSC trawl survey data. Atlantic croaker collected by NEAMAP have ranged from 7cm to 44 cm. Croaker reach maturity at an approximate average size of 18 cm, with all fish over 25 cm being sexually mature. In the northern part of their range, croaker spawn in the fall, and congregations of mature fish may be found in open water at this time of year, away from their normal shoreline habitat. Croaker have been aged to a maximum of 18 years. Croaker migrate south during the colder months and based on trawl survey data are usually absent from the northern extent of their Mid-Atlantic range in winter and early spring.

Atlantic Haddock: The Atlantic haddock, *Melanogrammus aeglefinus,* is a commercially-exploited groundfish found in the northwest and northeast Atlantic Ocean. This demersal gadoid species is distributed from Cape May, New Jersey, to the Strait of Belle Isle, Newfoundland, in the northwest Atlantic, where a total of six distinct haddock stocks have been identified. Two of these haddock stocks are found in U.S. waters: George's Bank and Gulf of Maine. The George's Bank stock is found in the shallow productive waters of George's Bank while the Gulf of Maine stock inhabits waters of the southwestern Gulf of Maine. Both stocks support important commercial fisheries. Commercial fishing for haddock occurs year round in U.S. waters. Otter trawl fishing gear produces the majority of haddock landings, while the remainder of the catch is taken with longlines or gill nets. Recreational catches are relatively minor and amount to roughly 1-2% of commercial catches in recent years. Most of the recreational haddock catch is taken with hook and line gear in the Gulf of Maine region during spring to late-autumn.

Adult haddock range in length from 30 cm up to a maximum size of about 1 m. The largest haddock captured in U.S. waters weighed 13.6 kg. The oldest recorded haddock in the U.S. waters was a 17 year old fish captured during a 1980 NEFSC research survey. Most of the U.S. commercial haddock catch is comprised of age 3 to 7 year old fish weighing between 1 and 3 kg. Haddock reach sexual maturity between ages 1 and 4. In recent years, the median age of maturity for females has been 1.8 years. Haddock spawning occurs from January to June, and peaks during February to early-April on George's Bank, the main spawning area. Haddock are primarily an offshore groundfish and are commonly found at depths of 40 m to 150 m. Adult haddock can be found at temperatures of 0° C to 13° C but generally prefer temperatures of 2° C to 9° C. Juvenile haddock tend to occupy shallower water on bank and shoal areas, while large adults are more commonly found in deeper water. Adult haddock under-take seasonal movements in the Western Gulf of Maine, the Great South Channel and on the northeast peak of George's Bank, spending much of winter in deeper waters and moving to shoaler waters in spring to spawn.

Adult haddock are benthic feeders. They have a diverse diet that includes gastropod and bivalve mollusks, polychaete worms, amphipods, crabs, shrimps, sea stars, sea urchins, sand dollars, brittle stars, and occasional fish eggs. Adult haddock will sometimes consume small fishes, especially herring. Pelagic larvae and small juvenile haddock feed on phytoplankton, copepods, and invertebrate eggs in the upper part of the water column. Juvenile haddock eat small crustaceans, primarily copepods and euphausiids, as well as polychaetes and small fishes. Juveniles make a transition from pelagic to demersal habitat at ages from 3 to 5 months. Juvenile haddock are eaten by elasmobranchs (spiny dogfish and skates) and many groundfish species (cod, pollock, cusk, white hake, red hake, silver hake, goosefish, halibut, and sea raven). Gray seals also prey on haddock.

Growth rates of haddock have fluctuated over the past 50 years. During the 1960s, an age-4 haddock averaged 48 cm to 50 cm. During the 1980s and 1990s when stock sizes were lower, size at age increased and an age-3 fish averaged about 48 cm to 50 cm in length. In recent years growth rates have slowed, with haddock reaching 48 cm to 50 cm at age 4. On George's Bank, haddock growth appears to be density-dependent, with reductions in mean lengths at age across age classes as stock size has increased in recent years. Commercial fishery mean weights at age of George's Bank haddock during 2001-2004 were below their long-term average for all age classes, with decreases ranging from 7% to 44%.

Haddock maturation rates have also changed through time. During the early 1960s, all females of age 4 and older were sexually mature and 75% of age-3 females were mature. Size at maturity of George's Bank haddock has declined in recent years. For example, median length of maturity for females was about 40 cm during 1977-1983, but declined to about 34-36 cm in the early 1990s. Since 1998, virtually all age-3 females and 50% of age-2 females are mature. Although earlier maturation will increase spawning stock biomass, the actual reproductive success of first-spawning haddock has not been documented.

Haddock are highly fecund broadcast spawners that spawn over rock, gravel, sand, or mud bottom. An average-sized female (55 cm) produces approximately 850,000 eggs. Larger females are capable of producing up to 3 million eggs annually. Haddock spawning is concentrated on the northeast peak of George's Bank. The western edge of George's Bank also supports a smaller spawning concentration. The two spawning components are persistent and exhibit phenotypic differences in otolith morphometrics. Spawning concentrations also occurred historically along the Maine coast. Females release eggs near the ocean bottom in batches where they are fertilized by a courting male. After fertilization, haddock eggs become buoyant and rise to the surface water layer where they drift with ocean currents. Juvenile haddock are pelagic for 3-5 months after hatching and settle to the bottom at a size of roughly 10 cm.

Atlantic Halibut: The Atlantic halibut, *Hippoglossus hippoglossus***,** is the largest species of flatfish found in the northwest Atlantic Ocean. This long-lived, late-maturing flatfish is distributed from Labrador to Southern New England. In the Gulf of Maine/George's Bank region, halibut supported important commercial fisheries from the early-1800s to the 1880s. The population was heavily overfished in the 19th and early 20th centuries and has not recovered. There is currently no directed fishery for Atlantic halibut within Federal waters of the U.S. Exclusive Economic Zone (EEZ), although some small-scale harvests occur within state waters off of Maine. Virtually all landings from the Gulf of Maine/George's Bank stock region occur as bycatch in U.S. or Canadian groundfish fisheries.

Adult Atlantic halibut range in length from 80 cm to 220 cm in the Gulf of Maine/George's Bank region. The largest halibut reported captured in U.S. waters was 280 kg dressed weight (headed and gutted) and was captured 88 km off Cape Ann. Females typically grow faster and achieve greater sizes than males. Maximum age is reported to be 50 years. Most of the U.S. bycatch of Atlantic halibut consists of age-5 to age-10 fish weighing between 20 kg to 40 kg. Atlantic halibut reach sexual maturity between 5 to 15 years and the median female age of maturity in the Gulf of Maine/George's Bank region is about 7 years. There have been no reports of Atlantic halibut spawning in the Gulf of Maine/George's Bank region in recent years. In general, Atlantic halibut spawn once per year in synchronous groups during late winter through early spring. Females can produce up to 7 million eggs per year depending on size. Spawning is believed to occur in waters of the upper continental slope at depths of 200 m or greater.

Atlantic Herring: The Atlantic herring, *Clupea harengus*, is widely distributed in continental shelf waters of the northwest Atlantic, from Labrador to Cape Hatteras. Important commercial fisheries for juvenile herring (ages 1 to 3) exist along the coasts of Maine and New Brunswick. Development of large-scale fisheries for adult herring is comparatively recent, primarily occurring in the Western Gulf of Maine, on George's Bank, and on the Scotian Shelf. Gulf of Maine herring migrate from summer feeding grounds along the Maine coast and on George's Bank to Southern New England and Mid-Atlantic areas during winter, with larger individuals tending to migrate farther distances. Tagging experiments provide evidence of intermixing of Gulf of Maine, George's Bank, and Scotian Shelf herring during different phases of the annual migration.

Spawning in the Gulf of Maine occurs during late August-October, beginning in northern locations and progressing southward. Atlantic herring are not fully mature until age 4. Age at maturity varies annually and appears to change in response to density dependent effects. Herring eggs are demersal and are typically deposited on gravel substrates. Primary spawning locations off the northeastern U.S. are located on the Maine coast, Jeffreys Ledge, Nantucket Shoals, and George's Bank. Incubation is temperature dependent, but usually occurs for 7 to 10 days. Larvae metamorphose by late spring into juvenile brit herring that may form large aggregations in coastal waters during summer. By age 2, juvenile herring are fully vulnerable to fixed and mobile gear coastal fisheries.

In the past, the herring resource along the East Coast of the U.S. was divided into the Gulf of Maine and George's Bank stocks. There is currently no genetic evidence to suggest that these two components are separate stocks. However, morphometric analyses suggest that discernable phenotypic differences exist among herring from the Gulf of Maine, George's Bank, and the Scotian shelf. Even so, fishery-independent measures of abundance for herring include fish originating from all spawning areas. As a consequence, herring from the Gulf of Maine and George's Bank components are combined for assessment purposes into a single coastal stock complex. This approach has many advantages over the separate stock approach, but also poses a number of technical and management challenges, particularly for the management of the smaller inshore component.

Atlantic Mackerel: Atlantic mackerel, *Scomber scombrus*, is a fast swimming, pelagic, schooling species distributed in the northwest Atlantic between Labrador and North Carolina. There are two major spawning components in the population: a southern group that spawns primarily in the Mid-Atlantic Bight during April and May, and a northern group that spawns in the Gulf of St. Lawrence in June and July. Both groups winter between Sable Island (off Nova Scotia) and Cape Hatteras in waters generally warmer than 7° C, with extensive northerly (spring) and southerly (autumn) migrations to and from spawning and summering grounds. The two groups are managed as a unit stock. Sexual maturity begins at age 2 and is usually complete by age 3. Maximum age is about 20 years. The NEAMAP Survey has collected these mackerel, primarily in the spring, in Block Island Sound, Rhode Island Sound, and off of the southern shore of eastern Long Island. Specimens collected to date range from 7 cm to 36 cm.

Atlantic Menhaden: The Atlantic menhaden, *Brevoortia tyrannus*, is a coastal pelagic schooling fish of the herring family, *Clupeidae*. Atlantic menhaden range from Nova Scotia to Florida. Adult menhaden average 20 cm to 30 cm in length, reaching a maximum known length of 47 cm. Menhaden are distinct among saltwater fishes along the U.S. East Coast in that it is capable of filter feeding phytoplankton and thus represent a direct piscine link to primary production. Menhaden are usually found in extremely tight schools that may range in size from a few hundred individuals to vast shoals covering acres. They exhibit seasonal north-south migrations, generally moving north and inshore in summer and south and to deeper in the winter.

Mature menhaden spawn over a broad geographic and temporal range, probably every month of the year but varying with locale. Spawning occurs both offshore on the continental shelf and near major sounds and bays. The eggs are buoyant and both eggs and larvae depend on Ekman transport and tidal current to reach coastal estuaries where the young develop. Atlantic menhaden are not long-lived, reaching about 8 years of age with a maximum record of 12. Reproductive maturity begins at about 2 years and by age 3 all are fully mature. Menhaden are an extremely important fish both recreationally and commercially. Commercially, they are not eaten directly by humans but processed into fishmeal and oil. Additionally, they are captured for bait for other fisheries. Recreationally, they are used for bait for many different gamefishes. They are also a vital component to the ecosystem by serving as a major food source to multiple species; menhaden are heavily preyed upon by many different fishes, sea birds, and marine mammals. Due to their tight schooling patterns and high position in the water column, menhaden have not been well represented in the NEAMAP Near Shore Trawl Survey.

Atlantic Salmon: The Atlantic salmon, *Salmo salar*, is a highly prized game and food fish native to New England rivers. The historic North American range of Atlantic salmon extended from the rivers of Ungava Bay, Canada, to rivers of Long Island Sound. As a consequence of industrial and agricultural development, most populations native to New England were extirpated. Remnant native populations of Atlantic salmon in the U.S. now persist only in Maine. Restoration and rehabilitation efforts, in the form of stocking and fish passage construction, are underway in the Connecticut, Pawcatuck, Merrimack, Saco, Kennebec, Penobscot, and eastern Maine rivers of New England.

Atlantic salmon life history is extremely complex owing to its use of both freshwater and marine habitats and long ocean migrations. Atlantic salmon spawn in freshwater during fall. Eggs remain in gravel substrates and hatch during winter, and fry emerge from the gravel in spring. Juvenile salmon, commonly called parr, remain in freshwater 1 to 3 years in New England rivers, depending on growth. When parr grow to sufficient size

(>13 cm) they develop into smolts and migrate to the ocean in spring. Tagging data for New England stocks indicate that U.S. salmon migrate as far north as Greenland.

After the first winter at sea for U.S. salmon (the fish are now referred to as 1 sea-winter or 1SW salmon), a small portion (~ 10%) of the cohort, typically males, become sexually mature and return to natal rivers to spawn. Those remaining at sea feed in the coastal waters of West Greenland and Canada (off the Newfoundland and Labrador coasts). Historically, it has been in these foraging areas that commercial northwest Atlantic gillnet fisheries for salmon occurred. After their second winter at sea, most U.S. salmon return home to spawn. Three sea-winter and repeat-spawning salmon life history patterns also occur in New England populations but have become rare (< 5%) with declining stock size.

Significant declines in abundance of Atlantic salmon populations in the U.S. prompted an endangered listing of the species under the Endangered Species Act (ESA). The ESA of 1973 was amended in 1978 to define a species as "...any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." A Distinct Population Segment (DPS) is a subgroup of a vertebrate species that is treated as a species for purposes of listing under the ESA. It is required that the subgroup be separable from the remainder of and significant to the species to which it belongs.

The strong homing capability of Atlantic salmon fosters the formation and maintenance of local breeding groups resulting in intra-specific sub-structuring. Stocks from a given area exhibit heritable adaptations to local riverine ecosystems. The importance of maintaining these local adaptations has been demonstrated in Atlantic salmon. Assessing DPS structure requires broad scale consideration of geologic and climatic features that shape population structure through natural selection. For Atlantic salmon, factors such as climate, soil type, and hydrology are particularly important because these factors influence ecosystem structure and function including transfer of energy in aquatic food chains. Numerous ecological classification systems were examined, which integrate the many factors necessary to perform such a DPS analysis. Biologists have delineated U.S. Atlantic salmon populations into 3 discrete DPSs for the purpose of management: 1) Long Island Sound DPS; 2) Central New England DPS; and the 3) Gulf of Maine DPS. Both the Long Island Sound and Central New England DPS were extirpated in the 1800s. Atlantic salmon stocks from the Penobscot River in Maine were used in the restoration programs in the Connecticut (Long Island Sound DPS) and in the Merrimack and Saco Rivers (Central New England DPS).

Atlantic Sea Scallops: Atlantic sea scallops, *Placopecten magellanicus,* are distributed in the northwest Atlantic Ocean from Newfoundland to North Carolina, mainly on sand and gravel sediments where bottom temperatures remain below 20° C. North of Cape Cod, concentrations generally occur in shallower waters (< 40 m deep). South of Cape Cod and on George's Bank, sea scallops typically occur at depths between 25 m and 200 m, with commercial concentrations generally between 35 and 100 m.

Sea scallops are filter feeders, feeding primarily on phytoplankton, but also on microzooplankton and detritus. Sea scallops grow rapidly during the first several years of life. Between ages 3 and 5, they commonly increase 50 % to 80% in shell height and quadruple their meat weight. During this time span, the number of meats per pound is reduced from greater than 100 to about 23. The largest observed size is about 23 cm shell height, but sea scallops rarely grow larger than 17 cm shell height. Sea scallops have been known to live more than 20 years. They usually become sexually mature at age 2, but individuals younger than age 4 probably contribute little to total egg production. Sexes are separate and fertilization is external. Spawning usually occurs in late summer and early autumn; spring spawning may also occur, especially in the Mid-Atlantic Bight. Sea scallops are highly fecund; a single large female can release hundreds of millions of eggs annually. Larvae remain in the water column for 4 to 7 weeks before settling to the bottom. Sea scallops attain commercial size at about 4 to 5 years old, though historically, 3 year-olds were often exploited.

Atlantic Sharpnose Shark: The Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, is a relatively small (to ~ 1 m), pelagic shark of the family *Carcharhinidae*, or requiem sharks. In the U.S., sharpnose sharks are found from Maine to Florida, but documented encounters north of North Carolina/Virginia are relatively rare. On NEAMAP, sharpnose sharks have been caught exclusively in the coastal waters of these two states, and all collections have occurred during the autumn surveys. They have ranged in size on the NEAMAP survey from 39 cm to 84 cm (pre-caudal length). Atlantic sharpnose sharks are managed in the U.S. by the NMFS Highly Migratory Species Management Division and the ASMFC.

Atlantic Sturgeon / Shortnose Sturgeon: The Atlantic sturgeon, *Acipenser oxyrhynchus*, and the shortnose sturgeon, *Acipenser brevirostrum*, are demersal, anadromous species distributed along the Atlantic coast of North America. Both species occur between Florida and New Brunswick, but the distribution of the Atlantic sturgeon extends further north to Labrador. Both species migrate from the marine environment to freshwater to spawn during late winter-early summer, with these migrations occurring later in the year at higher latitudes. In regions where the species co-occur, shortnose sturgeons (an endangered species), tend to begin their migration earlier than the Atlantic sturgeon. Spawning generally occurs in the lower sections of rivers, below the fall line. Eggs are deposited on hard surfaces on the bottom where they adhere for 4 to 6 days until hatching. Juvenile sturgeons remain in freshwater for their first summer before migrating to estuaries in winter. Juveniles remain in the freshwater-estuary system for 3 to 5 years before migrating to the near-shore marine environment as adults. Migration into the marine environment has only recently been documented for the shortnose sturgeon.

Tagging studies indicate that Atlantic sturgeons migrate extensively in the marine environment; fish tagged in the Hudson and Delaware Rivers have been recaptured as far north as coastal Maine and south to North Carolina. Sturgeons from southern systems have more restricted marine migrations, remaining closer to their natal rivers.

Sturgeons are considered to be among the most primitive bony fishes, with origins dating back 120 million years. Sturgeons are characterized by 5 rows of bony plates or scutes along the back rather than scales and have prominent barbels under their snout used as sensory organs. Juveniles and adults of both species are benthic (or bottom) feeders, consuming a variety of crustaceans, bivalves, worms, plants, and occasionally small fish. Shortnose are smaller than Atlantic sturgeons and may attain maximum sizes of approximately 100 cm and 23 kg, whereas Atlantic sturgeons reach maximum sizes of 430 cm and 363 kg. Both species are long lived, potentially reaching ages in excess of 60 years for females and about 30 for males. Maturity occurs in female shortnose sturgeons between the ages of 7 and 15, with maturity at younger ages at the southern end of the distributional range. Atlantic sturgeons exhibit a similar latitudinal pattern in female age at maturity, with southern fish maturing between ages 7 and 19, compared to sturgeon in the St. Lawrence River, Canada, reaching maturity in 27 to 29 years. Both species are highly fecund, with total egg production increasing proportional to body size; individual fish spawning once every 3 to 5 years.

There have been a total of 77 Atlantic sturgeon (0 shortnose sturgeon) caught during the 1060 tows conducted by the NEAMAP Bottom Trawl Survey between fall 2007 and fall 2010. There have been no sturgeon fatalities. These fish are the first of the fishes to be removed from the catch, and subsequently are carefully handled, measured, weighed, tagged and quickly returned to the water.

Atlantic Surf Clams: Atlantic surf clams, *Spisula solidissima*, are distributed along the western north Atlantic Ocean from the southern Gulf of St. Lawrence to Cape Hatteras. Commercial concentrations are found primarily off New Jersey, the Delmarva Peninsula, and on George's Bank. In the Mid-Atlantic region, surf clams are found from the inter-tidal zone to a depth of about 60 m but densities are low at depths greater than 40 m. Surf clams occur in both state (≤ 3 miles from shore) and Federal waters (i.e. the EEZ, between 3 and 200 miles from shore).

Maximum size is about 22.5 cm shell length, but surf clams larger than 20 cm are rare. Maximum age exceeds 30 years, and surf clams 15-20 years of age are common in many areas.

Surf clams are capable of reproduction in their first year of life, although full maturity may not be reached until the second year. Eggs and sperm are shed directly into the water column. Recruitment to the bottom occurs after a planktonic larval period of about 3 weeks.

Barndoor Skate: Barndoor skate, *Dipturus laevis***,** is a large-bodied species of the family *Rajidae* that reaches sizes of 150 cm and ages of more than 10. Males reach sexual maturity at age 6, at a size of 108 cm, while females attain maturity at age 6.5 and 116 cm. The center of distribution for barndoor skates is George's Bank and Southern New England, with some animals occasionally found in the Gulf of Maine and on the Scotian Shelf.

To date, NEAMAP has collected five barndoor skate. All were taken in Rhode Island Sound, and specimens ranged in size from 20 cm to 37 cm (disk width).

Black Sea Bass: Black sea bass, *Centropristis striata*, are distributed in the northwest Atlantic from Maine to Florida, with Cape Hatteras serving as a geographic boundary between northern and southern stocks. Sea bass are members of the family *Serranidae*, which includes groupers commonly found in tropical and sub-tropical waters. Structures such as reefs, wrecks and oyster beds are preferred habitats. Black sea bass may attain sizes up to 60 cm and 3.6 kg with maximum age of 10-12 years. Sexual maturity is attained between ages 2 and 4 for females. Black sea bass are protogynous hermaphrodites, meaning that they change sex from female to male. Born as females, most fish will change sex to males between ages 2 and 5. The factors that lead to the sex change have not been proven although it has been speculated that the relative scarcity of males in a spawning group may be the stimulus for a female to switch sex. Spawning in the northern stock generally occurs from April to June after fish have migrated into coastal habitats.

Males develop a pronounced blue hump on their heads during spawning season and aggressively defend territory, although actual spawning behavior is not well documented. Larvae and juveniles develop and grow in inshore habitats and juveniles attain lengths of 10 cm to14 cm by fall. Sea bass remain in coastal habitats until water temperatures decrease in fall into early winter, and then migrate to deeper offshore water along the edge of the continental shelf. In the spring, most fish return to the same area that was vacated the previous fall. Juvenile sea bass experience little if any growth throughout the winter. Adult black sea bass are omnivorous, feeding on a variety of benthic invertebrates, squid and fish.

Bluefish: The bluefish, *Pomatomus saltatrix*, is a migratory, pelagic species found throughout the world in most temperate coastal regions, except the eastern Pacific. Bluefish may reach ages of 12 years and sizes in excess of 100 cm and 14 kg. Along the U.S. Atlantic coast, bluefish are found from Maine to Florida and mix extensively during seasonal coastal migrations. During winter, large bluefish tend to remain in the Mid-Atlantic Bight, moving south to North Carolina by March. Small fish move farther south in winter with some fish wintering off the coast of Florida. As water temperatures increase, the spring migration north begins and spawning occurs in the South Atlantic Bight at this time. By summer, bluefish move north into the Mid-Atlantic Bight, although some medium size fish may remain off Florida. A second spawning occurs in the offshore waters of the Mid-Atlantic Bight during summer.

The result of these two spawning events is the appearance of two distinct size groups of juvenile bluefish during autumn; a spring spawned cohort consisting of fish about 15 cm to 25 cm in length and a summer spawned cohort consisting of fish about 4 cm to14 cm in length. Fish from the two spawning cohorts mix extensively during the year and constitute a single genetic stock. Bluefish are voracious predators, feeding primarily on squid and fish, particularly menhaden and smaller fish such as silversides and anchovies.

The NEAMAP Survey typically has collected large numbers of bluefish during both spring and fall cruises. These fish have been encountered throughout the survey area and have ranged in size from 7 cm to 75 cm.

Butterfish: The butterfish, *Peprilus triacanthus*, is a small, bony food fish with a thin oval body and weighing up to 0.5 kg,. Butterfish are short-lived and grow rapidly. Few live to more than 3 years, and most are sexually mature at age 1. Butterfish range from Florida to Newfoundland, but are primarily found from Cape Hatteras to the Gulf of Maine where the population is considered to be a unit stock.

Butterfish migrate in response to seasonal changes in water temperature. During summer, butterfish move northward and inshore to feed and spawn. Spawning occurs during June to August, and peaks progressively later at higher latitudes. During winter, butterfish move southward and offshore to avoid cool waters. Butterfish are primarily pelagic, and form loose schools that feed upon small fish, squid, and crustaceans. Butterfish have a high natural mortality rate and are preyed upon by many species including silver hake, bluefish, swordfish, and long-finned squid. During summer, juvenile butterfish associate with jellyfish to avoid predators.

Butterfish are one of the most common species collected by the NEAMAP Survey, throughout the sampling range. Specimens collected to date have ranged between 2 cm and 22 cm.

Clearnose Skate: Clearnose skate**,** *Raja eglanteria***,** is a moderately-sized (up to 90 cm) member of the family *Rajidae*, and live to be around 8 years old. Size at first maturity is 56 cm for males and 66 cm to 73 cm for females. Clearnose skates are a southern species, occurring primarily in the inshore waters of the Mid-Atlantic and Southern New England regions. Indeed, within the NEAMAP survey area, the largest collections of this species are concentrated in the more southern portion of the program's range. Clearnose collected by NEAMAP have ranged from 12 cm to 60 cm (disk width).

Goosefish: Goosefish, *Lophius americanus*, also called monkfish, are distributed in the northwest Atlantic from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras. Goosefish may be found from inshore areas to depths of at least 900 m. Seasonal onshore/ offshore migrations occur and appear to be related to spawning and possibly food availability.

Goosefish rest partially buried on soft bottom substrates and attract prey using a modified first dorsal fin ray that resembles a fishing pole and lure. Goosefish are piscivorous and commonly eat prey as large as themselves. Growth is rapid at about 10 cm per year, and is similar for both sexes up to age 6 and lengths of around 60 cm. Few males are found older than age 7, but females can live to 12-14 years or older. Goosefish as large as 138 cm have been captured in NEFSC Bottom Trawl Surveys, and as large as 100 cm have been sampled by NEAMAP.

Female goosefish begin to mature at age 4, and 50% of females are mature by age 5 (~ 43 cm). Males mature at slightly younger ages and smaller sizes (50% maturity at age 4 [~36 cm]). Spawning takes place from spring through early autumn, progressing from south to north, with most spawning occurring during the spring and early summer. Females lay a buoyant mucoid egg raft or veil which can be as large as 12 m long and 1.5 m wide and only a few mm thick. The eggs are arranged in a single layer in the veil, and the larvae hatch after 1-3 weeks, depending on water temperature. The larvae and juveniles spend several months in a pelagic phase before settling to a benthic existence at a size of about 8 cm.

Genetic studies have revealed a genetically homogeneous population of goosefish off the U.S. East Coast and survey information indicates little or no difference in growth and maturation rates between goosefish from southern and northern management regions. However, because of differences in how the fisheries in these two regions are prosecuted, goosefish are managed separately as two “stocks”: the "northern stock" (Gulf of Maine and northern George’s Bank) and the "southern stock" (southern George’s Bank/Mid-Atlantic).

Horseshoe crab: The horseshoe crab, *Limulus polyphemus*, is an arthropod of the class *Merostomata*. Horseshoe crabs are found on the U.S. East Coast from the Gulf of Maine to the Gulf of Mexico. They are vulnerable to a bottom trawl, and may be caught throughout the entire survey region, although they are most commonly encountered south of Long Island. Horseshoe crabs are encountered on the NEAMAP survey most often near the mouths of New York Harbor, Delaware Bay, and Chesapeake Bay. A commercial fishery exists for horseshoe crabs.

Little Skate: Little skate, *Leucoraja erinacea*, is the second smallest skate species of the family *Rajidae*, reaching sizes around 54 cm, and maximum ages between 8 and 12 years. Size at first maturity is reached at 39 cm for males and 40 cm to 42 cm for females. Little skate are found in all areas, but are primarily located on George’s Bank and in Southern New England. Little skate is the most abundant skate species collected by NEAMAP, and specimens ranging from 11 cm to 50 cm (disk width) have been sampled.

Long-Finned Squid: Long-finned squid, *Loligo pealeii*, are distributed primarily in continental shelf waters located between Newfoundland and the Gulf of Venezuela. In the northwest Atlantic Ocean, these squid are most abundant in the waters between George’s Bank and Cape Hatteras, where the species is commercially exploited. The stock area extends from the Gulf of Maine to Cape Hatteras. Distribution varies seasonally. North of Cape Hatteras, squid migrate offshore during late autumn to overwinter in warmer waters along the shelf edge and slope, and then return inshore during the spring where they remain until late autumn. Bottom trawl survey catches of *L. pealeii* are affected by water temperature, time-of-day, and depth, and the effects vary by body size. Long-finned squid live for about nine months, grow rapidly, and spawn year-round, with peaks during late spring and autumn. Individuals hatched in summer grow more rapidly than those hatched in winter and males grow faster and attain larger sizes than females.

Like the butterfish, long-finned squid are one of the most common species collected by the NEAMAP Survey, throughout the sampling range. Specimens collected to date have ranged between 1 cm and 29 cm (mantle length).

Ocean Pout: The ocean pout, *Macrozoarces americanus*, is a demersal eel-like species found in the northwest Atlantic from Labrador to Delaware. In U.S. waters, ocean pout are assessed as a unit stock from Gulf of Maine/Cape Cod Bay south to Delaware.

Stock identification studies suggest the existence of two stocks: one occupying the Bay of Fundy/northern Gulf of Maine region east of Cape Elizabeth, and a second stock ranging from Gulf of Maine/Cape Cod Bay south to Delaware. The southern stock is characterized by faster growth rates, and to date has supported the commercial fishery.

Ocean pout may attain lengths up to 98 cm and weights of 5.3 kg. Ocean pout prefer depths of 15 m to 80 m and temperatures of 6° to 7° C. Tagging studies and NEFSC Bottom Trawl Survey data indicate that ocean pout do not undertake extensive migrations, but rather move seasonally to different substrates. During this period, ocean pout are not available to commercial fishing operations. Typically, catches increase when adults return to their feeding grounds in late autumn and winter. The diet consists primarily of invertebrates, with fish being only a minor component. Median length at maturity for females was 26.2 cm and 31.3 cm for the Gulf of Maine area and Southern New England area, respectively, with a possible three-year egg development period. Past studies have indicated that ocean pout eggs are internally fertilized.

Ocean pout have been collected by the NEAMAP Survey in the past. Catches have been concentrated in Block Island Sound and Rhode Island Sound, and individuals have ranged in size from 24 cm to 71 cm.

Ocean Quahog: The ocean quahog, *Arctica islandica*, is a bivalve mollusk distributed in temperate and boreal waters on both sides of the north Atlantic Ocean. In the northwest Atlantic, quahogs occur from Newfoundland to Cape Hatteras. In U.S. waters, they are managed as a single stock.

Ocean quahogs are found at depths from 8 m to 400 m. Further north, they occur closer to shore. The U.S. stock resource is almost entirely within the EEZ, outside of state waters, and at depths between 20 m and 80 m. The notable exception is fishable concentrations in state waters off the coast of Maine. Ocean quahogs are rarely found where bottom water temperatures exceed 16° C. They burrow in a variety of substrates and are often associated with fine sand.

Ocean quahogs are among the longest lived, slowest growing marine organisms in the world. Off Southern New England, in the Mid-Atlantic Bight, and on George's Bank, they can live to at least 200 years. In the EEZ, they are relatively large and old, with most individuals, 7 cm -11 cm shell length. Growth is slower after about age 20, which is also about the age at which many individuals become vulnerable to fishing. Growth is faster on George's Bank and off Maine, although ocean quahogs in Maine waters are seldom larger than 7 cm.

Size and age at sexual maturity are variable and poorly known. Based on studies in Icelandic waters, 10%, 50% and 90% of female ocean quahogs were sexually mature at 4.0, 6.4, and 8.8 cm shell length, or approximately 2, 19, and 61 years of age. Spawning occurs over a protracted interval from summer through autumn. Free-floating larvae may drift far from their spawning location because they develop slowly and are planktonic for more than 30 days before settling. Major recruitment events appear to be separated by periods of decades.

Pollock: Pollock, *Pollachius virens*, occur on both sides of the North Atlantic; in the northwest Atlantic, the species is most abundant on the western Scotian Shelf and in the Gulf of Maine. One major spawning area exists in the Western Gulf of Maine and on George's Bank, and several areas have been identified on the Scotian Shelf. Tagging studies suggest considerable movement of pollock between the Scotian Shelf and George's Bank and, to a lesser extent, between the Scotian Shelf and the Gulf of Maine. Electrophoretic analyses of pollock tissue samples from the Scotian Shelf and Western Gulf of Maine showed no significant differences between areas, although differences in some morphometric and meristic characteristics were significant. Unlike earlier assessments conducted by U.S. scientists, the most recent assessment of this stock was restricted to the area primarily under U.S. management authority.
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Spawning occurs from November through February with a peak in December. Sexual maturation is essentially complete by age 6, although more than 50% of fish are mature before age 3. Juvenile pollock are common in inshore areas, but move offshore as they grow older. Pollock attain lengths up to 110 cm and weights of 16 kg.

Red Drum: The red drum, *Sciaenops ocellatus*, is a large, inshore demersal fish of the family *Sciaenidae*, or drums. They range in the U.S. from New York to the Gulf of Mexico. This species has been encountered in the survey region primarily off of North Carolina, and all specimens collected to date have been taken during fall cruises. Red drum that have been sampled by the bottom trawl survey are typically greater than 81 cm in length and have been recorded as large as 125 cm. While the red drum has only been encountered infrequently on NEAMAP Surveys, this species is heavily targeted by recreational fishers.

Red hake: Red hake, *Urophycis chuss*, is a demersal gadoid species distributed from the Gulf of St. Lawrence to North Carolina, and is most abundant from the Western Gulf of Maine through Southern New England waters. Red hake are separated into northern and southern stocks for management purposes. The northern stock is defined as the Gulf of Maine to northern George's Bank region, while the southern stock is defined as the Southern George's Bank to Mid-Atlantic Bight region. Both red hake stocks were last assessed in the fall of 1990.

Red hake migrate seasonally, preferring temperatures between 5° C and 12° C. During the spring and summer months, red hake move into shallower waters to spawn, and during the winter months move offshore to deep waters in the Gulf of Maine and the edge of the continental shelf along Southern New England and George’s Bank. Spawning occurs from May through November, with primary spawning grounds on the southwest part of George’s Bank and in the Southern New England area off of Montauk, Long Island.

Red hake do not grow as large as white hake, and normally reach a maximum size of 50 cm and 2 kg. However, females are generally larger than males of the same age, and reach a maximum length of 63 cm and a weight of 3.6 kg. Although they generally do not live longer than 8 years, red hake have been recorded up to 14 years old. In the northern stock, the age at 50% maturity is 1.4 years for males and 1.8 years for females, and the size at 50% maturity is 22 cm for males and 27 cm for females. In the southern red hake stock, the age at 50% maturity is 1.8 years for males and 1.7 years for females, and the size at 50% maturity is 24 cm for males and 25 cm for females.

Red hake prefer soft sand or muddy bottom, and feed primarily on crustaceans such as euphausiids, decapods, and rock crabs, as well as fish such as haddock, silver hake, sea robins, sand lance, mackerel, and small red hake. Primary predators of red hake include spiny dogfish, cod, goosefish, and silver hake. As juveniles, red hake seek shelter from predators in sea scallop beds, and are commonly found in the mantle cavities of (or underneath) sea scallops. In the fall, red hake likely leave the safety of the sea scallop beds due to their increasing size and to seek warmer temperatures in offshore waters.

River Herring: “River herring" is a term applied collectively to alewife, *Alosa pseudoharengus*, and blueback herring, *Alosa aestivalis*. The range of the alewife extends from Labrador to South Carolina, while the range of the blueback herring is from Nova Scotia to Florida. In coastal rivers where the distributions of the two species overlap, the fisheries are typically mixed. Both species are anadromous, migrating upriver to spawn during spring. Alewives can live as long as 10 years and may reach a maximum length of 36 cm. Blueback herring may live for about 7 or 8 years and can reach a maximum size of about 32 cm.

Alewives spawn in spring when water temperatures are between 16° C and 19° C; blueback herring spawn later in spring, when water temperatures are about 5° C warmer. Fecundity and age at maturity for both species are similar. Between 60,000 and 300,000 eggs are produced per female; most individuals are sexually mature at age 4.

Sand Tiger Shark: The sand tiger shark, *Odontaspis taurus*, is a relatively large (to ~ 3.3 m), shark of the family *Odontaspididae*. In the U.S., sand tiger sharks are found from Maine to northern Florida, and have been described as the most common of the coastal sharks between Cape Cod and Chesapeake Bay. On NEAMAP, sand tigers have been caught exclusively in the coastal waters of Virginia and North Carolina; this species has been collected during both spring and fall cruises. They have ranged in size on the

NEAMAP survey from 73 cm to 187 cm (pre-caudal length). These sharks are managed in the U.S. by the NMFS Highly Migratory Species Management Division and the ASMFC.

Sandbar Shark: The sandbar shark, *Carcharhinus plumbeus*, is a moderately-sized (to ~ 2.5 m), shark of the family *Carcharhinidae*, or requiem sharks. In the U.S., sandbar sharks are found from Massachusetts to northern Florida, and typically inhabit waters less than 18 m. On NEAMAP, sandbar sharks have been caught between New Jersey and North Carolina; this species has been collected during both spring and fall cruises. They have ranged in size on the NEAMAP survey from 46 cm to 88 cm (pre-caudal length). These sharks are managed in the U.S. by the NMFS Highly Migratory Species Management Division and the ASMFC.

Scup: Scup or porgy**,** *Stenotomus chrysops***,** is a demersal, schooling species distributed in the Mid-Atlantic Bight from Cape Cod to Cape Hatteras. Previous tagging studies have indicated the possibility of two stocks, one in Southern New England waters and the other extending south from New Jersey. However, the lack of definitive tag return data from these studies, coupled with distributional information from NEFSC and NEAMAP trawl surveys, support the concept of a single unit stock from New England to Cape Hatteras. A relatively new industry-cooperative tagging study for scup, designed to evaluate fish movement and estimate mortality rates, was initiated in 2005.

Scup undertake extensive migrations between coastal waters in summer and offshore waters in winter, migrating north and inshore to spawn in spring. Sexual maturity is essentially complete by age 3 at a total length of 21 cm. Scup attain a maximum fork length of about 40 cm, and ages of up to at least 14 years.

Scup are one of the most abundant species in NEAMAP collections. While these fish are sampled throughout the survey area, the majority of the specimens are collected in the northern part of the sampling range. To date, scup ranging from 3 cm to 43 cm have been collected.

Short-Finned Squid: The short-finned squid, *Illex illecebrosus*, is a highly migratory, transboundary species that is distributed in the northwest Atlantic Ocean from the Florida Straits to Newfoundland. The northern component of the stock, extending from Newfoundland to the southern Scotian Shelf, is assessed annually and managed by the Northwest Atlantic Fisheries Organization (NAFO) based on a total allowable catch (TAC). The southern and U.S. stock component, extending from the Gulf of Maine to Florida, has been managed since 1977 by the Mid-Atlantic Fishery Management Council, based on an annual TAC, under the provisions of the Atlantic Mackerel, Squid, and Butterfish FMP.

Illex illecebrosus live for less than one year, experience high natural mortality rates, and exhibit a protracted spawning season whereby overlapping “microcohorts” enter the population throughout the year over a wide geographic area and exhibit variable growth rates. Age estimation, accomplished by counting daily growth increments in the statoliths, has been validated for *I. illecebrosus*. Back-calculated hatch dates from statolith-based aging studies indicate that spawning occurs throughout most of the year. The only confirmed spawning area is located in the Mid-Atlantic Bight, where the winter cohort spawns during late May. Spawning may also occur offshore in the Gulf Stream/slope water frontal zone, where short-finned squid paralarvae have been collected, and south of Cape Hatteras, during winter, where squid hatchlings have been sampled. The life span of the winter cohort in U.S. waters ranges from 115 to 215 days. The species is semelparous and fishing mortality and spawning mortality occur simultaneously on the U.S. shelf. The species inhabits offshore shelf and slope waters primarily during spring through autumn. Species distribution and abundance are strongly influenced by oceanographic factors. Annual NEFSC survey indices of relative abundance and biomass and average body size suggest that the stock has experienced low and high productivity periods. The information provided herein reflects the results of the most recent peer-reviewed assessment of the U.S. component of the *I. illecebrosus* stock. Catches of *I. illecebrosus* on NEAMAP are relatively low, as this species is concentrated mainly offshore during the sampling periods of this program.

Silver Hake: Silver hake, also known as whiting, *Merluccius bilinearis*, range primarily from Newfoundland to South Carolina. Silver hake are fast swimmers with sharp teeth, and are important predators of fish, crustaceans, and squid. Although they do not swim in definitive schools, silver hake tend to aggregate in large numbers. In U.S. waters, two stocks have been identified based on differences of head and fin lengths, otolith morphometrics, otolith growth differences, and seasonal distribution patterns. The northern silver hake stock inhabits Gulf of Maine/northern George's Bank waters, and the southern stock is found in Southern George's Bank/Mid-Atlantic Bight waters.

As nocturnal, semi-pelagic predators, silver hake move up in the water column to feed at night, primarily between dusk and midnight, and return to rest on the bottom during the day, preferring sandy, muddy, or pebbly substrate.

There is some difference in diet between the two stocks. Northern silver hake primarily feed on euphausiids, Atlantic herring, silver hake, and other fish, while southern silver hake primarily feed on crangon shrimp, squids, cephalopods, and sand lance. Diet varies depending on size, sex, season, migration, spawning, and age. Small silver hake prey on euphausiids, while larger, especially older females prey primarily on fish. Silver hake tend to prey more heavily on fish during the spring and autumn, whereas during the summer months, their diets often include a mixture of fish, crustaceans, and mollusks.

Silver hake migrate in response to seasonal changes in water temperatures, moving toward shallow, warmer waters in the spring. They spawn in these shallow waters during late spring and early summer and then return to deeper waters in the autumn. The older, larger silver hake especially prefer deeper waters. During the summer, portions of both stocks can be found on George's Bank, whereas during the winter, fish in the northern stock move to deep basins in the Gulf of Maine, while fish in the southern stock move to outer continental shelf and slope waters. Silver hake are widely distributed, and have been observed at temperatures ranging from 2° to 17° C and depths from 11 m to 500 m. However, they are most commonly found between 7° C to 10º C.

Female silver hake are serial spawners, producing and releasing up to three batches of eggs in a single spawning season. Major spawning areas include the coastal region of the Gulf of Maine from Cape Cod to Grand Manan Island, southern and southeastern George's Bank, and the Southern New England area south of Martha's Vineyard. Peak spawning occurs earlier in the south (May to June) than in the north (July to August). Over one-half of age-2 fish (20 cm to 30 cm) and virtually all age-3 fish (25 cm to 35 cm) are sexually mature. Silver hake grow to a maximum length of over 70 cm, and ages up to 14 years have been observed in U.S. waters, although few fish older than age-6 have been observed in recent years.

Spanish Mackerel: The Spanish mackerel, *Scomberomorus maculatus*, is a small to medium-sized, coastal pelagic member of the *Scombridae*, or tuna family. They range in the U.S. from the Gulf of Mexico to as far north as Massachusetts. During NEAMAP Bottom Trawl Surveys, they are captured most commonly south of New Jersey; most are collected off of North Carolina. Spanish mackerel may reach up to 77 cm, but are typically encountered on the survey between 8 cm and 49 cm. There are both recreational and commercial fisheries for this species.

Spiny Dogfish: Spiny dogfish, *Squalus acanthias*, are distributed in the western north Atlantic from Labrador to Florida and are considered to be a unit stock in this region. During spring and autumn, spiny dogfish occur in coastal waters between North Carolina and Southern New England. In summer, dogfish migrate northward to the Gulf of Maine/George's Bank region and into Canadian waters, and return southward in autumn and winter. They tend to school by size and, when mature, by sex. Dogfish feed on many species of fish and crustaceans, but generally target the most abundant species. In the northwest Atlantic, maximum reported ages for males and females are 35 and 40 years, respectively. The species bears live young; the gestation period is about 18 to 22 months, and an average of 6 pups is produced (range of 2 to 15 pups). Size at maturity for females is around 80 cm, but can vary from 78 cm to 85 cm depending on the abundance of females.

Spot: The spot, *Leiostomus xanthurus*, is a small, shallow-water demersal species of the family *Sciaenidae*, or drums. They range in the U.S. from the Gulf of Mexico to as far north as Massachusetts, but on the survey are commonly encountered south of New York. Spot are capable of reaching about 34 cm. On the NEAMAP Survey, spot are usually encountered between 8 cm and 25 cm. Spot are very numerous and make up a significant component of the Mid-Atlantic inshore catch in the fall. They are often captured in the same habitats as the Atlantic croaker. Spot make north-south migrations, and in the spring survey period they are found primarily off North Carolina. Spot are both recreationally and commercially fished.

Spotted Sea Trout: The spotted sea trout, *Cynoscion nebulosus*, is a medium to large-sized coastal pelagic fish of the family *Sciaenidae*, or drums. In the U.S., spotted sea trout are found from the Gulf of Mexico to Cape Cod, but are rare north of Delaware Bay. These fish are found in very shallow water and can tolerate low salinities. They are rarely captured on NEAMAP, likely due to the extreme shallow habitat favoured by this species. Spotted sea trout are capable of reaching sizes of up to 90 cm, but on the survey are usually less than 32 cm. They are commercially fished, and are one of the most important recreational fishes, ranking second in catch by weight for U.S. anglers as recently as 1997.

Striped Bass: The striped bass**,** *Morone saxatilis***,** is an anadromous species distributed along the Atlantic coast from northern Florida to the St. Lawrence estuary. They have been successfully introduced in numerous inland lakes and reservoirs and to the Pacific coast, where they now occur from Mexico to British Columbia. The Atlantic coast stocks, which originate in the Chesapeake Bay, Delaware River, and Hudson River, undergo seasonal coastal migrations ranging from North Carolina to Nova Scotia, whereas stocks to the north or south remain within their natal rivers or estuaries. Recreational fishing on the coastal migratory stocks occurs year round, with peak activity occurring during the spring and fall migrations. Commercial fisheries are conducted seasonally, primarily with hook and line and gillnets.

Striped bass may attain lengths of up to 150 cm and weights of 25 kg to 35 kg. Maximum age is in excess of 25 years and sexual maturity is attained between ages 2 to 4 for males and 5 to 8 for females. Spawning occurs in the migratory stocks during April to June as fish move into fresh or brackish water. Water temperatures during spawning may range from 10° C to 23° C; peak spawning activity is observed between 15° C and 20° C. After spawning, most large females leave the estuaries and participate in coastal migrations. Males also leave the spawning grounds but may remain within the estuaries throughout the year. Striped bass are omnivorous, feeding on a variety of invertebrates and fish species, particularly clupeids such as menhaden and river herring.

Summer Flounder: The summer flounder**,** *Paralichthys dentatus,* is a demersal flatfish distributed from the southern Gulf of Maine to South Carolina. Important commercial and recreational fisheries exist from Cape Cod to Cape Hatteras. The resource is managed as a unit stock from North Carolina to Maine. Summer flounder are concentrated in bays and estuaries from late spring through early autumn, when an offshore migration to the outer continental shelf is undertaken. Spawning occurs during autumn and early winter, and the larvae are transported toward coastal areas by prevailing water currents. Development of post larvae and juveniles occurs primarily within bays and estuarine areas, notably Pamlico Sound and Chesapeake Bay. Most fish are sexually mature by age 2. Female summer flounder may live up to 20 years, but males rarely live for more than 10 years. Growth rates differ appreciably between the sexes with females attaining weights up to 11.8 kg.

Tautog: The tautog, *Tautoga onitis*, is one of two northern members of the *Labridae*, or wrasse family, in the U.S. Atlantic. They range in the U.S. from northern South Carolina to the Gulf of Maine, but are most abundant from Cape Cod to Chesapeake Bay. They are not often captured on NEAMAP surveys due to the fact that their preferred habitat is heavy structure. The presence of this species in the catch is usually associated with rocks, sponge, or other similar material collected in the net as well. Tautog are capable of reaching lengths up to 90 cm, but on the surveys have usually been between 8 cm and 49 cm. Tautog are both recreationally and commercially fished.

Thresher Shark: The thresher shark, *Alopias vulpinus*, is a relatively large (to 6 m – including tail), pelagic shark of the family *Alopiidae*. In the U.S., thresher sharks range from Maine to Florida, and typically are found in the waters of Southern New England during the summer. On NEAMAP, thresher sharks have been encountered between the central portion of Long Island and North Carolina; this species has been collected during both spring and fall cruises. They have ranged in size on the NEAMAP survey from 68 cm to 139 cm (pre-caudal length). Thresher sharks are managed in the U.S. by the NMFS Highly Migratory Species Management Division and the ASMFC.

Weakfish: The weakfish, *Cynoscion regalis*, is a medium to large-sized coastal pelagic fish of the family *Sciaenidae*, or drums. In the U.S., weakfish are found from Florida north to Massachusetts, but are most abundant from Virginia to New York. Weakfish are most often encountered on the survey in this geographic range, but have also been collected in the Sounds in the past. Weakfish are capable of reaching lengths greater than 100 cm, but on the survey are usually captured between 6 cm and 60 cm. Weakfish greater than 50 cm are rarely encountered on NEAMAP surveys, and it is unclear whether this phenomenon is due to larger individuals exhibiting trawl avoidance or a decline in the abundance of weakfish of this size. Weakfish can be numerous and are often a significant component of the Mid-Atlantic inshore survey catch. There are both recreational and commercial fisheries for this species.

White Hake: The white hake, *Urophycis tenuis*, occurs from Newfoundland to Southern New England and is common on muddy bottom throughout the Gulf of Maine. Depth distribution of white hake varies by age and season; juveniles typically occupy shallower areas than adults, but individuals of all ages tend to move inshore or shoalward in summer, dispersing to deeper areas in winter. Most trawl catches are taken at depths of 110 m or greater, although hake are taken as shallow as 27 m by gillnetting. Small white hake are difficult to distinguish from red hake, resulting in a small degree of bias in reported nominal catches.

Larval distributions indicate the presence of two spawning groups in the Gulf of Maine, George's Bank and Scotian Shelf region, one which spawns in deep water on the continental slope in late winter and early spring, and a second which spawns on the Scotian Shelf in the summer. Populations in U.S. waters appear to be supported by both spawning events, but individuals are not distinguishable in commercial landings. White hake attain a maximum length of at least 135 cm and weights of up to 21 kg, with females being larger. Ages up to 15 years have been documented. Juveniles feed primarily upon shrimp and other crustaceans, but adults feed almost exclusively on fish, including juveniles of their own species.

Windowpane: Windowpane**,** *Scophthalmus aquosus,* is a thin bodied, left-eyed flatfish species distributed in the northwest Atlantic from the Gulf of St. Lawrence to Florida. Windowpanes prefer sandy bottom habitats and are most abundant from George's Bank to the southern tip of Virginia. Windowpanes occur in bays and estuaries at depths from the shoreline to 60 m. On George's Bank, the species is most abundant on the shoals (depths < 60 m) during late spring through autumn but overwintering occurs in deeper waters out to 366 m.

In U.S. waters, windowpane flounder are assessed and managed as two stocks, Gulf of Maine/George's Bank and Southern New England/Mid-Atlantic based on differences in growth rates, size at maturity, and relative abundance trends.

The median length at maturity is 22.5 cm for females from the northern stock and 21.2 cm for females from the southern stock. The maximum length of windowpane flounder collected in NEFSC Bottom Trawl Surveys during 1963-2004 is 51 cm for the Gulf of Maine/George's Bank stock and 48 cm for the Southern New England/Mid-Atlantic stock. Fish from Southern New England attain a maximum age of about 8 years and females reach maturity between 3 and 4 years of age. With the exception of George's Bank, a split spawning season, with peaks in spring and autumn, occurs in most coastal areas between Virginia and Long Island. Spawning occurs in the southern Mid-Atlantic Bight during April or May and on George's Bank during July and August and then reoccurs in a north to south direction with a second peak in October or November depending on latitude. During the first year of life, spring-spawned fish have significantly faster growth rates than autumn-spawned fish, which may result in differential natural mortality rates between the two cohorts.

Witch Flounder: The witch flounder, *Glyptocephalus cynoglossus*, is a demersal flatfish distributed on both sides of the north Atlantic. In the northwest Atlantic, the species ranges from Labrador southward to Virginia, and is closely associated with mud or sand-mud bottom. In U.S. waters, witch flounder are common throughout the Gulf of Maine and in deeper areas on and adjacent to George's Bank and along the shelf edge as far south as Cape Hatteras. Witch flounder are assessed as a unit stock.

Witch flounder appear to be sedentary, preferring moderately deep areas; few fish are taken shallower than 27 m and most are caught between 110 m and 275 m. The diet of witch flounder consists mostly of polychaete worms. Witch flounder attain lengths up to 78 cm and weights of approximately 2 kg, but are slow-growing, late-maturing, and can live as old as 30 years. Female witch flounder reach maturity between ages 5 and 6; spawning occurs in late spring and summer. The larval period is relatively long, between 6 and 12 months.

Yellowtail Flounder: The yellowtail flounder, *Limanda ferruginea*, is a demersal flatfish distributed from Labrador to Chesapeake Bay generally at depths between 40 m and 70 m. Off the U.S. coast, 3 stocks are considered for management purposes: Cape Cod/Gulf of Maine, George's Bank, and Southern New England/Mid-Atlantic.

Yellowtail flounder have been described as relatively sedentary, although evidence exists for off bottom movements, limited seasonal movements, and transboundary movements.

Spawning occurs during spring and summer, peaking in May. Eggs are deposited on or near the bottom and after fertilization float to the surface. Larvae drift for approximately two months, then change form and settle to the bottom.

Off the northeast U.S., yellowtail flounder grow to 55 cm total length and attain weights of 1.0 kg. Growth is sexually dimorphic, with females growing at a faster rate than males. Yellowtail flounder appear to have variable maturity schedules, with age 2 females 40% mature during periods of high stock biomass to 90% mature during periods of low stock biomass.

Winter Flounder: The winter flounder, blackback, or lemon sole**,** *Psuedopleuronectes americanus*, is a demersal flatfish distributed in the northwest Atlantic from Labrador to Georgia. Important U.S. commercial and recreational fisheries exist from the Gulf of Maine to the Mid-Atlantic Bight. In U.S. waters, the resource is assessed and managed as 3 stocks: Gulf of Maine, Southern New England / Mid-Atlantic Bight, and George's Bank. Winter flounder generally occur in inshore bays and estuaries during the winter, and move to deeper water in the summer. Spawning occurs during the winter and spring months. Growth and maturity vary by stock; George's Bank fish have the fastest growth and reach the largest size, and they reach maturity at the earliest age and smallest size. Gulf of Maine fish grow the slowest and reach the smallest size, and they reach maturity at the oldest age and largest size. Winter flounder may grow up to 58 cm in total length and attain 15-20 years of age.

Winter flounder occur frequently in collections made by the NEAMAP Survey. While this species is sampled in both spring and fall, spring catches have typically been much greater. To date, winter flounder ranging between 8 cm and 49 cm have been collected.

Winter Skate: Winter skate, *Leucoraja ocellata***,** is a large-bodied member of the family *Rajidae*, and can potentially reach sizes of 150 cm and 20 years of age. Sexual maturity is reached at a large size of around 74 cm at about age 12. The center of distribution for winter skate is George's Bank and Southern New England, with some animals occasionally found in the Gulf of Maine, on the Scotian Shelf, and in the Mid-Atlantic. NEAMAP collections of winter skate have typically been greater in the spring than in the fall, and have been concentrated in the more northern portions of the survey area.

Life History Summaries – Non-Managed Species

Atlantic Thread Herring: The Atlantic thread herring, *Opisthonema oglinum*, is a small, coastal, pelagic fish of the family *Clupeidae*. In the U.S., Atlantic thread herring are found from Cape Cod to Florida. These herrings have usually been collected between the Maryland and Cape Hatteras on the NEAMAP Survey; most sampling of this species has occurred in the fall. They range in size on the NEAMAP survey from 4 cm to 24 cm. There are no directed fisheries for this species.

Atlantic Torpedo: The Atlantic torpedo, *Torpedo nobiliana*, is a medium-size electric ray (~2 m disk width) of the family *Torpedinidae*. Atlantic torpedo are found along the U.S. Atlantic coast from Maine to North Carolina. This species has typically been collected in Block Island/Rhode Island Sound and along the eastern portion of Long Island on the NEAMAP Survey. Atlantic torpedo captured on NEAMAP cruises ranged from 45 cm to 132 cm (disc width).

Bay Anchovy: The bay anchovy, *Anchoa mitchilli*, is a small, pelagic, shallow water species of the anchovy family, *Engraulidae*. They range from Maine to the Gulf of Mexico but are most abundant south of New England. This species is found from the littoral zone to depths as great as 70 m, but the NEFSC has documented that peak abundance occurs around 18 m and that beyond 36 m their numbers fall significantly. Bay anchovy usually reach a maximum size of around 7.5 cm, but have been recorded as large as 13 cm by NEAMAP. They are very short-lived and may reach up to 3 years, but few survive to this age. Bay anchovies are heavily preyed upon by other fishes and thus represent an important link in the ecosystem. South of New England they are found in large numbers, and in the south Atlantic and Gulf coasts are reported as having the largest numbers of any estuarine fish. They have only limited commercial use, and recreationally are used only for bait. Due to their small size, they are retained in bottom trawl surveys only through the use of a small-mesh liner. Of the 3 species of anchovy commonly encountered on the NEAMAP Survey, the bay anchovy is the second most abundant.

Bluntnose Stingray: The bluntnose stingray, *Dasyatis say*, is a medium-sized, demersal ray of the family *Dasyatidae*, or whiptail stingrays. Bluntnose stingrays in the U.S. are found from the Gulf of Mexico to New Jersey. On NEAMAP surveys, bluntnose have been encountered primarily in the fall and were typically captured off of the coasts of Virginia and North Carolina. Bluntnose stingrays captured on NEAMAP surveys ranged from 18 cm to 84 cm (disc width), with a fairly wide size distribution. There are no fisheries for this species other than as bycatch, and it can be dangerous to handle. Most individuals were able to be released live.

Bullnose Ray: The bullnose ray, *Myliobatis freminvillei*, is a medium-size ray (~2 m disk width) of the family *Myliobatidae*, the eagle rays. Bullnose rays are found along the U.S. Atlantic coast from Cape Cod to southern Florida. This species has typically been encountered between New Jersey and Cape Hatteras on the NEAMAP Survey; all bullnose collections to date have occurred during fall cruises. Bullnose rays captured on NEAMAP surveys have ranged from 22 cm to 137 cm (disc width).

Cownose Ray: The cownose ray, *Rhinoptera bonasus*, is a medium-size ray (~1 m disk width) of the family *Rhinopteridae*. Cownose rays are found along the Atlantic coast from Southern New England to northern Florida. This species is known to travel in extremely large schools and, on NEAMAP surveys, has typically been encountered between the mouth of the Chesapeake Bay and Cape Hatteras. Cownose rays captured on NEAMAP surveys have ranged from 17 cm to 112 cm (disc width); most individuals were able to be released alive.

Kingfishes: The kingfishes, *Menticirrhus* spp., are small, coastal fishes. Three kingfish species are collected by NEAMAP, namely: northern kingfish (*Menticirrhus saxatilis*), southern kingfish (*M. americanus*), and the gulf kingfish (*M. littoralis*). Because the morphologies of these species are very similar and large quantities of the three are often mixed in collections, the decision was made early in the survey's history to combine these three species at the genus level for quantification purposes. It should be noted that fishery landings of these species are aggregated and reported at the genus level as well.

In the U.S., the southern range of each of these three kingfish species is Florida. Northern kingfish are found as far north as Massachusetts, southern kingfish range to New York, and Virginia serves as a northern boundary for the gulf kingfish. Kingfishes have typically been encountered between New York and Cape Hatteras on NEAMAP and have been collected on both spring and fall surveys; they have ranged in size from 6 cm to 40 cm. The commercial and recreational fisheries for these species are considered to be relatively limited.

Roughtail Stingray: The roughtail stingray, *Dasyatis centroura*, is a large, demersal ray of the family *Dasyatidae*, or whiptail stingrays. Roughtail stingrays in the U.S. are found from the Gulf of Mexico to Cape Cod. On NEAMAP surveys, roughtails have been collected from Delaware to North Carolina, but the largest catches have typically occurred south of Maryland. Roughtail stingrays captured on NEAMAP cruises have ranged from 23 cm to 142 cm (disc width), with a fairly wide size distribution. There are no fisheries for this species other than as bycatch, and it can be dangerous to handle. Large individuals are typically able to be released live on NEAMAP.

Round Herring: The round herring, *Etrumeus teres*, is a small, pelagic, schooling fish of the family *Clupeidae,* or herrings. In the U.S., round herring are found from the Gulf of Mexico to the Gulf of Maine, but are most common south of Cape Cod. Round herring are captured on NEAMAP throughout the sampling area, but largest catches are typically encountered in the northern portion of the survey's range. Round herring collected on NEAMAP cruises range from 9 cm to 18 cm. They can be very numerous when encountered and are an important prey item for many fishes. This species is sometimes used as bait for recreational fishing, but there are no major commercial fisheries for these herring in U.S. waters.

Silver Perch: The silver perch, *Bairdiella chrysoura,* is a relatively small, coastal species of the family *Sciaenidae,* or drums. In the U.S., silver perch are found from New York to southern Florida. On NEAMAP Surveys, silver perch have typically been encountered between Maryland and Cape Hatteras, and have ranged in size from 8 cm to 23 cm. This species is of limited commercial value and, while taken at times, is not typically targeted by recreational fishers.

Smooth Butterfly Ray: The smooth butterfly ray, *Gymnura micrura*, is a medium-sized (~ 1 m), demersal ray of the family *Gymnuridae*. Smooth butterfly rays in the U.S. are found from Southern New England to Florida. On NEAMAP surveys, these rays have been encountered exclusively in the fall and were captured primarily off of the coasts of Virginia and North Carolina. Smooth butterfly rays captured on NEAMAP surveys ranged from 22 cm to 113 cm (disc width). There are no fisheries for this species other than as bycatch; nearly all individuals are able to be released live.

Smooth Dogfish: The smooth dogfish, *Mustelus canis*, is a small, demersal, near-shore species of shark of the family *Mustelidae*, or smoothhounds. In the U.S., smooth dogfish are found from the Gulf of Mexico to the Gulf of Maine, but are most common in the Mid-Atlantic from Cape Cod to Cape Hatteras. Smooth dogfish have been collected by NEAMAP throughout its survey area. They are capable of reaching sizes of up to 150 cm, but most fish sampled by NEAMAP have ranged between 29 cm and 122 cm (pre-caudal length). Smooth dogfish undergo strong seasonal north-south migrations and are more likely to be found offshore during the colder months. NEFSC and NEAMAP trawl survey data show that smooth dogfish feed heavily on decapod crustaceans, including at least 2 species of commercial importance. Both recreational and commercial fisheries occur for this species.

Spiny Butterfly Ray: The spiny butterfly ray, *Gymnura altavela*, is a large (to 2 m), demersal ray of the family *Gymnuridae*, or butterfly rays. Spiny butterfly rays, like their cogener the smooth butterfly ray, are found along the U.S. Atlantic coast from Southern New England to Florida. On NEAMAP surveys, these rays are encountered exclusively in the fall and primarily off of the coast North Carolina. Spiny butterfly rays captured on NEAMAP surveys range from 26 cm to 208 cm (disc width). There are no fisheries for this species other than as bycatch; nearly all individuals are able to be released live.

Spotted Hake: The spotted hake, *Urophycis regia*, is a small, demersal fish of the family *Gadidae*. In the U.S., spotted hake are found from the Gulf of Mexico to the Gulf of Maine. Spotted hake are most abundant on NEFSC trawl surveys from the southern flank of George’s Bank south to Cape Hatteras, and are collected by NEAMAP throughout its survey area. While spotted hake can reach a maximum size of 46 cm, specimens collected by NEAMAP have ranged between 3 cm and 37 cm. There are no directed fisheries for spotted hake.

Southern Stingray: The southern stingray, *Dasyatis americana*, is a large (to 3 m), demersal ray of the family *Dasyatidae*, or whiptail stingrays. Southern stingrays in the U.S. are found from the Gulf of Mexico to New Jersey. On NEAMAP surveys, southern stingrays are encountered primarily in the fall and off of the coast North Carolina. Southern stingrays captured on NEAMAP surveys range from 36 cm to 111 cm (disc width). There are no fisheries for this species other than as bycatch, and it can be dangerous to handle. Most individuals are released live.

Striped Anchovy: The striped anchovy, *Anchoa hepsetus*, is a small, pelagic, shallow-water species of the anchovy family, *Engraulidae*. It ranges in U.S. waters from the Gulf of Maine to the Gulf of Mexico, but is common only south of New England. The NEFSC surveys have documented a peak abundance for striped anchovy at around 20 m depth, and unlike the bay anchovy, their abundance significantly tapers much deeper, at around 60 m. They have been recorded beyond 100 m, although this is rare. It is larger on average than the bay anchovy in the Mid-Atlantic region; although striped anchovy are thought to reach a maximum size of 15 cm, several specimens as large as 19 cm have been collected by NEAMAP. Striped anchovy is also the most abundant of the anchovies sampled by this program. This species is an important prey item for numerous predatory fishes, including bluefish and weakfish.

Striped Sea Robin: The striped sea robin, *Prionotus evolans*, is a small, coastal, demersal fish of the family *Triglidae*. In the U.S., striped sea robins are found from Maine to Florida, but are rare north of Cape Cod. These sea robins are typically encountered between the central portion of Long Island and Cape Hatteras on the NEAMAP Survey, and have ranged in size from 5 cm to 45 cm. Striped sea robins can comprise an appreciable amount of the catch in the Mid-Atlantic portion of the survey region. There are no directed fisheries for this species.

4.2 Threatened and Endangered Species

The following species listed under the ESA of 1973 as endangered or threatened species may be found in the environment where the proposed study would occur. Also included in the list are a number of species identified as protected under either the Marine Mammal Protection Act of 1972 (MMPA) or the Migratory Bird Act of 1918.

Cetaceans

Northern right whale (*Eubalaena glacialis*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Blue whale (*Balaenoptera musculus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Minke whale (*Balaenoptera acutorostrata*)	Protected
Harbor porpoise (*Phocoena phocoena*)	Protected
Risso’s dolphin (*Grampus griseus*)	Protected
Pilot whale (*Globicephala* spp.)	Protected
White-sided dolphin (*Lagenorhynchus acutus*)	Protected
Common dolphin (*Delphinus delphis*)	Protected
Spotted and striped dolphins (*Stenella* spp.)	Protected
Bottlenose dolphin (*Tursiops truncatus*)	Protected

Seals

Harbor seal (*Phoca vitulina*)	Protected
Gray seal (*Halichoerus grypus*)	Protected
Harp seal (*Phoca groenlandica*)	Protected

Sea Turtles

Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Green sea turtle (*Chelonia mydas*)	Endangered
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened

Fish

Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered
Atlantic salmon (*Salmo salar*)	Endangered

Birds

Roseate tern (*Sterna dougallii dougallii*)	Endangered
Piping plover (*Charadrius melodus*)	Endangered

The following discussion is a summary of material presented in Amendment 16 to the Northeast Multispecies FMP (NMFS 2009). For a complete description of endangered species and marine mammals, this document can be accessed at http://www.nefmc.org/nemulti/index.html.

Although all of the protected species listed above may be found in the general geographical area where the proposed study would occur, not all would be affected by the survey. Some of these species primarily inhabit waters that are more inshore (e.g., shortnose sturgeon) or offshore (e.g., sei and sperm whales) relative to the NEAMAP survey area, prefer a different depth or temperature zone, and/or may migrate through the area only during times when NEAMAP is not sampling (e.g., hawksbill sea turtle). At least one species, the Atlantic salmon, no longer occurs in the NEAMAP survey area as it was extirpated from the Southern New England/New York area in the 1880s. In addition, certain protected species may not be vulnerable to capture or entanglement by trawl gear (e.g., Risso's dolphin, roseate tern, or piping plover). Therefore, the descriptions provided below focus only on those species that may be affected by the proposed trawl survey.

Status of Protected Species Potentially Affected by the Proposed Study:

North Atlantic Right Whale: The western North Atlantic right whale (*Eubalaena glacialis*) population, which numbers approximately 300 animals, ranges from wintering and calving grounds off the southeastern United States to summer feeding grounds off New England, in the northern Bay of Fundy, and on the Scotian Shelf. New England waters are a primary feeding ground. Principal prey items include copepods in the genera *Calanus* and *Pseudocalanus*, although they may feed on similar-sized zooplankton and other organisms. Feeding efficiency may depend on the ability of whales to find and exploit dense zooplankton patches. This is considered to be the most endangered whale in the world. Sources of mortality include ship strikes and entanglement in fixed fishing gear. Critical Habitat designations were made in three geographic areas for this species:

Cape Cod Bay, Great South Channel, and the Georgia/Florida coastal areas. All of these designations are outside of the proposed survey area and therefore, will not be affected.

Humpback Whale: Humpback whales (*Megaptera novaeangliae*) calve and mate in the West Indies and migrate to feeding areas in the northwestern Atlantic during the summer months. Six separate feeding areas are utilized in northern waters (Waring et al. 2001). Only one of these feeding areas, the Gulf of Maine, lies within U.S. waters contained within the management unit of the Northeast Multispecies FMP (Northeast Region). Most of the humpbacks that forage in the Gulf of Maine visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. Sightings are most frequent from mid-March through November between 41º N and 43º N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge (CeTAP 1982), and peak in May and August. However, small numbers of individuals may be present in this area year-round. They feed on a number of species of small schooling fishes, particularly sand lance and Atlantic herring, by filtering large amounts of water through their baleen to capture prey (Wynne and Schwartz 1999). The major known sources of mortality and injury of humpback whales include entanglement in commercial fishing gear, such as the sink gillnet gear, and ship strikes.

Fin Whale: Fin whales (*Balaenoptera physalus*) inhabit a wide range of latitudes between 20-75° N and 20-75° S (Perry et al. 1999). Fin whales spend the summer feeding in the relatively high latitudes of both hemispheres, particularly along the cold eastern boundary currents in the North Atlantic and North Pacific Oceans and in Antarctic waters (IWC 1992). Most migrate seasonally from relatively high-latitude Arctic and Antarctic feeding areas in the summer to relatively low-latitude breeding and calving areas in the winter (Perry et al. 1999). The overall distribution of fin whales may be based on prey availability. This species preys opportunistically on both zooplankton and fish (Watkins et al. 1984). In the western North Atlantic, fin whales feed on a variety of small schooling fishes (e.g., herring, capelin, sand lance) as well as squid and planktonic crustaceans (Wynne and Schwartz 1999). The major known sources of mortality and injury of fin whales include ship strikes and entanglement in commercial fishing gear, such as sink gillnets. However, many of the reports of mortality cannot be attributed to a particular source.

Leatherback Sea Turtle: Leatherback turtles (*Dermochelys coriacea*) are widely distributed throughout the marine waters of the world and are found in waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour 1972). The leatherback sea turtle is the largest living turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances that allow it to forage into the colder Northeast region waters (NMFS and USFWS 1995). Evidence from tag returns and strandings in the western North Atlantic suggests that adults engage in routine migrations among boreal, temperate, and tropical waters (NMFS and USFWS 1992). In the U.S., leatherback turtles are found throughout the western North Atlantic during the warmer months, particularly along the continental shelf and near the Gulf Stream edge. A 1979 aerial survey of the outer continental shelf from Cape Hatteras, North Carolina to Cape

Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island (CeTAP 1982). Shoop and Kenney (1992) also observed concentrations of leatherbacks during the summer off the south shore of Long Island and New Jersey. Leatherbacks in these waters are thought to be following jellyfish, their preferred prey.

Impacts to the leatherback population include fishery interactions as well as exploitation of the eggs (Ross 1979). Eckert et al. (1996) and Spotila et al. (1996) recorded that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. The sharp decline in leatherback populations may be attributable to the combination of the loss of long-lived adults in fishery-related mortality and of the lack of recruitment stemming from elimination of annual influxes of hatchlings because of egg harvesting. Leatherbacks are also susceptible to entanglement in lobster and crab pot gear.

Kemp's Ridley Sea Turtle: The Kemp's ridley (*Lepidochelys kempii*) is the most endangered of the world's sea turtle species. Of the seven extant species of sea turtles, the Kemp's ridley has declined to the lowest population levels. Juvenile Kemp's ridleys use northeastern and Mid-Atlantic coastal waters of the U.S. as primary developmental habitat during summer months, with shallow coastal embayments serving as important foraging grounds. Next to loggerheads, they are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June (Keinath et al. 1987; Musick and Limpus 1997). With the onset of winter and the decline of water temperatures from September to November, ridleys migrate to more southerly waters (Keinath et al. 1987; Musick and Limpus 1997). Turtles that do not head south soon enough face the risk of cold stunning in northern waters. Cold stunning can be a significant natural cause of mortality for sea turtles in Cape Cod Bay and Long Island Sound.

Like other turtle species, the severe decline in the Kemp's ridley population seems to have been heavily influenced by a combination of exploitation of eggs and impacts from fishery interactions. Currently, impacts to the Kemp's ridley population are similar to those discussed above for other sea turtle species. Takes of Kemp's ridley turtles have been recorded by sea sampling coverage in the Northeast otter trawl fishery, pelagic longline fishery, and southeast shrimp and summer flounder bottom trawl fisheries. Kemp's ridleys may also be affected by large-mesh gillnet fisheries.

Green Sea Turtle: Green turtles (*Chelonia mydas*) are distributed circumglobally. In the western Atlantic they range from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare north of Cape Hatteras (Wynne and Schwartz 1999). Most green turtle nesting in the continental United States occurs on the East Coast of Florida (Ehrhart 1979).

As is the case for loggerhead and Kemp's ridley sea turtles, green sea turtles use mid-Atlantic and northern areas of the U.S. coast as important summer developmental habitat. Green turtles are found in estuarine and coastal waters as far north as Long Island Sound, Chesapeake Bay, and the North Carolina sounds (Musick and Limpus 1997). Like loggerheads and Kemp's ridleys, green sea turtles that use northern waters during the summer must return to warmer waters when water temperatures drop or face the risk of cold stunning. Cold stunning of green turtles may occur in southern areas as well (e.g., Indian River, Florida), as these natural mortality events are dependent on water temperatures and not solely geographical location.

Impacts to the green sea turtle population are similar to those discussed above for other sea turtles species. Specifically, fishery mortality accounts for a large proportion of annual human-caused mortality outside of the nesting beaches, while other activities like dredging, pollution, and habitat destruction account for an unknown level of other mortality. Sea sampling coverage in the pelagic driftnet, pelagic longline, scallop dredge, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles.

Loggerhead Sea Turtle: Loggerhead sea turtles (*Caretta caretta*) occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian oceans in a wide range of habitats. These include open-ocean, continental shelves, bays, lagoons, and estuaries (NMFS and USFWS 1995). Loggerhead sea turtles are primarily benthic feeders, opportunistically foraging on crustaceans and mollusks (Wynne and Schwartz 1999). Under certain conditions they may also scavenge fish (NMFS and USFWS 1991). Horseshoe crabs are known to be a favorite prey item in the Chesapeake Bay area (Lutcavage and Musick 1985).

The threatened loggerhead sea turtle is the most abundant of the sea turtles listed as threatened or endangered in the U.S. waters. In the western North Atlantic, most loggerhead sea turtles nest from North Carolina to Florida (both coasts of Florida). The activity of the loggerhead is limited by temperature. Loggerheads commonly occur throughout the inner continental shelf from Florida through Cape Cod. These turtles may also occur as far north as Nova Scotia when oceanographic and prey conditions are favorable. Surveys conducted offshore, as well as sea turtle stranding data collected during November and December off North Carolina, suggest that sea turtles emigrating from northern waters in fall and winter months may concentrate in nearshore and southerly areas influenced by warmer Gulf Stream waters (Epperly et al. 1995). This is supported by the collected work of Morreale and Standora (1998) who satellite-tracked 12 loggerheads and three Kemp's ridleys. All of the turtles followed similar spatial and temporal corridors, migrating south from Long Island Sound during October through December. The turtles traveled within a narrow band along the continental shelf and became sedentary for one or two months south of Cape Hatteras.

Loggerhead sea turtles do not usually appear on the most northern summer foraging grounds in the Gulf of Maine until June but are found in Virginia as early as April. They remain in the Mid-Atlantic and northeast areas until as late as November and December in some cases, but the majority leaves the Gulf of Maine by mid-September. Aerial surveys of loggerhead turtles north of Cape Hatteras indicate that they are most common in waters from 22 m to 49 m deep, although they range from the beach to waters beyond the continental shelf (Shoop and Kenney 1992).

Loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic gyre for as long as 7-12 years before settling into benthic environments. Once loggerheads enter the benthic environment in waters off the coastal U.S., they are exposed to a suite of fisheries in Federal and state waters, namely the trawl, purse seine, hook and line, gillnet, pound net, longline, and trap fisheries. Loggerhead sea turtles are captured in fixed pound net gear in Long Island Sound, in pound net gear and trawls in summer flounder and other finfish fisheries in the Mid-Atlantic and Chesapeake Bay, in gillnet fisheries in the Mid-Atlantic and elsewhere, and in multispecies, monkfish, spiny dogfish, and northeast sink gillnet fisheries.

4.3 Physical Environment

This section summarizes the physical environment of the areas where the proposed study would occur. For more information about the physical characteristics of the environments described below, please refer to NOAA Technical Memorandum 181 (Stevenson et al. 2004).

<u>Mid-Atlantic Bight / Southern New England – Including Coastal Ocean, Block Island Sound, and Rhode Island Sound</u>

The Mid-Atlantic Bight / Southern New England region includes the shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream. The shelf's basic morphology and sediments derive from the retreat of the last ice sheet and the subsequent rise in sea level. Since that time, currents and waves have modified this basic structure.

Shelf and slope waters of this region have a slow, southwesterly flow that is occasionally interrupted by warm core rings or meanders from the Gulf Stream. Slope water tends to be warmer and more saline than shelf water because of its proximity to the Gulf Stream. The seasonal effects of warming and cooling increase in shallower, nearshore waters. Stratification of the water column occurs over the shelf and the top layer of slope water during the spring/early summer and is usually established by early June. Fall mixing results in homogenous shelf and upper slope waters by October in most years. A permanent thermocline exists in slope waters from 200 m - 600 m deep.

The shelf slopes gently from shore out to between 100 km and 200 km offshore where it transforms to the slope (100 m - 200 m water depth) at the shelf break. In both the Mid-Atlantic / Southern New England region and on Georges Bank, numerous canyons incise the slope, and some cut onto the shelf itself. The primary morphological features of the shelf include shelf valleys and channels, shoal massifs, scarps, and sand ridges and swales. The sediment type covering most of the shelf is sand, with some relatively small, localized areas of sand-shell, sand-gravel, and mud. On the slope, silty sand, silt, and clay predominate.

4.4 Essential Fish Habitat

Essential Fish Habitat (EFH) is broadly defined as "those waters and substrate necessary for spawning, breeding, feeding, or growth to maturity." The area affected by the proposed study has been identified as EFH for several species, including those managed under the Northeast multispecies complex; Atlantic sea scallop; Atlantic surf clam and ocean quahog; summer flounder, scup, and black sea bass; Atlantic mackerel, squid, and butterfish; Atlantic bluefish; Northeast skate; Atlantic billfish; and Atlantic tunas, swordfish, and sharks FMPs. Indeed, almost all of the coastal and offshore waters out to the outer boundary of the U.S. EEZ are designated as EFH (http://www.nero.noaa.gov/hcd/list.htm).

4.5 Socio-economic Environment

Since the implementation of the proposed study would not directly affect the standard operations of commercial or recreational fishing fleets in the region, there would be negligible social or economic impacts on these sectors. Commercial fishermen who harvest species that inhabit the NEAMAP survey area operate in Federal waters (3-200 miles) with Federal permits and in state waters (0-3 miles) under Federal or state-only permits. The information provided by the proposed study would be important for all commercial fishermen who target Federally managed species and/or Federal data-dependent state managed species whether or not they have a Federal permit. Also affected would be the associated businesses that support both commercial and recreational fisheries and the communities in which these fishermen live and/or do business. Federally permitted or state-only permitted party and charter businesses, along with their associated communities and businesses, that target Federal or state-managed species would also affected.

The proposed study would provide limited economic benefit to some individuals, including, but not limited to, the owner of the chartered research vessel, the associated crew and scientific staff, gear manufacturers, and supply retailers.

5.0 PROBABLE IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

5.1 Impacts of Alternative 1 (Proposed Study)

5.1.1 Impacts on Biological Environment/Fisheries Resources

Federally-regulated commercial fisheries that operate in the geographic scope of the proposed NEAMAP study include: gillnet, longline, trawl, seine, dredge, and trap fisheries. A list of the FMP-regulated fisheries in the Northeast region and the status of their respective stocks are provided (Table 4). Non-Federally regulated fisheries include nearshore gillnet fisheries in state waters from Connecticut to North Carolina, as well as horseshoe crab, whelk, and Virginia pound net fisheries. Commercial and non-commercial fisheries resources that are most likely to be impacted, albeit negligibly, by the proposed study are listed and described in Section 4.1 (above) of this document.

The impacts on local and regional fisheries resources would be minimal since the number and duration of the proposed tows per cruise would be very limited (i.e., 150 sampling sites per cruise; 20-minute tow at each; less than 30 days at sea per cruise), and only two cruises would be conducted per year. To estimate the degree of annual mortality for species that would likely be captured during this project's implementation over the 2011-2012 period, the results from the 2008 NEAMAP Surveys (spring and fall combined) may act as a reasonable surrogate. The 2008 sampling year was chosen since, at the time that this document was written, this was the most recent year for which NMFS had corresponding commercial and recreational data completely available for comparative purposes.

For the principal managed species, cumulative weights caught during the 2008 NEAMAP trawl surveys were extremely low relative to annual fisheries' landings recorded for those species over the same time period (Table 4). Specifically, cumulative weights sampled by NEAMAP were less than or equal to 0.3% of fishery landings for all but one species (weakfish), which is currently fished at extremely low levels in comparison with historical landings. As an example, Atlantic croaker is a species that has dominated NEAMAP catches by weight throughout the survey's relatively short history (Appendix IV). However note that, in 2008, an estimated 16,634,437 lb of croaker were landed by commercial and recreational fishers operating north of Cape Hatteras, whereas only 11,349 lb were captured during the NEAMAP cruises, a small percentage of those landed by the fisheries (Table 4).

Furthermore, relative to NEAMAP, NEFSC surveys occur over a considerably larger geographic area, include more days at sea, and involve a greater number of tows per cruise (NEFSC 2008c). As a result, the total catch of living marine resources by NEAMAP in 2008 was 75,080 kg (spring and fall cruises combined), while that of the NEFSC was 114,365 kg (again, spring and fall surveys combined) (NEFSC 2008a, NEFSC 2008b). Consequently, because the catch of living resources by NEAMAP is small compared with that of both the general fisheries and the Federal trawl surveys, it is very likely that the additional mortality experienced by managed stocks, as a result of the implementation of the proposed study during 2011 and 2012, would not have a biologically significant impact on fisheries resources.

Following-up on the discussion in Section 3.1, the impacts of the proposed project on horseshoe crabs would also be minimal, due not only to the short tow durations, but also to the general resilience of the individuals to survive capture via trawl gear. To date, 144 tows have been conducted in the Dr. Carl H. Shuster, Jr. Horseshoe Crab Reserve, resulting in the collection of 2005 horseshoe crabs. All specimens were immediately returned to the sea following collection of aggregate weight, carapace width, and sex

Table 4. Stock status and comparative landings values for selected fishes & invertebrates. Status is provided from NMFS (2010) [no asterisks] or ASMFC (2010) [asterisks]. "NEAMAP Catch (2008)" corresponds to combined weights from both NEAMAP 2008 cruises. "Fisheries Landings (2008)" represents combined commercial & recreational landings from inshore and ocean waters of New England and Mid-Atlantic states in 2008.

Species	Stock Status			Catch weights in pounds		NEAMAP Catch / Fisheries Landings
	Stock	Overfishing	Overfished	NEAMAP Catch (2008)	Fisheries Landings (2008)	
ATLANTIC COD	Gulf of Maine	yes	yes	0	21,880,508	0.00000
	Georges Bank	yes	yes			
HADDOCK	Gulf of Maine	no	yes	0	13,682,760	0.00000
	Georges Bank	no	yes			
POLLOCK		no	no	1	17,446,294	0.00000
WHITE HAKE		yes	yes	0	2,798,687	0.00000
RED HAKE	Gulf of Maine / N. Georges Bank	unknown	no	411	243,258	0.00169
	S. Georges Bank / Mid-Atlantic	undefined	no			
SILVER HAKE	Gulf of Maine / N. Georges Bank	no	no	1,617	12,918,976	0.00013
	S. Georges Bank / Mid-Atlantic	no	no			
REDFISH		no	no - rebuilding	0	2,387,371	0.00000
GOOSEFISH	North	no	no	346	21,756,608	0.00002
	South	no	no			
SPINY DOGFISH		no	no	11,060	8,852,814	0.00125
YELLOWTAIL FLOUNDER	S. New England / Mid-Atlantic	yes	yes	2	3,624,102	0.00000
	Georges Bank	yes	yes			
	Cape Cod / Gulf of Maine	yes	yes			
WINTER FLOUNDER	S. New England / Mid-Atlantic	yes	yes	1,535	5,520,531	0.00028
	Gulf of Maine	no	no			
	Georges Bank	yes	no			
AMERICAN PLAICE		no	yes	0	2,392,280	0.00000
WITCH FLOUNDER		no	no	0	2,174,153	0.00000
WINDOWPANE FLOUNDER	S. New England / Mid-Atlantic	no	yes	596	265,237	0.00225
	Gulf of Maine / Georges Bank	no	no			
SUMMER FLOUNDER		no	no	2,083	14,415,451	0.00014
BLUEFISH		no	no	2,027	20,923,979	0.00010
WEAKFISH		no*	yes*	13,644	783,172	0.01742
SCUP		no	no	8,287	9,051,827	0.00092
BLACK SEA BASS		no	no	351	3,002,820	0.00012
SPOT		unknown*	unknown*	10,871	5,042,354	0.00216
CROAKER	Mid-Atlantic	no*	no*	11,349	16,634,437	0.00068
BUTTERFISH		no	yes	6,194	1,231,050	0.00260
AMERICAN LOBSTER		yes*	unknown*	375	86,551,732	0.00000
LOLIGO		no	no	4,704	7,174,784	0.00066
ILLEX		no	unknown	0	11,760,693	0.00000

information and, while data regarding survey-induced mortality for these specimens is not available, at-sea observations indicate that likely fewer than 1% fail to survive the collection/handling process.

As noted in Section 3.1, only a limited number of tows are planned within the Horseshoe Crab Reserve's boundaries (Figure 2) over the 2011-2012 period (Appendices Ia-Id). Because NEAMAP horseshoe crab processing protocols have not changed relative to previous years, specimens collected within the reserve during the proposed project would still be returned to the sea immediately after processing. In fact, horseshoe crabs collected at any of the sampling sites proposed for this survey for the 2011-2012 period would be returned to the sea. As a result, it is reasonable to expect that the impact of the proposed NEAMAP study on horseshoe crabs would continue to be minimal. Further, the data obtained from the project could supplement existing surveys in detecting trends in relative abundance.

5.1.2 Impacts on Threatened and Endangered Species

Interactions between protected species and the trawl gear that would be used in this study would most likely be rare because the tows conducted by the vessel would be of short duration (20 minutes), using comparatively slow towing speeds (approximately 3.1 kt), and of a limited absolute number (150 tows per cruise). Indeed, since the NEAMAP Survey began full-scale sampling operations in 2007, there have been only eight encounters with protected species, each of which involved sea turtles. These occurred during the spring 2008, fall 2009, and spring and fall 2010 survey cruises. The species encountered, along with the dates, locations, and outcomes of these interactions are provided in Table 5. Specifically, four loggerhead, three Kemp's Ridley, and a single green sea turtle have been captured in the survey trawl to date. The number of encounters and the species composition of these interactions appear reasonable given the abundance and composition of the sea turtle population in the survey area (see Section 4.2) as well as the number of survey tows that have been conducted thus far. It is worth noting that combining the eight turtles encounters between fall 2007 and fall 2010 with the 1060 survey tows completed during this period yields an interaction rate of 0.008 sea turtles/survey-tow, or 1 turtle per 132.5 tows. Since tows are 20 minutes in duration, this rate could also be expressed as 0.025 sea turtles/tow hour, which matches the projected average interaction rate for this trawl survey in a prior Section 7 consultation.

For each interaction, the captured sea turtle was recognized by survey personnel as soon as the catch was released from the codend of the net into the sorting area. The specimens were immediately removed from the catch, identified to the species level, photographed, measured (curved length, notch to notch) and released. Handling proceeded according to established procedures found in 50 CFR 223.206(d)(1), and all appropriate telephone and written reports were filed following each interaction. More importantly, each turtle was quite 'lively' upon release from the codend, none were observed to have sustained any injury, and handling was efficient with most specimens being returned to the water within 5 minutes. Every turtle was observed to swim away rapidly from the boat upon release

Table 5. A complete listing of the interactions between the NEAMAP Near Shore Trawl Survey and protected species between fall 2007 and fall 2010 (i.e., the entire survey history). For each interaction, the survey cruise, date, and time of the encounter are given. The species captured, its curved shell length in centimeters (measured notch-to-notch), and the capture and release latitude and longitude are also provided. Each specimen was released alive and uninjured, and photographs were taken beginning in 2010. Handling time, defined as the time from which the codend was opened on the deck of the vessel to the time that the turtle was released, was less than 5 minutes in most cases.

Cruise	Date	Time	Species	Length (cm)	Cap./Rel. Lat.	Cap./Rel. Lon.	State	Alive	Injured	Photo	Approx. Handling Time
Spring 2008	4/25/2008	1110	*Caretta caretta*	NONE	35° 46.01' N	75° 28.83' W	NC	YES	NO	NO	< 5 MIN
Spring 2008	4/25/2008	1110	*Caretta caretta*	NONE	35° 46.01' N	75° 28.83' W	NC	YES	NO	NO	< 5 MIN
Fall 2009	10/14/2009	1825	*Lepidochelys kempii*	30	38° 25.27' N	75° 01.90' W	MD	YES	NO	NO	< 5 MIN
Fall 2009	10/22/2009	845	*Chelonia mydas*	30-40	37° 33.46' N	75° 34.17' W	VA	YES	NO	NO	< 5 MIN
Spring 2010	4/22/2010	825	*Caretta caretta*	113	35° 27.19' N	75° 26.88' W	NC	YES	NO	YES	10 MIN
Fall 2010	10/11/2010	1506	*Lepidochelys kempii*	31	39° 16.28' N	74° 29.13' W	NJ	YES	NO	YES	< 5 MIN
Fall 2010	10/19/2010	1220	*Caretta caretta*	96	38° 25.17' N	74° 56.23' W	MD	YES	NO	YES	< 5 MIN
Fall 2010	10/24/2010	1116	*Lepidochelys kempii*	25	36° 14.58' N	75° 45.54' W	NC	YES	NO	YES	5-7 MIN

(over the stern, vessel in neutral, sampling gear out of the water). Based on these observations, it is very likely that the mortality rate for these specimens was zero.

With respect to the proposed 2011 and 2012 sampling operations, four marine turtle species (loggerhead, Kemp's ridley, green, and leatherback) could potentially be affected. According to the National Research Council (NRC), "death rates [of sea turtles incidentally captured in trawls] are near zero until tow times exceed 60 minutes, then they rise rapidly with increasing tow times to around 50% for tow times in excess of 200 minutes" (Magnuson et al. 1990). On the basis of this finding, sea turtle conservation regulations specify that, for those limited circumstances where commercial shrimp trawlers may comply with tow time limits instead of using turtle excluder devices (TEDs), tow times be limited to 55 minutes from April through October and to 75 minutes from November through March (50 CFR 223.206(d)(3)). The tow times in the proposed study would be 20 minutes, far less than the 60-minute threshold where mortality becomes increasingly probable. Couple this information with the fact that the survey's efficient sampling and handling protocols (which remain unchanged for the proposed 2011 and 2012 sampling) prevented mortality or even injury to the eight turtles encountered by the survey to date, and it is clear that if a turtle is encountered in the proposed study, mortality (and even injury) remains highly unlikely. Because the rate of interaction with sea turtles is relatively low for this survey, and those that are encountered have an excellent chance of survival, this survey is not anticipated to have significant deleterious impacts on sea turtles.

No marine mammals have been encountered by NEAMAP to date. Nevertheless, three species of large whales may be affected by the proposed study: the Northern right whale, humpback whale, and fin whale. However, documented interactions between trawl gear and the large whales that may be found in the survey region are rare. The Mid-Atlantic mid-water trawl, Mid-Atlantic bottom trawl, and the Northeast bottom trawl fisheries, all which use gear similar to that of the proposed study, are listed as Category II fisheries on the NMFS 2008 List of Fisheries (LOF). In the absence of information indicating the frequency of incidental taking of marine mammals, other factors may be considered, such as fishing techniques, gear used, methods used to deter marine mammals, target species, seasons and areas fished, qualitative data from logbooks or fisher reports, stranding data, and species distribution of marine mammals in the area, to determine whether there is a likelihood of an incidental take in the fishery. Although these trawl fisheries are listed as Category II fisheries, it is because of the interactions of these fisheries with harbor seals, dolphin species, and pilot whales, and it is not in response to interactions with large whales. However, a fishery is categorized on the LOF at its highest level of classification; thus, these fisheries are listed as Category II. Although an interaction between marine mammals and the survey gear could potentially occur, in light of the limited number and duration of NEAMAP survey tows and the information presented above, it is unlikely that a marine mammal would be negatively impacted (i.e., incidental injury or death) by the proposed study.

Should sea turtles or marine mammals be encountered during the 2011 or 2012 sampling seasons, the applicants would continue to adhere to the protocols identified in the ESA formal Section 7 Consultation prepared for this action. This consultation would be completed prior to the start of the survey operations. In the past, these protocols for sea turtles have included:

1. Handling and resuscitating any sea turtles caught during the survey according to established procedures found in 50 CFR 223.206(d)(1). Further, these procedures were to be provided to the vessel operator prior to the initiation of survey activities.

2. Identifying any sea turtle caught and retrieved in the trawl gear to species. This required that at least one crew member experienced with the identification of western North Atlantic sea turtles be onboard at all times.

3. Notifying NMFS NERO by telephone or e-mail within 24 hours of an interaction between any endangered or threatened species, including but not limited to sea turtles, and the gear and/or vessel used in the survey.

4. Providing NMFS NERO with full written reports regarding endangered or threatened species interactions with trawl gear and/or vessels used in the survey.

5.1.3 Impacts on Physical Environment and Essential Fish Habitat

Impacts to bottom habitat by the proposed study would be minimal due to the small area swept relative to the total spatial extent of the survey, to the comparatively few stations sampled, and to the limited duration of tows.

Trawls are classified by their function, bag construction, or method of maintaining the mouth opening. Function may be defined by the part of the water column where the trawl operates (e.g., bottom) or by the species that it targets (Hayes 1983). The specific gear design used is often a result of the target species (whether they are found on or off the bottom) as well as the composition of the bottom (e.g., smooth versus rough and soft versus hard). There are three components of the otter trawl that come in contact with the sea floor: the doors, the ground cables and bridles that attach the doors to the wings of the net, and the sweep (or foot-rope) which runs along the bottom of the net mouth. Bottom trawls are towed at a variety of speeds, but average about 3 kts.

Several studies have been conducted to evaluate the impact of bottom trawl gear on habitat. It was demonstrated that the physical effects of trawl doors contacting the bottom produced furrows up to 10 cm deep and berms 10 cm to 20 cm high on mud bottom. Evidence from four studies indicated that there is a large variation in the duration of these features (2 to 18 months). There is also evidence that repeated tows increase bottom roughness, fine surface sediments are re-suspended and dispersed, and that rollers can compress sediment. A single pass with a trawl did not cause sediments to be turned over, but single and multiple tows smoothed surface features.

The effects of mobile bottom-tending gear (trawls and dredges) on fish habitat have also been reviewed by the NRC (NRC 2002). This study determined that repeated use of trawls or dredges reduces bottom habitat complexity by the loss of erect and sessile epifauna and by smoothing sedimentary bedforms and bottom roughness. This activity, when repeated over a long term, also results in discernable changes in benthic communities, which involve a shift from larger-bodied, long-lived, benthic organisms to smaller, shorter-lived ones. This shift may result in loss of benthic productivity and thus, biomass available for fish predators. Therefore, such changes in bottom structure and loss of productivity can reduce the value of the bottom habitat for demersal fish. These effects varied with sediment type with lower level of impact on sandy communities, where there is a high natural dynamic nature to these bedforms, to a high degree of impact on hard bottom areas such as bedrock, cobble and coarse gravel, where the substrate and attached epifauna are more stable. In the Northwest Atlantic, the more valued groundfish habitat is located in areas where there is a high percentage of gravel and cobble. Additional information regarding gear effects on marine habitats is provided by the Northeast Region Essential Fish Habitat Steering Committee (2002).

Based on the above information, it is likely that the impacts of this proposed study on the physical environment and EFH would be minimal. Not only would this survey conduct a limited number of tows (i.e., 150) per cruise, with an average area swept of only 20,917 m^2 per tow, but nearly all would occur over sandy communities, which have been shown to endure a lower level of impact as a result of trawling and dredging activities. Further, relative to the area swept annually by the NEFSC Bottom Trawl Surveys (126 km^2) and commercial fishery (assumed $137.2 x 10^3$ km^2), the projected annual area swept for the NEAMAP survey (6.2 km^2) is appreciably smaller (NRC 2002, NEFSC 2008c).

5.1.4 Impacts on Socio-economic Resources

There would be no significant adverse effects on adjacent human communities by the proposed study because its scale, duration, and funding are limited. At most, some fishermen may experience a relatively small, short-term economic loss if interactions between the NEAMAP trawl and commercial gears (e.g., fixed gear) were to occur. VIMS, however, has both the mechanisms in place to provide compensation/replacement in the event of such a loss, as well as a history for doing so (from other surveys) in a timely manner. On the other hand, there would be beneficial long-term effects on the human communities from the information and data obtained by conducting this survey of fisheries resources.

Like the various surveys conducted by the NEFSC, NEAMAP is designed to improve the quality of fish, shellfish, invertebrate, and benthic resource data used for stock assessment, habitat designation, and management/regulatory purposes. While NEAMAP data have yet to be incorporated into these actions due to the short history of the survey, it is anticipated that the information generated by this program will be used in these applications in the near future (i.e., over the next year or so). The continuation of the NEAMAP field, laboratory, and analysis activities would enable this survey to continue to develop its time series of fisheries data. Once established, these data will most likely have a positive impact by supplying a significant amount of information for an area no longer sampled by the NEFSC surveys (i.e., inshore waters of Southern New England and the Mid-Atlantic Bight). These data have a strong potential to become part of the infrastructure used for advanced assessment models utilizing the stocks' age structures, among other features. In general, more information provides for greater confidence in parameter estimates of stock assessments.

Once its time series is established, the NEAMAP Survey would likely provide indirect, positive impacts to the individuals and communities that rely upon commercial fisheries and the marine environment, and it is likely that these benefits would be similar to those arising from the NEFSC sampling efforts. Specifically, for the inshore waters of Southern New England and the Mid-Atlantic Bight, NEAMAP would allow managers and scientists to:

- **Monitor recruitment** in order to predict future landings and stock sizes. Depending on the species, research vessel surveys can allow extrapolation of the strength of incoming age groups up to several years before they are allowed to be landed.

- **Monitor abundance and survival of harvestable sizes:** Although recruitment prediction is one important element of fishery forecasts, it is equally important to calculate the survival rate of the portion of the stock already subjected to fishing. The catch-at-age data collected from NEAMAP will likely become an important source of information used to estimate survival rates from one year to the next. In practice, fishery scientists usually combine catch-at-age data from the surveys with similar data from the commercial fishery catch to improve estimates of fishing mortality and stock sizes. These combined estimates allow calculation of the population that must have existed to yield the catch levels observed during the recent history of the fishery. Research survey-derived abundance estimates of harvestable sizes may be the only source of data available for species that have never been fished in the past, or are currently fished at very low levels.

- **Monitor the geographic distribution of species:** Some species lead sedentary lives while others are highly migratory. Research vessel surveys are a major source of data on the movement patterns and geographic extent of stocks. Distribution maps can be drawn from reports of fishermen, but these may give a biased picture of the stock, emphasizing only where high density fishable concentrations exist. Distribution data are important not only for fishery management, but also for evaluating the population level effects of pollution and environmental change.

- **Monitor ecosystem changes:** The trawl survey conducted by NEAMAP was designed to be multipurpose. This survey is not directed at one species, but rather generates data on over 160 species of fish and invertebrates in northeastern U.S. continental shelf waters (Appendix IV). Many of these species are relatively rare, and have little or no commercial or recreational value. However, when we evaluate the effect of intensive harvesting on selected species, we can observe the response of the entire animal community. The multi-species surveying approach employed by NEAMAP thus provides an important research opportunity in the emerging field of ecosystem-based management.

- **Monitor biological rates of the stocks:** Apart from basic information on the abundance and distribution of species, NEAMAP collects data on a range of biological rates for stocks. These processes include growth, sexual maturity, and feeding. Changes in growth and maturity parameters directly influence assessment calculations related to spawning stock biomass, yield per recruit, and percent of maximum spawning potential. These parameters have the potential to change dramatically for a given species over time.

- **Collect environmental data and support other research:** NEAMAP operations occur continuously during daylight hours while the survey is at sea (approximately 60 days per year). This presents a superb opportunity to collect environmental information (temperature, salinity, pollution levels, etc.) and to allow outside researchers to collect a host of data not directly related to stock assessments. Each of the surveys conducted by NEAMAP to date has collected and archived a relatively extensive array of environmental measurements and usually has had a "shopping list" of samples to be obtained for researchers at other academic institutions and government agencies.

5.2 Impacts of Alternative 2 (No Action Alternative)

5.2.1 Impacts on Biological Environment/Fisheries Resources

Fisheries-independent monitoring provides insight into the status of fish stocks without the biases inherent in catch-related information derived from fisheries-dependent surveys. Such biases may include changes in market price, statutes, or other factors that affect commercial fishing operations. There are, however, several areas of concern with existing Atlantic coast fisheries-independent surveys. These concerns were outlined in a resolution passed by the ASMFC. One of the main concerns was a large gap in survey coverage in the Mid-Atlantic region; this void has since been filled by the NEAMAP Near Shore Trawl Survey.

By not conducting the proposed study, the sampling gap for fisheries-independent data in the inshore waters of the Mid-Atlantic and Southern New England would re-emerge. Biological, abundance, and distribution data for many economically valuable species that inhabit these waters would be unavailable to scientists and fisheries managers. There would not be any short-term, direct, negative impacts to the fishes and invertebrates of the inshore waters of the Mid-Atlantic Bight and Southern New England however, should the proposed study not occur.

5.2.2 Impacts on Threatened and Endangered Species

If this proposed study is not conducted, there would not be any negative impacts to protected resources.

5.2.3 Impacts on Physical Environment and Essential Fish Habitat

No impacts to the physical environment or habitat would occur if this project was not undertaken.

5.2.4 Impacts on Socio-economic Resources

There would be no direct impacts on human communities or the social and economic environment if this study is not completed. However, by not conducting the proposed NEAMAP study, valuable information for the near-coastal waters of Southern New England and the Mid-Atlantic Bight would not be obtained. Specifically, the abundance, distribution, biological, environmental, and other ancillary data listed in Section 5.1.4 would no longer be available for the inshore waters of these regions, both of which have been shown to support abundant and diverse living marine resources seasonally and, in turn, commercial and recreational fisheries.

Currently, the data for these inshore waters that are used in stock assessments and subsequent management are provided by a relatively few state-supported surveys and the most recent years of the NEFSC Surveys (prior to cessation of inshore sampling by the NEFSC). It is anticipated that, as the time series of NEAMAP data becomes established, this survey will serve as the main source of information for the nearshore waters of Southern New England and the Mid-Atlantic Bight in assessments. If the survey were to cease operations, however, NEAMAP data would not be available to provide future support to the various assessment and management activities listed above. Because, for some species, an appreciable portion of the population occurs within the NEAMAP survey area, the lack of the NEAMAP data could result in significant biases in these assessments and resulting management plans. This, in turn, could lead to the use of an ever more precautionary management approach, which may unnecessarily reduce fishing opportunities and negatively impact fishermen, vessel owners, persons involved in supporting industries, the families of each, and consumers of seafood products. Thus, in the absence of the information provided by NEAMAP, human communities may experience indirect negative effects in both the relative short- and long-term.

5.3 Cumulative Effects

Overview

Cumulative effects are the impacts on the environment that result from the incremental influence of a single action when added to other past, present, and reasonably foreseeable future actions.

Temporal and Geographic Scope of Cumulative Impacts Analysis

This analysis is limited to the geographical area, defined in Section 4.3, within which the NEAMAP survey program would operate. In all instances, the analysis attempts to take into account both present and reasonably foreseeable future actions that are occurring or may occur within the next five years. The discussion of past actions and events reflects underlying differences in the availability of historical information as well as differences in the period of time that must be considered to provide adequate context for understanding the current circumstances. In all cases, the information presented and analysis conducted is commensurate with the overall impacts associated with this action. All analyses are projected for five years into the future.

Past, Present, and Reasonably Foreseeable Future Actions

Fishery Actions

The historic state and Federal fishery management practices have resulted in overall positive impacts on the health of the commercial and recreational stocks present in the NEAMAP survey area. To the degree with which this regulatory regime is complied, the cumulative impacts of past, present, and reasonably foreseeable future fishery management actions should generally be associated with positive long-term outcomes. Constraining fishing effort through regulatory actions can often have negative short-term socio-economic impacts. These impacts are usually necessary to bring about long-term sustainability of a given resource, and as such, should, in the long-term, promote positive effects on human communities, especially those that are economically dependent upon Federally and state-managed stocks.

Commercial and recreational fishing has been identified as a cause of negative impacts to marine habitat and EFH. Fishing operations are expected to continue over the next five years and beyond and continue to contribute to adverse impacts to habitat and EFH, though the intensity and degree of these impacts can not be predicted. Management measures implemented through Federal and state management of fisheries have mitigated some of the negative impacts of fishing, such as the creation of closed or protected areas and the requirement of gear restrictions.

In addition, several actions have impacted and will likely continue to impact protected resources found within the geographic area of the NEAMAP survey. Fishing activities have and are expected to continue operations in the future and protected species in the survey area would continue to be impacted by fishing gear, though to an unknown degree. Both ESA-listed sea turtles and marine mammals and MMPA species have and continue to be negatively impacted by a variety of anthropogenic activities. Past trawl/dredge survey operations have had a negligible impact on all marine mammal populations. A number of actions are being undertaken by NMFS to mitigate negative impacts and reduce threats to protected species. These actions include the Atlantic Large Whale Take Reduction Plan, the Atlantic Trawl Gear Take Reduction Plan, and the Bottlenose Dolphin Take Reduction Plan.

Non-Fishing Activities

Non-fishing activities that introduce chemical pollutants; sewage; changes in water temperature, salinity, dissolved oxygen, and suspended sediment into the marine environment pose a risk to the human environment. Human-induced non-fishing activities tend to be localized in nearshore areas and marine project areas where they occur. Examples of these activities include, but are not limited to, point source pollution, agricultural and urban runoff, port maintenance, beach nourishment, coastal development, marine transportation, marine mining, liquefied natural gas terminals, wind energy farms, dredging and disposal of dredged material. Many of these have occurred in the past and present and will continue in the reasonably foreseeable future. Wherever these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and, as such, may indirectly constrain the sustainability of fishery resources, non-target species, and protected resources. It is likely that these projects would have negative impacts caused from disturbance and construction activities in the area immediately around the affected project area. Given the wide distribution of fishery resources, minor overall negative effects to offshore habitat, protected resources, and target and non-target species are anticipated since the affected areas are localized to the project sites, which involve a small percentage of the fish populations and their habitat. Any impacts to inshore water quality from these permitted projects, including impacts to planktonic, juvenile and adult life stages, are unknown but likely minor due to the transient and limited exposure.

Further, these projects are permitted by other Federal and state agencies, who conduct examinations of potential biological, socio-economic, and habitat impacts. In addition to guidelines mandated by the Magnuson Act and the Fish and Wildlife Coordination Act, NMFS, the Councils, and the other Federal and State regulatory agencies review these projects through a regulatory review process required by the Clean Water Act, Rivers and Harbors Act, and the Marine Protection, Research, and Sanctuaries Act for certain activities that are regulated by Federal, state, and local authorities. These reviews limit and often mitigate the impact of these projects. The jurisdiction of these authorities is in "waters of the U.S." and ranges from inland riverine to marine habitats offshore in the EEZ.

In addition, NMFS and the U.S. Fish and Wildlife Service share responsibility for implementing the ESA. The ESA requires NMFS to designate "critical habitat" for any species it lists under the ESA (i.e., areas that contain physical or biological features essential to conservation, which may require special management considerations or protection) and to develop and implement recovery plans for threatened or endangered species. The ESA provides another avenue for NMFS to review actions by other entities that may impact endangered and protected resources whose management units are under NMFS' jurisdiction.

Although only two offshore wind energy projects have formally been proposed in the northeast region, at least 20 other separate projects may be proposed in the near future. Cape Wind Associates (CWA) proposes to construct a wind farm on Horseshoe Shoal, located between Cape Cod and Nantucket in Nantucket Sound, Massachusetts. The CWA project would have 130 wind turbines located as close as 4.1 miles offshore of Cape Cod in an area of approximately 24 square miles with the turbines being placed at a minimum of 0.3 miles apart. The turbines will be interconnected by cables, which will relay the energy to the shore-based power grid.

The Army Corps of Engineers developed a Draft Environmental Impact Statement (DEIS) for the proposed CWA project on Horseshoe Shoal. Subsequently, the Minerals Management Service was named the lead Federal agency, and a new DEIS is under development. If constructed, the turbines would preempt other bottom uses in an area similar to oil and natural gas leases. The potential impacts associated with the CWA offshore wind energy project include the construction, operation and removal of turbine platforms and transmission cables; thermal and vibration impacts; and changes to species assemblages within the area from the introduction of vertical structures.

Effects on Fisheries

Collectively, fish and shellfish landed by the commercial fishing industry during a ten-year period (2000-2009) in three Mid-Atlantic States exceeded 2.1 billion pounds (Table 6).

Table 6. Commercial fishery landings for all species reported in Delaware, New Jersey, and New York (combined) from 2000 to 2009.
Source: http://www.st.nmfs.gov/st1/commercial/landings/annual_landings.html.

Year	Total landed pounds
2009	200,064,635
2008	226,507,687
2007	223,294,477
2006	218,140,094
2005	206,591,328
2004	214,581,796
2003	226,502,515
2002	200,020,113
2001	189,829,626
2000	194,910,899
Sum	*2,100,443,170*

In addition to studies conducted by Gottschall et al. (2000) and NFI (2004), other fisheries-independent surveys have occurred with varying frequency in the Mid-Atlantic/Southern New England region. These include the Massachusetts Inshore Bottom Trawl Survey, the Maryland Coastal Bays Trawl Survey, the New Jersey Ocean Trawl Survey, and the University of Rhode Island's Graduate School of Oceanography (URI/GSO) Trawl Survey.

Cumulative impacts on fisheries resources are not restricted to current and historic commercial and recreational fishing and survey activities (e.g., legal harvests, bycatch levels, gear effects). Non-fishing activities, derived from natural and anthropogenic sources, also affect the biological and physical dimensions of the marine environment. Collectively, their effects may be widespread or localized and their duration, and intensity may vary. These natural events and human actions include, but are not limited to, beach nourishment activities, introductions of exotic and invasive species, power plant impingement and entrainment, oil and mineral resource exploration and extraction, nutrient enrichment and hypoxia, non-point source pollution, sea level rise, and storm events.

The expected volume of principal fish and invertebrates removed by the proposed study is likely to be at least an order of magnitude smaller than annual removals associated with routine commercial and recreational fisheries' activities (Table 4). This minor percentage of catch associated with each species, due in part to the project's limited temporal duration and spatial extent, will have a negligible impact on the corresponding stocks.

The proposed research would utilize one vessel under a single owner and occur for a relatively short period of time (approximately 30 days per cruise, two cruises per year). Therefore, economic and social impacts from the proposed research would be very minor and would not result in significant cumulative impacts.

In combination with historic, current, and future fishing and non-fishing activities, no significant cumulative or synergistic effects would result as a consequence of the implementation of the proposed study, due to its limited scope and nature.

Effects on Protected Species

Documented interactions between endangered or threatened marine mammals and the North Atlantic bottom trawl fishery are extremely rare and have been mainly limited to harbor seals, pilot whales, and some dolphin species. Interactions between commercial bottom trawl fisheries and sea turtles, while more common, are still relatively infrequent (i.e., 119 interactions between December 2004 and January 2008). Negative encounters such as gear entanglements with marine mammals are improbable on NEAMAP; none have occurred to date. Interactions with sea turtles are expected to continue to be rare events, based on the information contained in the previous ESA formal Section 7 Consultation for NEAMAP and the encounters documented during past survey sampling activities. As noted in Section 5.1.2, the rate of interaction between sea turtles and the NEAMAP survey gear from fall 2007 through fall 2010 was 0.008 sea turtles/survey tow (0.025 sea turtles/tow hour). Eight turtles were captured during the seven survey cruises conducted over this period and, because of the sampling and subsequent turtle handling procedures employed by this survey, all were released alive and uninjured. These protocols remain unchanged for the proposed 2011 and 2012 sampling activities. Therefore, when combined with the effects of other past, present, and reasonably foreseeable fishing and non-fishing activities (including incidental mortality via ship strikes), the proposed study would not result in significant cumulative impacts to protected species.

Effects on Habitat

The effects of mobile-tending gear (trawls and dredges) on fish habitat have been recently reviewed by the NRC. This study determined that repeated use of trawls/dredges reduces bottom habitat complexity through loss of erect and sessile epifauna, smoothing sedimentary bedforms and bottom roughness. This activity, when repeated over a long term, also results in discernable changes in benthic organisms, with shifts toward smaller, shorter-lived ones. This shift can result in a loss of benthic productivity and thus biomass available for fish predators. However, the operations of the NEAMAP survey program are expected to have relatively minor impacts on habitat and EFH based on the information and analysis presented in this document. In particular, when compared with the impacts of the commercial fisheries, its limited size and duration make the impact of the NEAMAP study negligible.

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8.0 COMPLIANCE WITH OTHER ENVIRONMENTAL STATUTES AND REGULATIONS

Endangered Species Act (ESA)

Section 7 of the ESA requires Federal agencies conducting, authorizing, or funding activities that affect threatened or endangered species to ensure that those effects do not jeopardize the continued existence of listed species. NMFS has concluded that the proposed study and the prosecution of the associated fisheries is not likely to result in jeopardy to any ESA-listed species under NOAA Fisheries Service jurisdiction, or alter or modify any critical habitat, based on the discussion in this document. For further information on the potential impacts of the fishery and proposed action, see Section 5.1.2 of this document. Once this EA is submitted, it is expected that NMFS would initiate a formal Section 7 consultation on this action under Section 7 of the ESA.

Marine Mammal Protection Act (MMPA)

NMFS has reviewed the impacts of the proposed study on marine mammals and concluded that the actions proposed are consistent with the provisions of the MMPA and would not alter existing measures to protect the species likely to inhabit the management units of the subject fisheries. For further information on the potential impacts of the proposed study, see Section 5.1.2.

National Environmental Policy Act (NEPA)

Finding of No Significant Impact:

National Oceanic and Atmospheric Administration Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) regulations at 40 CFR 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant in making a finding of no significant impact and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1. *Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?*

Response: The proposed action will not jeopardize the sustainability of any target species because the spatio-temporal extent of the study is extremely narrow and a Letter of Acknowledgement (LOA) will be obtained. The mortality associated with this survey will be virtually undetectable relative to other permitted fishing activities. For further information on impacts of the proposed research activity, see Section 5.0.

2. *Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?*

Response: The project is not expected to jeopardize the sustainability of any non-target species. The limited number of tows in the study area makes it unlikely that the experiment would have any significant impact on the rebuilding resources. For more discussion on the effects of this project on non-target species, see Section 3.1.

3. *Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?*

Response: The proposed action will not allow substantial damage to the ocean and coastal habitats and/or EFH as defined under the Magnuson-Stevens Act and identified in FMPs. This project is limited in scope and duration; the amount of time that fishing gear will be in contact with the bottom is minimal. For further information on the physical environment and EFH found in the study area, including the impacts of trawling activities on habitat, see Sections 4.3, 4.4, and 5.1.3.

4. *Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?*

Response: The proposed action will not have a substantial adverse impact on public health and safety. The proposed trawling activities are of limited scope and duration and involve routine scientific operations and collection of biological information on finfish and invertebrates to be used in the long-term management of these species.

5. *Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?*

Response: It is expected that there will be no adverse impact on endangered or threatened species, marine mammals, or critical habitat of these species. Historical data from the bottom trawl fishery within and around the study areas show very few interactions with endangered or threatened species, including marine mammals. No marine mammals have been encountered by the NEAMAP survey gear to date. Sea turtles are known to occur in the study area, particularly in the summer months, but large concentrations of animals are not expected to be encountered when the proposed study will take place each year (i.e., spring and fall, 2011 & 2012). Moreover, the proposed study is of limited magnitude and duration and involves short (20 minute) tow times compared to routine fishery operations. This will reduce the risk of interactions with protected species even further. The rate at which this survey encountered sea turtles between fall 2007 and fall 2010 (covers the entire time period for which this survey has been operating at full capacity) was very low (0.008 sea turtles/tow or 0.025 sea turtles/tow hour), and each of the eight turtles collected during this time period were released alive and uninjured. Because the survey design and protocols proposed for 2011 and 2012 are identical to those employed for the 2007-2010 period, it is expected that this survey will continue to have no adverse effects on sea turtles. For additional information on protected resources found in the study area and impacts of the proposed study, see Section 5.1.

6. *Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g. benthic productivity, predator-prey relationships, etc.)?*

Response: The project will not have a substantial impact on biodiversity and ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.) primarily because of the limited scope and duration of the project. This project would not result in a significant increase in fishing or research activities in the proposed study areas. See Section 5.0 for a discussion of the impacts of the proposed project.

7. *Are significant social or economic impacts interrelated with natural or physical environmental effects?*

Response: There are not significant social or economic impacts interrelated with significant natural or physical environmental effects stemming from this project. As discussed in Sections 4.5 and 5.3, no significant social, economic, or environmental effects are expected as a result of this project.

8. Are the effects on the quality of the human environment likely to be highly controversial?

Response: The effects of the project on the quality of the human environment are not expected to be highly controversial. See Section 5.1 for information about the affected human environment.

9. *Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historical or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?*

Response: There are no known historic or cultural resources, park land, prime farmlands, wetlands, or wild scenic rivers in the study area. The principal element of the survey will be bottom trawl gear that is consistent with commercial fishing gear that is commonly used throughout the study area. A full description of the impacts on the physical environment can be found in Section 5.1.3.

10. *Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?*

Response: Due to extensive experience with trawl surveys, expected effects of this study on the human environment would not be highly uncertain or involve unique or unknown risks. (Section 5.1)

11. *Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?*

Response: It is unlikely that the proposed action is related to any other actions (either insignificant with cumulatively significant impacts, or significant) in the survey area. The NEAMAP Near Shore Trawl survey is designed to sample an area that will not be sampled by any other state or Federal finfish sampling surveys. Because the proposed action is the only of its kind occurring in the NEAMAP survey area, it is not related to these other actions.

12. *Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects in or eligible for listing in the National Register of Historic Places or may cause loss or degradation of significant scientific, cultural or historical resources?*

Response: There are no adjacent human communities that will be affected by this study. The study will take place in ocean waters and will not affect any human communities on the adjacent shorelines. There are no known districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places in the survey area. Due to the minimal impact on the human environment, the effect of this study will not be significant on scientific, cultural, or historical resources.

13. *Can the proposed action reasonably be expected to result in the introduction or spread of nonindigenous species?*

Response: The proposed activity does not include any practices that are reasonably expected to result in the introduction or spread of a nonindigenous species. For example, the survey gear (sampling net) is only used in the survey area and is thoroughly dried between research surveys, eliminating the possibility that nonindigenous species could be introduced into the survey area via the gear. Also, the survey vessel is not designed to carry ballast water, so introduction of nonindigenous species by this survey through ballast water is not possible either.

14. *Is the proposed action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?*

Response: The proposed action is not likely to establish a precedent for future actions with significant effects and does not represent a decision in principle about a future consideration. NOAA's support for the proposed action (NEAMAP Near Shore Trawl Survey) does not guarantee support for future projects initiated by the NEAMAP or any similar or related projects initiated by any other organizations or groups. Furthermore, NOAA's support for the NEAMAP Near Shore Trawl Survey in 2011 does not guarantee support for this project into the future.

15. *Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?*

Response: The proposed action is not expected to threaten a violation of Federal, state, or local law or requirements imposed for the protection of the environment. The organizations that will be conducting these studies will comply with all associated laws and permitting requirements.

16. *Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on target species or non-target species?*

Response: The proposed action is not expected to result in cumulative adverse effects that could substantially affect target species or non-target species. The projected catch of species (Table 2b&c, Table 3b&c, Table 4) is expected to have a negligible effect on stocks due to the study's limited scope, magnitude, and duration. The small number of days that this project requires, in addition to ongoing fishing activities in the proposed study area and other proposed research activities, would not result in significant cumulative adverse impacts to habitat or EFH. The study would not result in significant cumulative impacts to protected species because interactions with these animals would be very rare. For more information on the cumulative effects of this project, see Section 5.3.

DETERMINATION

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for the Northeast Area Monitoring and Assessment Program Near Shore Trawl Program, it is hereby determined that the proposed action will not significantly impact the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an EIS for this action is not necessary.

Nancy Thompson, Ph.D. — Date: 3/16/2011

Science and Research Director for Northeast Fisheries Science Center, NOAA

9.0 REFERENCES

Atlantic States Marine Fisheries Commission (ASMFC). 2004. Addendum III to the Interstate Fishery Management Plan For Horseshoe Crab. Fishery Management Report No. 32c. 14 pp.

Atlantic States Marine Fisheries Commission (ASMFC). 2010. Stock Status Overview. 29 pp.

Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report for the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.

Eckert, S.A., Nellis, D.W., Eckert, K.L., and G.L. Kooyman. 1996. Diving patterns of two leatherback sea turtles (*Demochelys coriacea*) during interesting intervals at Sandy Point, St. Croix, U.S. Virgin Islands. *Herpetologica* 42(3): 381-388.

Ehrhart, L.M. 1979. A survey of marine turtle nesting at Kennedy Space Center, Cape Canaveral Air Force Station, North Brevard County, Florida, 1-122. Unpublished report to the Division of Marine Fisheries. St Petersburg, FL.

Epperly, S.P., Braun, J., Chester, A.J., Cross, F.A., Merriner, J., and P.A. Teater. 1995. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. *Bull. Mar. Sci.* 56(2): 519-540.

Ernst, C.H. and R.W. Barbour. 1972. Turtles of the United States. Univ. Press of Kentucky, Lexington. 347 pp.

Gottschall, K.F., Johnson, M.W., and D.G. Simpson. 2000. The distribution and size composition of finfish, American lobster, and long-finned squid in Long Island Sound based on the Connecticut Fisheries Division bottom trawl survey, 1984-1994. NOAA Technical Report NMFS 148. 195 pp.

Hayes, M.L. 1983. Active fish capture methods. Pages 123-145 *in* Nielson, L.A. and D.L. Johnson, eds. Fisheries Techniques. American Fisheries Society, Bethesda, MD.

International Whaling Commission (IWC). 1992. Report of the comprehensive assessment special meeting on North Atlantic fin whales. Rep. Int. Whal. Comm. 42: 595-644.

Keinath, J.A., Musick, J.A., and R.A. Byles. 1987. Aspects of the biology of Virginia's sea turtles: 1979-1986. *Virginia J. Sci.* 38(4): 329-336.

Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. *Copeia* 1985(2): 449-456.

Magnuson, J.J., Bjorndal, K.A., DuPaul, W.D., Graham, G.L., Owens, D.W., Pritchard, P.C.H., Richardson, J.I., Saul, G.E., and C.W. West. 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C. 274 pp.

Morreale, S.J. and E.A. Standora. 1998. Occurrence, movement and behavior of the Kemp's ridley and other sea turtles in New York waters. Okeanos Ocean Research Foundation Annual Report to the New York State Department of Environmental Conservation. April 1989-April 1990. Wildlife Contract #C001984.

Musick, J.A. and C.J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. Pgs. 137-164 *in* Lutz, P.L. and J.A. Musick, eds. The Biology of Sea Turtles. CRC Press, New York. 432 pp.

National Fisheries Institute (NFI). 2004. Supplemental finfish survey targeting Mid-Atlantic migratory species - January 2004 cruise report. Haskin Shellfish Research Laboratory and Rutgers, The State University of New Jersey. 62 pp.

National Marine Fisheries Service (NMFS). 2005. Annual Report to Congress on the Status of U.S. Fisheries - 2004. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Silver Spring, MD. 20 pp.

National Marine Fisheries Service (NMFS). 2009. Amendment 16 to the Northeast Multispecies Fishery Management Plan. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Northeast Fisheries Science Center, Wood's Hole, MA. 905 pp.

National Marine Fisheries Service (NMFS). 2010. Annual Report to Congress on the Status of U.S. Fisheries - 2009. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Silver Spring, MD. 28 pp.

National Marine Fisheries Service and United States Fish and Wildlife Service (NMFS and USFWS). 1991. Recovery plan for the U.S. population of loggerhead turtle. National Marine Fisheries Service, Washington, D.C. 64 pp.

National Marine Fisheries Service and United States Fish and Wildlife Service (NMFS and USFWS). 1992. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

National Marine Fisheries Service and United States Fish and Wildlife Service (NMFS and USFWS). 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, MD.

National Research Council (NRC). 2002. Effects of trawling and dredging on seafloor habitat. Washington, DC: National Academy Press.

Northeast Fisheries Science Center (NEFSC). 2007. Resource Survey Report: Bottom Trawl Survey, Cape Hatteras - Gulf of Maine, September 4 - October 31, 2007. NOAA Fisheries, Woods Hole, MA. 36 pp.

Northeast Fisheries Science Center (NEFSC). 2008a. Resource Survey Report: Bottom Trawl Survey, Cape Hatteras - Gulf of Maine, March 6 – May 3, 2008. NOAA Fisheries, Woods Hole, MA. 37 pp.

Northeast Fisheries Science Center (NEFSC). 2008b. Resource Survey Report: Bottom Trawl Survey, Cape Hatteras - Gulf of Maine, September 3 - November 8, 2008. NOAA Fisheries, Woods Hole, MA. 36 pp.

Northeast Fisheries Science Center (NEFSC). 2008c. Environmental Assessment for the Northeast Fisheries Science Center's Research Surveys. NOAA Fisheries, Woods Hole, MA. 176 pp

Northeast Fisheries Science Center (NEFSC). 2009a. Resource Survey Report: Bottom Trawl Survey, Cape Hatteras - Gulf of Maine, March 7 - April 21, 2006. NOAA Fisheries, Woods Hole, MA. 36 pp.

Northeast Fisheries Science Center (NEFSC). 2009b. Resource Survey Report: Bottom Trawl Survey, Cape Hatteras - Gulf of Maine, September 5 - October 6, 2006. NOAA Fisheries, Woods Hole, MA. 36 pp.

Northeast Fisheries Science Center (NEFSC). 2010. Resource Survey Report: Bottom Trawl Survey, Cape Hatteras - Gulf of Maine, February 27 – May 3, 2010. NOAA Fisheries, Woods Hole, MA. 38 pp.

Northeast Region Essential Fish Habitat Steering Committee. 2002. Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern United States, October 23-25, 2001, Boston, MA. Northeast Fish. Sci. Cent. Ref. Doc. 02-01. 86 pp.

Perry, S.L., DeMaster, D.P., and G.K. Silber. 1999. The sperm whale *in* The great whales: History and status of six species listed as endangered under the U.S. Endangered Species Act of 1973. *Mar. Fish. Rev. Special Edition* 61(1): 59-74.

Ross, J.P. 1979. Green turtle, *Chelonia mydas*, background paper, summary of the status of sea turtles. Report to WWF/IUCN. 4 pp.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. *Herpetology Monographs* 6: 43-67.

Spotila, J.R., Dunham, A.E., Leslie, A.J., Steyermark, A.C., Plotkin, P.T., and F.V. Paladino. 1996. Worldwide population decline of *Demochelys coriacea*: are leatherback turtles going extinct? *Chelonian Conservation and Biology* 2(2): 209-222.

Stevenson D., Chiarella L., Stephan D., Reid R., Wilhelm K., McCarthy J., and M. Pentony 2004. Characterization of the fishing practices and marine benthic ecosystems of the northeast US shelf, and an evaluation of the potential effects of fishing on essential habitat. NOAA Tech Memo NMFS NE 181; 179 p.

Walls, E.A., Berkson, J., and S.A. Smith. 2002. The horseshoe crab, *Limulus polyphemus*: 200 million years of existence, 100 years of study. *Reviews in Fisheries Science* 10(1): 39–73.

Waring, G.T., Quintal, J.M., and S.L. Swartz (eds). 2001. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments. NOAA Technical Memorandum NMFS-NE-168.

Watkins, W.A., Moore, K.E., Sigurjonsson, J., Wartzok, D., and G. Notarbartolo di Sciara. 1984. Fin whale (*Balaenoptera physalus*) tracked by radio in the Irminger Sea. *Rit Fiskideildar* 8(1): 1-14.

Wynne, K. and M. Schwartz. 1999. Guide to marine mammals and turtles of the U.S. Atlantic and Gulf of Mexico. Rhode Island Sea Grant, Narragansett. 115 pp.

APPENDIX I
NEAMAP Near Shore Trawl Survey
Locations of Sampling Sites
Spring & Fall Cruises
2011 & 2012

Appendix Ia. Latitude/longitude coordinates of the 150 cells (i.e., sampling sites) selected for sampling by the NEAMAP Near Shore Trawl Survey during the spring 2011 cruise.

Station	Depth Group	Avg Depth(ft)	SW Corner		NW Corner		SE Corner		NE Corner		CELL
			Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
Region 1											
1	40-60	49.08	41.02	-71.90	41.02	-71.88	41.05	-71.90	41.05	-71.88	012-242
2	40-60	59.45	40.97	-72.00	40.97	-71.98	41.00	-72.00	41.00	-71.98	016-240
Region 2											
3	20-40	30.81	40.95	-72.15	40.95	-72.13	40.97	-72.15	40.97	-72.13	022-239
4	20-40	37.96	40.95	-72.13	40.95	-72.10	40.97	-72.13	40.97	-72.10	021-239
5	40-60	41.30	40.90	-72.25	40.90	-72.23	40.92	-72.25	40.92	-72.23	026-237
6	40-60	45.80	40.87	-72.30	40.87	-72.28	40.90	-72.30	40.90	-72.28	028-236
7	40-60	59.90	40.87	-72.28	40.87	-72.25	40.90	-72.28	40.90	-72.25	027-236
Region 3											
8	20-40	37.07	40.67	-72.98	40.67	-72.95	40.70	-72.98	40.70	-72.95	055-228
9	20-40	39.33	40.82	-72.45	40.82	-72.43	40.85	-72.45	40.85	-72.43	034-234
10	40-60	41.27	40.77	-72.63	40.77	-72.60	40.80	-72.63	40.80	-72.60	041-232
11	40-60	48.46	40.70	-72.88	40.70	-72.85	40.72	-72.88	40.72	-72.85	051-229
12	40-60	59.90	40.77	-72.58	40.77	-72.55	40.80	-72.58	40.80	-72.55	039-232
Region 4											
13	20-40	34.39	40.60	-73.35	40.60	-73.33	40.62	-73.35	40.62	-73.33	070-225
14	20-40	34.02	40.55	-73.68	40.55	-73.65	40.57	-73.68	40.57	-73.65	083-223
15	40-60	44.69	40.60	-73.23	40.60	-73.20	40.62	-73.23	40.62	-73.20	065-225
16	40-60	57.47	40.55	-73.40	40.55	-73.38	40.57	-73.40	40.57	-73.38	072-223
17	40-60	59.24	40.50	-73.68	40.50	-73.65	40.52	-73.68	40.52	-73.65	083-221
Region 5											
18	20-40	32.99	40.30	-73.98	40.30	-73.95	40.32	-73.98	40.32	-73.95	095-213
19	20-40	36.86	40.35	-73.98	40.35	-73.95	40.37	-73.98	40.37	-73.95	095-215
20	40-60	59.90	40.47	-73.85	40.47	-73.83	40.50	-73.85	40.50	-73.83	090-220
21	40-60	59.90	40.35	-73.93	40.35	-73.90	40.37	-73.93	40.37	-73.90	093-215
22	40-60	59.90	40.30	-73.93	40.30	-73.90	40.32	-73.93	40.32	-73.90	093-213
Region 6											
23	20-40	32.03	39.92	-74.08	39.92	-74.05	39.95	-74.08	39.95	-74.05	099-198
24	20-40	34.42	39.72	-74.10	39.72	-74.08	39.75	-74.10	39.75	-74.08	100-190
25	40-60	59.28	39.75	-74.03	39.75	-74.00	39.77	-74.03	39.77	-74.00	097-191
26	40-60	44.67	39.72	-74.08	39.72	-74.05	39.75	-74.08	39.75	-74.05	099-190
27	40-60	48.51	39.67	-74.10	39.67	-74.08	39.70	-74.10	39.70	-74.08	100-188
Region 7											
28	20-40	21.00	39.47	-74.30	39.47	-74.28	39.50	-74.30	39.50	-74.28	108-180
29	20-40	18.47	39.37	-74.38	39.37	-74.35	39.40	-74.38	39.40	-74.35	111-176
30	20-40	24.96	39.30	-74.50	39.30	-74.48	39.32	-74.50	39.32	-74.48	116-173
31	20-40	32.09	39.30	-74.43	39.30	-74.40	39.32	-74.43	39.32	-74.40	113-173
32	40-60	56.98	39.55	-74.15	39.55	-74.13	39.57	-74.15	39.57	-74.13	102-183
33	40-60	54.95	39.60	-74.15	39.60	-74.13	39.62	-74.15	39.62	-74.13	102-185
34	40-60	59.24	39.50	-74.20	39.50	-74.18	39.52	-74.20	39.52	-74.18	104-181
35	40-60	41.57	39.37	-74.30	39.37	-74.28	39.40	-74.30	39.40	-74.28	108-176

36	40-60	42.35	39.35	-74.33	39.35	-74.30	39.37	-74.33	39.37	-74.30	109-175
37	40-60	54.71	39.27	-74.35	39.27	-74.33	39.30	-74.35	39.30	-74.33	110-172
Region 8											
38	20-40	39.66	39.10	-74.65	39.10	-74.63	39.12	-74.65	39.12	-74.63	122-165
39	20-40	33.44	39.07	-74.70	39.07	-74.68	39.10	-74.70	39.10	-74.68	124-164
40	40-60	59.92	39.05	-74.50	39.05	-74.48	39.07	-74.50	39.07	-74.48	116-163
41	40-60	46.51	39.00	-74.55	39.00	-74.53	39.02	-74.55	39.02	-74.53	118-161
42	40-60	44.34	38.95	-74.58	38.95	-74.55	38.97	-74.58	38.97	-74.55	119-159
43	40-60	54.05	39.00	-74.58	39.00	-74.55	39.02	-74.58	39.02	-74.55	119-161
44	40-60	58.10	38.82	-74.63	38.82	-74.60	38.85	-74.63	38.85	-74.60	121-154
45	40-60	54.07	38.87	-74.73	38.87	-74.70	38.90	-74.73	38.90	-74.70	125-156
46	40-60	49.06	38.92	-74.75	38.92	-74.73	38.95	-74.75	38.95	-74.73	126-158
Region 9											
47	20-40	29.03	38.90	-74.93	38.90	-74.90	38.92	-74.93	38.92	-74.90	133-157
48	20-40	24.07	38.87	-75.00	38.87	-74.98	38.90	-75.00	38.90	-74.98	136-156
49	20-40	38.53	38.55	-75.03	38.55	-75.00	38.57	-75.03	38.57	-75.00	137-143
50	20-40	38.54	38.70	-75.03	38.70	-75.00	38.72	-75.03	38.72	-75.00	137-149
51	40-60	42.49	38.87	-74.83	38.87	-74.80	38.90	-74.83	38.90	-74.80	129-156
52	40-60	53.79	38.47	-74.90	38.47	-74.88	38.50	-74.90	38.50	-74.88	132-140
53	40-60	43.17	38.77	-74.93	38.77	-74.90	38.80	-74.93	38.80	-74.90	133-152
54	40-60	42.50	38.80	-74.93	38.80	-74.90	38.82	-74.93	38.82	-74.90	133-153
55	40-60	40.45	38.80	-74.95	38.80	-74.93	38.82	-74.95	38.82	-74.93	134-153
56	40-60	43.45	38.47	-75.00	38.47	-74.98	38.50	-75.00	38.50	-74.98	136-140
57	40-60	59.90	38.80	-74.78	38.80	-74.75	38.82	-74.78	38.82	-74.75	127-153
58	40-60	59.90	38.82	-74.70	38.82	-74.68	38.85	-74.70	38.85	-74.68	124-154
59	60-90	89.56	38.62	-74.85	38.62	-74.83	38.65	-74.85	38.65	-74.83	130-146
60	60-90	83.92	38.65	-74.85	38.65	-74.83	38.67	-74.85	38.67	-74.83	130-147
61	60-90	76.30	38.55	-74.88	38.55	-74.85	38.57	-74.88	38.57	-74.85	131-143
62	60-90	65.94	38.55	-74.93	38.55	-74.90	38.57	-74.93	38.57	-74.90	133-143
63	60-90	65.19	38.72	-74.95	38.72	-74.93	38.75	-74.95	38.75	-74.93	134-150
Region 10											
64	20-40	30.32	38.35	-75.08	38.35	-75.05	38.37	-75.08	38.37	-75.05	139-135
65	20-40	38.29	38.10	-75.18	38.10	-75.15	38.12	-75.18	38.12	-75.15	143-125
66	40-60	40.10	38.10	-75.13	38.10	-75.10	38.12	-75.13	38.12	-75.10	141-125
67	40-60	51.65	38.35	-74.95	38.35	-74.93	38.37	-74.95	38.37	-74.93	134-135
68	40-60	58.46	38.30	-75.00	38.30	-74.98	38.32	-75.00	38.32	-74.98	136-133
69	40-60	41.64	38.07	-75.03	38.07	-75.00	38.10	-75.03	38.10	-75.00	137-124
70	40-60	58.10	38.12	-75.05	38.12	-75.03	38.15	-75.05	38.15	-75.03	138-126
71	40-60	55.46	38.07	-75.08	38.07	-75.05	38.10	-75.08	38.10	-75.05	139-124
72	40-60	46.07	38.25	-75.10	38.25	-75.08	38.27	-75.10	38.27	-75.08	140-131
73	40-60	51.68	38.12	-75.13	38.12	-75.10	38.15	-75.13	38.15	-75.10	141-126
Region 11											
74	20-40	21.44	37.95	-75.30	37.95	-75.28	37.97	-75.30	37.97	-75.28	148-119
75	20-40	21.90	37.82	-75.38	37.82	-75.35	37.85	-75.38	37.85	-75.35	151-114
76	20-40	39.83	37.75	-75.50	37.75	-75.48	37.77	-75.50	37.77	-75.48	156-111
77	20-40	32.54	37.77	-75.50	37.77	-75.48	37.80	-75.50	37.80	-75.48	156-112
78	20-40	37.52	37.55	-75.58	37.55	-75.55	37.57	-75.58	37.57	-75.55	159-103
79	40-60	55.40	37.82	-75.23	37.82	-75.20	37.85	-75.23	37.85	-75.20	145-114

80	40-60	53.59	37.67	-75.38	37.67	-75.35	37.70	-75.38	37.70	-75.35	151-108
81	40-60	46.60	37.72	-75.40	37.72	-75.38	37.75	-75.40	37.75	-75.38	152-110
82	40-60	41.50	37.77	-75.43	37.77	-75.40	37.80	-75.43	37.80	-75.40	153-112
83	40-60	51.11	37.62	-75.48	37.62	-75.45	37.65	-75.48	37.65	-75.45	155-106
84	40-60	54.02	37.67	-75.48	37.67	-75.45	37.70	-75.48	37.70	-75.45	155-108
85	40-60	42.89	37.60	-75.53	37.60	-75.50	37.62	-75.53	37.62	-75.50	157-105
86	40-60	40.83	37.55	-75.55	37.55	-75.53	37.57	-75.55	37.57	-75.53	158-103
Region 12											
87	20-40	27.04	37.52	-75.60	37.52	-75.58	37.55	-75.60	37.55	-75.58	160-102
88	20-40	28.45	37.47	-75.63	37.47	-75.60	37.50	-75.63	37.50	-75.60	161-100
89	20-40	34.48	37.37	-75.65	37.37	-75.63	37.40	-75.65	37.40	-75.63	162-096
90	20-40	20.83	37.25	-75.75	37.25	-75.73	37.27	-75.75	37.27	-75.73	166-091
91	20-40	18.18	37.25	-75.78	37.25	-75.75	37.27	-75.78	37.27	-75.75	167-091
92	40-60	56.36	37.35	-75.53	37.35	-75.50	37.37	-75.53	37.37	-75.50	157-095
93	40-60	59.62	37.27	-75.58	37.27	-75.55	37.30	-75.58	37.30	-75.55	159-092
94	40-60	52.81	37.30	-75.58	37.30	-75.55	37.32	-75.58	37.32	-75.55	159-093
95	40-60	51.32	37.17	-75.65	37.17	-75.63	37.20	-75.65	37.20	-75.63	162-088
Region 13											
96	20-40	37.85	36.95	-75.85	36.95	-75.83	36.97	-75.85	36.97	-75.83	170-079
97	20-40	38.32	37.00	-75.85	37.00	-75.83	37.02	-75.85	37.02	-75.83	170-081
98	20-40	24.80	37.07	-75.85	37.07	-75.83	37.10	-75.85	37.10	-75.83	170-084
99	20-40	20.53	37.05	-75.93	37.05	-75.90	37.07	-75.93	37.07	-75.90	173-083
100	20-40	22.79	37.00	-75.98	37.00	-75.95	37.02	-75.98	37.02	-75.95	175-081
101	20-40	39.67	36.97	-76.00	36.97	-75.98	37.00	-76.00	37.00	-75.98	176-080
102	40-60	57.45	37.02	-75.70	37.02	-75.68	37.05	-75.70	37.05	-75.68	164-082
103	40-60	47.11	37.15	-75.70	37.15	-75.68	37.17	-75.70	37.17	-75.68	164-087
104	40-60	56.83	36.87	-75.78	36.87	-75.75	36.90	-75.78	36.90	-75.75	167-076
105	40-60	51.80	36.97	-75.78	36.97	-75.75	37.00	-75.78	37.00	-75.75	167-080
106	40-60	50.10	36.70	-75.80	36.70	-75.78	36.72	-75.80	36.72	-75.78	168-069
107	40-60	52.04	36.60	-75.83	36.60	-75.80	36.62	-75.83	36.62	-75.80	169-065
108	40-60	50.80	36.70	-75.83	36.70	-75.80	36.72	-75.83	36.72	-75.80	169-069
109	40-60	56.03	36.77	-75.83	36.77	-75.80	36.80	-75.83	36.80	-75.80	169-072
110	40-60	41.71	36.90	-75.90	36.90	-75.88	36.92	-75.90	36.92	-75.88	172-077
111	40-60	51.65	36.87	-75.93	36.87	-75.90	36.90	-75.93	36.90	-75.90	173-076
Region 14											
112	20-40	27.61	36.27	-75.80	36.27	-75.78	36.30	-75.80	36.30	-75.78	168-052
113	20-40	27.25	36.22	-75.78	36.22	-75.75	36.25	-75.78	36.25	-75.75	167-050
114	40-60	59.90	35.92	-75.58	35.92	-75.55	35.95	-75.58	35.95	-75.55	159-038
115	40-60	56.63	35.88	-75.58	35.88	-75.55	35.90	-75.58	35.90	-75.55	159-036
116	40-60	59.22	36.12	-75.70	36.12	-75.68	36.15	-75.70	36.15	-75.68	164-046
117	40-60	56.73	36.30	-75.75	36.30	-75.73	36.32	-75.75	36.32	-75.73	166-053
118	40-60	53.10	36.42	-75.80	36.42	-75.78	36.45	-75.80	36.45	-75.78	168-058
Region 15											
119	20-40	39.47	35.40	-75.48	35.40	-75.45	35.43	-75.48	35.43	-75.45	155-017
120	20-40	34.21	35.83	-75.55	35.83	-75.53	35.85	-75.55	35.85	-75.53	158-034
121	40-60	54.50	35.60	-75.43	35.60	-75.40	35.63	-75.43	35.63	-75.40	153-025
122	40-60	54.73	35.75	-75.45	35.75	-75.43	35.78	-75.45	35.78	-75.43	154-031
123	40-60	52.91	35.28	-75.48	35.28	-75.45	35.30	-75.48	35.30	-75.45	155-012

124	40-60	54.78	35.83	-75.53	35.83	-75.50	35.85	-75.53	35.85	-75.50	157-034
Block Island Sound											
125	60-90	80.91	41.25	-71.98	41.25	-71.95	41.28	-71.98	41.28	-71.95	945-911
126	60-90	61.15	41.08	-71.98	41.08	-71.95	41.10	-71.98	41.10	-71.95	945-904
127	60-90	70.23	41.15	-72.10	41.15	-72.08	41.18	-72.10	41.18	-72.08	950-907
128	90+	107.69	41.20	-71.65	41.20	-71.63	41.23	-71.65	41.23	-71.63	932-909
129	90+	115.24	41.28	-71.70	41.28	-71.68	41.30	-71.70	41.30	-71.68	934-912
130	90+	107.28	41.28	-71.75	41.28	-71.73	41.30	-71.75	41.30	-71.73	936-912
131	90+	120.05	41.20	-71.85	41.20	-71.83	41.23	-71.85	41.23	-71.83	940-909
132	90+	117.72	41.23	-71.85	41.23	-71.83	41.25	-71.85	41.25	-71.83	940-910
133	90+	124.01	41.25	-71.85	41.25	-71.83	41.28	-71.85	41.28	-71.83	940-911
134	90+	130.26	41.25	-71.90	41.25	-71.88	41.28	-71.90	41.28	-71.88	942-911
Rhode Island Sound											
135	60-90	85.74	41.38	-71.03	41.38	-71.00	41.40	-71.03	41.40	-71.00	907-916
136	60-90	67.30	41.38	-71.05	41.38	-71.03	41.40	-71.05	41.40	-71.03	908-916
137	60-90	86.09	41.33	-71.08	41.33	-71.05	41.35	-71.08	41.35	-71.05	909-914
138	60-90	73.18	41.38	-71.18	41.38	-71.15	41.40	-71.18	41.40	-71.15	913-916
139	60-90	84.02	41.38	-71.23	41.38	-71.20	41.40	-71.23	41.40	-71.20	915-916
140	60-90	86.32	41.10	-71.53	41.10	-71.50	41.13	-71.53	41.13	-71.50	927-905
141	90+	109.14	41.30	-70.98	41.30	-70.95	41.33	-70.98	41.33	-70.95	905-913
142	90+	117.65	41.28	-71.00	41.28	-70.98	41.30	-71.00	41.30	-70.98	906-912
143	90+	129.40	41.28	-71.05	41.28	-71.03	41.30	-71.05	41.30	-71.03	908-912
144	90+	113.61	41.30	-71.28	41.30	-71.25	41.33	-71.28	41.33	-71.25	917-913
145	90+	120.84	41.28	-71.30	41.28	-71.28	41.30	-71.30	41.30	-71.28	918-912
146	90+	118.52	41.25	-71.33	41.25	-71.30	41.28	-71.33	41.28	-71.30	919-911
147	90+	113.05	41.28	-71.35	41.28	-71.33	41.30	-71.35	41.30	-71.33	920-912
148	90+	99.21	41.30	-71.35	41.30	-71.33	41.33	-71.35	41.33	-71.33	920-913
149	90+	111.11	41.33	-71.38	41.33	-71.35	41.35	-71.38	41.35	-71.35	921-914
150	90+	121.91	41.25	-71.40	41.25	-71.38	41.28	-71.40	41.28	-71.38	922-911

Appendix Ib. Latitude/longitude coordinates of the 150 cells (i.e. sampling sites) selected for sampling by the NEAMAP Near Shore Trawl Survey during the fall 2011 cruise.

Station	Depth Group	Avg Depth(ft)	SW Corner		NW Corner		SE Corner		NE Corner		CELL
			Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
Region 1											
1	40-60	59.90	41.02	-71.88	41.02	-71.85	41.05	-71.88	41.05	-71.85	011-242
2	40-60	59.90	41.00	-71.90	41.00	-71.88	41.02	-71.90	41.02	-71.88	012-241
Region 2											
3	20-40	31.56	40.90	-72.28	40.90	-72.25	40.92	-72.28	40.92	-72.25	027-237
4	20-40	32.15	40.87	-72.33	40.87	-72.30	40.90	-72.33	40.90	-72.30	029-236
5	40-60	57.92	40.95	-72.05	40.95	-72.03	40.97	-72.05	40.97	-72.03	018-239
6	40-60	57.58	40.85	-72.35	40.85	-72.33	40.87	-72.35	40.87	-72.33	030-235
7	40-60	59.90	40.87	-72.28	40.87	-72.25	40.90	-72.28	40.90	-72.25	027-236
Region 3											
8	20-40	37.07	40.67	-72.98	40.67	-72.95	40.70	-72.98	40.70	-72.95	055-228
9	20-40	39.96	40.62	-73.15	40.62	-73.13	40.65	-73.15	40.65	-73.13	062-226
10	40-60	50.63	40.60	-73.20	40.60	-73.18	40.62	-73.20	40.62	-73.18	064-225
11	40-60	59.90	40.70	-72.85	40.70	-72.83	40.72	-72.85	40.72	-72.83	050-229
12	40-60	59.90	40.67	-72.93	40.67	-72.90	40.70	-72.93	40.70	-72.90	053-228
Region 4											
13	20-40	38.14	40.60	-73.30	40.60	-73.28	40.62	-73.30	40.62	-73.28	068-225
14	20-40	34.02	40.55	-73.68	40.55	-73.65	40.57	-73.68	40.57	-73.65	083-223
15	40-60	55.44	40.52	-73.50	40.52	-73.48	40.55	-73.50	40.55	-73.48	076-222
16	40-60	44.43	40.55	-73.50	40.55	-73.48	40.57	-73.50	40.57	-73.48	076-223
17	40-60	59.24	40.50	-73.68	40.50	-73.65	40.52	-73.68	40.52	-73.65	083-221
Region 5											
18	20-40	36.89	40.50	-73.90	40.50	-73.88	40.52	-73.90	40.52	-73.88	092-221
19	20-40	28.24	40.47	-73.98	40.47	-73.95	40.50	-73.98	40.50	-73.95	095-220
20	40-60	42.96	40.50	-73.88	40.50	-73.85	40.52	-73.88	40.52	-73.85	091-221
21	40-60	58.79	40.17	-73.95	40.17	-73.93	40.20	-73.95	40.20	-73.93	094-208
22	40-60	59.90	40.22	-73.95	40.22	-73.93	40.25	-73.95	40.25	-73.93	094-210
Region 6											
23	20-40	32.03	39.92	-74.08	39.92	-74.05	39.95	-74.08	39.95	-74.05	099-198
24	20-40	39.93	39.75	-74.08	39.75	-74.05	39.77	-74.08	39.77	-74.05	099-191
25	40-60	49.85	39.70	-74.05	39.70	-74.03	39.72	-74.05	39.72	-74.03	098-189
26	40-60	58.16	39.97	-74.05	39.97	-74.03	40.00	-74.05	40.00	-74.03	098-200
27	40-60	59.90	39.93	-74.05	39.93	-74.03	39.95	-74.05	39.95	-74.03	098-198
Region 7											
28	20-40	24.22	39.30	-74.53	39.30	-74.50	39.32	-74.53	39.32	-74.50	117-173
29	20-40	37.17	39.62	-74.18	39.62	-74.15	39.65	-74.18	39.65	-74.15	103-186
30	20-40	28.87	39.22	-74.63	39.22	-74.60	39.25	-74.63	39.25	-74.60	121-170
31	20-40	21.00	39.35	-74.40	39.35	-74.38	39.38	-74.40	39.38	-74.38	112-175
32	40-60	59.06	39.55	-74.08	39.55	-74.05	39.57	-74.08	39.57	-74.05	099-183
33	40-60	58.39	39.60	-74.10	39.60	-74.08	39.62	-74.10	39.62	-74.08	100-185
34	40-60	57.12	39.22	-74.38	39.22	-74.35	39.25	-74.38	39.25	-74.35	111-170
35	40-60	56.18	39.22	-74.40	39.22	-74.38	39.25	-74.40	39.25	-74.38	112-170
36	40-60	45.75	39.27	-74.40	39.27	-74.38	39.30	-74.40	39.30	-74.38	112-172
37	40-60	52.78	39.22	-74.48	39.22	-74.45	39.25	-74.48	39.25	-74.45	115-170

Region 8											
38	20-40	39.88	38.95	-74.68	38.95	-74.65	38.97	-74.68	38.97	-74.65	123-159
39	20-40	38.94	38.95	-74.78	38.95	-74.75	38.97	-74.78	38.97	-74.75	127-159
40	40-60	46.08	38.95	-74.60	38.95	-74.58	38.97	-74.60	38.97	-74.58	120-159
41	40-60	53.72	39.05	-74.60	39.05	-74.58	39.07	-74.60	39.07	-74.58	120-163
42	40-60	44.46	38.82	-74.65	38.82	-74.63	38.85	-74.65	38.85	-74.63	122-154
43	40-60	47.75	39.07	-74.65	39.07	-74.63	39.10	-74.65	39.10	-74.63	122-164
44	40-60	41.75	38.97	-74.73	38.97	-74.70	39.00	-74.73	39.00	-74.70	125-160
45	40-60	49.47	38.87	-74.75	38.87	-74.73	38.90	-74.75	38.90	-74.73	126-156
46	40-60	40.14	38.97	-74.78	38.97	-74.75	39.00	-74.78	39.00	-74.75	127-160
Region 9											
47	20-40	27.22	38.62	-75.08	38.62	-75.05	38.65	-75.08	38.65	-75.05	139-146
48	20-40	38.96	38.82	-74.93	38.82	-74.90	38.85	-74.93	38.85	-74.90	133-154
49	20-40	39.43	38.52	-75.03	38.52	-75.00	38.55	-75.03	38.55	-75.00	137-142
50	20-40	30.45	38.55	-75.05	38.55	-75.03	38.57	-75.05	38.57	-75.03	138-143
51	40-60	58.34	38.70	-74.85	38.70	-74.83	38.72	-74.85	38.72	-74.83	130-149
52	40-60	43.17	38.77	-74.93	38.77	-74.90	38.80	-74.93	38.80	-74.90	133-152
53	40-60	50.55	38.47	-74.95	38.47	-74.93	38.50	-74.95	38.50	-74.93	134-140
54	40-60	56.98	38.45	-74.98	38.45	-74.95	38.47	-74.98	38.47	-74.95	135-139
55	40-60	45.15	38.55	-75.00	38.55	-74.98	38.57	-75.00	38.57	-74.98	136-143
56	40-60	44.42	38.80	-75.00	38.80	-74.98	38.82	-75.00	38.82	-74.98	136-153
57	40-60	48.50	38.80	-75.03	38.80	-75.00	38.82	-75.03	38.82	-75.00	137-153
58	40-60	59.90	38.82	-74.70	38.82	-74.68	38.85	-74.70	38.85	-74.68	124-154
59	60-90	86.79	38.62	-74.83	38.62	-74.80	38.65	-74.83	38.65	-74.80	129-146
60	60-90	89.56	38.62	-74.85	38.62	-74.83	38.65	-74.85	38.65	-74.83	130-146
61	60-90	62.38	38.52	-74.93	38.52	-74.90	38.55	-74.93	38.55	-74.90	133-142
62	60-90	68.96	38.62	-74.93	38.62	-74.90	38.65	-74.93	38.65	-74.90	133-146
63	60-90	69.53	38.75	-75.00	38.75	-74.98	38.77	-75.00	38.77	-74.98	136-151
Region 10											
64	20-40	39.75	38.30	-75.08	38.30	-75.05	38.32	-75.08	38.32	-75.05	139-133
65	20-40	38.64	38.02	-75.20	38.02	-75.18	38.05	-75.20	38.05	-75.18	144-122
66	40-60	59.90	38.17	-75.03	38.17	-75.00	38.20	-75.03	38.20	-75.00	137-128
67	40-60	40.10	38.10	-75.13	38.10	-75.10	38.12	-75.13	38.12	-75.10	141-125
68	40-60	57.91	38.25	-74.98	38.25	-74.95	38.27	-74.98	38.27	-74.95	135-131
69	40-60	59.88	38.40	-74.98	38.40	-74.95	38.42	-74.98	38.42	-74.95	135-137
70	40-60	47.64	38.02	-75.03	38.02	-75.00	38.05	-75.03	38.05	-75.00	137-122
71	40-60	41.64	38.07	-75.03	38.07	-75.00	38.10	-75.03	38.10	-75.00	137-124
72	40-60	41.88	38.12	-75.10	38.12	-75.08	38.15	-75.10	38.15	-75.08	140-126
73	40-60	59.90	38.33	-74.88	38.33	-74.85	38.35	-74.88	38.35	-74.85	131-134
Region 11											
74	20-40	22.28	37.77	-75.53	37.77	-75.50	37.80	-75.53	37.80	-75.50	157-112
75	20-40	18.86	37.70	-75.58	37.70	-75.55	37.72	-75.58	37.72	-75.55	159-109
76	20-40	38.04	38.00	-75.15	38.00	-75.13	38.02	-75.15	38.02	-75.13	142-121
77	20-40	37.29	37.92	-75.28	37.92	-75.25	37.95	-75.28	37.95	-75.25	147-118
78	20-40	19.69	37.60	-75.60	37.60	-75.58	37.62	-75.60	37.62	-75.58	160-105
79	40-60	57.70	37.90	-75.13	37.90	-75.10	37.92	-75.13	37.92	-75.10	141-117
80	40-60	41.17	37.95	-75.18	37.95	-75.15	37.97	-75.18	37.97	-75.15	143-119
81	40-60	55.29	37.85	-75.23	37.85	-75.20	37.87	-75.23	37.87	-75.20	145-115

82	40-60	43.86	37.87	-75.28	37.87	-75.25	37.90	-75.28	37.90	-75.25	147-116
83	40-60	50.44	37.65	-75.35	37.65	-75.33	37.67	-75.35	37.67	-75.33	150-107
84	40-60	42.39	37.77	-75.38	37.77	-75.35	37.80	-75.38	37.80	-75.35	151-112
85	40-60	48.71	37.72	-75.48	37.72	-75.45	37.75	-75.48	37.75	-75.45	155-110
86	40-60	42.89	37.60	-75.53	37.60	-75.50	37.62	-75.53	37.62	-75.50	157-105
Region 12											
87	20-40	20.00	37.25	-75.80	37.25	-75.78	37.27	-75.80	37.27	-75.78	168-091
88	20-40	37.73	37.52	-75.58	37.52	-75.55	37.55	-75.58	37.55	-75.55	159-102
89	20-40	37.72	37.22	-75.70	37.22	-75.68	37.25	-75.70	37.25	-75.68	164-090
90	20-40	22.73	37.30	-75.70	37.30	-75.68	37.32	-75.70	37.32	-75.68	164-093
91	20-40	19.45	37.20	-75.78	37.20	-75.75	37.22	-75.78	37.22	-75.75	167-089
92	40-60	55.59	37.47	-75.48	37.47	-75.45	37.50	-75.48	37.50	-75.45	155-100
93	40-60	51.25	37.47	-75.53	37.47	-75.50	37.50	-75.53	37.50	-75.50	157-100
94	40-60	54.27	37.37	-75.55	37.37	-75.53	37.40	-75.55	37.40	-75.53	158-096
95	40-60	44.68	37.40	-75.60	37.40	-75.58	37.42	-75.60	37.42	-75.58	160-097
Region 13											
96	20-40	26.13	36.72	-75.95	36.72	-75.93	36.75	-75.95	36.75	-75.93	174-070
97	20-40	20.00	37.15	-75.85	37.15	-75.83	37.17	-75.85	37.17	-75.83	170-087
98	20-40	22.14	37.15	-75.80	37.15	-75.78	37.17	-75.80	37.17	-75.78	168-087
99	20-40	33.33	36.60	-75.85	36.60	-75.83	36.62	-75.85	36.62	-75.83	170-065
100	20-40	39.52	36.75	-75.90	36.75	-75.88	36.77	-75.90	36.77	-75.88	172-071
101	20-40	20.53	37.05	-75.93	37.05	-75.90	37.07	-75.93	37.07	-75.90	173-083
102	40-60	52.27	37.15	-75.63	37.15	-75.60	37.17	-75.63	37.17	-75.60	161-087
103	40-60	59.63	37.00	-75.70	37.00	-75.68	37.02	-75.70	37.02	-75.68	164-081
104	40-60	48.90	37.07	-75.73	37.07	-75.70	37.10	-75.73	37.10	-75.70	165-084
105	40-60	43.62	37.15	-75.73	37.15	-75.70	37.17	-75.73	37.17	-75.70	165-087
106	40-60	40.77	37.12	-75.75	37.12	-75.73	37.15	-75.75	37.15	-75.73	166-086
107	40-60	58.13	36.55	-75.78	36.55	-75.75	36.57	-75.78	36.57	-75.75	167-063
108	40-60	56.83	36.87	-75.78	36.87	-75.75	36.90	-75.78	36.90	-75.75	167-076
109	40-60	44.33	36.90	-75.83	36.90	-75.80	36.92	-75.83	36.92	-75.80	169-077
110	40-60	43.72	36.85	-75.93	36.85	-75.90	36.87	-75.93	36.87	-75.90	173-075
111	40-60	58.85	36.95	-75.98	36.95	-75.95	36.97	-75.98	36.97	-75.95	175-079
Region 14											
112	20-40	29.44	36.40	-75.83	36.40	-75.80	36.42	-75.83	36.42	-75.80	169-057
113	20-40	38.55	36.42	-75.83	36.42	-75.80	36.45	-75.83	36.45	-75.80	169-058
114	40-60	59.90	36.00	-75.63	36.00	-75.60	36.02	-75.63	36.02	-75.60	161-041
115	40-60	59.13	35.92	-75.60	35.92	-75.58	35.95	-75.60	35.95	-75.58	160-038
116	40-60	59.22	36.12	-75.70	36.12	-75.68	36.15	-75.70	36.15	-75.68	164-046
117	40-60	40.14	36.25	-75.78	36.25	-75.75	36.27	-75.78	36.27	-75.75	167-051
118	40-60	49.05	36.37	-75.80	36.37	-75.78	36.40	-75.80	36.40	-75.78	168-056
Region 15											
119	20-40	25.88	35.80	-75.55	35.80	-75.53	35.83	-75.55	35.83	-75.53	158-033
120	20-40	35.03	35.23	-75.50	35.23	-75.48	35.25	-75.50	35.25	-75.48	156-010
121	40-60	59.90	35.80	-75.50	35.80	-75.48	35.83	-75.50	35.83	-75.48	156-033
122	40-60	56.43	35.50	-75.43	35.50	-75.40	35.53	-75.43	35.53	-75.40	153-021
123	40-60	50.00	35.60	-75.45	35.60	-75.43	35.63	-75.45	35.63	-75.43	154-025
124	40-60	44.83	35.33	-75.48	35.33	-75.45	35.35	-75.48	35.35	-75.45	155-014
Block Island Sound											

125	60-90	60.80	41.08	-71.95	41.08	-71.93	41.10	-71.95	41.10	-71.93	944-904
126	60-90	70.43	41.30	-71.75	41.30	-71.73	41.33	-71.75	41.33	-71.73	936-913
127	60-90	70.57	41.13	-71.80	41.13	-71.78	41.15	-71.80	41.15	-71.78	938-906
128	90+	124.01	41.25	-71.85	41.25	-71.83	41.28	-71.85	41.28	-71.83	940-911
129	90+	114.82	41.20	-71.88	41.20	-71.85	41.23	-71.88	41.23	-71.85	941-909
130	90+	115.11	41.15	-71.90	41.15	-71.88	41.18	-71.90	41.18	-71.88	942-907
131	90+	119.68	41.18	-71.90	41.18	-71.88	41.20	-71.90	41.20	-71.88	942-908
132	90+	129.05	41.20	-71.98	41.20	-71.95	41.23	-71.98	41.23	-71.95	945-909
133	90+	92.47	41.18	-72.08	41.18	-72.05	41.20	-72.08	41.20	-72.05	949-908
134	90+	90.40	41.20	-72.08	41.20	-72.05	41.23	-72.08	41.23	-72.05	949-909
Rhode Island Sound											
135	60-90	82.15	41.35	-71.10	41.35	-71.08	41.38	-71.10	41.38	-71.08	910-915
136	60-90	73.54	41.38	-71.10	41.38	-71.08	41.40	-71.10	41.40	-71.08	910-916
137	60-90	88.42	41.35	-71.23	41.35	-71.20	41.38	-71.23	41.38	-71.20	915-915
138	60-90	83.36	41.40	-71.28	41.40	-71.25	41.43	-71.28	41.43	-71.25	917-917
139	60-90	64.01	41.43	-71.43	41.43	-71.40	41.45	-71.43	41.45	-71.40	923-918
140	60-90	80.14	41.08	-71.60	41.08	-71.58	41.10	-71.60	41.10	-71.58	930-904
141	90+	109.14	41.30	-70.98	41.30	-70.95	41.33	-70.98	41.33	-70.95	905-913
142	90+	119.83	41.28	-71.10	41.28	-71.08	41.30	-71.10	41.30	-71.08	910-912
143	90+	93.26	41.35	-71.18	41.35	-71.15	41.38	-71.18	41.38	-71.15	913-915
144	90+	120.67	41.25	-71.23	41.25	-71.20	41.28	-71.23	41.28	-71.20	915-911
145	90+	97.65	41.33	-71.28	41.33	-71.25	41.35	-71.28	41.35	-71.25	917-914
146	90+	120.34	41.20	-71.33	41.20	-71.30	41.23	-71.33	41.23	-71.30	919-909
147	90+	120.23	41.10	-71.40	41.10	-71.38	41.13	-71.40	41.13	-71.38	922-905
148	90+	121.66	41.23	-71.40	41.23	-71.38	41.25	-71.40	41.25	-71.38	922-910
149	90+	121.40	41.08	-71.43	41.08	-71.40	41.10	-71.43	41.10	-71.40	923-904
150	90+	118.50	41.23	-71.45	41.23	-71.43	41.25	-71.45	41.25	-71.43	924-910

Appendix Ic. Latitude/longitude coordinates of the 150 cells (i.e. sampling sites) selected for sampling by the NEAMAP Near Shore Trawl Survey during the spring 2012 cruise.

Station	Depth Group	Avg Depth(ft)	SW Corner		NW Corner		SE Corner		NE Corner		CELL
			Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
Region 1											
1	40-60	49.08	41.02	-71.90	41.02	-71.88	41.05	-71.90	41.05	-71.88	012-242
2	40-60	52.56	41.00	-71.95	41.00	-71.93	41.02	-71.95	41.02	-71.93	014-241
Region 2											
3	20-40	35.82	40.97	-72.08	40.97	-72.05	41.00	-72.08	41.00	-72.05	019-240
4	20-40	37.96	40.95	-72.13	40.95	-72.10	40.97	-72.13	40.97	-72.10	021-239
5	40-60	53.32	40.97	-72.03	40.97	-72.00	41.00	-72.03	41.00	-72.00	017-240
6	40-60	53.33	40.82	-72.43	40.82	-72.40	40.85	-72.43	40.85	-72.40	033-234
7	40-60	59.90	40.87	-72.28	40.87	-72.25	40.90	-72.28	40.90	-72.25	027-236
Region 3											
8	20-40	38.29	40.70	-72.90	40.70	-72.88	40.72	-72.90	40.72	-72.88	052-229
9	20-40	39.96	40.62	-73.15	40.62	-73.13	40.65	-73.15	40.65	-73.13	062-226
10	40-60	51.81	40.65	-73.00	40.65	-72.98	40.67	-73.00	40.67	-72.98	056-227
11	40-60	57.29	40.62	-73.05	40.62	-73.03	40.65	-73.05	40.65	-73.03	058-226
12	40-60	59.90	40.77	-72.55	40.77	-72.53	40.80	-72.55	40.80	-72.53	038-232
Region 4											
13	20-40	36.46	40.60	-73.33	40.60	-73.30	40.62	-73.33	40.62	-73.30	069-225
14	20-40	31.04	40.55	-73.58	40.55	-73.55	40.57	-73.58	40.57	-73.55	079-223
15	40-60	59.94	40.57	-73.30	40.57	-73.28	40.60	-73.30	40.60	-73.28	068-224
16	40-60	55.17	40.57	-73.35	40.57	-73.33	40.60	-73.35	40.60	-73.33	070-224
17	40-60	44.43	40.55	-73.50	40.55	-73.48	40.57	-73.50	40.57	-73.48	076-223
Region 5											
18	20-40	38.95	40.52	-73.85	40.52	-73.83	40.55	-73.85	40.55	-73.83	090-222
19	20-40	36.86	40.35	-73.98	40.35	-73.95	40.37	-73.98	40.37	-73.95	095-215
20	40-60	57.84	40.45	-73.90	40.45	-73.88	40.47	-73.90	40.47	-73.88	092-219
21	40-60	59.90	40.42	-73.93	40.42	-73.90	40.45	-73.93	40.45	-73.90	093-218
22	40-60	59.90	40.30	-73.93	40.30	-73.90	40.32	-73.93	40.32	-73.90	093-213
Region 6											
23	20-40	34.27	39.95	-74.08	39.95	-74.05	39.97	-74.08	39.97	-74.05	099-199
24	20-40	37.93	39.70	-74.10	39.70	-74.08	39.72	-74.10	39.72	-74.08	100-189
25	40-60	57.35	40.10	-74.00	40.10	-73.98	40.12	-74.00	40.12	-73.98	096-205
26	40-60	59.28	39.75	-74.03	39.75	-74.00	39.77	-74.03	39.77	-74.00	097-191
27	40-60	49.85	39.70	-74.05	39.70	-74.03	39.72	-74.05	39.72	-74.03	098-189
Region 7											
28	20-40	21.00	39.33	-74.48	39.33	-74.45	39.35	-74.48	39.36	-74.45	114-174
29	20-40	23.27	39.52	-74.25	39.52	-74.23	39.55	-74.25	39.55	-74.23	106-182
30	20-40	36.46	39.42	-74.28	39.42	-74.25	39.45	-74.28	39.45	-74.25	107-178
31	20-40	25.01	39.47	-74.28	39.47	-74.25	39.50	-74.28	39.50	-74.25	107-180
32	40-60	57.67	39.57	-74.13	39.57	-74.10	39.60	-74.13	39.60	-74.10	101-184
33	40-60	42.35	39.35	-74.33	39.35	-74.30	39.37	-74.33	39.37	-74.30	109-175
34	40-60	46.64	39.27	-74.38	39.27	-74.35	39.30	-74.38	39.30	-74.35	111-172
35	40-60	40.92	39.30	-74.38	39.30	-74.35	39.32	-74.38	39.32	-74.35	111-173
36	40-60	55.51	39.22	-74.43	39.22	-74.40	39.25	-74.43	39.25	-74.40	113-170

37	40-60	44.97	39.25	-74.53	39.25	-74.50	39.27	-74.53	39.27	-74.50	117-171
Region 8											
38	20-40	28.47	38.95	-74.65	38.95	-74.63	38.97	-74.65	38.97	-74.63	122-159
39	20-40	38.94	38.95	-74.78	38.95	-74.75	38.97	-74.78	38.97	-74.75	127-159
40	40-60	58.50	38.97	-74.53	38.97	-74.50	39.00	-74.53	39.00	-74.50	117-160
41	40-60	50.99	39.00	-74.60	39.00	-74.58	39.02	-74.60	39.02	-74.58	120-161
42	40-60	56.26	39.05	-74.63	39.05	-74.60	39.07	-74.63	39.07	-74.60	121-163
43	40-60	40.57	39.12	-74.65	39.12	-74.63	39.15	-74.65	39.15	-74.63	122-166
44	40-60	50.03	38.95	-74.70	38.95	-74.68	38.97	-74.70	38.97	-74.68	124-159
45	40-60	50.43	38.90	-74.73	38.90	-74.70	38.92	-74.73	38.92	-74.70	125-157
46	40-60	41.21	39.02	-74.73	39.02	-74.70	39.05	-74.73	39.05	-74.70	125-162
Region 9											
47	20-40	30.54	38.85	-74.93	38.85	-74.90	38.87	-74.93	38.87	-74.90	133-155
48	20-40	33.87	38.57	-75.05	38.57	-75.03	38.60	-75.05	38.60	-75.03	138-144
49	20-40	36.22	38.62	-75.05	38.62	-75.03	38.65	-75.05	38.65	-75.03	138-146
50	20-40	36.24	38.72	-75.05	38.72	-75.03	38.75	-75.05	38.75	-75.03	138-150
51	40-60	51.79	38.82	-74.80	38.82	-74.78	38.85	-74.80	38.85	-74.78	128-154
52	40-60	45.74	38.80	-74.85	38.80	-74.83	38.82	-74.85	38.82	-74.83	130-153
53	40-60	46.66	38.80	-74.88	38.80	-74.85	38.82	-74.88	38.82	-74.85	131-153
54	40-60	44.71	38.77	-74.90	38.77	-74.88	38.80	-74.90	38.80	-74.88	132-152
55	40-60	56.69	38.55	-74.95	38.55	-74.93	38.57	-74.95	38.57	-74.93	134-143
56	40-60	41.79	38.80	-74.98	38.80	-74.95	38.82	-74.98	38.82	-74.95	135-153
57	40-60	43.45	38.47	-75.00	38.47	-74.98	38.50	-75.00	38.50	-74.98	136-140
58	40-60	45.56	38.57	-75.00	38.57	-74.98	38.60	-75.00	38.60	-74.98	136-144
59	60-90	70.20	38.60	-74.90	38.60	-74.88	38.62	-74.90	38.62	-74.88	132-145
60	60-90	90.56	38.67	-74.90	38.67	-74.88	38.70	-74.90	38.70	-74.88	132-148
61	60-90	60.53	38.60	-74.95	38.60	-74.93	38.62	-74.95	38.62	-74.93	134-145
62	60-90	61.98	38.62	-74.95	38.62	-74.93	38.65	-74.95	38.65	-74.93	134-146
63	60-90	68.65	38.62	-74.75	38.62	-74.73	38.65	-74.75	38.65	-74.73	126-146
Region 10											
64	20-40	31.78	38.20	-75.15	38.20	-75.13	38.22	-75.15	38.22	-75.13	142-129
65	20-40	36.35	38.25	-75.05	38.25	-75.03	38.27	-75.05	38.27	-75.03	138-131
66	40-60	40.10	38.05	-75.05	38.05	-75.03	38.07	-75.05	38.07	-75.03	138-123
67	40-60	47.55	38.40	-75.03	38.40	-75.00	38.42	-75.03	38.42	-75.00	137-137
68	40-60	56.42	38.10	-75.08	38.10	-75.05	38.12	-75.08	38.12	-75.05	139-125
69	40-60	47.10	38.10	-75.10	38.10	-75.08	38.12	-75.10	38.12	-75.08	140-125
70	40-60	53.14	38.15	-75.13	38.15	-75.10	38.17	-75.13	38.17	-75.10	141-127
71	40-60	59.90	38.27	-74.98	38.27	-74.95	38.30	-74.98	38.30	-74.95	135-132
72	40-60	59.90	38.25	-75.00	38.25	-74.98	38.27	-75.00	38.27	-74.98	136-131
73	40-60	59.90	38.35	-74.93	38.35	-74.90	38.37	-74.93	38.37	-74.90	133-135
Region 11											
74	20-40	18.86	37.70	-75.58	37.70	-75.55	37.72	-75.58	37.72	-75.55	159-109
75	20-40	34.45	37.90	-75.30	37.90	-75.28	37.92	-75.30	37.92	-75.28	148-117
76	20-40	39.92	37.82	-75.33	37.82	-75.30	37.85	-75.33	37.85	-75.30	149-114
77	20-40	28.46	37.75	-75.53	37.75	-75.50	37.77	-75.53	37.77	-75.50	157-111
78	20-40	20.93	37.67	-75.58	37.67	-75.55	37.70	-75.58	37.70	-75.55	159-108
79	40-60	59.90	37.57	-75.43	37.57	-75.40	37.60	-75.43	37.60	-75.40	153-104
80	40-60	52.49	37.92	-75.18	37.92	-75.15	37.95	-75.18	37.95	-75.15	143-118

81	40-60	43.82	37.80	-75.33	37.80	-75.30	37.82	-75.33	37.82	-75.30	149-113
82	40-60	46.43	37.65	-75.38	37.65	-75.35	37.67	-75.38	37.67	-75.35	151-107
83	40-60	58.07	37.57	-75.40	37.57	-75.38	37.60	-75.40	37.60	-75.38	152-104
84	40-60	52.98	37.62	-75.45	37.62	-75.43	37.65	-75.45	37.65	-75.43	154-106
85	40-60	44.92	37.75	-75.45	37.75	-75.43	37.77	-75.45	37.77	-75.43	154-111
86	40-60	46.19	37.60	-75.50	37.60	-75.48	37.62	-75.50	37.62	-75.48	156-105
Region 12											
87	20-40	37.06	37.45	-75.60	37.45	-75.58	37.47	-75.60	37.47	-75.58	160-099
88	20-40	34.48	37.37	-75.65	37.37	-75.63	37.40	-75.65	37.40	-75.63	162-096
89	20-40	18.30	37.32	-75.70	37.32	-75.68	37.35	-75.70	37.35	-75.68	164-094
90	20-40	18.24	37.27	-75.75	37.27	-75.73	37.30	-75.75	37.30	-75.73	166-092
91	20-40	18.67	37.17	-75.80	37.17	-75.78	37.20	-75.80	37.20	-75.78	168-088
92	40-60	48.57	37.52	-75.48	37.52	-75.45	37.55	-75.48	37.55	-75.45	155-102
93	40-60	47.38	37.32	-75.58	37.32	-75.55	37.35	-75.58	37.35	-75.55	159-094
94	40-60	48.78	37.30	-75.60	37.30	-75.58	37.32	-75.60	37.32	-75.58	160-093
95	40-60	40.66	37.32	-75.65	37.32	-75.63	37.35	-75.65	37.35	-75.63	162-094
Region 13											
96	20-40	25.27	36.62	-75.90	36.62	-75.88	36.65	-75.90	36.65	-75.88	172-066
97	20-40	34.96	37.07	-75.78	37.07	-75.75	37.10	-75.78	37.10	-75.75	167-084
98	20-40	37.85	36.95	-75.85	36.95	-75.83	36.97	-75.85	36.97	-75.83	170-079
99	20-40	27.46	37.05	-75.85	37.05	-75.83	37.07	-75.85	37.07	-75.83	170-083
100	20-40	20.53	37.05	-75.93	37.05	-75.90	37.07	-75.93	37.07	-75.90	173-083
101	20-40	39.67	36.97	-76.00	36.97	-75.98	37.00	-76.00	37.00	-75.98	176-080
102	40-60	50.85	37.07	-75.70	37.07	-75.68	37.10	-75.70	37.10	-75.68	164-084
103	40-60	55.10	36.90	-75.73	36.90	-75.70	36.92	-75.73	36.92	-75.70	165-077
104	40-60	43.62	37.15	-75.73	37.15	-75.70	37.17	-75.73	37.17	-75.70	165-087
105	40-60	43.09	37.07	-75.75	37.07	-75.73	37.10	-75.75	37.10	-75.73	166-084
106	40-60	55.10	36.90	-75.78	36.90	-75.75	36.92	-75.78	36.92	-75.75	167-077
107	40-60	45.68	36.95	-75.80	36.95	-75.78	36.97	-75.80	36.97	-75.78	168-079
108	40-60	56.03	36.77	-75.83	36.77	-75.80	36.80	-75.83	36.80	-75.80	169-072
109	40-60	44.32	36.97	-75.83	36.97	-75.80	37.00	-75.83	37.00	-75.80	169-080
110	40-60	43.72	36.85	-75.93	36.85	-75.90	36.87	-75.93	36.87	-75.90	173-075
111	40-60	52.72	36.92	-75.95	36.92	-75.93	36.95	-75.95	36.95	-75.93	174-078
Region 14											
112	20-40	32.60	36.10	-75.73	36.10	-75.70	36.12	-75.73	36.12	-75.70	165-045
113	20-40	34.44	36.12	-75.73	36.12	-75.70	36.15	-75.73	36.15	-75.70	165-046
114	40-60	57.42	35.85	-75.58	35.85	-75.55	35.88	-75.58	35.88	-75.55	159-035
115	40-60	59.97	35.97	-75.63	35.97	-75.60	36.00	-75.63	36.00	-75.60	161-040
116	40-60	52.05	36.15	-75.73	36.15	-75.70	36.17	-75.73	36.17	-75.70	165-047
117	40-60	40.14	36.25	-75.78	36.25	-75.75	36.27	-75.78	36.27	-75.75	167-051
118	40-60	53.21	36.30	-75.78	36.30	-75.75	36.32	-75.78	36.32	-75.75	167-053
Region 15											
119	20-40	25.00	35.63	-75.48	35.63	-75.45	35.65	-75.48	35.65	-75.45	155-026
120	20-40	35.03	35.23	-75.50	35.23	-75.48	35.25	-75.50	35.25	-75.48	156-010
121	40-60	54.49	35.58	-75.40	35.58	-75.38	35.60	-75.40	35.60	-75.38	152-024
122	40-60	59.38	35.28	-75.45	35.28	-75.43	35.30	-75.45	35.30	-75.43	154-012
123	40-60	50.00	35.50	-75.45	35.50	-75.43	35.53	-75.45	35.53	-75.43	154-021
124	40-60	54.73	35.75	-75.45	35.75	-75.43	35.78	-75.45	35.78	-75.43	154-031

Block Island Sound											
125	60-90	82.53	41.13	-71.98	41.13	-71.95	41.15	-71.98	41.15	-71.95	945-906
126	60-90	65.39	41.08	-72.00	41.08	-71.98	41.10	-72.00	41.10	-71.98	946-904
127	60-90	81.05	41.13	-72.08	41.13	-72.05	41.15	-72.08	41.15	-72.05	949-906
128	90+	120.79	41.25	-71.70	41.25	-71.68	41.28	-71.70	41.28	-71.68	934-911
129	90+	112.24	41.23	-71.78	41.23	-71.75	41.25	-71.78	41.25	-71.75	937-910
130	90+	107.68	41.23	-71.80	41.23	-71.78	41.25	-71.80	41.25	-71.78	938-910
131	90+	124.01	41.25	-71.85	41.25	-71.83	41.28	-71.85	41.28	-71.83	940-911
132	90+	108.33	41.20	-71.93	41.20	-71.90	41.23	-71.93	41.23	-71.90	943-909
133	90+	123.80	41.20	-72.00	41.20	-71.98	41.23	-72.00	41.23	-71.98	946-909
134	90+	92.47	41.18	-72.08	41.18	-72.05	41.20	-72.08	41.20	-72.05	949-908
Rhode Island Sound											
135	60-90	86.09	41.33	-71.08	41.33	-71.05	41.35	-71.08	41.35	-71.05	909-914
136	60-90	86.01	41.28	-71.43	41.28	-71.40	41.30	-71.43	41.30	-71.40	923-912
137	60-90	86.00	41.38	-71.45	41.38	-71.43	41.40	-71.45	41.40	-71.43	924-916
138	60-90	62.31	41.30	-71.48	41.30	-71.45	41.33	-71.48	41.33	-71.45	925-913
139	60-90	76.30	41.30	-71.53	41.30	-71.50	41.33	-71.53	41.33	-71.50	927-913
140	60-90	89.05	41.08	-71.58	41.08	-71.55	41.10	-71.58	41.10	-71.55	929-904
141	90+	104.30	41.30	-70.90	41.30	-70.88	41.33	-70.90	41.33	-70.88	902-913
142	90+	126.73	41.18	-71.33	41.18	-71.30	41.20	-71.33	41.20	-71.30	919-908
143	90+	120.34	41.20	-71.33	41.20	-71.30	41.23	-71.33	41.23	-71.30	919-909
144	90+	112.16	41.20	-71.35	41.20	-71.33	41.23	-71.35	41.23	-71.33	920-909
145	90+	99.21	41.30	-71.35	41.30	-71.33	41.33	-71.35	41.33	-71.33	920-913
146	90+	118.98	41.13	-71.38	41.13	-71.35	41.15	-71.38	41.15	-71.35	921-906
147	90+	111.75	41.30	-71.38	41.30	-71.35	41.33	-71.38	41.33	-71.35	921-913
148	90+	131.64	41.25	-71.48	41.25	-71.45	41.28	-71.48	41.28	-71.45	925-911
149	90+	96.04	41.15	-71.53	41.15	-71.50	41.18	-71.53	41.18	-71.50	927-907
150	90+	91.05	41.13	-71.55	41.13	-71.53	41.15	-71.55	41.15	-71.53	928-906

Appendix Id. Latitude/longitude coordinates of the 150 cells (i.e. sampling sites) selected for sampling by the NEAMAP Near Shore Trawl Survey during the fall 2012 cruise.

Station	Depth Group	Avg Depth(ft)	SW Corner		NW Corner		SE Corner		NE Corner		CELL
			Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	Lat.	Lon.	
Region 1											
1	40-60	58.28	41.00	-71.93	41.00	-71.90	41.02	-71.93	41.02	-71.90	013-241
2	40-60	59.90	40.97	-71.98	40.97	-71.95	41.00	-71.98	41.00	-71.95	015-240
Region 2											
3	20-40	30.81	40.95	-72.15	40.95	-72.13	40.97	-72.15	40.97	-72.13	022-239
4	20-40	31.56	40.90	-72.28	40.90	-72.25	40.92	-72.28	40.92	-72.25	027-237
5	40-60	41.66	40.97	-72.05	40.97	-72.03	41.00	-72.05	41.00	-72.03	018-240
6	40-60	59.90	40.85	-72.33	40.85	-72.30	40.87	-72.33	40.87	-72.30	029-235
7	40-60	59.90	40.82	-72.40	40.82	-72.38	40.85	-72.40	40.85	-72.38	032-234
Region 3											
8	20-40	33.59	40.70	-72.93	40.70	-72.90	40.72	-72.93	40.72	-72.90	053-229
9	20-40	34.54	40.80	-72.55	40.80	-72.53	40.82	-72.55	40.82	-72.53	038-233
10	40-60	59.19	40.80	-72.50	40.80	-72.48	40.82	-72.50	40.82	-72.48	036-233
11	40-60	41.27	40.77	-72.63	40.77	-72.60	40.80	-72.63	40.80	-72.60	041-232
12	40-60	59.90	40.60	-73.15	40.60	-73.13	40.62	-73.15	40.62	-73.13	062-225
Region 4											
13	20-40	38.14	40.60	-73.30	40.60	-73.28	40.62	-73.30	40.62	-73.28	068-225
14	20-40	34.54	40.55	-73.65	40.55	-73.63	40.57	-73.65	40.57	-73.63	082-223
15	40-60	55.44	40.52	-73.50	40.52	-73.48	40.55	-73.50	40.55	-73.48	076-222
16	40-60	44.43	40.55	-73.50	40.55	-73.48	40.57	-73.50	40.57	-73.48	076-223
17	40-60	59.48	40.50	-73.53	40.50	-73.50	40.52	-73.53	40.52	-73.50	077-221
Region 5											
18	20-40	39.62	40.55	-73.78	40.55	-73.75	40.57	-73.78	40.57	-73.75	087-223
19	20-40	34.93	40.47	-73.95	40.47	-73.93	40.50	-73.95	40.50	-73.93	094-220
20	40-60	45.81	40.20	-74.00	40.20	-73.98	40.22	-74.00	40.22	-73.98	096-209
21	40-60	59.90	40.50	-73.70	40.50	-73.68	40.52	-73.70	40.52	-73.68	084-221
22	40-60	59.90	40.35	-73.93	40.35	-73.90	40.37	-73.93	40.37	-73.90	093-215
Region 6											
23	20-40	24.10	39.67	-74.15	39.67	-74.13	39.70	-74.15	39.70	-74.13	102-188
24	20-40	31.67	40.02	-74.05	40.02	-74.03	40.05	-74.05	40.05	-74.03	098-202
25	40-60	44.77	39.65	-74.13	39.65	-74.10	39.67	-74.13	39.67	-74.10	101-187
26	40-60	59.90	39.93	-74.05	39.93	-74.03	39.95	-74.05	39.95	-74.03	098-198
27	40-60	59.90	40.12	-73.98	40.12	-73.95	40.15	-73.98	40.15	-73.95	095-206
Region 7											
28	20-40	18.47	39.37	-74.38	39.37	-74.35	39.40	-74.38	39.40	-74.35	111-176
29	20-40	38.15	39.32	-74.38	39.32	-74.35	39.35	-74.38	39.35	-74.35	111-174
30	20-40	29.72	39.35	-74.38	39.35	-74.35	39.37	-74.38	39.37	-74.35	111-175
31	20-40	33.81	39.30	-74.40	39.30	-74.38	39.32	-74.40	39.32	-74.38	112-173
32	40-60	47.98	39.37	-74.28	39.37	-74.25	39.40	-74.28	39.40	-74.25	107-176
33	40-60	41.57	39.37	-74.30	39.37	-74.28	39.40	-74.30	39.40	-74.28	108-176
34	40-60	56.25	39.30	-74.33	39.30	-74.30	39.32	-74.33	39.32	-74.30	109-173
35	40-60	46.64	39.27	-74.38	39.27	-74.35	39.30	-74.38	39.30	-74.35	111-172
36	40-60	50.37	39.25	-74.45	39.25	-74.43	39.27	-74.45	39.27	-74.43	114-171
37	40-60	58.75	39.17	-74.53	39.17	-74.50	39.20	-74.53	39.20	-74.50	117-168

Region 8											
38	20-40	36.96	38.92	-74.83	38.92	-74.80	38.95	-74.83	38.95	-74.80	129-158
39	20-40	27.10	38.95	-74.83	38.95	-74.80	38.97	-74.83	38.97	-74.80	129-159
40	40-60	57.97	39.02	-74.53	39.02	-74.50	39.05	-74.53	39.05	-74.50	117-162
41	40-60	59.50	39.15	-74.53	39.15	-74.50	39.17	-74.53	39.17	-74.50	117-167
42	40-60	52.88	39.10	-74.58	39.10	-74.55	39.12	-74.58	39.12	-74.55	119-165
43	40-60	52.81	39.15	-74.58	39.15	-74.55	39.17	-74.58	39.17	-74.55	119-167
44	40-60	46.08	38.95	-74.60	38.95	-74.58	38.97	-74.60	38.97	-74.58	120-159
45	40-60	47.21	39.07	-74.68	39.07	-74.65	39.10	-74.68	39.10	-74.65	123-164
46	40-60	41.88	38.95	-74.73	38.95	-74.70	38.97	-74.73	38.97	-74.70	125-159
Region 9											
47	20-40	36.25	38.70	-75.08	38.70	-75.05	38.72	-75.08	38.72	-75.05	139-149
48	20-40	33.36	38.87	-74.85	38.87	-74.83	38.90	-74.85	38.90	-74.83	130-156
49	20-40	23.30	38.87	-74.95	38.87	-74.93	38.90	-74.95	38.90	-74.93	134-156
50	20-40	37.45	38.65	-75.05	38.65	-75.03	38.67	-75.05	38.67	-75.03	138-147
51	40-60	56.76	38.80	-74.80	38.80	-74.78	38.82	-74.80	38.82	-74.78	128-153
52	40-60	51.79	38.82	-74.80	38.82	-74.78	38.85	-74.80	38.85	-74.78	128-154
53	40-60	53.89	38.80	-74.83	38.80	-74.80	38.82	-74.83	38.82	-74.80	129-153
54	40-60	58.34	38.70	-74.85	38.70	-74.83	38.72	-74.85	38.72	-74.83	130-149
55	40-60	54.77	38.72	-74.85	38.72	-74.83	38.75	-74.85	38.75	-74.83	130-150
56	40-60	53.79	38.47	-74.90	38.47	-74.88	38.50	-74.90	38.50	-74.88	132-140
57	40-60	59.58	38.62	-74.98	38.62	-74.95	38.65	-74.98	38.65	-74.95	135-146
58	40-60	44.01	38.67	-75.00	38.67	-74.98	38.70	-75.00	38.70	-74.98	136-148
59	60-90	92.96	38.65	-74.88	38.65	-74.85	38.67	-74.88	38.67	-74.85	131-147
60	60-90	76.97	38.67	-74.88	38.67	-74.85	38.70	-74.88	38.70	-74.85	131-148
61	60-90	70.20	38.60	-74.90	38.60	-74.88	38.62	-74.90	38.62	-74.88	132-145
62	60-90	68.96	38.62	-74.93	38.62	-74.90	38.65	-74.93	38.65	-74.90	133-146
63	60-90	69.26	38.65	-74.78	38.65	-74.75	38.67	-74.78	38.67	-74.75	127-147
Region 10											
64	20-40	35.04	38.35	-75.05	38.35	-75.03	38.37	-75.05	38.37	-75.03	138-135
65	20-40	38.76	38.37	-75.05	38.37	-75.03	38.40	-75.05	38.40	-75.03	138-136
66	40-60	59.90	38.17	-75.03	38.17	-75.00	38.20	-75.03	38.20	-75.00	137-128
67	40-60	57.31	38.42	-74.88	38.42	-74.85	38.45	-74.88	38.45	-74.85	131-138
68	40-60	45.27	38.40	-74.93	38.40	-74.90	38.42	-74.93	38.42	-74.90	133-137
69	40-60	57.38	38.42	-74.98	38.42	-74.95	38.45	-74.98	38.45	-74.95	135-138
70	40-60	50.64	38.30	-75.03	38.30	-75.00	38.32	-75.03	38.32	-75.00	137-133
71	40-60	48.66	38.32	-75.03	38.32	-75.00	38.35	-75.03	38.35	-75.00	137-134
72	40-60	40.84	38.30	-75.05	38.30	-75.03	38.32	-75.05	38.32	-75.03	138-133
73	40-60	40.80	38.07	-75.15	38.07	-75.13	38.10	-75.15	38.10	-75.13	142-124
Region 11											
74	20-40	38.04	38.00	-75.15	38.00	-75.13	38.02	-75.15	38.02	-75.13	142-121
75	20-40	23.03	37.85	-75.35	37.85	-75.33	37.87	-75.35	37.87	-75.33	150-115
76	20-40	27.06	37.82	-75.40	37.82	-75.38	37.85	-75.40	37.85	-75.38	152-114
77	20-40	29.77	37.82	-75.43	37.82	-75.40	37.85	-75.43	37.85	-75.40	153-114
78	20-40	24.51	37.65	-75.58	37.65	-75.55	37.67	-75.58	37.67	-75.55	159-107
79	40-60	52.40	38.00	-75.03	38.00	-75.00	38.02	-75.03	38.02	-75.00	137-121
80	40-60	44.73	38.00	-75.13	38.00	-75.10	38.02	-75.13	38.02	-75.10	141-121
81	40-60	40.86	37.87	-75.23	37.87	-75.20	37.90	-75.23	37.90	-75.20	145-116

82	40-60	54.56	37.62	-75.43	37.62	-75.40	37.65	-75.43	37.65	-75.40	153-106
83	40-60	50.51	37.67	-75.43	37.67	-75.40	37.70	-75.43	37.70	-75.40	153-108
84	40-60	50.76	37.57	-75.45	37.57	-75.43	37.60	-75.45	37.60	-75.43	154-104
85	40-60	40.36	37.77	-75.45	37.77	-75.43	37.80	-75.45	37.80	-75.43	154-112
86	40-60	41.79	37.57	-75.55	37.57	-75.53	37.60	-75.55	37.60	-75.53	158-104
Region 12											
87	20-40	20.00	37.40	-75.70	37.40	-75.68	37.42	-75.70	37.42	-75.68	164-097
88	20-40	20.00	37.30	-75.75	37.30	-75.73	37.32	-75.75	37.32	-75.73	166-093
89	20-40	37.73	37.52	-75.58	37.52	-75.55	37.55	-75.58	37.55	-75.55	159-102
90	20-40	20.00	37.22	-75.78	37.22	-75.75	37.25	-75.78	37.25	-75.75	167-090
91	20-40	21.05	37.27	-75.78	37.27	-75.75	37.30	-75.78	37.30	-75.75	167-092
92	40-60	48.57	37.52	-75.48	37.52	-75.45	37.55	-75.48	37.55	-75.45	155-102
93	40-60	43.38	37.35	-75.60	37.35	-75.58	37.37	-75.60	37.37	-75.58	160-095
94	40-60	40.66	37.32	-75.65	37.32	-75.63	37.35	-75.65	37.35	-75.63	162-094
95	40-60	47.17	37.17	-75.68	37.17	-75.65	37.20	-75.68	37.20	-75.65	163-088
Region 13											
96	20-40	27.21	36.75	-75.95	36.75	-75.93	36.77	-75.95	36.77	-75.93	174-071
97	20-40	39.98	37.10	-75.75	37.10	-75.73	37.12	-75.75	37.12	-75.73	166-085
98	20-40	25.68	37.10	-75.83	37.10	-75.80	37.12	-75.83	37.12	-75.80	169-085
99	20-40	38.32	37.00	-75.85	37.00	-75.83	37.02	-75.85	37.02	-75.83	170-081
100	20-40	25.11	37.05	-75.88	37.05	-75.85	37.07	-75.88	37.07	-75.85	171-083
101	20-40	32.46	36.95	-75.95	36.95	-75.93	36.97	-75.95	36.97	-75.93	174-079
102	40-60	42.05	37.05	-75.75	37.05	-75.73	37.07	-75.75	37.07	-75.73	166-083
103	40-60	55.10	36.90	-75.78	36.90	-75.75	36.92	-75.78	36.92	-75.75	167-077
104	40-60	57.87	36.55	-75.80	36.55	-75.78	36.57	-75.80	36.57	-75.78	168-063
105	40-60	58.29	36.67	-75.80	36.67	-75.78	36.70	-75.80	36.70	-75.78	168-068
106	40-60	53.86	36.87	-75.80	36.87	-75.78	36.90	-75.80	36.90	-75.78	168-076
107	40-60	55.00	36.82	-75.83	36.82	-75.80	36.85	-75.83	36.85	-75.80	169-074
108	40-60	48.33	36.70	-75.85	36.70	-75.83	36.72	-75.85	36.72	-75.83	170-069
109	40-60	50.01	36.77	-75.85	36.77	-75.83	36.80	-75.85	36.80	-75.83	170-072
110	40-60	41.71	36.90	-75.90	36.90	-75.88	36.92	-75.90	36.92	-75.88	172-077
111	40-60	53.84	36.90	-75.95	36.90	-75.93	36.92	-75.95	36.92	-75.93	174-077
Region 14											
112	20-40	21.59	36.42	-75.85	36.42	-75.83	36.45	-75.85	36.45	-75.83	170-058
113	20-40	25.14	36.45	-75.85	36.45	-75.83	36.47	-75.85	36.47	-75.83	170-059
114	40-60	59.90	35.95	-75.60	35.95	-75.58	35.97	-75.60	35.97	-75.58	160-039
115	40-60	58.60	35.90	-75.58	35.90	-75.55	35.92	-75.58	35.92	-75.55	159-037
116	40-60	58.88	36.32	-75.78	36.32	-75.75	36.35	-75.78	36.35	-75.75	167-054
117	40-60	57.27	36.35	-75.78	36.35	-75.75	36.37	-75.78	36.37	-75.75	167-055
118	40-60	43.51	36.32	-75.80	36.32	-75.78	36.35	-75.80	36.35	-75.78	168-054
Region 15											
119	20-40	25.00	35.60	-75.48	35.60	-75.45	35.63	-75.48	35.63	-75.45	155-025
120	20-40	28.05	35.20	-75.50	35.20	-75.48	35.23	-75.50	35.23	-75.48	156-009
121	40-60	59.90	35.63	-75.43	35.63	-75.40	35.65	-75.43	35.65	-75.40	153-026
122	40-60	59.90	35.65	-75.45	35.65	-75.43	35.68	-75.45	35.68	-75.43	154-027
123	40-60	59.38	35.28	-75.45	35.28	-75.43	35.30	-75.45	35.30	-75.43	154-012
124	40-60	48.56	35.38	-75.45	35.38	-75.43	35.40	-75.45	35.40	-75.43	154-016
Block Island Sound											

125	60-90	61.28	41.15	-71.65	41.15	-71.63	41.18	-71.65	41.18	-71.63	932-907
126	60-90	77.21	41.15	-72.00	41.15	-71.98	41.18	-72.00	41.18	-71.98	946-907
127	60-90	80.91	41.15	-72.05	41.15	-72.03	41.18	-72.05	41.18	-72.03	948-907
128	90+	110.85	41.23	-71.63	41.23	-71.60	41.25	-71.63	41.25	-71.60	931-910
129	90+	107.28	41.28	-71.75	41.28	-71.73	41.30	-71.75	41.30	-71.73	936-912
130	90+	111.39	41.18	-71.95	41.18	-71.93	41.20	-71.95	41.20	-71.93	944-908
131	90+	133.22	41.23	-71.95	41.23	-71.93	41.25	-71.95	41.25	-71.93	944-910
132	90+	101.26	41.18	-72.03	41.18	-72.00	41.20	-72.03	41.20	-72.00	947-908
133	90+	112.49	41.23	-72.03	41.23	-72.00	41.25	-72.03	41.25	-72.00	947-910
134	90+	90.40	41.20	-72.08	41.20	-72.05	41.23	-72.08	41.23	-72.05	949-909
Rhode Island Sound											
135	60-90	67.30	41.38	-71.05	41.38	-71.03	41.40	-71.05	41.40	-71.03	908-916
136	60-90	76.50	41.38	-71.13	41.38	-71.10	41.40	-71.13	41.40	-71.10	911-916
137	60-90	70.05	41.43	-71.18	41.43	-71.15	41.45	-71.18	41.45	-71.15	913-918
138	60-90	70.71	41.43	-71.28	41.43	-71.25	41.45	-71.28	41.45	-71.25	917-918
139	60-90	79.05	41.43	-71.30	41.43	-71.28	41.45	-71.30	41.45	-71.28	918-918
140	60-90	78.49	41.10	-71.60	41.10	-71.58	41.13	-71.60	41.13	-71.58	930-905
141	90+	97.45	41.35	-70.93	41.35	-70.90	41.38	-70.93	41.38	-70.90	903-915
142	90+	109.24	41.30	-70.95	41.30	-70.93	41.33	-70.95	41.33	-70.93	904-913
143	90+	99.80	41.33	-70.95	41.33	-70.93	41.35	-70.95	41.35	-70.93	904-914
144	90+	129.40	41.28	-71.05	41.28	-71.03	41.30	-71.05	41.30	-71.03	908-912
145	90+	105.37	41.30	-71.25	41.30	-71.23	41.33	-71.25	41.33	-71.23	916-913
146	90+	105.57	41.33	-71.25	41.33	-71.23	41.35	-71.25	41.35	-71.23	916-914
147	90+	99.81	41.30	-71.33	41.30	-71.30	41.33	-71.33	41.33	-71.30	919-913
148	90+	119.12	41.20	-71.50	41.20	-71.48	41.23	-71.50	41.23	-71.48	926-909
149	90+	126.31	41.25	-71.55	41.25	-71.53	41.28	-71.55	41.28	-71.53	928-911
150	90+	119.14	41.28	-71.60	41.28	-71.58	41.30	-71.60	41.30	-71.58	930-912

APPENDIX II
NEAMAP Near Shore Trawl Survey
Subsampling Methodology

Northeast Area Monitoring and Assessment Program
Near Shore Trawl Survey Pilot Cruise
Sub-Sampling Protocol

Background

The Northeast Area Monitoring and Assessment Program (NEAMAP) near shore trawl survey will likely collect large quantities of fishes and invertebrates at certain sampling sites. It is therefore necessary to develop a well-defined sub-sampling protocol prior to conducting the pilot cruise to be able to process these fishes and select invertebrates quickly and efficiently. This document outlines four specific sub-sampling strategies and provides general criteria for instances in which each of these would be implemented. It is important to note that it is possible to use a combination of methods (e.g., “Mixed Sub-Sampling by Weight” and “Discard by Count Sub-Sampling”), as needed, and that all sub-sampling decisions will be the responsibility of the chief scientist. The procedures presented in this document have been adapted from protocols developed by the National Oceanographic and Atmospheric Administration, Northeast Fisheries Science Center’s bottom trawl survey.

No Sub-Sampling – A Small to Moderate Amount of Each of One or More Species *i*, Size-Class *j*

Processing the entire catch is preferable to sub-sampling, as the latter reduces the precision of the total catch estimate. It is believed that NEAMAP’s crew of seven (five scientists and two fishermen), will be capable of processing an entire catch consisting of a small to moderate amount (e.g., $\leq$ 200 specimens) of each of one or more species *i*, size-class *j*, in a timely manner without having to sub-sample.

In this situation, all specimens will be sorted into baskets by species and, if size (i.e., length)-classes within a species are present, by size-class as well. Visual inspection of the catch will be used to determine whether size-classes are present for a particular species as well as to establish length ranges for each size-class. For “priority” species, 10 individuals from each size-class will be removed for full processing (i.e., record individual length, weight, sex, and maturity stage; remove stomach and appropriate hard parts for later diet analysis and age determination, respectively). Specimens not chosen for full processing (the remainder) will be processed by recording aggregate weight ($W_{R_{ij}}$) and count ($C_{R_{ij}}$), along with individual lengths, for each species *i*, size-class *j*. Total weight (W_{T_i}) for each species *i* will be calculated using

$$W_{T_{ij}} = W_{R_{ij}} + W_{P_{ij}} \tag{1}$$

and

$$W_{T_i} = \sum_{j=1}^{n} W_{T_{ij}} \tag{2}$$

where $W_{P_{ij}}$ is the total weight of all of the fully-processed individuals of species *i*, size-class *j*, and *n* is the total number of size-classes of species *i*. Total count (C_{T_i}) for species *i* will be obtained by

$$C_{T_{ij}} = C_{R_{ij}} + C_{P_{ij}} \tag{3}$$

and

$$C_{T_i} = \sum_{j=1}^{n} C_{T_{ij}} \tag{4}$$

where $C_{P_{ij}}$ is the number of fully-processed individuals of species *i*, size-class *j*. Note that for "non-priority" species, $W_{P_{ij}} = 0$ and $C_{P_{ij}} = 0$, so $W_{T_{ij}} = W_{R_{ij}}$ and $C_{T_{ij}} = C_{R_{ij}}$. Length-frequency data will be generated for each species *i*, size-class *j*, by combining the length data from all fully-processed and "remainder" specimens of the given species/size-class. The length-frequency distribution for a species *i* is then obtained by combining the aforementioned data across the *n* size-classes of this species.

Sex, maturity, diet, and age-structure information will be scaled from the fully-processed specimens of species *i*, size-class *j*, to the total catch of this species/size-class using the expansion factor ($E_{P_{ij}}$)

$$E_{P_{ij}} = \frac{C_{T_{ij}}}{C_{P_{ij}}} \quad (5).$$

These data can also be combined across *n* size-classes of species *i* to generate catch-level estimates for that species.

Again, the decision of which sub-sample approach to use will be made on a case-by-case basis by the chief scientist, as situations will arise when it will be possible to completely process larger catches (e.g., when there is a long steam to the next sampling site) and impractical to process smaller catches (e.g., catch is comprised of an extremely large number of species *i*, size-class *j*).

Straight Sub-Sampling by Weight – A Moderately Large Amount of a Single Species *i*, Size-Class *j*; A Very Large Amount of a Single Species *i*, Size-Class *j*, Specimens Small to Medium Size; A Moderately Large Amount of Each of a Few Species *i*, Size-Class *j*

When a NEAMAP trawl tow yields a moderately large amount (e.g., 200 - 500 specimens) of a particular species *i*, size-class *j*, or a very large amount (e.g., 500 specimens or greater) of a species/size-class comprised of small to medium-sized specimens, “Straight Sub-Sampling by Weight” will be used to estimate the catch parameters for that species. If this dominant species *i*, size-class *j*, is a “priority”, 10 specimens will first be removed for full processing. The entire remaining catch will then be sorted by species and, when appropriate, size-class. Some baskets containing the dominant species *i*, size-class *j*, will be selected as a representative sub-sample, and all remaining (the “leftover”) baskets containing this species/size-class will be weighed ($W_{L_{ij}}$). The number of sub-sample baskets selected will vary, as the goal is to obtain a sufficient number of animals (i.e., 150-200) in the sub-sample to generate a reliable representation of the total catch of the species/size-class. For example, 150-200 large Atlantic croaker will fill more baskets than the same number of small spot. Weight ($W_{S_{ij}}$), count ($C_{S_{ij}}$), and individual length data will be recorded from the sub-sample. The total weight ($W_{T_{ij}}$) of species *i*, size-class *j*, collected is given by

$$W_{T_{ij}} = W_{L_{ij}} + W_{S_{ij}} + W_{P_{ij}} \quad (6).$$

The weight ($W_{S_{ij}}$) and count ($C_{S_{ij}}$) data from the sub-sample, the weight data from specimens not chosen as sub-sample ($W_{L_{ij}}$), and the number of fully-processed individuals ($C_{P_{ij}}$) will be combined to estimate the total count of species *i*, size *j*, collected ($C_{T_{ij}}$)

$$C_{T_{ij}} = C_{P_{ij}} + \left(\frac{W_{L_{ij}} + W_{S_{ij}}}{W_{S_{ij}}} * C_{S_{ij}} \right) \quad (7).$$

Length-frequency for the dominant species *i*, size-class *j*, will be generated by scaling the length data collected from the sub-sample and fully-processed specimens to the total catch of the species/size-class using an expansion factor ($E_{F_{ij}}$)

$$E_{F_{ij}} = \frac{C_{T_{ij}}}{C_{P_{ij}} + C_{S_{ij}}} \quad (8).$$

The sex, maturity, diet, and age-structure data collected from the fully-processed individuals will be scaled to the total catch of species *i*, size-class *j*, using $E_{P_{ij}}$ (Equation 5).

The total catch estimates for each of the remaining species *i*, size-class *j*, will be determined using an appropriate sub-sampling protocol (includes “No Sub-Sampling”). In order to generate catch-level estimates for each species *i*, data will be combined across the *n* size-classes of that species.

In cases where a NEAMAP trawl tow produces a moderately large (e.g., 200 - 500 specimens each) catch of each of a few (e.g., less than four) species/size-classes, sub-sampling will occur separately for each dominant species *i*, size-class *j*, according to the "Straight Sub-Sampling by Weight" procedure outlined above. Again, to generate catch-level estimates for each species *i*, data will be combined across the *n* size-classes of that species.

Mixed Sub-Sampling by Weight – A Moderately Large Amount of Each of Several Species *i*, Size-Class *j*, Specimens Similar Size; A Very Large Amount of Each of Two or More Species *i*, Size-Class *j*, Specimens Small to Medium Size

"Mixed Sub-Sampling by Weight" will be used when a moderately large (e.g., 200 - 500 specimens) amount of each of several (e.g., four or more) species *i*, size-class *j*, is collected, and specimens comprising each are of similar size. Species/size-classes that are either composed of relatively smaller or larger individuals or represented by relatively few individuals will first be sorted out of the catch. Other protocols defined in this document (i.e., "No Sub-Sampling", "Straight Sub-Sampling by Weight", and "Discard by Count Sub-Sampling") will be used to process these species/size-classes.

Ten specimens per size-class will then be removed from the mixed pile for each "priority" species present. The remaining specimens in the pile will be well mixed and placed (unsorted) into baskets. Some baskets (number depending on the composition of the catch) will be selected as the sub-sample, such that each species/size-class in the mix is adequately represented. The weight of all baskets not chosen for the sub-sample (the "leftover") will be recorded to obtain the remaining weight (W_L) of all species *i*, size-class *j*, in the mix. The mixed sub-sample will be weighed (W_S) and then sorted by species/size-class. Sub-sample weight ($W_{S_{ij}}$) and count ($C_{S_{ij}}$) for each of these species *i*, size-class *j*, along with individual specimen lengths, will be recorded. Total weight ($W_{T_{ij}}$) for each of these species *i*, size-class *j*, in the mix will be calculated using

$$W_{T_{ij}} = W_{P_{ij}} + \left(\frac{W_L + W_S}{W_S} * W_{S_{ij}} \right) \quad (9).$$

Total count ($C_{T_{ij}}$) for each species *i*, size-class *j*, in the mix will be calculated using

$$C_{T_{ij}} = C_{P_{ij}} + \left(\frac{W_L + W_S}{W_S} * C_{S_{ij}} \right) \quad (10).$$

Length-frequency will be obtained for each of these species *i*, size-class *j*, by scaling the length data collected from the sub-sampled and fully-processed individuals to the total catch using the expansion factor in Equation 8. Sex, maturity, diet, and age-structure data will be scaled from the fully-processed specimens to the total catch using $E_{P_{ij}}$ (Equation

5). Again, data can be combined across the *n* size-classes of species *i* to generate catch-level estimates for that species.

The "Mixed Sub-Sampling by Weight" protocol outlined above will also be used when a very large (e.g., 500 specimens or greater) amount of each of two or more species *i*, size-class *j*, is collected, and all specimens are small to medium size.

Discard by Count Sub-Sampling – A Very Large Amount of Each of One or More Species *i*, Size-Class *j*, Specimens Relatively Large Size

On occasions when a very large amount (e.g., 500 specimens or greater) of each of one or more species *i*, size-class *j*, is collected, and the specimens are relatively large, "Discard by Count Sub-Sampling" will be used. The following protocol is defined for the case in which a very large amount of a single species *i*, size-class *j*, is collected, and all specimens are relatively large. If this dominant species/size-class is a "priority", 10 individuals will first be removed for full processing. Several baskets (enough to obtain a sufficient sub-sample) will then be filled with specimens of this species *i*, size-class *j*, and set aside. The remaining (leftover) specimens of this species/size-class will be counted ($C_{L_{ij}}$) and discarded. The total weight of the sub-sample ($W_{S_{ij}}$) will be recorded, as will sub-sample count ($C_{S_{ij}}$) and individual lengths. Total weight ($W_{T_{ij}}$) of species *i*, size-class *j*, is then calculated using

$$W_{T_{ij}} = W_{P_{ij}} + \left(\frac{C_{L_{ij}} + C_{S_{ij}}}{C_{S_{ij}}} * W_{S_{ij}} \right) \quad (12).$$

The total count ($C_{T_{ij}}$) of species *i*, size-class *j*, is

$$C_{T_{ij}} = C_{L_{ij}} + C_{S_{ij}} + C_{P_{ij}} \quad (13).$$

Length-frequency will be obtained for this species *i*, size-class *j*, by scaling the length data collected from the sub-sampled and fully-processed individuals to the total catch using the expansion factor in Equation 8. The sex, maturity, diet, and age-structure data collected from the fully-processed individuals will be scaled to the total catch using $E_{P_{ij}}$ (Equation 5). As before, data can be combined across the *n* size-classes of species *i* to generate catch-level estimates for that species. If a very large amount of each of more than one species *i*, size-class *j*, (all specimens large) is collected, "Discard by Count Sub-Sampling" will occur separately for each according to the procedure outlined above.

APPENDIX III
NEAMAP Near Shore Trawl Survey
Survey Gear Design

Design of a proposed research survey bottom trawl to conduct standardized resource surveys on a newly designed research vessel.

TRAWL PARAMETERS:

A.) maintain a consistent bottom contact over a speed range of 3.0 to 3.8 knots.
B.) maintain a headrope height of 4.5 - 5.5 meters.
C.) utilize interchangeable sweeps, one for good bottom and one for rough bottom.

TRAWL SPECIFICATIONS:

The design consists of a three bridle trawl with a fishing circle of 400 meshes of 12cm 4mm br. PE. Side panels, top square, top bellies, 2nd and 3rd bottom bellies are of 6cm 2.5mm br. PE. The codend is of approx. 12cm dbl 4mm br. PE with a 1 inch knotless liner material and is attached to the tailpiece with zipper rings to facilitate changing. The exact size of codend mesh size will correspond to the 12cm dbl 4mm material required for the cut out 12cm selvage.

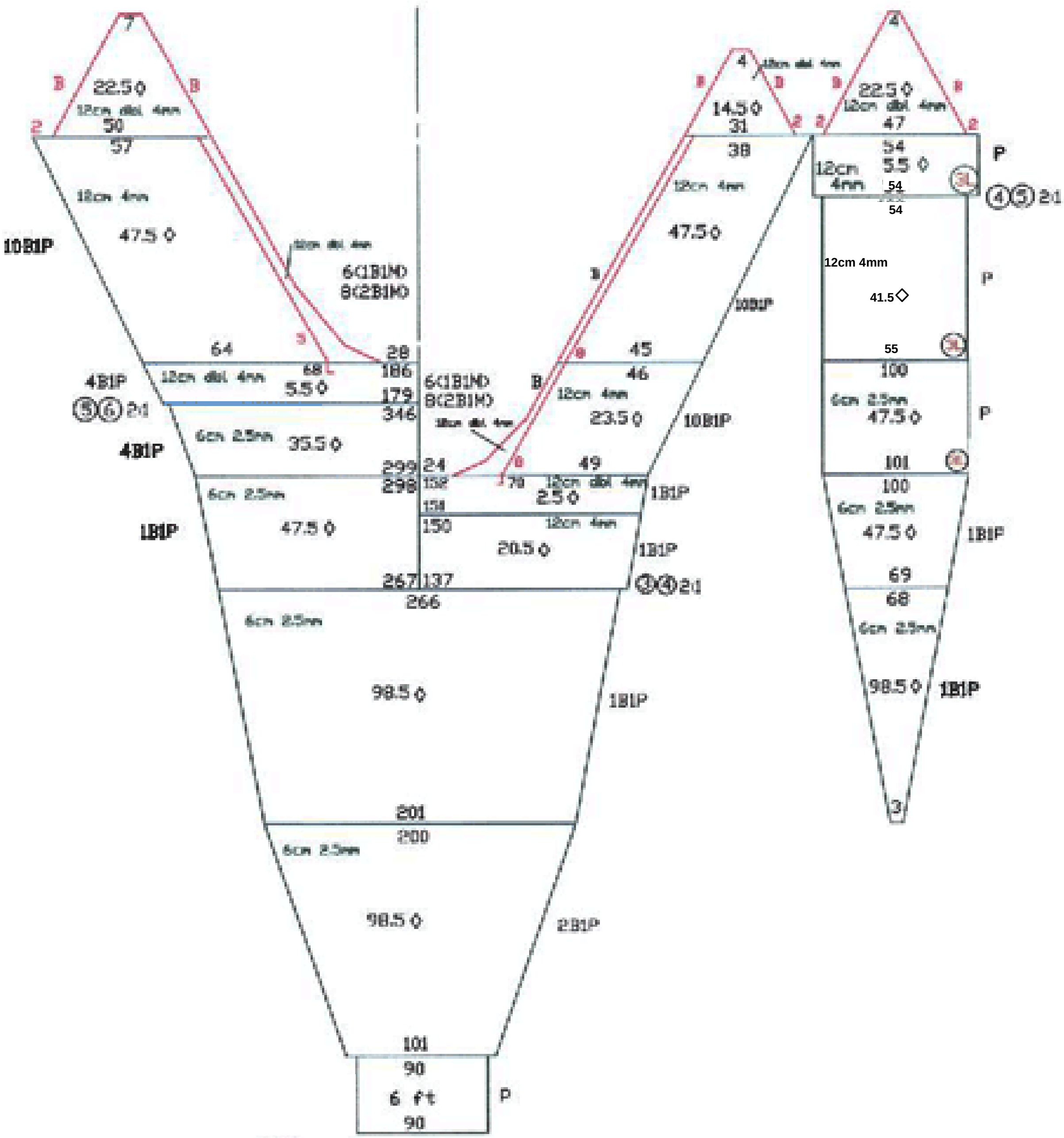
The trawl is mounted on 3/4" ss IWRC combination with 5/8" ss combination "up and down" lines. Floats consist of approx. 60 8" HD center hole plastic floats.

The trawl accommodates the utilization of two sweeps. The good bottom sweep consists of 3" rubber discs with leads and the rough bottom sweep has 16 and 14 inch rock hoppers with floppies without leads. Both sweeps are on 3/4 inch ss wire. The weights of the sweeps in air/sea water are approx. 643/371lbs and 2560/448lbs respectively.

Submitted to: Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543 under NFFM-7220-4-14243 of May 26, 2004.

Submitted jointly by: Reidar's Manufacturing Inc., Superior Trawl and Trawlworks, Inc.

400 x 12cm 3Br



Trawl

- 4-seam
  3- bridle
- 400 x 12cm 4800cm or 1890inches
- Foot rope = 2700cm
- Head rope = 2336cm

Twine size and thickness

- 12cm 4mm reg. braided pe
  - in top & bottom wings
  - in 1st 5.5 meshes of the side panel
  - in bunts
  - in 1st bottom belly
- 6cm 2.5mm reg. braided pe
  - from the square back
  - almost the entire side panel
  - from the 2nd bottom belly back

Selvedge

- selvedge will be cut out of 12.6cm (str. Mesh) dbl 4mm web
- 8 meshes deep on the bottom wing bars
- 5 meshes deep on the top wing bars
- All jibs, (top, bottom and side), are to be made from 12cm dbl 4mm web

Tailpiece

- tailpiece diameter is 180 meshes of 6cm 2.5mm
- 6 ft tailpiece with 30 large plastic rings for quick change of the codend
- The rings should be sewn up on the tailpiece to create a skirt that will enter the top of the codend.

Codend

- The codend is to be made from the same material as the selvedge, 12cm dbl 4mm
- The codend is 75meshes in diameter and 75meshes deep
- It is to have 30 large plastic rings on the trawl end
- It is to have 30 ¼" x 2 SS rings at the terminus

Liner

- size of the liner? (the allowable mesh size is something that is being debated at the Science Center)

Gore ropes

It was felt that at least for this 1st prototype gore ropes would not be necessary.

Hanging lines

Headrope

- ¾" stainless steel combination
- ¾" SS HWR thimbles
- The headrope is 2070cm eye to eye (see hanging information)
- The headrope eye, the top jib end meshes and the upper wing end eye are all put in a ¾" Blue Line bow shackle with the headrope extension chain of 11mm long link coming from it
- The extension chain of 3/8 Trawlex is 133cm – 9cm(3/4" bow shackle) = 124cm to even. An additional 50cm of is to be added to facilitate the slacking out of the headrope during the initial towing trials. This yields a total chain length of 174cm.

Wing End

- 5/8" stainless steel combination
- 5/8" SS HWR thimbles
- The upper wing end is 552cm eye to eye
- The lower wing end is 459cm eye to eye (see hanging information)
- The top jib eye goes into the ¾ " shackle on the top (see above)
- The two side panel eyes and the middle jib end meshes are put into a 3/4 bow shackle with middle extension coming from it.
- The middle extension is made of 5/8 SS wire with 5/8 HWR thimbles. It is 133cm – 9cm(3/4 bow shackle) = 124cm eye to eye

Footrope

- rubber covered wire
    - 2433 – [2 * 10(5/8 hammerlock)] = 2413 eye to eye
    - 5/8 stainless wire
    - 2 3/8 spacer cookies
    - use of a 2-hole hanger
    - 1 link to pass traveler through
    - Selvedge will be sewn to the 2-hole hangers with single 5mm pe.

Floats

- 60 – 8" center hole floats
- The floats are mounted vertically in two 30 – float strings with the first float of each string starting 50cm from the center of the headrope.
- The first 24 floats are mounted at 25cm on center and the remaining 6 floats are mounted at 50cm on center

Sweep to Footrope Attachment

-zipper traveler

- 9/16 galv. Wire 2700cm eye to eye

Sweep

flat sweep 3-piece

-center

- 890cm eye to eye
- ¾ Stainless wire
- 3" cookies
- 8 - 1.33lb leads per section for a total of 112 leads
- 1st and last drop chains at 25cm
- 60cm drop chain spacing
- 15 drop chains
- 3-link ½ trlx chains
- clamp in every 3rd section 4 clamps total

-wing sections

- 820cm eye to eye (75cm adjusting chain)
- 3" cookies
- 2 leads per section 22 leads total per wing section
- no lead in 1st and last sections
- 3-link ½ trlx drop chains
- 1st drop chain at 25cm (center end)
- last drop chain at 135 (wing end)
- 60cm spacing
- 12 drop chains
- clamp in every 3rd section 4 clamps total

****Rock hopper sweep is not used by NEAMAP ****

-rock hopper sweep

center

- 890cm ETE
- disc size
  - 2 - 16" rock hoppers per section with 1 in the end sections
  - 30 - 16" rock hoppers total
  - 8 - 16" floppies per section with 2 in the end sections
  - 116 – 16" floppies total
  - 5" spacer discs

no lead

- 3-link ½ " long link trawlex drop chains
- 1st and last drop chains at 25cm
- 60cm drop chain spacing
- 15 drop chains
- clamp in every 3rd section 4 clamps total

wings

- 820 ETE
- disc size
    - 2 - 14" rock hoppers per section with 1 in the 1st section
    - 23 – 14" rock hoppers total in each wing
    - 8 14" floppies per section with 2 in the 1st section
    - 90 – 14" floppies in each wing
    - 1 – 12" bunt bobbin in the last section
    - 5" spacer discs

  no lead

- 3-link ½" long link trlx drop chains
- 1st drop chain at 25cm (center end)
- last drop chain at 135 (wing end)
- 60cm spacing
- 12 drop chains
- clamp in every 3rd section   4 clamps total

HANGING INFORMATION

NEFSC SURVEY TRAWL
400 x 12cm - 3-bridal
HL = 2700cm

TWINE SIZE = 12.00cm Bars hung at 105% FOOTROPE EXT = 97.cm

****

BOTTOM
24. MESHES @ 6. = 138.0
6. 1B1M @ 10. = 60.0
9. 2B1M @ 16. = 144.0
BUNT BARS = 151.
WING + 1/2 = 605.
JIB + 1/2 = 188.
TOTAL WEBBING = 2433. - (2 * 10 (5/8 Hammer lock)) = 2413 ETE
EXT = 133. - 9(3/4 bow shac.) =. 124 ETE (5/8 SS wire)
TOTAL FOOTROPE = 2700

TOP
30. MESHES @ 6. = 174.0
6. 1B1M @ 10. = 60.0
9. 2B1M @ 16. = 144.0
WING BARS = 454.
JIB + 1/2 = 290.
TOTAL WEBBING = 2070.
EXT = 133. - 9 =124 to even + 50 for slacking = 174 ETE (3/8 trawlex chain)
TOTAL HEADROPE = 2336.

WING END
LOWER
BOT 15. Bars @ 1.025 = 183.
SIDE 23. Bars @ 1.0 = 276.
TOTAL WEBBING = 459.
EXT = 133. - 9 = 124 ETE (5/8 SS wire)
TOTAL WING END = 726.
UPPER
TOP 23. Bars @ 1.0 = 276..
SIDE 23. Bars @ 1.0 = 276.
TOTAL WEBBING = 552.
EXT = 133. - 9 = 124 ETE (5/8 SS wire)
TOTAL WING END = 818

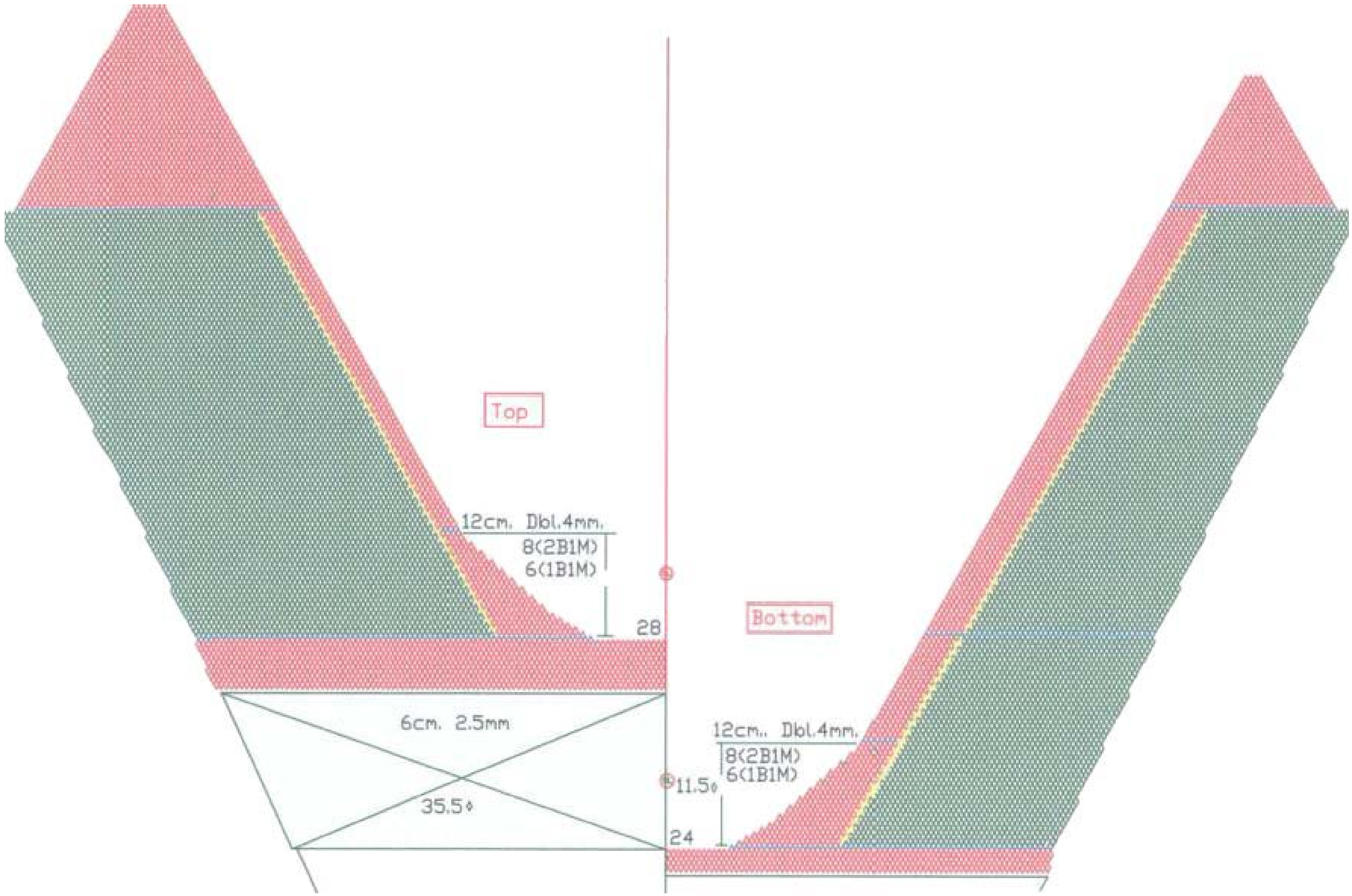
TRAVELER
ZIPPER TRAVELER 9/16 Galv
EYE TO CENTER = 1350
ADD 50cm FOR OTHER EYE

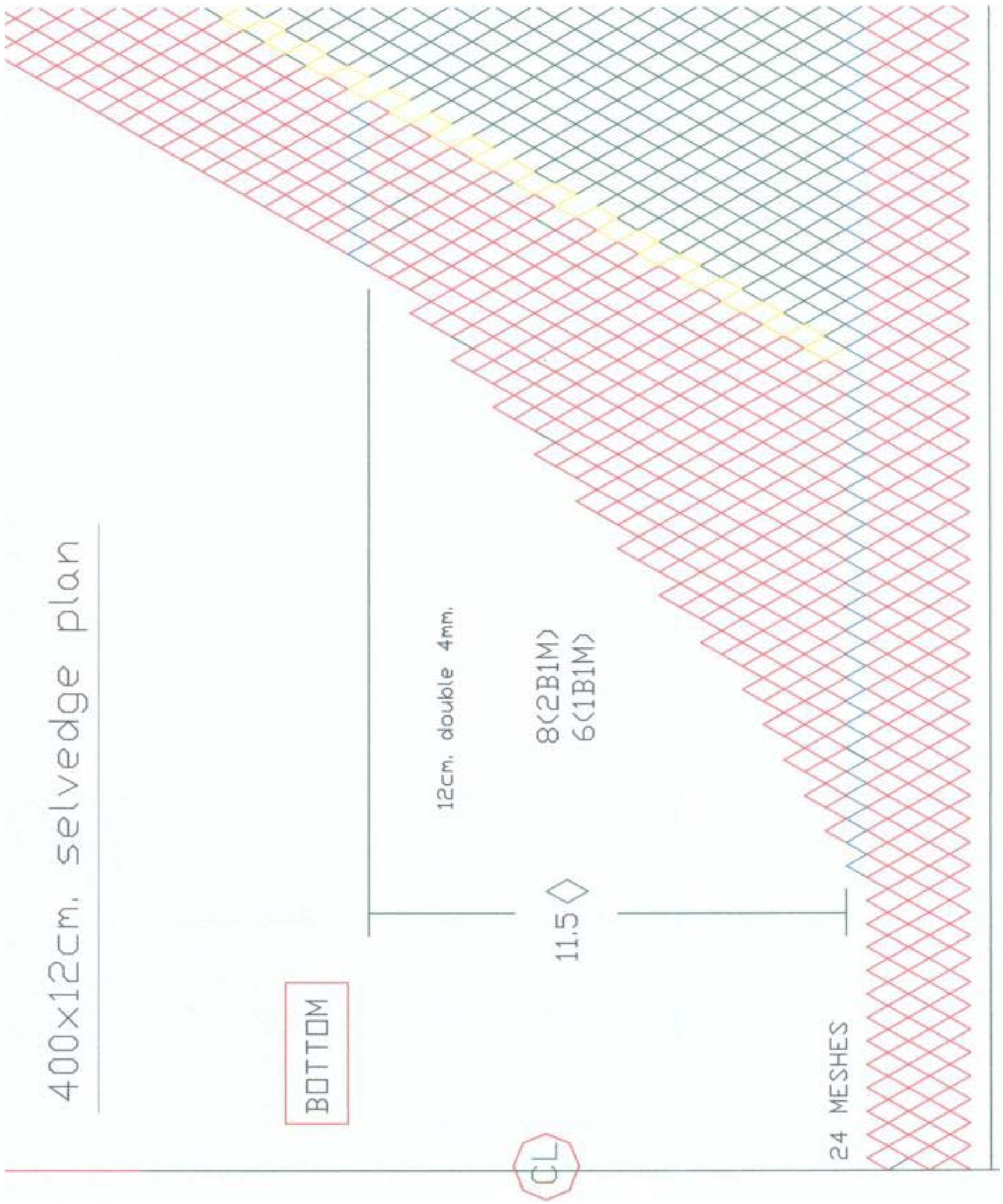
FLOATS 60 8" center hole

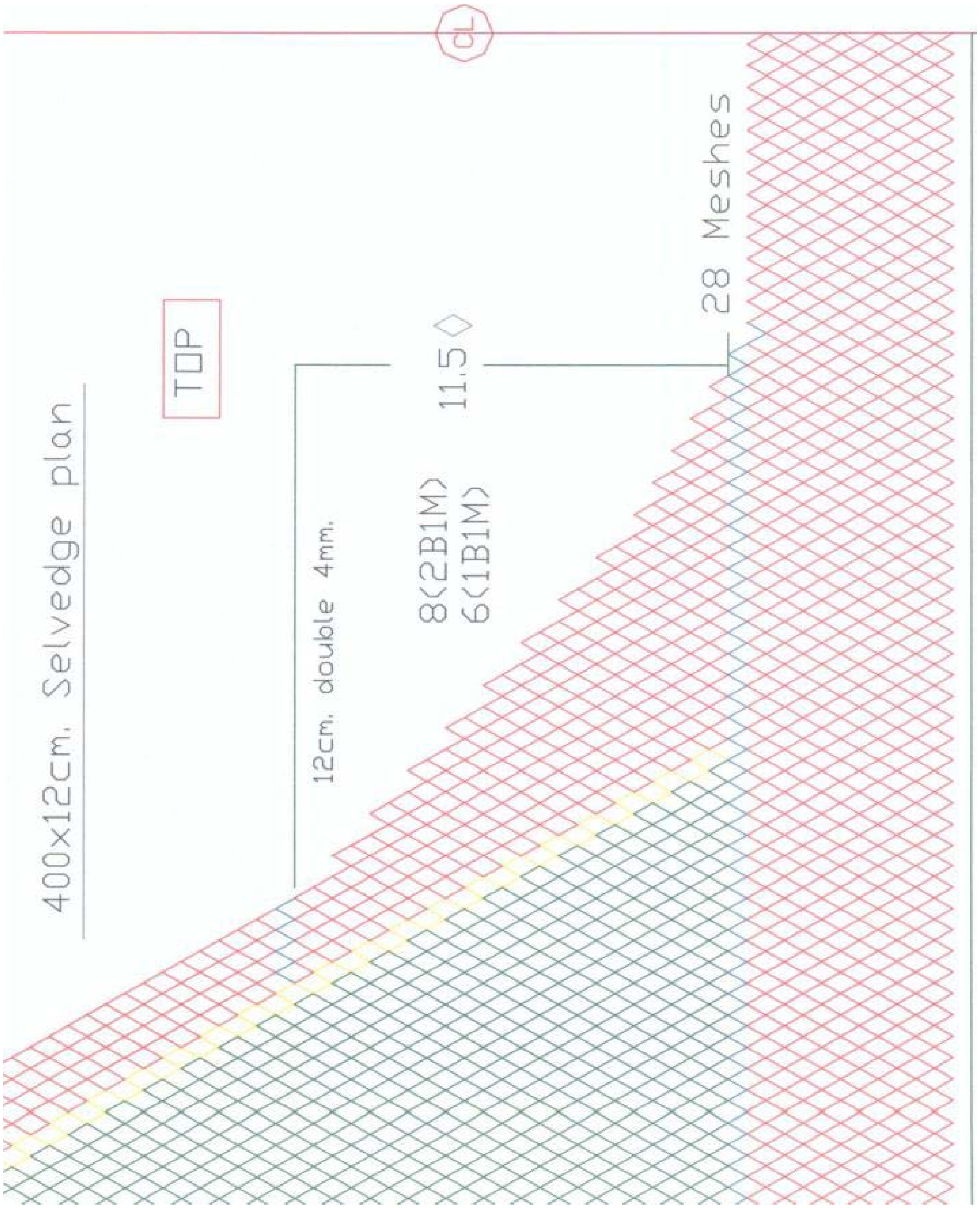
SWEEP 75cm ADJUSTING CHAIN

CENTER 890cm
1st & last = 25
others = 60
15 Chains

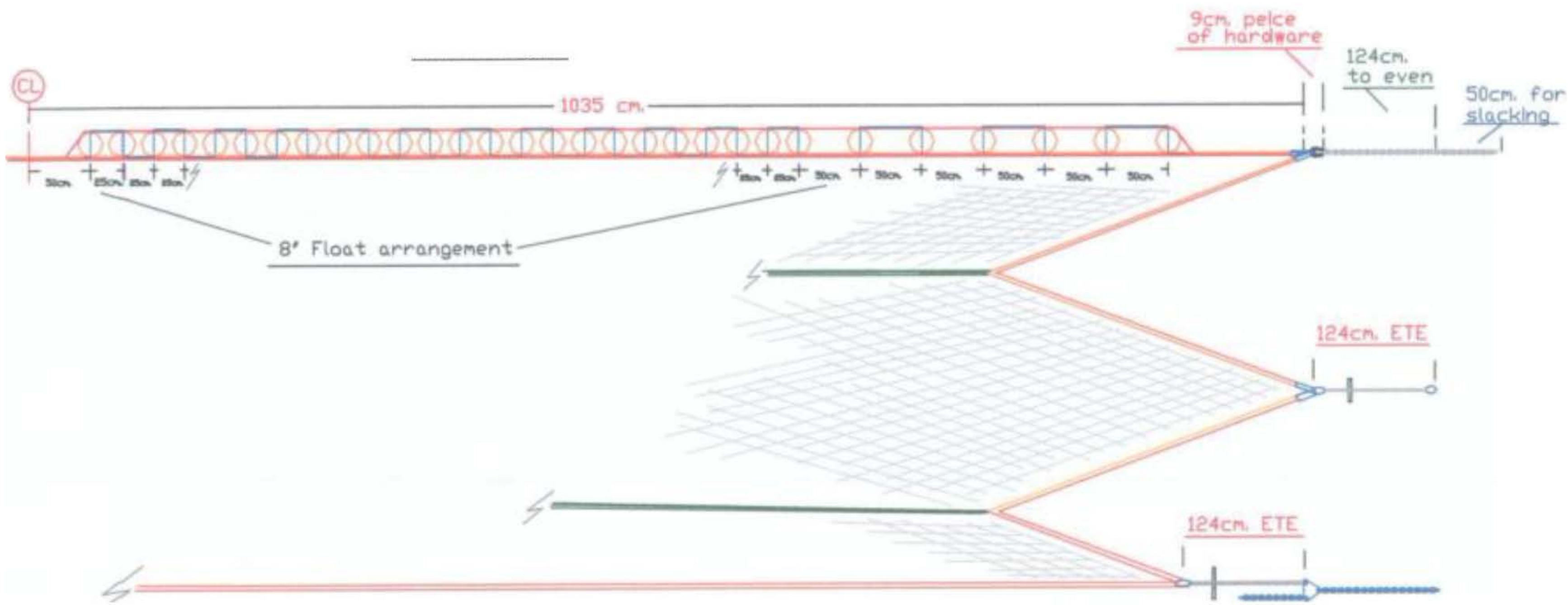
WINGS 820cm
1st = 25
last = 135
others = 60
12 chains


Top
12cm. Dbl.4mm.
8(2B1M)
6(1B1M)
28
6cm. 2.5mm
35.5φ
Bottom
12cm.. Dbl.4mm.
8(2B1M)
6(1B1M)
11.5φ
24


400x12cm. selvedge plan
BOTTOM
12cm. double 4mm.
8(2B1M)
6(1B1M)
11.5◇
24 MESHES
CL

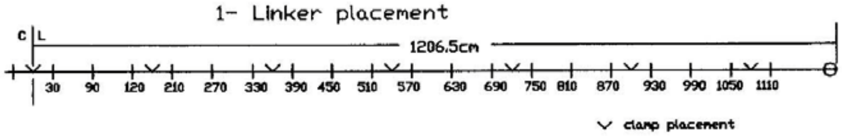

400x12cm. Selvedge plan
TOP
12cm. double 4mm.
8(2B1M)
6(1B1M)
11.5 ◇
28 Meshes
CL

400 x 12cm   3-Br   HL = 2700cm



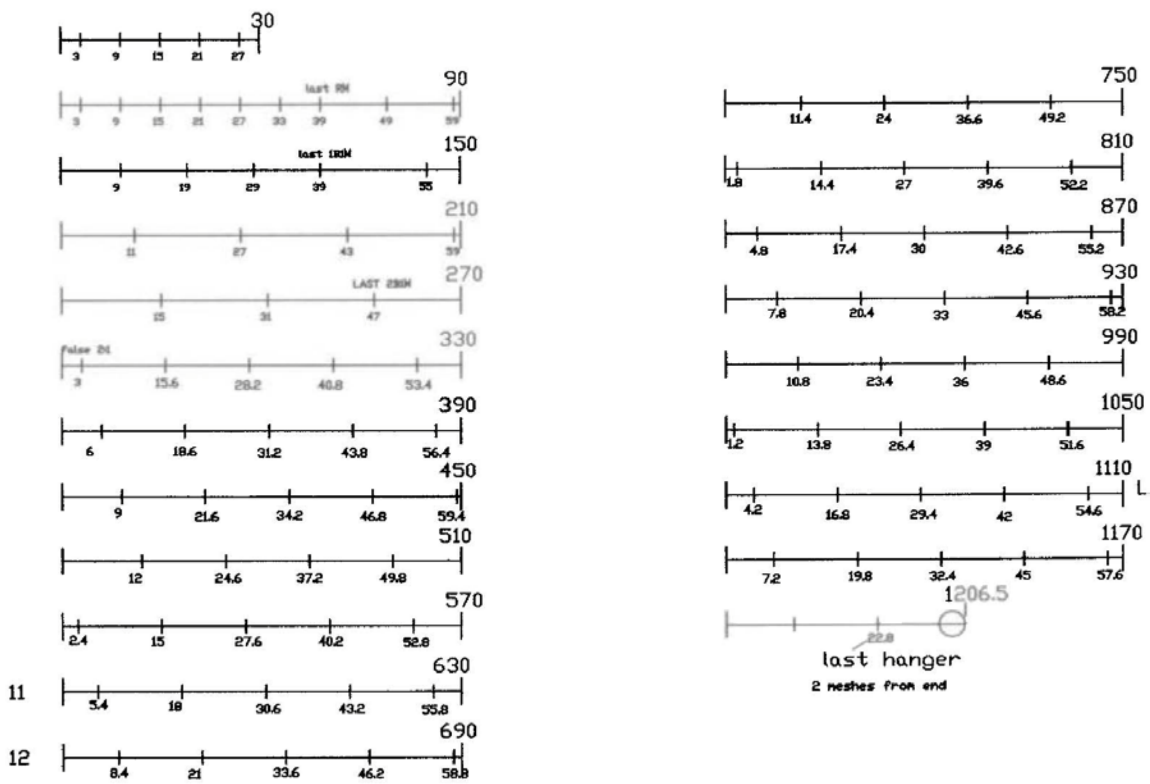
400 x 12cm 3- bridle FR = 2700cm Rubberline = 2413

1- Linker placement

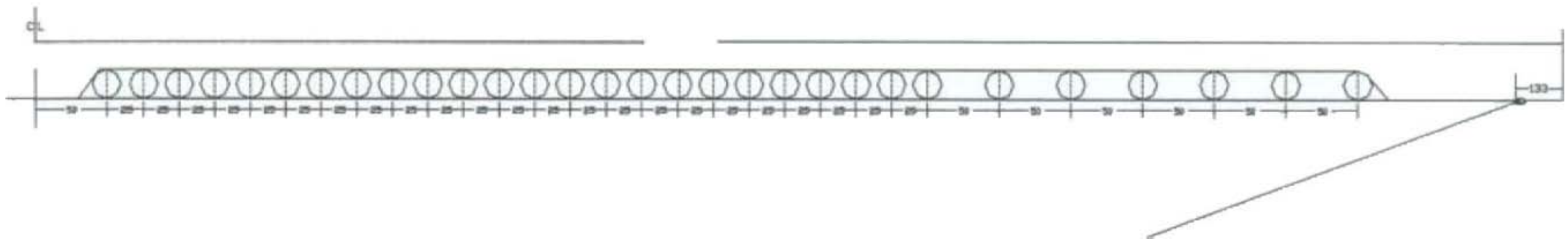


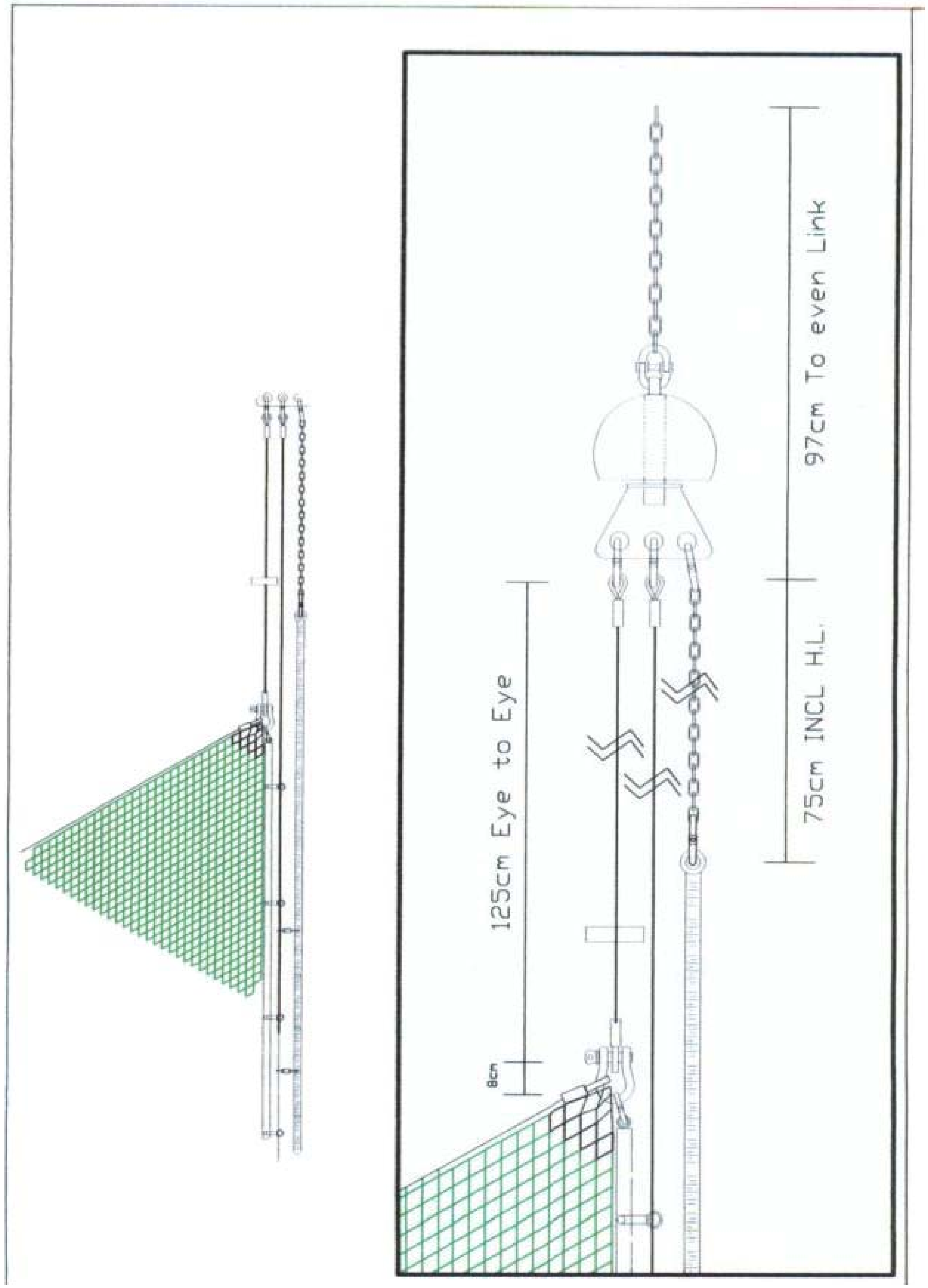
38 i - Linkers Total

200 2 - Hole Hangers Total

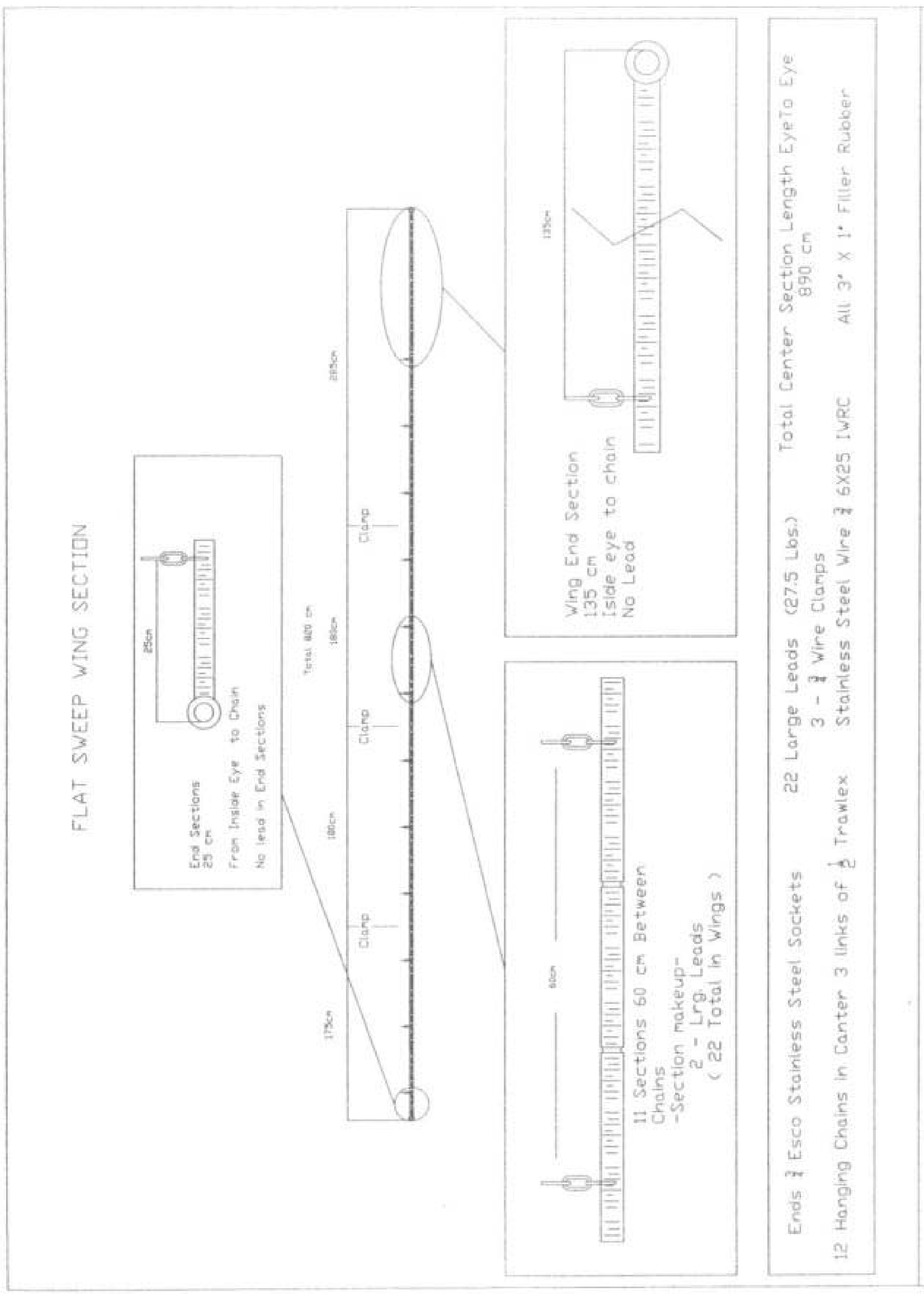


400 x 12cm 3-br Float Arrangement

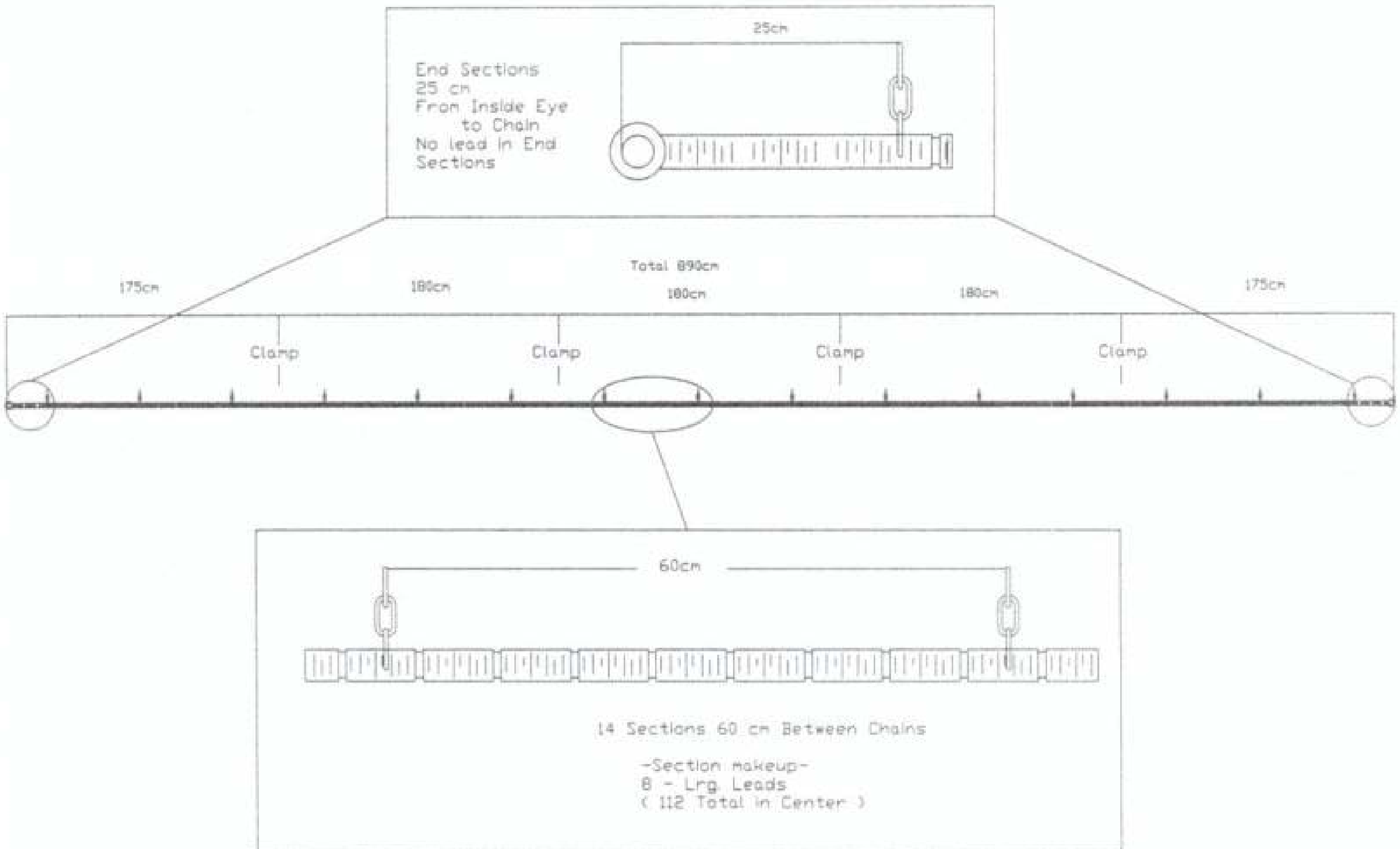




97cm To even Link
75cm INCL H.L.
125cm Eye to Eye
8cm

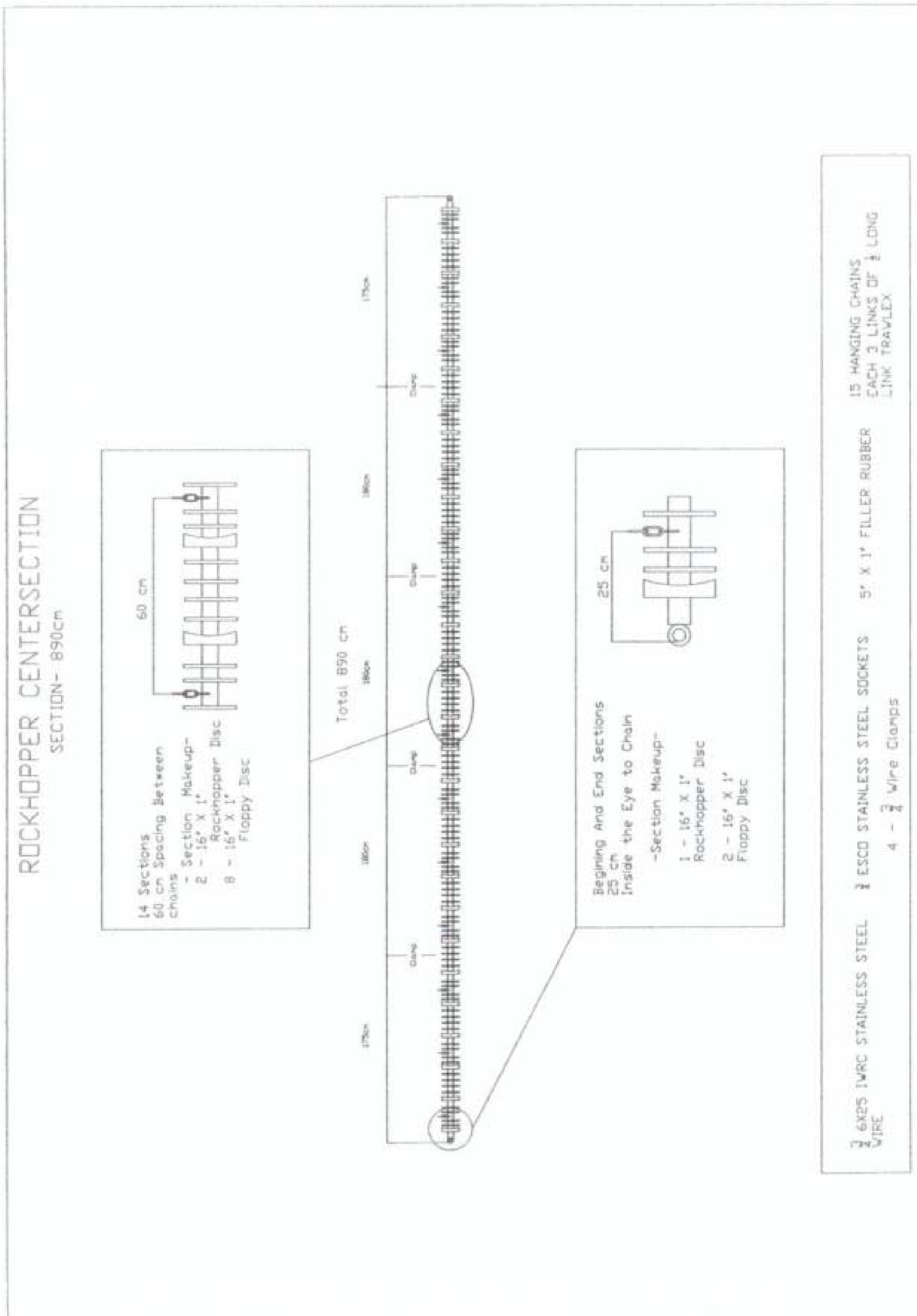

FLAT SWEEP WING SECTION
End Sections
25 cm
From Inside Eye to Chain
No lead in End Sections
25cm
Total 820 cm
175cm
180cm
180cm
285cm
Clamp
Clamp
Clamp
135cm
Wing End Section
135 cm
Iside eye to chain
No Lead
60cm
11 Sections 60 cm Between
Chains
-Section makeup-
2 - Lrg. Leads
(22 Total in Wings)
Ends ¾ Esco Stainless Steel Sockets
22 Large Leads (27.5 Lbs.)
3 - ¾ Wire Clamps
Total Center Section Length EyeTo Eye
890 cm
12 Hanging Chains in Canter 3 links of ½ Trawlex
Stainless Steel Wire ¾ 6X25 IWRC
All 3" X 1" Filler Rubber

FLAT SWEEP CENTER SECTION

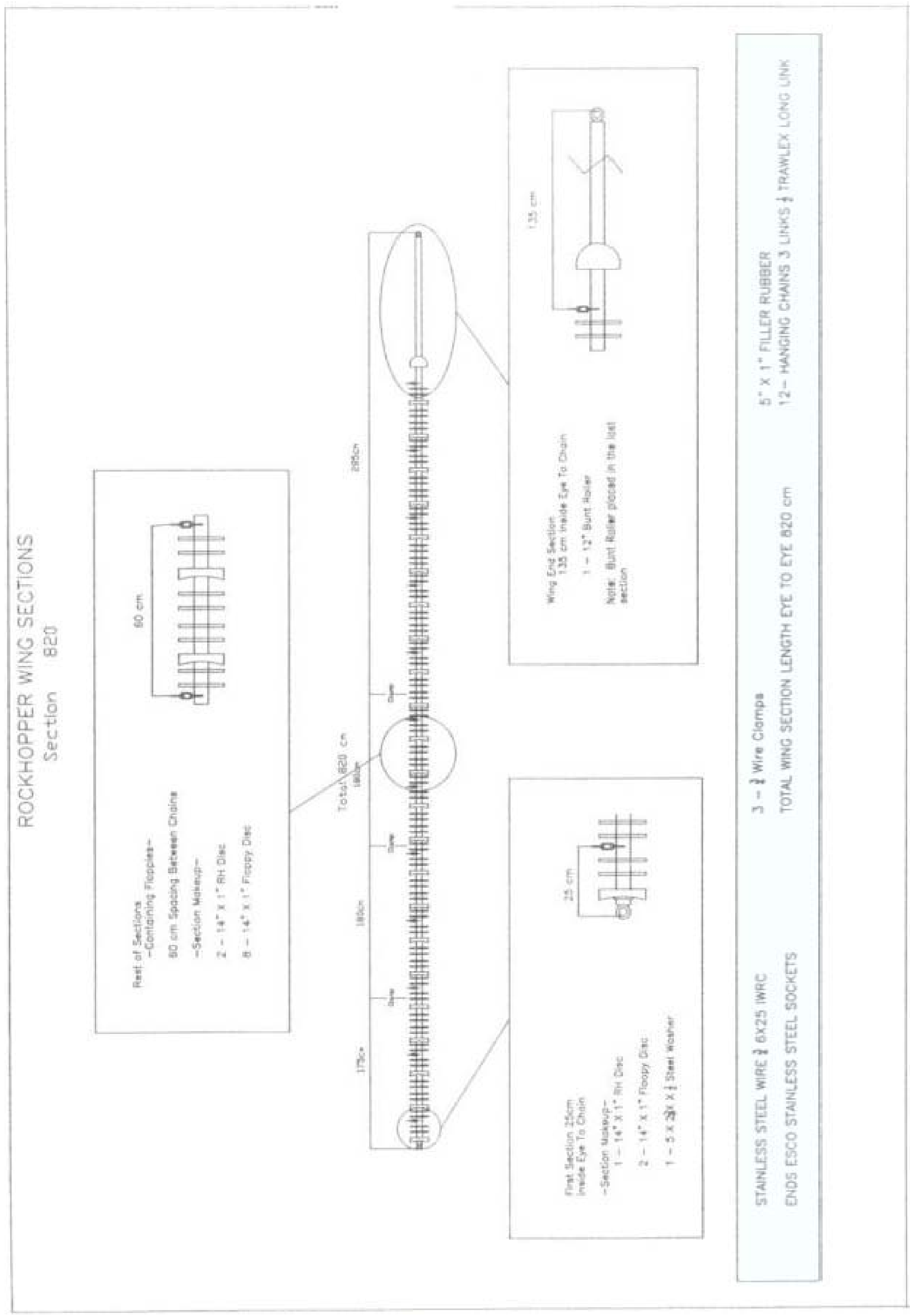


15 Hanging Chains in Canter3 links of ½ Trawlex
112 Lrg. leads 140 Lbs.
Stainless Steel Wire ¾ 6X25 IWRC
4 - ¾ Wire Clamps
Total Center Section Length Eye To Eye 890 cm
Ends ¾ Esco Stainless Steel Sockets
All 3" X 1" Filler Rubber

****Rock hopper sweep is not used by NEAMAP ****



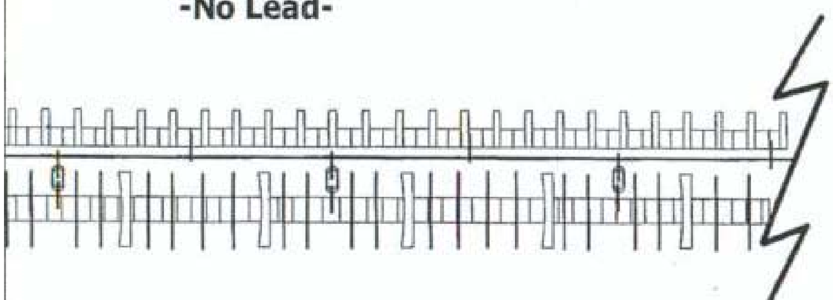
****Rock hopper sweep is not used by NEAMAP ****



Weight Of Sweeps:

Approximate +/- 5%

	Weight in Air	Weight in water
3"Cookie Sweep w/160large leads @ 1.4lbs.	597 Lbs.	332 Lbs.
16"/14" Rockhopper Sweep -No Lead-	2240 Lbs.	360 Lbs.



Notes: Both sweeps on 3/4 6x25 Iwrc s/s wire

16"x1" Rockhopper discs 2.5" Thick +/- .5"
14"x1" Rockhopper discs 2.0" Thick +/- .5"

APPENDIX IV
NEAMAP Near Shore Trawl Survey
Historical Catch

Appendix IV. Total biomass collected, by species, during all NEAMAP Near Shore Trawl Survey cruises conducted between fall 2007 and fall 2010. Values represent aggregate weights of all specimens caught across all seven cruises, and species are sorted by total catch weight.

COMMON NAME	TOTAL WEIGHT (KG)
Little skate	38422.704
Atlantic croaker	26825.449
Weakfish	22914.169
Winter skate	22059.067
Butterfish	21302.283
Scup	17980.894
Spot	16173.137
Clearnose skate	15595.537
Horseshoe crab	11466.231
Spiny dogfish	11196.925
Smooth dogfish	9924.469
Striped bass	9758.343
Longfin inshore squid	9599.637
Kingfishes	8160.106
Cownose ray	7242.735
Striped anchovy	4512.195
Spiny butterfly ray	3671.064
Summer flounder	3421.288
Bluntnose stingray	2667.806
Bluefish	2609.131
Bullnose ray	2581.752
Winter flounder	2197.887
Smooth butterfly ray	1626.523
Spotted hake	1417.175
Silver perch	1403.804
Atlantic menhaden	1330.579
Windowpane	1273.756
Roughtail stingray	1230.008
Atlantic sturgeon	1104.480
Silver hake	1054.897
Striped searobin	1051.352
Bay anchovy	992.361
Thresher shark	903.100
Sand tiger shark	849.090
Alewife	605.578
Black seabass	503.873

Ocean pout	413.091
American lobster	391.771
Atlantic torpedo	384.135
Sandbar shark	370.644
Atlantic herring	368.891
Atlantic sharpnose shark	341.620
Blueback herring	312.631
Atlantic cutlassfish	310.743
Goosefish	297.151
Round herring	273.243
Red hake	256.477
Pigfish	240.677
Red drum	240.482
Atlantic angel shark	224.277
Harvestfish	211.944
Atlantic thread herring	197.559
Northern searobin	193.661
Tautog	192.872
Southern stingray	189.880
Fourspot flounder	164.754
Black drum	159.909
Atlantic moonfish	146.150
Sheepshead	142.492
Banded drum	127.326
American shad	123.393
Pinfish	119.453
White shrimp	116.136
Great white shark	105.575
Inshore lizardfish	104.722
Hogchoker	103.292
Cannonball jelly	95.686
Northern stargazer	95.204
Atlantic rock crab	94.080
Northern puffer	78.191
Atlantic brief squid	75.425
Atlantic stingray	73.943
Common spider crab	71.819
Longhorn sculpin	70.464
Atlantic spadefish	59.307
Spanish mackerel	57.953
Striped burrfish	55.484
Sea scallop	54.687
Northern sennet	51.300
Brown shrimp	46.646

Dusky shark	42.946
Yellowtail flounder	41.540
Hickory shad	35.670
Sea raven	33.156
Cobia	33.091
Rough scad	28.885
King mackerel	26.715
Alfonsinos	22.580
Blue runner	22.296
Blackcheek tonguefish	22.159
Round scad	19.544
American eel	16.581
Knobbed whelk	15.842
Quahog clam	14.542
Gray triggerfish	14.148
Moon jelly	13.295
Atlantic mackerel	12.102
Gulf Stream flounder	11.576
Moon snail	11.275
Lady crab	10.144
Spanish sardine	9.511
Cunner	8.962
Blue crab	8.861
Florida pompano	7.668
Six spine spider crab	7.000
Spinner shark	6.900
Bigeye scad	6.309
Conger eel	5.935
Channeled whelk	5.192
Jonah crab	5.079
Silver anchovy	5.032
Purple sea urchin	4.125
Spotted seatrout	4.073
Crevalle jack	2.748
Spotfin mojarra	2.501
Striped cusk-eel	2.437
Barndoor skate	2.289
Atlantic cod	2.288
Etropus flounders	2.132
Sand dollar	1.860
Bigeye	1.785
Fawn cusk-eel	1.741
Smallmouth flounder	1.605
Lookdown	1.518

African pompano	1.269
Mantis shrimp	1.268
Cero	1.160
White mullet	1.140
Sand shrimp	1.086
Silver seatrout	0.895
Northern shortfin squid	0.887
Atlantic bumper	0.842
Atlantic surfclam	0.817
Orange filefish	0.595
Banded rudderfish	0.594
Wolf eelpout	0.580
Fourbeard rockling	0.553
Permit	0.495
Blue mussel	0.448
Bluespotted cornetfish	0.436
American sand lance	0.413
Fringed flounder	0.360
Mackerel scad	0.355
Grass shrimp	0.308
Planehead filefish	0.273
Dwarf goatfish	0.259
Longspine snipefish	0.245
Atlantic pomfret	0.185
Lesser blue crab	0.173
Sharksucker	0.165
Barrelfish	0.160
Northern pipefish	0.137
Short bigeye	0.128
Pollock	0.074
Star drum	0.065
Red goatfish	0.062
Lane snapper	0.056
White perch	0.055
Silver jenny	0.054
Triggerfishes	0.050
Banded gunnel	0.048
Pink shrimp	0.042
Lined seahorse	0.030
Spotfin butterflyfish	0.015
Northern sand lance	0.012
Flying gurnard	0.004
Green sea turtle	*No weight
Kemp's ridley sea turtle	*No weight

Loggerhead turtle	*No weight