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Northeast Area Monitoring and Assessment Program (NEAMAP) Data collection and analysis in support of single and multispecies stock assessments in the Mid-Atlantic: Northeast Area Monitoring and Assessment Program Near Shore Trawl Survey

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Introduction

Concerns regarding the status of fishery-independent data collection from continental shelf waters between Cape Hatteras, North Carolina and the U.S. / Canadian border led the Atlantic States Marine Fisheries Commission's (ASMFC) Management and Science Committee (MSC) to draft a resolution in 1997 calling for the formation of the Northeast Area Monitoring and Assessment Program (NEAMAP) (ASMFC 2002). NEAMAP is a cooperative state-federal program modeled after the Southeast Area Monitoring and Assessment Program (SEAMAP), which has been coordinating fishery-independent data collection south of Cape Hatteras since the mid-1980s (Rester 2001). The four main goals of this new program directly address the deficiencies noted by the MSC for this region and include 1) developing fishery-independent surveys for areas where current sampling is either inadequate or absent 2) coordinating data collection among existing surveys as well as any new surveys 3) providing for efficient management and dissemination of data and 4) establishing outreach programs (ASMFC 2002). The NEAMAP Memorandum of Understanding was signed by all partner agencies by July 2004.

One of the first major efforts of the NEAMAP was to design a trawl survey that would operate in the coastal zone (i.e., between the 6.1 m and 27.4 m depth contours) of the Mid-Atlantic Bight (MAB - i.e., Montauk, New York to Cape Hatteras, North Carolina). While the National Marine Fisheries Service (NMFS), Northeast Fisheries Science Center's (NEFSC) Bottom Trawl Survey had been sampling from Cape Hatteras to the U.S. / Canadian border in waters less than 366 m since 1963, few sites were sampled inshore of the 27.4 m contour due to the sizes of the sampling area and research vessels (NEFSC 1988, R. Brown, NMFS, pers. comm). In addition, of the six coastal states in the MAB, only New Jersey conducts a fishery-independent trawl survey in its coastal zone (Byrne 2004). The NEAMAP Southern New England and Mid Atlantic Near Shore Trawl Survey (NEAMAP SNE/MA) was therefore developed to address this gap in fishery-independent survey coverage, which is consistent with the program goals. The main objectives of this new survey were defined to include the estimation of abundance, biomass, length frequency distribution, age-structure, diet composition, and various other assessment-related parameters for fishes and select invertebrates inhabiting the survey area.

In early 2005, the ASMFC received $250,000 through the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) and made these funds available for pilot work designed to assess the viability of the NEAMAP SNE/MA. The Virginia Institute of Marine Science (VIMS) provided the sole response to the Commission's request for proposals and was awarded the contract for this work in August 2005. VIMS conducted two brief pre-pilot cruises and a full pilot survey in 2006 (Bonzek *et al*. 2007).

Following a favorable review of the pilot sampling, the ASMFC bundled funds from a combination of sources in an effort to provide the resources necessary to support the initiation of full-scale sampling operations for NEAMAP SNE/MA. The ASMFC awarded VIMS this new contract in the late spring of 2007, and the first full NEAMAP SNE/MA cruise was scheduled for fall 2007.

Two significant changes to the NEAMAP SNE/MA survey area were implemented prior to this first full-scale cruise:

- In 2007, the NEFSC took delivery of the *FSV Henry B. Bigelow*, began preliminary sampling operations with this new vessel, and determined that this boat could safely operate in waters as shallow as 18.3 m. NEFSC personnel then determined that future surveys would likely extend inshore to that depth contour (R. Brown, NMFS, pers. comm.). The NEAMAP Operations Committee subsequently decided that the offshore boundary of the NEAMAP SNE/MA survey between Montauk and Cape Hatteras should be realigned to coincide with the inshore boundary of the NEFSC survey, and that NEAMAP SNE/MA should discontinue sampling between the 18.3 m and 27.4 m contours in these waters.
- The NEFSC contributed an appreciable amount of funding toward NEAMAP SNE/MA full implementation with the provision that Block Island Sound (BIS) and Rhode Island Sound (RIS), regions that were under-sampled at the time, be added to the NEAMAP SNE/MA sampling area. These waters are deeper than those sampled along the coast by NEAMAP SNE/MA; however, the offshore extent of sampling in these sounds (with respect to distance from shore) is consistent with that along the coast. The NEAMAP SNE/MA Survey has sampled BIS and RIS since the fall of 2007 and intends to continue to do so.

VIMS acquired funding for full sampling (i.e., two cruises, one in the spring and one in the fall, each covering the entire survey range) in 2008 from two sources, ASMFC “Plus-up” funds and Research Set-Aside (RSA) quota provided by the Mid-Atlantic Fishery Management Council and the National Oceanographic and Atmospheric Administration (NOAA). ASMFC “Plus-up” was used for the spring survey, while the proceeds derived from the auction of RSA quota supported the fall cruise. All sampling in 2009 and 2010 was funded through the Mid-Atlantic RSA Program; for 2011 and 2012, partial support (approximately 20%) was gained though the Commercial Fisheries Research Foundation (CFRF) for operations in BIS and RIS. CFRF funding was discontinued so for 2013 and 2014 the program was again fully funded by the Mid-Atlantic Multi-species RSA. This report summarizes the results of the both the spring and fall 2015 survey cruises and for many analyses includes data for all prior cruises.

Methods

The following protocols and procedures were developed by the ASMFC NEAMAP Operations Committee, Trawl Technical Committee, and survey personnel at VIMS and approved through an external peer review of the NEAMAP SNE/MA Trawl Survey. This review was conducted in December 2008 in Virginia Beach, Virginia, and all associated documents are currently available (Bonzek *et al.* 2008, ASMFC 2009). While the review found no major deficiencies with the survey, some recommendations were offered to improve data collection both in the field and in the laboratory. Efforts to implement these suggestions are ongoing and are discussed in the following sections where they occur.

Stratification of the Survey Area / Station Selection

Sampling sites are selected for each cruise of the NEAMAP SNE/MA Near Shore Trawl Survey using a stratified random design. During the planning stages of the survey, the Operations Committee and personnel at VIMS developed a stratification scheme for the survey area. Because the NEFSC sampled these same waters for decades prior to the arrival of the *Bigelow*, and since the NEAMAP SNE/MA Survey is effectively viewed as an inshore complement to the NEFSC Bottom Trawl Surveys, consistency with the historical strata boundaries used by the NEFSC for the inshore waters of the MAB and Southern New England (SNE) was the primary consideration. Alternate stratification options for the near shore coastal zone (i.e., NEAMAP SNE/MA sampling area) were also open for consideration.

An examination of NEFSC inshore strata revealed that the major divisions among survey regions (latitudinal divisions from New Jersey to the south, longitudinal divisions off of Long Island and in BIS and RIS) generally correspond well with major estuarine outflows (Figure 1). These boundary definitions were therefore adopted for use by the NEAMAP SNE/MA Survey; minor modifications were made to align regional boundaries more closely with state borders. Evaluation of the NEFSC depth strata definitions, however, indicated that in some areas (primarily in the more southern regions) near shore stratum boundaries did not correspond well to actual depth contours. NEAMAP SNE/MA depth strata were therefore redrawn using depth sounding data from the National Ocean Service and strata ranges of 6.1 m - 12.2 m and 12.2 m - 18.3 m from Montauk to Cape Hatteras, and 18.3 m - 27.4 m and 27.4 m - 36.6 m in BIS and RIS. Following the delineation of strata, each region / depth stratum combination was subdivided into a grid pattern, with each cell of the grid measuring 1.5 x 1.5 minutes (1.8 nm^2, corrected for the difference in nm per degree of longitude at the latitudes sampled by the survey) and representing a potential sampling site. In 2013 these grid cells were reexamined, as the rectangular shape of each cell necessarily meant that some cells extended into waters beyond the depth boundaries of the survey and even onto land. Prior to this review the 'untrawlable' portions of such cells were estimated by eye and the cell weight was adjusted proportionally. During this assessment the boundaries of such cells were redrawn to closely correspond with the contours within the defined depth range of the survey. These new cell definitions were input into a Geographic Information System so that the area of each cell could be accurately calculated and the appropriate cell weight defined.

One of the main goals of the NEAMAP SNE/MA trawl survey is to increase fishery-independent sampling intensity in the nearshore zone of the MAB and SNE. When designing the survey, it was decided that the target sampling intensity would be approximately 1 station per 30 nm^2, a moderately high intensity when compared with other fishery-independent trawl surveys operating along the US East Coast. This intensity, when applied to the NEAMAP SNE/MA survey area, results in the sampling of 150 sites per cruise. The number of cells (sites) to be sampled in each stratum during each survey cruise was then determined by proportional allocation, based on the surface area of each stratum (Table 1 – note that the values in this table differ slightly from those in the same table in prior reports due to the cell boundary redefinition described above). A minimum of 2 sites was assigned to smallest of the strata (i.e., those receiving less than 2 based on proportional allocation).

Prior to each survey, a SAS program is used to randomly select the cells to be sampled from each region / depth stratum during that cruise (SAS, 2002). Again, the number of cells selected in a particular stratum is approximately proportional to the surface area of that stratum. Once these 150 'primary' sampling sites (i.e., those to be sampled during the upcoming cruise) are generated, the program selects a set of 'alternate' sites. In instances where sampling a primary site is not possible due to fixed gear, bad bottom, vessel traffic, etc., an alternate site is selected in its stead. If an alternate is sampled in the place of an untowable primary, the alternate is required to occupy the same region / depth stratum as the aberrant primary. Usually, the alternate chosen is the closest towable alternate to that primary. The actual locations sampled during both 2015 cruises are provided (Figure 2. A: spring survey, B: fall survey).

Table 1. Number of available sampling sites (Num. cells) in each region / depth stratum along with the number selected for sampling per stratum per cruise (Stations sampled). Totals for each region, along with surface area (nm^2) and sampling intensity (nm^2 per Station) are also given.

Region	**State***	**Stations Sampled**								**Totals**			**nm^2 per Station**
		6.1m-12.2m		**12.2m – 18.3m**		**18.3m – 27.4m**		**27.4m –36.6m**					
		Stations sampled	**Num. cells**	**Stations sampled**	**Num. cells**	**Stations sampled**	**Num. cells**	**Stations sampled**	**Num. cells**	**Stations sampled**	**Num. cells**	**nm^2****	
RIS	**RI**					6	98	10	161	16	259	543.5	34.0
BIS	**RI**					3	49	7	89	10	138	288.0	28.8
1	**NY**	0	0	2	20					2	20	29.1	14.6
2	**NY**	2	18	3	20					5	38	37.3	7.5
3	**NY**	2	30	3	35					5	65	63.0	12.6
4	**NY**	2	28	3	35					5	63	100.1	20.0
5	**NY**	2	30	3	45					5	75	157.2	31.4
6	**NJ**	2	27	3	42					5	69	132.0	26.4
7	**NJ**	4	45	6	97					10	142	301.8	30.2
8	**NJ**	2	32	7	90					9	122	263.6	29.3
9	**DE**	4	59	8	113	5	69			17	241	527.5	31.0
10	**MD**	2	40	8	114					10	154	326.6	32.7
11	**VA**	5	63	8	122					13	185	389.6	30.0
12	**VA**	5	48	4	67					9	115	242.7	27.0
13	**VA**	6	92	10	142					16	234	502.1	31.4
14	**NC**	2	26	5	82					7	108	214.6	30.7
15	**NC**	2	31	4	70					6	101	197.1	32.9
Total		42	569	77	1094	14	216	17	259	150	2129	4315.8	28.8

* Note that region boundaries are not perfectly aligned with all state boundaries:

- Some stations in RI Sound may occur in MA
- Some stations in BI Sound may occur in NY
- Region 5 spans the NY-NJ Harbor area
- Some stations in Region 9 may occur in NJ

** Calculation does not account for decreases in distance per minute of longitude as latitude increases.

Species Priority Lists

During the survey design phase, the NEAMAP Operations Committee developed a set of species priority lists intended to guide catch processing and sample collection. Species of management interest in the MAB and SNE were to be of top priority and taken for full processing (see *Procedures at Each Station* below) at each sampling site in which they were collected (Table 2). Initially, this list was subdivided into Priority 'A', 'B', and 'C' so that if time and/or resources became limited, species could be eliminated from full processing in a manner that would preserve the most important species (i.e., Priority 'A') at the expense of those of lesser interest ('B' and 'C' species). In practice, because survey personnel work quickly and efficiently, time constraints are not an issue and it has never been necessary to eliminate any of the Priority 'B' or 'C' species from full processing. Because the species on each of these lists have been and will continue to be treated as though they are all 'A' species, the 'B' and 'C' designations were eliminated and all of these species were included as 'A' list. For all other fishes (here called Priority 'D'), aggregate weights and individual length measurements, at a minimum, are recorded. A third category ('E') includes species which require special handling, such as sharks (other than dogfish) and sturgeon, which are measured, weighed, tagged, and released. Select invertebrates of management interest are also Priority 'E' species; individual length, weight, and sex are recorded, at a minimum, from these. One species, windowpane, was added to the 'A' list beginning in 2012. For presentation in this report a Priority 'F' category is also defined, which is constituted by species (invertebrates) which cannot be reasonably enumerated, weighed, and measured as other species (e.g. barnacles, sponges, various small shrimp species, squid 'egg mops') which may be accounted for by total number, total weight, or even just presence.

Table 2. Species priority 'A' list.

A LIST			
Alewife	*Alosa pseudoharengus*	Red Drum	*Sciaenops ocellatus*
All skate species	*Leucoraja sp. & Raja sp.*	Scup	*Stenotomus chrysops*
American Shad	*Alosa sapidissima*	Silver Hake	*Merluccius bilinearis*
Atlantic Cod	*Gadus morhua*	Smooth Dogfish	*Mustelus canis*
Atlantic Croaker	*Micropogonias undulatus*	Spanish Mackerel	*Scomberomorus maculatus*
Atlantic Herring	*Clupea harengus*	Speckled Trout	*Cynoscion nebulosus*
Atlantic Mackerel	*Scomber scombrus*	Spiny Dogfish	*Squalus acanthias*
Atlantic Menhaden	*Brevoortia tyrannus*	Spot	*Leiostomus xanthurus*
Black Drum	*Pogonias cromis*	Striped Bass	*Morone saxatilis*
Black Sea Bass	*Centropristis striata*	Summer Flounder	*Paralichthys dentatus*
Blueback Herring	*Alosa aestivalis*	Tautog	*Tautoga onitis*
Bluefish	*Pomatomus saltatrix*	Weakfish	*Cynoscion regalis*
Butterfish	*Peprilus triacanthus*	Windowpane	*Scophthalmus aquosus*
Haddock	*Melanogrammus aeglefinus*	Winter Founder	*Pseudopleuronectes americanus*
Monkfish	*Lophius americanus*	Yellowtail Flounder	*Limanda ferruginea*
Pollock	*Pollachius virens*		

Gear Performance

The NEAMAP SNE/MA Survey uses the 400 x 12cm, three-bridle four-seam bottom trawl designed by the Mid-Atlantic / New England Fishery Management Council Trawl Survey Advisory Panel for all sampling operations. This net is paired with a set of Thyboron, Type IV 66" doors. Wingspread, doorspread, headrope height, and bottom contact were monitored during each tow of the spring and fall 2016 cruises using a digital Simrad® PX Trawl Monitoring System, which replaced the NetMind® system used on previous cruises. Wingspread sensors were positioned on the middle 'jib' of the net, which is consistent with NEFSC procedures for this gear, and doorspread sensors were mounted in the trawl doors according to manufacturer specifications. The headrope sensor was affixed to the center of the headline. The bottom contact sensor, which is effectively an inclinometer, was attached to the center of the footrope and used to evaluate the timing of the initial bottom contact of the footgear at the beginning of a tow, liftoff of the footgear during haul back, and the behavior of the gear throughout each tow. The inclusion of this bottom contact sensor was based on the recommendations of the NEAMAP SNE/MA peer review panel. The bottom contact sensor was attached for all tows during the fall of 2009 and the resulting data confirmed that the net was on the bottom at the proper phases of each tow. Due to the relative complexity in attaching and detaching this sensor before and after each tow, in 2015 the sensor was used for only one tow per stratum per cruise. A catch sensor was mounted in the cod-end, and set to signal when the catch reached approximately 2,200 kg. GPS coordinates and vessel speed were recorded every 2 seconds during each tow. These data were used to plot tow tracks for each station.

It is important to note that, while the performance of the survey gear had been recorded on all previous cruises, NEAMAP SNE/MA began to use these data to assess tow validity in 2009. The peer review panel recommended that acceptable ranges be defined for headrope height and wingspread such that if the average value of both of these parameters for a given tow fell outside of these ranges, the tow be considered invalid, the catch discarded, and a re-tow of the sampling site be initiated. Doorspread was not included since doorspread and wingspread are typically highly correlated (Gómez and Jiménez 1994). Such a procedure is intended to promote consistency in the performance of the survey gear and resulting catch data. The review panel and VIMS personnel agreed that 4.7 m to 5.8 m would be an appropriate range for headrope height while 12.3 m to 14.7 m would be acceptable for wingspread. These values were generated by adding to the optimal ranges of each parameter (5.0m – 5.5m headline and defined by the Trawl Survey Advisory Panel), 5% of the midpoint of each range.

It should be noted that a limited degree of subjectivity is allowed on the part of the Chief Scientist when the decision is made to accept a tow. This is based on two sets of facts:

- During a tow it is known that the net monitoring equipment sends a certain amount of obviously incorrect data readings (e.g headline height reading goes changes from 5.2m to 3.3m to 5.2m within a short time period). These readings may not be immediately filtered out by the program which analyzes the data and reports the tow averages. If the on-screen data during the tow has shown the net to be in proper fishing condition but the program reports readings that are somewhat out of range, the Chief Scientist may accept the tow.

- Environmental conditions (e.g. currents, winds, bottom variability) can make it impossible to conduct a tow which results in both headline height and wingspread falling within the range of acceptable values. This can be true over the entire immediate geographic area. The Chief Scientist must choose between not collecting data over some relatively large environmental zone and collecting data with the net in a somewhat non-standard configuration. In such conditions if the ratio of height to spread shows that the net was performing properly, even if somewhat over or under-spread, the tow can be conducted and accepted as valid. These tows can be filtered out of the dataset later, should the end-user (e.g., assessment scientist) determine that these data suffer from comparability issues.

Procedures at Each Sampling Site

The *F/V Darana R* served as the sampling platform for all field operations in 2016 as well as for all previous surveys (both pilot and full-scale cruises). This vessel is a 27.4 m (waterline length) commercial stern-dragger, owned and operated by Captain James A. Ruhle, Sr. of Wanchese, North Carolina.

All fishing operations were conducted during daylight hours. Standard tows were 20 minutes in duration with a target tow speed of 3.0 kts. During the spring 2016 cruise, one tow was truncated at 18 minutes due known ‘bad bottom.’ No tows were shortened during the fall 2016 cruise.

At each station, several standard variables were recorded. These included:

- *Station identification parameters* - date, station number, stratum, station sampling cell number.
- *Tow parameters* - beginning & ending tow location, vessel speed & direction, engine RPMs, duration of tow, water depth, current direction.
- *Gear identification and operational parameters* - net type code & net number, door type code & door numbers, tow warp length, trawl door spread, wing spread, headline height & bottom contact of the footgear.
- *Atmospheric and weather data* - air temperature, wind speed & direction, barometric pressure, relative humidity, general weather state, sea state.
- *Hydrographic data* - water temperature, salinity, dissolved oxygen, pH.

Upon arrival at a sampling site, the Captain and Chief Scientist jointly determined the desired starting point and path for the tow. To further decrease the possibility of sampling bias, beginning with the spring 2013 cruise the approximate starting point of the tow within the sampling cell was randomly pre-assigned at one of the cell’s corners. However, flexibility was allowed with regard to both the starting point and the tow path so that a complete tow (i.e., 20 minutes in duration) could be executed while remaining within the boundaries of the defined cell.

Vessel crew personnel were responsible for all of the fishing-related aspects of the survey (gear handling, maintenance, repair, etc.). The Captain and Chief Scientist were charged with determining the amount of wire to be set by the winches; for a given tow, the lengths deployed from each winch were equal and a function of water depth (Table 3). One scientist was present in the wheelhouse during deployment and retrieval of the trawl. For the set-out, the Captain would signal when the winch breaks were engaged; this marked the beginning time of the tow. At this point, the scientist would activate the Netmind software, the tow track recording software, and the digital countdown timer clock (used to record tow time).

Table 3. Relationship between warp length and water depth used by the NEAMAP SNE/MA Near Shore Trawl Survey.

Water Depth (m)	Warp Length (fm)
<6.1	65
6.1 - 12.2	70
12.2 - 36.6	75
>36.6	100

At the conclusion of each tow, the scientist signaled the Captain when the clock reached zero time, haul-back commenced, and the Simrad and tow track programs were stopped. Average headrope height and wingspread were then calculated to assess tow validity. Assuming that gear performance was acceptable, vessel crew dumped the catch into one of two sorting checkers (depending on the size of the catch) for processing. Otherwise, a re-tow of the sampling site would be initiated (this was not necessary in 2016).

Hydrographic data (water temperature, salinity, dissolved oxygen) were recorded at the end of each tow while the vessel was stationary and the fishing crew emptied the catch. This protocol was developed as a time-saving mechanism; prior to 2010 these data were collected preceding setting the gear, resulting in a pause in net streaming (and therefore survey operations) while instruments were deployed and these data were recorded. Measurements were taken at approximately 1 m below the surface, at 2m of depth, then at approximately 2m depth intervals, and finally at 0.5 m to 1 m above the bottom. Beginning with the fall 2013 cruise a sensor measuring photosynthetically active radiation (PAR) was deployed simultaneously with the hydrographic instrument. However, after the cruise a fault was discovered in the time-syncing of the two devices so it was impossible to assign accurate depths to the PAR readings which rendered them unusable. This fault was corrected and PAR data were successfully recorded for both cruises during 2016.

Each catch was sorted by species and modal size group (e.g., small, medium, and large size) within species. Aggregate biomass (kg) and individual length measurements were recorded for each species-size group combination of the Priority 'D' species. For Priority 'A' species, a subsample of five individuals from each size group was selected for full processing (see next paragraph). For some very common Priority 'A' species including Spot (*Leiostomus xanthurus*), butterfish (*Peprilus triacanthus*), skates, and dogfishes, only three individuals per size group were sampled for full processing.

Data collected from each of these subsampled specimens included individual length (mm fork length where appropriate, mm total length for species lacking a forked caudal fin, mm pre-caudal length for sharks and dogfishes, mm disk width for skates, mm carapace width for crabs, mm prosomal width for horseshoe crabs), individual whole and eviscerated weights (measured in grams, accuracy depended upon the balance on which individuals were measured), and macroscopic sex and maturity stage (immature, mature-resting, mature-ripe, mature-spent) determination. Stomachs were removed (except for Spot and butterfish; previous sampling indicated that little useful data could be obtained from the stomach contents of these species) and those containing prey items were preserved for subsequent examination. Otoliths or other appropriate ageing structures were removed from each subsampled specimen for later age determination. For the Priority 'A' species, all specimens not selected for the full processing were weighed (aggregate weight), and individual length measurements were recorded as described for Priority 'D' species above.

Following the recommendation of the peer review panel, the NEAMAP SNE/MA Survey began recording individual length, weight, and sex from an additional 15 specimens per size-class per species per tow from the following fishes: Black Sea Bass (*Centropristis striata*), Summer Flounder (*Paralichthys dentatus*), Striped Bass (*Morone saxatilis*), Winter Flounder (*Pseudopleuronectes americanus*), skates, and dogfishes. These species were chosen because either they are known to exhibit sex-specific growth patterns or sex determination through the examination of external characters is possible.

Additional data are recorded from several species which initially were classified as Priority 'D' species but later became Priority 'E.' The number of species and the number of additional data elements recorded both continue to increase. These include:

- American Lobster: Since the spring 2010 cruise the following parameters have been recorded for a large subsample of specimens:
    - Individual length and weight
    - Sex and maturity
    - Presence/Absence of shell disease
    - Presence/Absence of berries/eggs (only females)
    - Egg stage (only females with eggs)
    - Presence/Absence of a v-notch (only females)
    - Following publication of a possible method to determine lobster age (Kilada at al., 2012), in spring 2013 a small number of 'gastric mill' structures were removed and preserved for future analysis. Should the method prove reliable this will become a routine part of the NEAMAP SNE/MA sampling protocol.
- Horseshoe Crab:
    - Since the initial NEAMAP SNE/MA cruise a subsample of specimens was selected for determination and recording of sex so that sex-specific analyses could later be performed.

  - In addition, beginning with the spring 2011 cruise, maturity and reproductive status (i.e. evidence of prior spawning) were ascertained for these same subsampled specimens.
- Longfin Inshore Squid:
  - Beginning with the spring 2013 cruise a subsample of specimens was selected for determination of sex and maturity stage. Unlike most fish species however, maturity stage is not readily apparent by simple examination. For each sex, four different external and internal measurements must be recorded and then maturity can be inferred and assigned using a regression method (Macy, 1982) during post processing of data.

Nearly all biological and some physical data were recorded electronically at sea. Electronic data collection procedures for the NEAMAP SNE/MA survey have gone through several iterations and continue to evolve. During spring 2013 a new data entry and editing program, the Fisheries Environment for Electronic Data (FEED) was introduced. This program was developed under direction of personnel at VIMS and specific applications can be developed for virtually any data entry/editing need. The program accepts data directly from several different electronic measuring boards as well as any device which sends data through a COM port (e.g. balances). Even though electronic data collection has always been used on NEAMAP SNE/MA cruises, this new application has decreased processing time both at-sea and during post-cruise operations at VIMS.

In the event of a large catch, appropriate subsampling methods were implemented (Bonzek *et al.* 2008). In accordance with recommendations of the NEAMAP SNE/MA peer review panel, improved subsampling methods to more closely approximate random sampling procedures were implemented in 2009 and continued throughout 2016.

Laboratory Methods

Otoliths and other appropriate ageing structures were (and are in the process of being) prepared according to methodology established by the NEFSC, Old Dominion University, and VIMS. Typically, one otolith was selected and mounted on a piece of 100 weight paper with a thin layer of *Crystal Bond*. A thin transverse section was cut through the nucleus of the otolith, perpendicular to the sulcal groove, using two *Buehler* diamond wafering blades and a low speed *Isomet* saw. The resulting section was mounted on a glass slide and covered with *Crystal Bond*. If necessary, the sample was wet-sanded to an appropriate thickness before being covered. Some smaller, fragile otoliths were read whole. Both sectioned and whole otoliths were most commonly viewed using transmitted light under a dissecting microscope. Other structures such as vertebrae, opercles, and spines were processed and read using the standardized and accepted methodologies for each. For all hard parts, ages were assigned as the mode of three independent readings, one by each of three readers, and were adjusted as necessary to account for the timing of sample collection and mark formation.

Stomach samples were (and are being) analyzed according to standard procedures (Hyslop 1980). Prey items were identified to the lowest possible taxonomic level. Experienced laboratory personnel are able to process, on average, approximately 60 to 70 stomachs per person per day.

Analytical Methods

Abundance Indices: The methodology employed to calculate relative abundance indices for the NEAMAP SNE/MA survey has evolved with nearly every annual report and is still being developed.

- Initially, as it was considered impractical to report point estimates with only one or two data points, abundance was reported as 'minimum trawlable abundance' by state. These were area-expanded area-swept calculations and helped show the general pattern of distribution of species of interest (Bonzek *et al*., 2007).
- Catch data from fishery-independent trawl surveys tend not to be normally distributed. Preliminary analyses of NEAMAP SNE/MA data showed that, at least for some species, these data followed a log-normal distribution. As a result, following reports utilized the stratified geometric mean of catch per standard area swept, including catch data from all stations for every species so analyzed, as an appropriate form for the abundance indices generated by this survey (Bonzek *et al.* 2009).
- The next iteration involved making two simultaneous changes to the methodology used for calculating abundance indices. First, due to the small number of years sampled through 2009, as stated above, prior abundances had been calculated using data from all survey strata, for all species. Given the broad geographic range of the survey, for many species this resulted in a larger than necessary number of zero values entering the calculation, as some species were rarely captured in many survey strata. These zero values both unnecessarily biased point estimates and inflated variance estimates. In 2010-2011 it was considered that enough data had been gathered over relatively warm and relatively cold years so that reasonable restrictions could be defined as to which strata were to be used for each species. Therefore strata were selected for inclusion and exclusion on a species by species basis (these defined strata can still be refined as more data are gathered in future years).
- For the current report, abundance estimates are presented as the (back-transformed) geometric mean, using only the strata of importance for each species.

  For a given species, its abundance index for a particular survey cruise is given by:

$$\hat{N} = \exp\left(\sum_{s=1}^{n_s} \hat{A}_s \hat{\bar{N}}_s \right) \tag{1}$$

  where n_s is the total number of strata in which the species was captured, $\hat{A}_s$ is an estimate of the proportion of the total survey area in stratum s, and $\hat{\bar{N}}_s$ is an estimate of the loge transformed mean catch (number or biomass) of the species per standard area swept in stratum s during that cruise. The latter term is calculated using:

$$\hat{\hat{N}}_s = \frac{\sum_{t=1}^{n_{t,s}} \log_e \left(\frac{c_{t,s}}{\hat{a}_{t,s}/25000} \right)}{n_{t,s}}$$

(2),

where $\hat{a}_{t,s}$ is an estimate of the area swept by the trawl (generated from wing spread and tow track data) during tow t in stratum s, 25,000m^2 is the approximate area swept on a typical tow (making the quantity [$\hat{a}_{t,s}$ / 25000] approximately 1), $n_{t,s}$ is the number of tows t in stratum s that produced the species of interest, and $c_{t,s}$ is the catch of the species from tow t in stratum s.

- In addition to the overall abundance estimates, for several species in this report, either separate young-of-year (YOY) or several age-specific indices are also reported.
    - For species for which either a reliable literature source or examination of NEAMAP SNE/MA length-frequency plots (or both) revealed a dependable single YOY length cutoff value (separately for spring and fall surveys) this value was used to segregate the youngest survey age class (typically age-0 in the fall and age-1 in the spring as the species passed its assigned assessment birthdate during the succeeding winter) to calculate indices for that youngest age class. These species are Alewife, Atlantic Menhaden, Blueback Herring, Silver Hake, and Smooth Dogfish. This method was also used to generate indices for the two age-0 (spring spawn vs. summer spawn) Bluefish cohorts.
    - For species for which a sufficient numbers of otoliths have been examined to allow estimation of age-length keys (ALK), these keys were developed and the proportional age-at-size assignments were made to NEAMAP SNE/MA length data and age-specific abundance indices then calculated. For certain species, aged specimens from other VIMS surveys were used either alone or in conjunction with NEAMAP SNE/MA samples to achieve adequate sample sizes. Wherever sufficient data were available, these age-specific indices were calculated for the same age classes as were used in the most recent assessments. These species are Atlantic Croaker (ages 0 – 4+), Bluefish (age 0 – spring and summer cohorts separately), Summer Flounder (ages 0 – 7+), Weakfish (ages 0 – 3+), and Winter Flounder (ages 1 – 7+).

      Analyses in the current report use year-specific ALKs for all cases for which reliable such ALKs can be determined from survey data. For years for which ageing has not yet been completed (usually the most recent years) or for species for which an inadequate number of ages exists within a single year (e.g. Black Sea Bass), ALKs pooled over all years or over a subset of years were used.

- NEAMAP SNE/MA investigators are still evaluating alternatives for abundance index calculation. Preliminary examination of NEAMAP SNE/MA catches indicates that for at least some species a delta lognormal based index may best fit the underlying statistical distribution of catches. While these investigators realize that these several changes can result in a certain amount of confusion by users of these data, it is still early in the NEAMAP SNE/MA time series and it is considered preferable to eventually make these calculations as statistically robust as they can be rather than to too-early settle on an inferior methodology simply for the sake of consistency. It was hoped that these investigations could have been completed in time for the present annual report but this was not possible.

Length-Frequency: Length-frequency histograms were constructed for each species by survey cruise using 1cm or 0.5cm length bins (depending on the size range of the species). These were identified using bin midpoints (e.g., a 25cm bin represented individuals ranging from 24.5cm to 25.4cm in length). Although these histograms are presented by survey cruise, the generation of length-frequency distributions by year, sex, sub-area, overall, and a number of other variables, is possible.

For this and several other stock parameters, data from specimens taken as a subsample (either for full processing or in the event of a large catch) were expanded to the entire sample (i.e., catch-level) for parameter estimation. Because of the potential for differential rates of subsampling among size groups of a given species, failure to account for such factors would bias resulting parameter estimates. In the NEAMAP SNE/MA database, each specimen was assigned a calculated expansion factor, which indicated the number of fish that the individual represented in the total sample for the station in which the animal was collected.

Age-Structure: Age-frequency histograms were generated by cruise for each of the Priority ‘A’ species for which age data are currently available (i.e., processing, reading, and age assignment has been completed). These distributions were constructed by scaling the age data from specimens taken for full processing to the catch-level, using the expansion factors described above. Again, while the age data are presented by survey cruise, the generation of these age-structures by year, sex, sub-area, overall, and a number of other variables (or a combination of these variables), is possible. For species and years for which ages have not yet been included in the data base, ages were assigned by applying a year-pooled ALK to the length data. Note that the maximum age assigned by an ALK may be significantly younger than the maximum age attained by a species.

Diet Composition: It is well known that fishes distribute in temporally and spatially varying aggregations. The biological and ecological characteristics of a particular fish species collected by fishery-independent or -dependent activities inevitably reflect this underlying spatio-temporal structure. Intuitively, it follows then that the diets (and other biological parameters) of individuals captured by a single gear deployment (e.g., NEAMAP SNE/MA tow) will be more similar to one another than to the diets of individuals captured at a different time or location (Bogstad *et al*. 1995).

Under this assumption, the diet index percent by weight for a given species can be represented as a cluster sampling estimator since, as implied above, trawl collections essentially yield a cluster (or clusters if multiple size groups are sampled) of the species at each sampling site. The equation is given by (Bogstad *et al*. 1995, Buckel *et al*. 1999):

$$\%W_k = \frac{\sum_{i=1}^{n} M_i q_{ik}}{\sum_{i=1}^{n} M_i} * 100 \qquad (3),$$

where

$$q_{ik} = \frac{w_{ik}}{w_i} \qquad (4),$$

And where n is the total number of clusters collected of the fish species of interest, M_i is the number of that species collected in cluster i, w_i is the total weight of all prey items encountered in the stomachs of the fish collected and processed from cluster i, and w_{ik} is the total weight of prey type k in these stomachs.

This estimator was used to calculate the diet compositions of the NEAMAP SNE/MA Priority 'A' species (for those where diet data are currently available); the resulting diet descriptions are included in this report. Again, while these diets reflect a combination of data collected from the eleven full-scale survey cruises, presentations of diet by sub-area, year, cruise, size, age, etc., are possible (for those where diet data are currently available); the resulting diet descriptions are included in this report.

The percent weight (%W), percent number (%N) indices are each useful in different contexts so both are presented here. For %W and %N, only those specific prey types that reach a 1% threshold in the overall diet are shown individually. All others are summed into broader taxonomic categories (On the figures showing diets for each species, prey items which were identified to a low taxonomic level but which did not reach the 1% threshold are combined in categories labeled 'xxxxxx-other' where 'xxxxx' represents a broad taxonomic group such as crustaceans. In combination these prey types may reach well beyond the 1% threshold. Prey items that could not be identified below a broad taxonomic level are labeled 'unid xxxxxx'). Further, for these indices, closely related prey types (e.g. different species of mysids or of amphipods) are generally summed and reported together as a group.

In each diet composition figure, prey types are ordered first in descending order of percentage by weight by broad taxonomic category (e.g. fishes, crustaceans, molluscs) and within each category by descending order by weight of each specific prey type. For clarity and ease of comparison, the same order of broad taxonomic groups is maintained in the %N figure even though this may not reflect the true decreasing order by that measure (e.g. for some predator species, fishes may constitute a plurality of their diet by weight but smaller crustaceans may dominate by number).

Results

General Cruise Information / Station Sampling

The spring 2016 survey began on 20 April and ended on 19 May, while the fall cruise spanned from 29 September to 16 November. All 150 sites were sampled during each of these surveys. The number of primary and alternate sites sampled during each cruise is given both by region and overall (Table 4). At the cruise level, the rate at which alternate sites were substituted for primaries declined from 12%-15% in early survey years to about 8%-10% in 2011-2016. This was to be expected as the survey personnel gained experience fishing in questionable areas and as the data base of non-towable areas improved. Among regions within a cruise, the frequency of alternate sampling continued to be variable. In particular, and as in previous years, the sampling of alternate sites in the place of primaries occurred most often in BIS and especially in RIS for both surveys. These Sounds are notorious for their bad bottom and large fixed-gear (i.e., lobster pots) areas and, as a result, finding a 'towable lane' within a primary cell was often not possible. Lack of familiarity with these waters was also an issue; the captain of the survey vessel had not fished in these sounds prior to his involvement with NEAMAP SNE/MA. While the survey protocol calls for sampling of the closest suitable alternate in the event of an untowable primary, this was often not possible in the Sounds for the same reasons outlined above. It is anticipated that the rates of substitution of alternates for primaries in BIS and RIS will continue to decline in future cruises, as NEAMAP SNE/MA continues to accumulate information on known towable and untowable locations in these waters through both survey experience and cooperation with local industry representatives.

Outside of the Sounds, the rate of alternate sampling tended to be low though somewhat variable. The sampling of alternates in the more northern portion of the survey range (i.e., off of New York and New Jersey) was mainly due to rocky bottom and the presence of wrecks, while issues related to water depth (specifically, the lack of), were the most common cause of alternate substitution off of Virginia and North Carolina.

Table 4. Number of sites sampled in each region during the spring and fall 2016 NEAMAP SNE/MA cruises. The numbers of primary and alternate sites sampled in each region are given in parentheses.

Region	Spring 2016 Total - (*Prim. / Alt.*)	Fall 2016 Total - (*Prim. / Alt.*)	Region	Spring 2016 Total - (*Prim. / Alt.*)	Fall 2016 Total - (*Prim. / Alt.*)
RI Sound	**16 -** *(7 /9)*	**16 -** (*11 / 5*)	**8**	**9 -** *(9 / 0)*	**9 -** (9 / *0*)
BI Sound	**10 -** *(8 /2)*	**10 -** (7 / *3*)	**9**	**17 -** *(17 / 0)*	**17 -** *(12 / 5)*
1	**2 -** *(1 / 1)*	**2 -** *(2 / 0)*	**10**	**10 -** *(10 / 0)*	**10 -** (10 / *0*)
2	**5 -** *(5 / 0)*	**5 -** *(5 / 0)*	**11**	**13 -** *(13 / 0)*	**13 -** (*12 / 1*)
3	**5 -** *(5 / 0)*	**5 -** *(5 / 0)*	**12**	**9 -** *(9 / 0)*	**9 -** (9 / *0*)
4	**5 -** *(4 / 1)*	**5 -** *(4 / 1)*	**13**	**16 -** *(16 / 0)*	**16 -** (*15 / 1*)
5	**5 -** *(4 / 1)*	**5 -** *(4 / 1)*	**14**	**7 -** *(7 / 0)*	**7 -** (7 / *0*)
6	**5 -** *(5 / 0)*	**5 -** *(4 / 1)*	**15**	**6 -** *(6 / 0)*	**6 -** (6 / *0*)
7	**10 -** *(10 / 0)*	**10 -** (10 / *0*)	**Total**	**150 -** (*136 / 14*)	**150 -** (*132 / 18*)

Water Temperature

Because of the relatively narrow near shore band of water sampled by NEAMAP SNE/MA, catches can be influenced by environmental factors that affect the movement of fish into and out of the sampling area. Most likely, bottom temperature is a driving force in the distribution and availability of many species. For each cruise, geographic information system (GIS) figures are provided which summarize the bottom temperature data recorded at each station with interpolation among stations (Figures 3A-3S). Each figure has three representations of temperature data: a) a figure at the top of each page gives the bottom temperatures averaged over all spring or fall cruises (as appropriate), b) interpolated actual measurements from the cruise, and c) a figure with the difference between a and b. From these figures the following general patterns are apparent from visual examination:

- Spring 2008: Warmer than average through nearly the entire sampling range.
- Spring 2009: Most areas were cooler than average except in southern NY and northern NJ.
- Spring 2010: Below average bottom temperatures except in the middle portion of the sampling range between mid-NJ and VA.
- Spring 2011: Somewhat below average temperatures were seen up and down the coast.
- Spring 2012: Warmer than average temperatures during the entire survey period.
- Spring 2013: Cooler than average temperatures throughout the survey range.
- Spring 2014: Very cool temperatures in all regions.
- Spring 2015: Moderate to slightly cooler-than-average temperatures in nearly all regions.
- Spring 2016: Moderate temperatures in nearly all regions.
- Fall 2007: Below average temperatures were found in RIS, BIS, to a point about halfway down Long Island and considerably above average temperatures below that point
- Fall 2008 temperatures were measured as about average to below average in the middle portion of the sampling range (mid Long Island south to Delaware) and somewhat-to-very above average to the north and south.
- Fall 2009: The 2007 pattern was exactly reversed with above average temperatures found in RIS and BIS and cool to very cool from there southward.
- Fall 2010: Average-to-slightly-below-average temperatures through the sampling area.
- Fall 2011: Near average in most locations except for a patch of very cold water at deeper stations in RIS.
- Fall 2012: Similar to Fall 2011 with average-to-slightly-below-average temperatures throughout the range.
- Fall 2013: Cooler than average temperatures throughout the survey range.
- Fall 2014: Warm temperatures from approximately northern New Jersey and southward with moderate to cool temperatures in the northern areas.
- Fall 2015: Moderate to slightly cooler-than-average temperatures in nearly all regions.
- Fall 2016: Slightly cooler-than-average temperatures in nearly all regions except BIS which was somewhat warmer than average.

An analysis first presented for 2013 data interpolates all of the water column temperature data within each of several survey areas is presented again including data for 2016 (Figure 4). Though these figures can be difficult to interpret as the temperature range does not match that of those in Figure 3, they do demonstrate that temperature is quite variable throughout the water column and over the geographic range of the survey.

It is expected/hoped that future analyses of such environmental variability can help explain variability in survey catches and could even be incorporated into abundance index calculations.

Gear Performance

The NEAMAP SNE/MA Trawl Survey currently owns four nets identical in design and construction. Until 2014 NEAMAP SNE/MA has generally used one of these nets during the spring cruises (designated "G02") and a second net during fall sampling ("G01"), unless significant damage occurred during a cruise and the primary net had to be replaced. The 'fall net' had its bottom bellies replaced, due to normal wear and tear, prior to 2010 sampling. Other sections of the net were showing their age so this net was retired in 2014 and net "G03" became the 'fall net'. Likewise the 'spring net' (#G02) underwent extensive repairs (bottom bellies, footrope, sweep, and traveler wires, up and down lines all replaced) due to its being torn in half off of the coast of New Jersey during the 107th tow of the spring 2009 survey. This net was returned to the manufacturer to be rebuilt according to the original specifications. Both of these nets were subjected to the NEAMAP SNE/MA gear certification process before being returned to service (Bonzek *et al.* 2008). During the spring 2016 cruise, net G02 was used for the first 111 tows but suffered major damage and was replaced by G03 for the remainder of the trip and this net was used for the entire fall 2016 cruise. During 2016 the procedure for certifying nets for use was improved and formalized and Net "G04" has now been certified for future use. VIMS owns two pairs of Thyboron type IV 66" trawl doors though through 2015 only one set had been used for sampling. In early 2016 the second set of doors was prepped for use with the Simrad doorspread sensors and were used for both trips in 2016. The rear 'knife edges' upon which the doors ride along the bottom are replaced prior to each survey.

As was observed during the pilot cruises and all previous full-scale surveys, the NEAMAP SNE/MA survey gear performed consistently and within expected ranges during the spring and fall 2016 cruises and do not exhibit any substantial differences in configuration among the four NEAMAP SNE/MA depth strata (Figure 5A, 5B). The cruise averages for door spread (30.5m spring, 33.4 m fall), wing spread (13.2m spring, 14.1 m fall), and headline height (5.3m spring, 4.9 m fall) were within optimal ranges for the both 2016 cruises. Average towing speed was 3.0 kts for the spring and 3.1 kts for the fall cruise. For both cruises, the overwhelming majority of the station averages for each of these parameters fell within the optimal ranges. Because all fell within the acceptable ranges, or were accepted by the Chief Scientist based on criteria previously explained, it was not necessary to disregard any tows due to poor net performance.

Catch Summary

Over 1,052,000 individual specimens (fishes and invertebrates) weighing approximately 70,100 kg and representing approximately 150 species, including boreal, temperate, and tropical fishes, were collected during the two surveys conducted in 2016 (Table5, Table 6). As expected, catches were larger and more diverse on the fall surveys relative to the spring cruises. In all, individual length measurements were recorded for 194,511 animals. Lab processing is virtually complete on the 5,451 stomach samples.

As of the date of this report, 6,250 of the 11,546 ageing structures (otoliths, vertebrae, spines, opercles) collected during 2016 have been aged. The species for which ageing has been completed include those which are managed and which have annual assessment updates. Most of those which have not been completed are from species for which accepted ageing protocols have not been established (e.g. many elasmobranchs).

A change has been implemented in ageing protocols to improve the accuracy of age determination. As noted in previous reports the NEAMAP SNE/MA protocol was to process all age structures collected from a given species in a given year at one time (i.e., spring and fall samples processed together after the fall survey). The aforementioned protocol was in place to facilitate 'blind reading' of these samples to avoid bias. Previously only the senior readers had information about the catch time and location because they must interpret otolith edge patterns in the context of the season in which the specimen was captured. As experience has been gained however, it became apparent that each reader must be aware of the season and general latitude of capture in order to correctly interpret edge patterns in relation to the time of annulus formation. No readers are aware of the specimen's size or sex.

To assure consistency in ageing methodologies across programs, sample exchanges have been implemented between NEAMAP SNE/MA staff at VIMS and fish ageing personnel at the NEFSC's Fishery Biology Program in Woods Hole, MA.

NEAMAP SNE/MA personnel have been and continue to be active participants in several interstate workshops who purpose is to standardize protocols for determining fish ages from hard parts, for species of interest. Significant progress has been made for some species, while others are still under study.

Table 5. For each species collected during the NEAMAP SNE/MA spring 2016 cruise, the total number and biomass of specimens caught, number measured for individual length, number sampled for ageing, and number of stomachs collected that contained prey. Species are grouped by priority level.

Priority "A" Species					
SpeciesName	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
alewife	7,905	368.1	2,442	318	178
American shad	3,343	99.1	1,638	282	192
Atlantic cod	3	6.9	3	3	3
Atlantic croaker	4,243	565.0	1,821	193	115
Atlantic herring	4,421	253.9	940	52	26
Atlantic mackerel	117	13.1	117	92	73
Atlantic menhaden	677	28.5	259	52	2
black drum	2	4.8	2	2	1
black seabass	574	318.8	574	182	138
blueback herring	28,524	354.1	4,630	245	112
bluefish	15	21.6	15	15	9
butterfish	18,480	860.5	5,679	465	
clearnose skate	1,745	2,049.5	1,568	229	172
goosefish	19	55.7	19	19	12
little skate	5,219	2,604.6	3,669	310	271
scup	39,921	987.3	7,428	680	264
silver hake	1,015	33.9	331	149	113
smooth dogfish	292	948.8	292	178	174
spiny dogfish	989	2,966.6	738	240	178
spot	1,222	39.1	877	44	
striped bass	4	30.4	4	4	3
summer flounder	562	312.8	562	429	171
tautog	9	10.9	9	9	8
weakfish	6,411	288.0	2,584	268	139
windowpane	585	127.8	585	282	133
winter flounder	916	321.2	916	371	305
winter skate	2,468	3,852.8	2,082	376	305
yellowtail flounder	8	4.2	8	8	8
TOTAL	**129,689**	**17,528.1**	**39,792**	**5,497**	**3,105**

Table 5. continued.

Priority "D" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
American eel	1	0.5	1		
Atlantic brief squid	28	0.3	28		
Atlantic bumper	1	0.0	1		
Atlantic cutlassfish	136	2.7	136		
Atlantic rock crab	143	14.0	143		
Atlantic surfclam	1	0.3			
Atlantic thread herring	1	0.0	1		
banded drum	37	0.8	11		
bay anchovy	50,810	180.4	8,356		
common spider crab	167	29.6	85		
cunner	27	6.9	27		
fourspot flounder	256	54.3	256		
Gulf Stream flounder	2	0.0	2		
harvestfish	2	0.2	2		
hickory shad	4	0.8	4		
iridescent swimming crab	1	0.0	1		
kingfish (Menticirrhus spp.)	4,069	344.7	1,524		
knobbed whelk	1	0.1	1		
lady crab	206	1.8	206		
longfin inshore squid	15,429	537.8	6,797		
longhorn sculpin	26	9.2	26		
mantis shrimp	1	0.0	1		
northern puffer	273	35.6	273		
northern searobin	1,151	227.3	324		
northern shortfin squid	5	0.3	5		
ocean pout	19	21.8	19		
pigfish	2	0.1	2		
pinfish	8	0.4	8		
red hake	1,438	92.8	919	1	1
sea raven	1	0.5	1		
silver perch	2,583	91.8	1,067		
six spine spider crab	36	4.6	36		
smallmouth flounder	60	1.0	60		
spotted hake	15,190	293.5	6,640		
striped anchovy	3,068	43.1	1,560		
striped burrfish	1	0.5	1		
striped cusk-eel	6	0.3	6		
striped searobin	756	143.9	365		
unidentified whelk		0.1			
white shrimp	80	2.2	80		
TOTAL	**96,026**	**2,144.4**	**28,975**	**1**	**1**

Table 5. continued.

Priority "E" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
American lobster	195	64.1	195		
Atlantic stingray	1	0.2	1		
Atlantic sturgeon	13	162.6	13		
blue crab, sex unknown	3	0.4	3		
bluntnose stingray	261	2,366.9	105		
bullnose ray	1	2.8	1		
cownose ray	1	1.1	1		
horseshoe crab	1,266	1,075.8	1,266		
jonah crab	8	1.0	8		
little & winter skates	1	0.2	1		
sandbar shark	2	4.1	2		
smooth butterfly ray	1	0.8	1		
thresher shark	3	92.7	3		
TOTAL	**1,756**	**3,772.7**	**1,600**	**0**	**0**

Priority "F" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
clam (Macoma spp.)	1	0.5			
common grass shrimp	3	0.0			
grass shrimp	89	0.2			
keyhole urchin	1	0.0			
lions mane jellyfish		1.0			
moon snail	41	3.7			
potato sponge (monkey dung)		2.1			
purple sea urchin	17	1.6			
quahog clam	2	0.5	2		
roughneck shrimp	9	0.0			
sand dollar	5	0.0			
sand shrimp	75	0.2			
squid egg mop		3.2			
unidentified hermit crab	3	0.1			
unidentified hydroid		207.3			
unidentified moon snail	17	1.3			
unidentified mud crab	2	0.0			
unidentified sea stars	18	0.6			
TOTAL	**283**	**222.4**	**N/A**	**N/A**	**N/A**
CRUISE TOTAL	**489,855**	**30,340.7**	**98,052**	**6,959**	**3,388**

Table 6. For each species collected during the NEAMAP SNE/MA fall 2016 cruise, the total number and biomass of specimens caught, number measured for individual length, number sampled for ageing, and number of stomachs collected that contained prey. Species are grouped by priority level.

Priority "A" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
alewife	226	10.6	106	19	5
American shad	21	2.1	21	21	7
Atlantic croaker	37,127	1,680.9	2,001	173	57
Atlantic herring	1	0.0	1	1	1
Atlantic mackerel	1	0.3	1	1	
Atlantic menhaden	257	48.7	257	105	
black drum	6	2.6	6	6	3
black seabass	295	143.8	295	177	123
blueback herring	28	1.0	28	7	1
bluefish	20,126	2,617.4	3,594	434	179
butterfish	59,529	2,827.7	11,815	529	
clearnose skate	917	1,167.7	917	332	288
goosefish	7	5.6	7	7	4
haddock	74	2.6	74	31	15
little skate	5,213	2,688.9	4,264	274	183
red drum	6	77.7	6	6	4
scup	72,610	2,473.7	10,568	530	237
silver hake	132	12.3	132	67	33
smooth dogfish	224	182.6	224	109	105
spiny dogfish	2,027	3,092.1	732	110	73
spot	3,063	206.1	1,165	98	
spotted seatrout	8	1.3	8	8	
striped bass	17	104.8	17	11	2
summer flounder	301	152.4	301	279	126
tautog	9	5.1	9	9	4
weakfish	78,029	5,813.3	14,800	615	331
windowpane	317	57.9	317	228	114
winter flounder	221	56.9	221	145	43
winter skate	1,583	2,720.1	1,315	254	124
TOTAL	**282,375**	**26,156.0**	**53,202**	**4,586**	**2,062**

Table 6. continued.

Priority "D" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
American eel	1	0.3	1		
Atlantic brief squid	3,453	21.4	2,062		
Atlantic cutlassfish	2,667	19.1	1,483		
Atlantic moonfish	925	6.6	865		
Atlantic needlefish	3	0.2	3		
Atlantic rock crab	32	2.6	32		
Atlantic spadefish	15	0.3	15		
Atlantic thread herring	4	0.1	4		
banded drum	634	9.0	349		
bay anchovy	29,579	81.6	4,272		
bigeye scad	15	0.9	15		
blackcheek tonguefish	12	0.4	12		
blue runner	13	1.1	13		
bluespotted cornetfish	2	0.1	2		
brown shrimp	269	4.4	189		
common Atlantic shore octopus	1	0.4	1		
common puffers	1	0.4	1		
common spider crab	52	4.1	52		
crevalle jack	3	0.4	3		
cunner	3	0.4	3		
fourspot flounder	42	7.7	42		
gray triggerfish	1	0.4	1		
Gulf Stream flounder	42	0.6	42		
harvestfish	600	21.2	301		
hickory shad	7	1.8	7		
hogchoker	48	3.2	48		
inshore lizardfish	23	3.1	23		
iridescent swimming crab	34	0.2	34		
kingfish (Menticirrhus spp.)	19,019	2,686.5	4,930	1	1
knobbed whelk	4	3.3	4		
lady crab	119	5.1	119		
longfin inshore squid	54,828	1,341.1	13,261		
lookdown	2	0.0	2		
mackerel scad	1	0.5	1		
macro algae		695.7			
mantis shrimp	1	0.0	1		
mojarras	23	0.2	23		
naked goby	2	0.0	2		
northern puffer	304	49.1	304		
northern searobin	41	9.8	41		
northern sennet	724	56.2	221		
northern stargazer	2	1.7	2		
pigfish	806	39.0	468		
pinfish	29	1.4	29		
pink shrimp	2	0.0	2		
red goatfish	4	0.1	4		
red hake	10	1.2	10		
rough scad	51	1.8	51		
round herring	129	2.3	129		
round scad	25	0.4	25		
sea raven	2	1.4	2		
sea scallop	1	0.1	1		
sheepshead	63	218.6	63		
silver perch	18,708	526.4	3,405		
six spine spider crab	16	0.6	16		
smallmouth flounder	67	0.9	67		
spotfin mojarra	109	1.5	109		
spotted hake	1,556	223.0	1,225		
star drum	26	0.3	26		
striped anchovy	98,268	1,619.4	4,609		
striped burrfish	145	29.2	145		
striped cusk-eel	20	0.7	20		
striped searobin	105	31.3	105		
unidentifed pipefishes	9	0.1	9		
unidentified echinoderm	1	0.0			
white shrimp	44,074	594.0	2,015		
TOTAL	**277,777**	**8,335.1**	**41,321**	**1**	**1**

Table 6. continued.

Priority "E" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
American lobster	43	15.1	43		
Atlantic angel shark	27	254.5	27		
Atlantic sharpnose shark	1	4.4	1		
Atlantic stingray	17	5.4	17		
Atlantic sturgeon	15	299.6	15		
blue crab, adult female	24	4.2	24		
blue crab, juvenile female	1	0.1	1		
blue crab, male	2	0.0	2		
blue crab, sex unknown	73	12.1	73		
bluntnose stingray	9	35.2	9		
bullnose ray	176	261.2	176		
cownose ray	573	1,239.6	251		
horseshoe crab	1,200	1,598.4	1,200		
jonah crab	5	0.3	5		
Kemp's ridley sea turtle	2		2		
little & winter skates	16	2.0	16		
loggerhead turtle	1		1		
roughtail stingray	5	39.2	5		
sand tiger shark	4	42.0	4		
sandbar shark	13	44.6	13		
smooth butterfly ray	13	23.0	13		
southern stingray	4	0.8	4		
spiny butterfly ray	21	275.6	21		
thresher shark	13	810.9	13		
TOTAL	**2,258**	**4,968.0**	**1,936**	**0**	**0**

Priority "F" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
Atlantic jackknife clam	1	0.0			
blue mussel	50	7.9			
bryozoans/dead man fingers		0.3			
cannonball jelly		73.5			
lions mane jellyfish		12.3			
moon jelly		51.5			
moon snail	12	0.5			
potato sponge (monkey dung)		1.4			
purple sea urchin	3	0.0			
quahog clam	1	0.2	1		
roughneck shrimp	46	0.1			
sand dollar	5	0.1			
sea cucumber	1	0.0			
shell		0.8			
speckled crab	2	0.1	2		
squid egg mop		0.6			
unidentified corals or anemones		0.3			
unidentified hermit crab	1	0.1			
unidentified hydroid		13.5			
unidentified jellyfish		143.2			
unidentified sea stars	10	0.3			
TOTAL	**132**	**306.9**	**N/A**	**N/A**	**N/A**
CRUISE TOTAL	**562,542**	**39,766.0**	**96,459**	**4,587**	**2,063**

Species Data Summaries

The data summaries presented in this report include the information collected on each of the NEAMAP SNE/MA Trawl Survey full-scale cruises conducted to date and focus on species that are of management interest to the Mid-Atlantic Fishery Management Council, the New England Fishery Management Council and the ASMFC. Some species which are not managed but considered valuable from an ecological standpoint, are also included. Data summaries for several species which were not included in previous reports due to the relatively small numbers captured during NEAMAP SNE/MA cruises are presented in this report (American Goosefish, Atlantic Cod, Black Drum, Sandbar Shark, Smooth Butterfly Ray, Spiny Butterfly Ray, Tautog, Yellowtail Flounder). For some of these species catches may be rare enough so that indices of abundance would not be considered reliable, but analyses of other biological parameters may be useful to assessments and to managers.

It is important to note that these summaries represent only a subset of the biological and ecological analyses that are feasible using the data collected by the NEAMAP SNE/MA Survey. Several additional analyses are possible for each of the species included in this report, as well as for others that have been collected by this survey but are not presented. Some analyses (e.g., length-weight relationships, growth curves) found in previous reports are excluded here in an effort to make the scope of this document somewhat manageable. Certainly, any NEAMAP SNE/MA information (data or analyses) requested by assessment scientists and managers would be made available in a timely manner.

For a small subset of species that are not captured in large numbers but are of particular interest or concern (Atlantic sturgeon – Figure 6A, sea turtles – Figure 6B, and coastal sharks – Figure 6C) single-page summaries of NEAMAP SNE/MA catches over all survey years are presented, showing geographic locations and numbers in a GIS format.

Although this report focuses on the data collected during 2016, some information from previous years is included in these species summaries to both place the 2016 data in context as well as to increase sample sizes. Relative indices of abundance are given for most species included in this report and are presented by survey (spring or fall) as stratified geometric mean of catch per standard area swept. The total number and biomass collected, number sampled for individual length measurements, and numbers taken and processed for age determination and diet composition (Priority ‘A’ species only) are also given for each cruise. Catch distribution plots and length-frequencies are provided for these species on a per-cruise basis. For most species, especially those with documented sexual dimorphic growth patterns, sex-specific length frequency histograms are given, and sex ratios by size are presented for all Priority ‘A’ species as well as for some of the invertebrates, and were generated by combining data across all cruises (spring and fall separately). Age-frequency distributions (by cruise) and maturity rate regressions (all cruises combined), and diet compositions (all cruises combined) are also included for these priority species where field collections and subsequent laboratory progress have resulted in sufficient sample sizes.

For most species, the following tables and figures are presented:

- GIS figures showing the biomass of that species collected at each sampling site for each of the 2016 cruises. These figures, along with a separate table given alongside, also highlight the strata used for index calculation separately for spring and fall surveys.
- A table presenting, for each cruise, the total number of specimens of that species collected, total biomass of these individuals, number sampled for individual length measurements, number taken for full processing (including age and stomach analysis), and the number of age and stomach samples processed to date.
- A table is shown with relative abundance indices (number and biomass) calculated as stratified geometric mean of catch per standard area swept, for all ages/sizes combined; additionally for species for which a reasonable basis for separating either the youngest age class present in the data (usually either 0 or 1) existed or age-specific data were available, separate indices are presented for these subgroupings as well. Sample sizes (number of stations used for index calculation) and lower and upper 95% confidence limits are also,
- Figures displaying stratified geometric mean catch per standard area swept (both number and biomass) for each cruise given (confidence limits are not displayed on the figures as they tend to mask trends in the indices due to expansion of the y-axis scale).
- Length-frequency histograms, by cruise.
- Sex-specific length-frequency histogram for each cruise.
- Age-frequency histograms for each cruise, indicating the number caught at each age along with the year-class associated with each age group (Priority 'A' only, when available). Where necessary (e.g. for species for which ages have yet to be assigned for the most recent years), age-frequencies calculated through application of pooled ALKs are shown (in contrasting color to those from actual aged specimens). The y-axis for these plots is scaled separately for each year.
- Age-frequency bubble plots, standardized to 3,000 trawl-minutes (20 minutes per tow x 150 tows per cruise x 2 cruises) for each cruise. Data shown are similar to the age-frequency histograms except for the trawl-minute standardization and a uniform scaling process. Where necessary (e.g. for species for which ages have yet to be assigned for the most recent years), age-frequencies calculated through application of pooled ALKs are shown (in contrasting color to those from actual aged specimens). These plots allow the reader to more easily follow year class progression through time.
- Histogram of sex ratio by size group, annotated with the number of specimens examined in each size category (available only for Priority 'A' species and select invertebrates). These histograms were generated by combining data across all cruises (spring and fall separately).
- Figures presenting results of maturity logistical regression analyses by length, and where possible by age, with values given for 50% and 95% maturity, separately for each sex.
- Bar plots of diet composition by weight and by number, generated using data from all survey cruises combined. The number of stomachs examined as well as the number of 'clusters' sampled (i.e., effective sample size) is provided. Diet is presented for Priority 'A' species only, when available. Major prey taxa (crustaceans, fishes, molluscs, worms,

miscellaneous) are presented in descending order by weight for each predator (i.e. the taxon with the highest percent-by-weight is the leftmost on the x-axis, the second highest is next, etc.). Within each major taxon, individual prey types are also presented in descending order, left-to-right. For consistency, the same major-taxon order is maintained for the figure which gives diet by number. Only prey types which total at least 1% of the diet are shown individually. Within a major taxon, prey types which represent less than 1% of the diet are lumped together into a 'taxon-other' category (e.g. 'crustaceans-other'). These categories are distinguished from prey types which could not be identified to a level lower than the major taxon (e.g. a prey item which could only be identified as a crustacean). For simplicity, some prey types (e.g. all amphipod species, all mysids) are lumped together even if some specimens were identified to lower taxonomic levels.

Species have been arranged alphabetically in this data summary section, and a full listing of species, along with their associated table and figure numbers, is given below (Each species is followed by a code or codes that designate the management authorities responsible: A = ASMFC, F = Federal, M = MAFMC, N = NEFMC, S = SAFMC, X = not managed or managed individually by states.). Text associated with these tables and figures is provided following this list. Detailed descriptions of these data and analyses are included for the MAFMC-managed and selected other species, while a listing of the contents of the tables and figures is given for all others.

Species list

Alewife (*Alosa pseudoharengus*)

The NEAMAP SNE/MA survey consistently captures a far greater number of Alewives during spring surveys than during those in the fall (Table 7). During the spring, tows containing this species are spotty but are distributed throughout the survey range while during the fall positive tows are normally limited to a few stations in Rhode Island Sound (Figure 7). Spring abundance indices followed a generally flat or somewhat declining trend from 2008 through 2013, then increased moderately in 2014 and 2015 and rose significantly in 2016. Indices from fall surveys likely are not representative of the overall stock status (Table 8, Figure 8). As the survey samples mostly smaller/younger specimens, only Age-0 (fall) and Age-1 (spring) age-specific indices are calculated. Currently these age-classes are defined by simple length cutoff values but a better delineation can be achieved once ageing protocols are established and otoliths ages can be assigned (see next paragraph).

In most years, specimens smaller than 16cm predominate during spring surveys and are thought to be those which were spawned the previous spring (Figure 9). In December 2013 NEAMAP personnel participated in an ASMFC-sponsored river herring ageing workshop and a follow-up workshop in March 2016. However, due to life-history complexities, varying interpretations of light and dark bands, differences in preferred hard-parts to be sampled (scales vs. otoliths), and sample storage issues (deterioration over time), firm ageing protocols have yet to be determined.

In size classes up to about 22cm the sex ratio of specimens for which sex could be determined is approximately 50/50. Above that size, the ratio tends to be skewed towards females, though the current sample sizes in that range from NEAMAP SNE/MA is relatively small (Figure 10). Both males and females reach 50% maturity rates at 15-16cm (likely age-1s) and 95% maturity at 22-24cm (likely age-2s - Figure 11).

Among identifiable prey species found in Alewife stomachs, various small crustaceans account for about 75% of the diet both by weight and number, with about half of that amount coming from copepods. However, about 20% of stomach contents are unidentifiable material and much of that matter is likely to have come from these same small crustaceans. Worms, small fishes, and molluscs together account for only about 3% of the diet as measured either by weight and number (Figure 12).

American Goosefish (*Lophius americanus*)

Figure 13. American Goosefish biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

Table 9. American Goosefish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Table 10. American Goosefish geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

Figure 14. American Goosefish geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

Figure 15. American Goosefish length-frequency distributions, by cruise.

Figure 16. American Goosefish length-frequency distributions, by cruise and sex.

Figure 17. American Goosefish sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 18. American Goosefish maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 19. American Goosefish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016.

In spring surveys American Goosefish are captured in small numbers (typically not more than 2-3 specimens in any tow) throughout the survey range at 10%-20% of the index stations. The species is nearly absent from the survey tows during the fall (Figure 13, Table 9). While the small number of specimens captured may indicate that the NEAMAP SNE/MA abundance indices are not representative of the entire stock, at least some information from the survey may be useful to assessments and to management. Only abundance indices from the spring surveys are shown (Table 10, Figure 14).

Specimens are captured over a fairly large size range, and in most years no obvious size cohorts are present in NEAMAP SNE/MA data, though a distinct cohort of small specimens was captured in Spring 2016 (Figure 15). Likewise, no noticeable pattern in the sizes or in the capture rates between males and females is apparent (Figure 16).

Though sample sizes are relatively small, there appears to be a pattern in sex ratios by size of a predominance of females in small and large size classes with proportionally more males in the middle size range (Figure 17). Males and females appear to mature at nearly the same size with both reaching a 50% maturity rate at 39-41cm and 95% maturity at about 50cm (Figure 18).

Unsurprisingly, a variety of fish species constitute the largest portion (88% by weight, 82% by number) of the diet. Longfin Squid and the Pandalid shrimp called the bristled longbeak (*Dichelopandalus leptocerus*) constitute most of the remainder (Figure 19).

American Lobster (*Homarus americanus*)

Figure 20. American Lobster biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 11. American Lobster sampling rates for each NEAMAP SNE/MA cruise.

Table 12. American Lobster geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 21. American Lobster geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 22. American Lobster length-frequency distributions, by cruise.

Figure 23. American Lobster length-frequency distributions, by cruise and sex.

Figure 24. American Lobster sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 25. American Lobster disease status (percent positive) by cruise, 2010-2016.

Figure 26. American Lobster percent of females with egg masses by cruise, 2010-2016.

Survey catches of the American Lobster are concentrated in Block Island Sound and Rhode Island Sound, though specimens have been captured as far south as the mouth of Chesapeake Bay (Figure 20). Catch rates between spring and fall surveys are comparable (Table 11). Abundance indices for both spring surveys have followed a generally declining trend, both overall and for sex-specific indices (Table 12, Figure 21).

Relatively few individuals are captured above the legal size limit (Figure 22) however, relatively more large females are found than are males (Figure 23). This may be due to the practice of “V-notching” and releasing egg-bearing females. Except at the largest size category, sex ratios are almost exactly 50-50 (Figure 24).

For some time, a bacterial shell disease characterized by black spots, ulcers, and a thinning shell has been prevalent in Southern New England. Since 2010 NEAMAP SNE/MA has noted the presence or absence of obvious disease signs. Such signs are much more prevalent in spring than in fall (likely due to seasonal molting). Prevalence in spring declined from about 26% in 2010 to 15% in 2013, rose to 26% in 2014 and 32% in 2015 and fell dramatically in 2016 to only 8% (Figure 25). Unlike most years, prevalence in fall 2014 was nearly as high as during the spring of that year but in 2015 and 2016 the proportion of diseased specimen was in line with most other years at about 8.5% and 4.7% respectively. It should be noted that these data represent only seven years in a multi-decadal outbreak.

NEAMAP SNE/MA also notes the presence or absence of eggs on female specimens and the proportion of females with egg masses (‘berries’) during each cruise is presented (Figure 26). Presence or absence of a v-notch is also noted but those data are not presented here.

American Shad (*Alosa sapidissima*)

Figure 27. American Shad biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 13. American Shad sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 14. American Shad geometric mean indices of abundance, by number and biomass, for spring NEAMAP SNE/MA surveys, for all specimens captured.

Figure 28. American Shad geometric mean indices of abundance, by number and biomass, for spring NEAMAP SNE/MA surveys, for all specimens captured.

Figure 29. American Shad length-frequency distributions, by cruise.

Figure 30. American Shad length-frequency distributions, by cruise and sex.

Figure 31. American Shad sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 32. American Shad diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

American Shad are both well represented and well distributed in NEAMAP SNE/MA tows during spring surveys but are nearly absent from the survey during the fall (Figure 27, Table 13). Indices of abundance are calculated only for the spring and show a flat-to-moderately increasing profile through 2014 but with increases in 2015 and 2016 (Table 14, Figure 28).

Most specimens captured by the survey measure less than 20cm and no obvious size cohorts are present in the length frequency distributions (Figure 29). There does not appear to be any sex-specific differences in the sizes of individuals from the survey (Figure 30). Likewise, the sex-ratio is even at all size classes except those small and large categories with extremely small sample sizes (Figure 31).

The vast majority of the diet (over 80% as measured either by weight or number) is constituted by crustaceans, mostly copepods, amphipods, cumaceans, and mysids. Unidentifiable material comprises nearly all of the remainder of the matter in American Shad stomachs and it is likely that most of that category was originally the same mix of small crustaceans (Figure 30).

Atlantic Cod (*Gadus morhua*)

Figure 33. Atlantic Cod biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

Table 15. Atlantic Cod sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Figure 34. Atlantic Cod length-frequency distributions, by cruise.

Figure 35. Atlantic Cod diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016.

Atlantic Cod are captured in very small numbers (0-15 total) during spring NEAMAP SNE/MA cruises (Figure 33, Table 15). These numbers are so small that calculation of abundance indices would not yield meaningful results.

Specimens over a fairly large size range have been captured, but again the numbers are so small that little relevant information can be gleaned from length frequencies (Figure 33).

About 75% (by both weight and number) of the diet of NEAMAP SNE/MA specimens is made up by a variety crustacean species with miscellaneous taxa, fishes, molluscs, and worms constituting a decreasing proportion of the remainder. Again however, the sample sizes represented are very small (Figure 35).

Of particular note however is a single tow in Region 5 (NY Harbor area) during the spring 2013 survey at which both an Atlantic cod and a Spot were captured.

Atlantic Croaker (*Micropogonias undulatus*)

Figure 36. Atlantic Croaker biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 16. Atlantic Croaker sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 17. Atlantic Croaker geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP SNE/MA surveys (age-specific indices for age-2 and older calculated for fall surveys only).

Figure 37. Atlantic Croaker geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys.

Figure 38. Atlantic Croaker length-frequency distributions, by cruise.

Figure 39. Atlantic Croaker length-frequency distributions, by cruise and sex.

Figure 40. Atlantic Croaker age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 41. Atlantic Croaker catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 42. Atlantic Croaker sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 43. Atlantic Croaker maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 44. Atlantic Croaker maturity at age, by sex for all cruises pooled, 2007-2016.

Figure 45. Atlantic Croaker diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Croaker catches during the spring surveys are generally limited geographically to southern NEAMAP SNE/MA Regions as this species migrates into the NEAMAP SNE/MA survey area. During fall cruises it has often been observed that the 'southern mix' of species (Croaker, Spot, Weakfish, Clearnose Skate) appears abruptly as the survey moves through Barnegat Light, NJ while following its fall 'north-to-south' sampling pattern (Figure 36).

Typically, total croaker captures in the fall are several times higher than those for spring surveys (as described above) and in previous years varied within a narrow range (46,000 – 74,000 by number, 5,100 kg – 7,600 kg by weight). In fall 2012 over 319,000 croaker were sampled (nearly 4.5 times the previous high value) weighing nearly 22,000 kg (2.8 times the previous high value). This was followed by the capture of the largest spring season time-series catches in 2013 and the second-largest number captured during the fall 2013 survey. However, in both spring and fall 2014 survey abundances were back into the ranges observed prior to 2012 and in 2015 fell again to a very low value. Croakers were captured at only 19 stations during the spring survey but due to a single tow containing over 52,000 fish the total catch was the highest of the time series. During the fall 2016 survey, of the 58 tows in which Croaker were captured, most were in just single or double digits with two tows contained 16,000 and 20,000 specimens respectively (Table 16).

Overall abundance indices generally followed the trends in total catch levels. For spring, following a generally increasing trend over the previous four years, abundance dropped close to a time series low in 2012, jumped to very high levels in 2013 (these were primarily small, Age-1 fish) then declined consistently over the next three years to the same levels seen during 2008-2012. The fall time series follows a nearly identical trend, but offset by year, as those young fish appeared first as Age-0 in fall 2012. Despite the relatively high total catch numbers in 2016, abundance indices declined because the geometric mean calculation tends to dampen the effect of few tows with large catches (Table 17, Figure 37).

Atlantic Croaker are sampled by NEAMAP SNE/MA over the nearly entire size range of the stock. In spring, specimens have measured between 6.5cm and 29cm while in fall that range expands to between 1.0cm and 45.0cm (Figure 38). Most individuals captured typically range between 12cm and 28cm.

Examination of length frequencies by sex (Figure 39) and sex ratios by size (Figure 42) reveal little evidence of sexually dimorphic growth patterns, though there is a preponderance of females in specimens measuring 32cm and larger.

Moderate numbers of croaker to age-11 have been captured though specimens aged 2 and less dominate the NEAMAP SNE/MA samples (Figures 40, 41). When a strong year class is present, as in 2008 and 2012, it appears that NEAMAP SNE/MA samples allow the cohorts to be followed over a period of several years.

Both males and females reach the 50% maturity rate at about 17cm which corresponds to about 1 year since hatching. Similarly, both sexes reach the 95% maturity at 23-24cm, which on average is about age 2.5 (Figure 43, Figure 44).

As might be expected, large portions of the stomach contents for this species are not identifiable, or are only identifiable to a high taxonomic level. Of the identifiable items, Atlantic croaker show themselves to be generalist consumers with all major taxonomic groups contributing roughly equal percentages (20%-30% each for crustaceans, worms, fishes and miscellaneous items, and 15% for molluscs (Figure 45). Because these taxonomic groups are consumed in roughly equal proportions, the relative order of importance among them is somewhat different when expressed by percent weight or percent number.

Atlantic Menhaden (*Brevoortia tyrannus*)

Figure 46. Atlantic Menhaden biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 18. Atlantic Menhaden sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 19. Atlantic Menhaden geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured.

Figure 47. Atlantic Menhaden geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 48. Atlantic Menhaden length-frequency distributions, by cruise.

Figure 49. Atlantic Menhaden sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 50. Atlantic Menhaden maturity at length, by sex for all cruises pooled, 2007-2016.

Substantial differences in catch patterns for Atlantic Menhaden are observed between spring and fall surveys. In the spring, catches can often be fairly consistent but are limited to the southernmost survey Regions as the species begins its inshore/northward annual migration. In spring 2016 however small numbers of Menhaden were captured throughout the survey range. In the fall, interactions with the species are fairly rare but are distributed throughout the survey range (Figure 46, Table 18).

Both of these patterns make for potentially unreliable abundance indices caused by year-specific environmental factors or by random encounters with large schools. Nonetheless, abundance information for this highly important species is important for assessment and management so indices are presented. In 2016, the spring index was near the time series low though in fall both the numerical and biomass indices were at time series high values (Table 19, Figure 47).

Using size cutoffs presented in ASMFC assessment documents, it is apparent that age-0 specimens typically predominate in survey fall catches and then these same year-classes are observed again in the spring as age-1 (Figure 48).

No discernable pattern is seen in sex ratios among the various size classes (Figure 49). Both sexes appear to reach the 50% maturity threshold at about 18cm, and 95% are mature at 22-25cm (Figure 48). It should be noted that while the abundance data from the survey may be of questionable value, the maturity schedule developed from NEAMAP SNE/MA made a significant contribution to the recent positive stock assessment for Atlantic Menhaden.

Bay Anchovy (*Anchoa mitchilli*)

Figure 51. Bay Anchovy biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 21. Bay Anchovy sampling rates for each NEAMAP SNE/MA cruise.

Table 18. Bay Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 52. Bay Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 53. Bay Anchovy length-frequency distributions, by cruise.

This highly important forage species is both widely distributed and very abundant in survey tows both in the spring and fall; though in the spring the specimens tend to be captured in the shallow/nearest-to-shore stations. While exceptions occur, a geographic pattern is often observed in which Bay Anchovy are typically rare or absent in survey tows conducted near the major estuarine outflows (Figure 51, Table 20).

Patterns in the abundance indices exhibit a great deal of year-to-year variability and distinguishing patterns is difficult, though a declining trend does appear to be present for the fall surveys (Table 21, Figure 52). Interestingly, though total catch numbers for spring and fall are on approximately the same scale, the geometric mean abundance indices are about an order of magnitude greater in spring than in fall. This is likely due to moderate-but-consistent catches in the spring and highly variable catches in the fall. Geometric mean indices tend to dampen the effect of infrequent large catches. No cohorts are apparent in the length-frequencies for this “annual-crop” species (Figure 53).

Black Drum (*Pogonias cromis*)

Figure 54. Black Drum biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

Table 22. Black Drum sampling rates for each NEAMAP cruise.

Table 23. Black Drum geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Figure 55. Black Drum geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Figure 56. Black Drum length-frequency distributions, by cruise.

Figure 55. Black Drum age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 56. Black Drum catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 57. Black Drum diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016.

This species is nearly always absent from spring surveys but can be moderately common during the fall (Figure 54, Table 22). Abundance indices for the spring, though presented, are likely not indicative of true abundance. Fall indices have varied without pattern but with high variability within a small range of values (Table 23, Figure 55). Though the trend lines between abundance by number vs. weight are similar, the magnitude of the biomass indices can vary broadly depending upon whether catches were dominated by small or large specimens.

The rare individuals captured during spring NEAMAP SNE/MA surveys have always been large (80+cm) adult specimens while those captured in the fall are nearly all smaller (<30cm). These smaller fish have nearly all been age-0 (Figure 56, Figure 57) so the fall index may be used as representing primarily young-of-year abundance.

A variety of shelled molluscs constitute about 70% of the diet by weight and 66% by number, followed in importance by several different crustacean species (14% by %W 16% by %N). Most of the remainder is classified as being unidentifiable but originally was likely one of the previous two categories (Figure 57).

Black Sea Bass (*Centropristis striata*)

Figure 58. Black Sea Bass biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 24. Black Sea Bass sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 25. Black Sea Bass geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP SNE/MA surveys.

Figure 59. Black Sea Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and by age class (B).

Figure 60. Black Sea Bass length-frequency distributions, by cruise.

Figure 61. Black Sea Bass length-frequency distributions, by cruise and sex.

Figure 62. Black Sea Bass age-frequency distribution, by cruise.

Figure 63. Black Sea Bass catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 64. Black Sea Bass sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 65. Black Sea Bass maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 66. Black Sea Bass maturity at age, by sex for all cruises pooled, 2007-2016.

Figure 67. Black Sea Bass diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Trawl surveys are not considered to be the ideal platforms for sampling this species, given the structure-orientated nature of sea bass and the tendency for trawl surveys to avoid towing their gear over structure. It seems, however, that enough fish are collected by NEAMAP SNE/MA to extract a variety of useful information. Indeed during spring this species is captured at 60%-80% of the 'index stations' over a relatively small geographic area (RIS, GIS, and along Long Island) and in fall the species is present in 30%-40% of the stations over the entire survey area. For both the spring and fall surveys, NEAMAP achieved time series high catch rates following the abundant 2011 year class, then fell in 2015 but rose again in 2016 (Table 24).

With respect to the distribution of the catches of Black Sea Bass, collections during the spring 2016 survey were the second highest of the time series and were concentrated in Rhode Island Sound and Block Island Sound with spotty catches seen as far south as Region 14 (upper part of NC). During the fall, survey catches again were also generally low in Regions 1-15 (NY – NC) but most tows produced significant catches in RIS and BIS (Figure 58).

Overall abundance indices for spring surveys were nearly flat between 2008 and 2012 but have increased substantially since, again reflecting the abundance of the 2011 year class. For fall survey data, abundance over all age groups was relatively flat from 2007 to 2010, rose appreciably in 2011 and 2012 and has remained at relatively higher levels in the most recent years (Table 25, Figure 59). Age-0 Black Sea Bass are only captured in significant numbers during the fall survey. While it appears that there may be a declining trend in age-0 abundance, the high degree of variability makes it difficult to discern a definitive pattern. For both the spring and fall time series it appears that abundance has increased in the older age classes in recent years, generally reflective of the 2011 fish moving through the stock.

A broad size range (~4cm – 60cm TL among all cruises) of Black Sea Bass was collected during each of the surveys, and included both juvenile and adult specimens (Figure 60). The majority of the sea bass collected ranged between 15cm and 40cm TL, and it appeared that multiple modal size groups (likely corresponding to age-classes) were present. The 2011 year class is readily apparent as a cohort moving through the year-specific plots. A 60cm sea bass (a male, age-16, weighing 3.1kg), which is believed to be the maximum size for this species, was collected during the spring 2008 cruise and a second one of the same size was collected during the fall of 2010 male, age-10, weighing 2.8kg).

Black Sea Bass are protogynous hermaphrodites, meaning that at least some members begin life as female and, around a certain size, switch to male. This life history characteristic is evident in the trends both in length distribution by sex (Figure 61) and in sex ratio by size (Figure 64) documented by the NEAMAP SNE/MA Survey. It is important to note however that this species is incompletely metagonous, meaning that some fish are actually born as males are remain so throughout their lifetime, while some females never switch to male and as is evidenced in both of the aforementioned figures.

While specimens between ages 0 and 16 have been captured during NEAMAP SNE/MA cruises, the large majority of sea bass taken are ages 0-4 (Figures 62, 63). No particular pattern of age distributions has been observed, except, as mentioned above, the 2011 year class is easily observed as it passes through successive years.

Due to the unusual life history of this species, the maturity schedules for males and females are markedly different with males reaching 50% maturity and about 18cm (age-1.7) and females not until 21cm (age-2.2; Figure 65, Figure 66). Both males and females reach the 95% maturity threshold at about 28-30cm, though this size represents age 3.4 for males and 3.8 for females.

Crustaceans comprised the largest portion (64.8% by weight, 68.9% by number) of the diet of Black Sea Bass sampled by the NEAMAP SNE/MA Survey (Figure 67). This is consistent with the findings of several past studies. Rock Crabs (*Cancer irroratus*), Amphipods, Hermit Crabs (superfamily *Paguroidea*), and Sand Shrimp (*Crangon septemspinosa*) were the main crustaceans consumed. Fishes accounted for 18.5% of the Sea Bass diet by weight and 14.9% by number and were represented mainly by Butterfish and Bay Anchovy among identifiable species. Longfin Inshore Squid accounted for approximately 3% of the diet by both weight and number.

Blueback Herring (*Alosa aestivalis*)

Figure 68. Blueback Herring biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 26. Blueback Herring sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 27. Blueback Herring geometric mean indices of abundance, by number and biomass, for spring NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured.

Figure 69. Blueback Herring geometric mean indices of abundance, by number and biomass, for spring NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 70. Blueback Herring length-frequency distributions, by cruise.

Figure 71. Blueback Herring sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 72. Blueback Herring maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 73. Blueback Herring diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Blueback Herring can be quite abundant and well distributed during spring NEAMAP SNE/MA surveys but typically are nearly absent from catches during the fall and this pattern was observed during 2016 (Figure 68, Table 27). Total numbers caught have remained within a fairly narrow range with the exception of 2011 when 71,000 specimens were captured in a single tow. The second-highest total number of specimens were captured during the spring 2014 survey and these fish were well distributed over the survey area (the species was captured at 51% of all survey stations).

NEAMAP SNE/MA abundance indices are calculated only for the spring surveys and between 2007 and 2013 trended generally downward when expressed either in numbers or biomass. However, overall abundance reached a time series high value in spring 2014 and has remained higher than earlier values in 2015 and 2016 (Table 27, Figure 69). As most specimens captured in the spring are typically smaller than the size cutoff established to differentiate age-1 fish from older specimens (Figure 70) the age-1 indices follow the same general pattern as that for all Blueback combined.

As is typical for many species, at smaller sizes it is difficult to determine the sex of individual specimens by gross examination of gonads so up to about 12.5cm the sex ratio for this species is unknown. At medium sizes the ratio is close to even between males and females and then tends towards females at larger sizes (Figure 71). Both sexes are estimated to reach 50% maturity at 16-17cm and 95% maturity at 22-24cm (Figure 72).

Nearly the entire diet for Blueback (~97% both as %W and %N), as measured by NEAMAP SNE/MA consists of copepods, with another 2-3% represented by other small crustaceans. Other taxa are nearly non-existent in the diet analyses (Figure 73).

Bluefish (*Pomatomus saltatrix*)

Figure 74. Bluefish biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 28. Bluefish sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 29. Bluefish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and by age (Age-0 spring and summer cohorts shown separately).

Figure 75. Bluefish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A), for the youngest year class captured (B) and (using fall data only) for the spring and summer age-0 cohorts separately (C).

Figure 76. Bluefish length-frequency distributions, by cruise.

Figure 77. Bluefish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 78. Bluefish catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 79. Bluefish sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 80. Bluefish maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 81. Bluefish maturity at age, by sex for all cruises pooled, 2007-2016.

Figure 82. Bluefish diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Following the pattern typically seen for this species, Bluefish were rarely captured during the spring 2016 but was sampled throughout the NEAMAP SNE/MA survey range during the fall 2016 cruise. Catches were consistent along nearly the entire coast with the species present in about 68% of all survey tows. Bluefish are a fast-swimming, coastal pelagic species, and as such survey trawls are not deemed the most effective tool for sampling this species, at least at larger sizes. Nevertheless, appreciable amounts (number and biomass) of Bluefish were caught during fall surveys and one spring survey (Figure 74, Table 28).

Fall Bluefish indices of overall abundance (both number and biomass) were relatively stable over the time series with low survey variability (Table 29 – Figure 75). As the species does not usually reinvade the survey area until later in the spring after survey operations are completed indices as measured during spring cruises are likely not representative of true abundance. This is evidenced by the small number of survey strata in which the species appears in the spring and by the broad confidence limits for spring cruises. It is likely that spring catches are determined more by water temperatures than by abundance.

Bluefish are believed to exhibit an extended and geographically widespread spawning season, with two distinct concentrations, one in the spring in the South Atlantic Bight and one during summer in the Middle Atlantic Bight (Kendall and Walford, 1979). This pattern results in two distinct YOY cohorts. Examination of NEAMAP SNE/MA length frequency plots (Figure 76) reveals these two cohorts in NEAMAP SNE/MA data and cohort strength can likely be estimated separately. Therefore, using fall survey data only, YOY indices are calculated both for all YOY fish pooled and for each cohort separately (Table 29, Figure 75). Interestingly, the indices for each cohort appear to have followed nearly opposing trends over the time series. The spring cohort followed a mild but consistent decline between 2007 and 2010 before rising substantially in both 2011 and 2012 then falling again to the previous levels. Summer cohort YOY increased consistently between 2007 and 2009 before following an equally consistent decline in 2010, 2011, and 2012 then rising in 2013 and falling again in 2014. This pattern generally held in 2016.

Bluefish collected during the fall surveys generally ranged from 7cm to 75cm FL (Figure 76). The sizes of the majority of the specimens sampled during each of these surveys indicate that YOY and age-1 fish were the dominant age-classes sampled. This is probably due both to the structure of the population (i.e., more younger fish available) and the ability for larger, faster Bluefish to avoid the trawl. Bluefish collected during spring cruises were almost exclusively those from the previous summer cohort, though a small number of larger specimens are normally captured.

The vast majority of fall NEAMAP SNE/MA captures are age-0 and those in the spring are age-1, though individuals to age-9 have been seen. As the NEAMAP SNE/MA samples are dominated by age-0 and age-1 fish, it is not possible to evaluate the survey's ability to follow year classes through time (Figure 77, Figure 78).

A plot of sex ratio by size (Figure 79) showed that Bluefish do not exhibit any apparent sexually dimorphic trends, and ratios were approximately 1:1 (male to female) for most length groups. Similarly, the maturity schedules for males and females are nearly identical with both sexes reaching the 50% maturity rate at about 30cm (age 1.7-1.8 based on a 1 January birthdate) and 95% maturity at 44cm (about age-3; Figure 80, Figure 81).

As expected, the diet of Bluefish collected by NEAMAP SNE/MA was overwhelmingly dominated by fishes, 96.0% by %W and 92.4% by %N (Figure 82). Bay Anchovy accounted for roughly half of the Bluefish diet by both weight and by number. Butterfish, Striped Anchovy and Sand Lances also constituted significant amounts of the identifiable teleost prey types. The morphology and behavior of this species are well suited for a piscivorous lifestyle. Besides fishes, Longfin Squid were the only other specifically identifiable prey type accounting for any appreciable portion of Bluefish diets.

Brown Shrimp (*Farfantepenaeus aztecus*)

Figure 83. Brown Shrimp biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 30. Brown Shrimp sampling rates for each NEAMAP SNE/MA cruise.

Table 31. Brown Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 84. Brown Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 85. Brown Shrimp length-frequency distributions, by cruise.

Brown Shrimp are typically not highly abundant in NEAMAP SNE/MA tows, being limited to the southernmost survey Region in the spring (if they are present at all) and near the Virginia and North Carolina coasts in the fall (Figure 83, Table 30). Abundance indices are likely to be related more to local environmental conditions than to overall stock abundance (Table 31, Figure 85). When present in the survey a narrow length frequency band is usually seen, with a mode at 13-14cm total length though a separate distinct group with a mode at 5cm- 6cm was present in 2014.

Butterfish (*Peprilis triacantus*)

Figure 86. Butterfish biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 32. Butterfish sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 33. Butterfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and by age class.

Figure 87. Butterfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and by age class (B).

Figure 88. Butterfish length-frequency distributions, by cruise.

Figure 89. Butterfish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 90. Butterfish catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 91. Butterfish sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 92. Butterfish maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 93. Butterfish maturity at age, by sex for all cruises pooled, 2007-2016.

Butterfish have consistently been one of the most abundant species in collections made by the NEAMAP SNE/MA Trawl Survey and are ubiquitous throughout the survey's range (Figure 86). In the spring of 2016 catches were consistent but moderate throughout the survey area though without any extraordinarily large tows as can often occur. Fall abundances were most consistently highest in the Sounds, and along the coasts of Long Island and Virginia. For both the spring survey the total number of butterfish captured was 'average' but the number captured during fall 2016 was the smallest of any fall cruise (Table

32). Given the relatively consistent and abundant catches of this species by the NEAMAP SNE/MA gear, it is likely that butterfish were well sampled by this survey.

Spring and fall indices have exhibited similar trends over the time series but offset by one year (Table 33, Figure 87). For example, high index values in the fall 2010 and 2011 surveys were followed by high values in the 2011 and 2012 spring surveys; and low values in the fall of 2012 and 2014 were followed by low values in the spring of 2013 and 2015. This trend continued in the most recent surveys with an uptick in the fall 2015 index being reflected by an uptick in the spring of 2016. Time series values for both surveys have varied widely but without any apparent direction up or down. As catches for this species tend to be dominated by younger fish, age-specific abundance patterns tend to follow those for the all ages combined. A notable exception however is a sharp decline in age-0 fish during the spring 2012 when overall abundance reached a time series high but age-0 abundance was the second-lowest in the time series. NEAMAP SNE/MA abundance indices for this species are likely highly influenced by environmental conditions (mainly temperature) before and during the survey. NEAMAP SNE/MA data played a significant role in the recently approved stock assessment and subsequent management actions (NEFSC 2014).

Examination of cruise-by-cruise length frequencies (Figure 88) reveals that in several years distinct year-classes may be evident. An interesting but unexplained pattern is observable in the fall survey length distribution plots in that a peak in abundance seems to alternate back and forth each year between 6cm-8cm and 9cm-11cm though this pattern is not evident in 2015, when the smaller modal group would have been expected to dominate, but in fact larger fish were more abundant in survey tows.

As this species is relatively short-lived, generally, there is not an evident pattern of age-cohorts moving through the stock as measured by NEAMAP SNE/MA. That is, a large recruitment of age-0 butterfish in one year is not necessarily seen the following year; conversely, a large cohort of age-1 specimens may be seen which was not in evidence during the previous year. However, an apparent large year class in 2013 does appear to be evident as age-1s in 2014 and age-2s in 2015, though it was absent in 2016 (Figure 89, Figure 90).

No apparent trends were evident in the butterfish sex ratio by size (Figure 91); however it was not possible to accurately classify most of the fish smaller than 10cm FL due to the small size of the gonads. Similarly, 50% of both males and females attain sexual maturity at about 11cm FL which corresponds to about age 1.5 based on a 1 January birthdate. Both sexes reach the 95% maturity rate at about 15cm or 2.8 years.

From NEAMAP samples, both male and female butterfish reach the 50% maturity rate at approximately 11cm (1.5 years) and 95% at 15cm (2.8 years; Figure 92, Figure 93).

Diet samples are not taken for this species as previous experience reveals that little identifiable prey is observable in preserved stomachs.

Clearnose Skate (*Raja eglanteria*)

Figure 94. Clearnose Skate biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 34. Clearnose Skate sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 35. Clearnose Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 95. Clearnose Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 96. Clearnose Skate width-frequency distributions, by cruise.

Figure 97. Clearnose Skate width-frequency distributions, by cruise and sex.

Figure 98. Clearnose Skate sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 99. Clearnose Skate maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 100. Clearnose Skate diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Though this species is managed as a part of the skate complex by the New England Fishery Management Council and is sometimes present even in the northernmost survey stations, this species is usually most abundant from New Jersey and southward. In the spring Clearnose Skate are captured in nearly every tow in Regions 8-15 and the same is true during fall surveys for regions 1-15 (Figure 94). The total number of specimens captured during NEAMAP SNE/MA surveys is remarkably consistent within season, ranging between 1,600 and 3,200 in the spring and 875 and 1,500 in the fall (Table 34).

Likewise, abundance indices for both seasons have generally varied without trend within a fairly narrow range; though after a sharp increase in the fall 2012 index abundance fell in 2013 to previous levels rose slightly to an ‘average’ value in 2014, fell to a time series low in 2015 but rose modestly in 2016 (Table 35, Figure 95).

In most survey years no evidence is observed of size cohorts within the portion of the stock captured by the NEAMAP SNE/MA survey (Figure 96). Specimens typically range between 20-50cm disk width, with a peak at about 42cm during both seasonal surveys. Males are typically somewhat more abundant in survey tows than are females and at about 40cm the mode for males is somewhat smaller than that for females at about 45cm (Figure 97). These patterns are also seen in size-specific sex ratio data (Figure 98). Similarly, males appear to reach sexual maturity at a slight smaller size, with 50% being mature at about 35cm (95% at 42cm) whereas 50% of females are mature at 37cm (and 95% at 44cm; Figure 99).

The diets of Clearnose Skate are comprised of a variety of crustaceans, fishes, and molluscs in decreasing order (51.7%, 31.1%, 15.9% by %W, respectively; 61.5%, 20.3%, and 14.6% by % N). The portion of the diets comprised of crustaceans is dominated by a selection of small crabs and shrimp while among fishes appreciable amounts of Atlantic Croaker, Spot, Sand Lances, Butterfish, and several other species are present as well. Clams and Longfin Squid are the most abundant molluscs in the diet of this species (Figure 100).

Horseshoe Crab (*Limulus polyphemus*)

Figure 101. Horseshoe crab biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 36. Horseshoe Crab sampling rates for each NEAMAP SNE/MA cruise.

Table 37. Horseshoe Crab geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 102. Horseshoe Crab geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by sex.

Figure 103. Horseshoe Crab width-frequency distributions, by cruise.

Figure 104. Horseshoe Crab width-frequency distributions, by cruise and sex.

Figure 105. Horseshoe Crab sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 106. Horseshoe Crab maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 107. Horseshoe Crab virginity at length, by sex for all cruises pooled, 2007-2016.

Due to the multiple uses to which this species is put, and to the apparent relative efficiency with which the NEAMAP SNE/MA sampling gear captures horseshoe crabs, it is apparent that NEAMAP SNE/MA can contribute significantly to the understanding and the stock assessment for this species.

Following its generally accepted distribution and migration patterns, catches are typically highest near-and-to-the-south of Delaware Bay and somewhat to the south, but specimens are captured throughout the survey range even occasionally in RIS and BIS (Figure 101). Within any given year, total catch rates in the spring surveys usually exceed those in the fall, though this is not always the case. Spring total catch numbers and weights generally rise and fall in alternate year and this is reflected in abundance indices. Catch rates in the fall tend to bounce around a mean but rose to a time-series high value in 2015 and remained high in 2016. This is also reflected in index values (Table 36, Table 37, Figure 102).

Due to the differential uses to which animals from each sex are put, sex-specific abundances are presented, though the patterns for each sex follow together almost perfectly, but with females showing slightly higher numbers (and weights), especially during the spring.

A wide size range of specimens was captured in each NEAMAP SNE/MA seasonal survey, ranging between 8cm and 45cm, with most measuring between 12cm and 32cm (Figure 103). During many surveys, a cohort (perhaps a year class) of specimens less than 16cm is apparent (more often in spring than in fall). If it can be verified that this cohort corresponds to a particular age class then year class specific estimates of abundance can be provided in future reports.

Sex-specific length-frequency histograms (Figure 104) and sex-ratios by size class (Figure 105) reveal a pattern of sexually dimorphic growth, with the largest specimens (greater than about 25cm) nearly always being females.

As male Horseshoe Crabs are typically smaller than females, it is not surprising that there is a marked difference in sizes at maturity between the sexes. Fifty percent of males are sexually mature at about 18cm CW and 95% are mature at about 21cm. Females however don't reach these maturity rates until 23cm and 27cm respectively (Figure 106).

Similarly, as described by Walls et al. (2002) by examining the presence or absence of the 'atrophied nonmoveable chela' (males) or the presence or absence of 'mating scars' and the the carapace (females) it is possible to determine whether an individual crab has ever mated. NEAMAP SNE/MA records these data. Fifty percent of males are classified as non-virgin at about 19.5cm with 95% having mated at about 24cm. For females, these figures are 26cm and 32cm, respectively (Figure 107).

Kingfish (*Menticirrhus* spp.)

Figure 108. Kingfish biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 38. Kingfish sampling rates for each NEAMAP SNE/MA cruise.

Table 39. Kingfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age class.

Figure 109. Kingfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and by age class (B).

Figure 110. Kingfish length-frequency distributions, by cruise.

Figure 111. Kingfish sex ratio, by length group, for all cruises pooled, 2012-2016.

Figure 112. Kingfish maturity at length, by sex for all cruises pooled, 2012-2016.

Three closely related species of Kingfish occur within the NEAMAP SNE/MA sampling area. These are the Northern Kingfish (*Menticirrhus saxatilis*), the Southern Kingfish (*Menticirrhus americanus*), and the Gulf Kingfish (*Menticirrhus littoralis*). As there are no consistently reliable field identification characters, these species are generally lumped together both in fisheries dependent and fisheries independent data. While it would be preferable to not do so, NEAMAP SNE/MA follows this precedent and records all specimens simply as Kingfish.

Kingfish are present throughout the survey range but are most abundant from mid-New Jersey and southward, especially in Virginia and North Carolina waters. During fall trips, in Regions 6-15 Kingfish are typically present in nearly every tow and this pattern was present in 2016 (Figure 108). Kingfish are typically (though not always) more abundant during fall surveys than in the spring (Table 38).

As this species was temporarily reclassified as a 'Priority A' species in 2012 and 2013 (in support of a student dissertation project), and as processing of the ageing samples has been delayed so that personnel can concentrate their time on other species, age-length keys were developed using data from the ChesMMAP survey which is also prosecuted by the VIMS Multispecies Research Group. These keys will likely have to be updated when NEAMAP SNE/MA samples are processed, and therefore the age-specific indices will change in future reports.

Though, as previously stated, Kingfish are abundant during both the spring and fall survey seasons, comparing abundance indices for the two seasons is difficult. In the spring, after an initial high value in 2008, three consecutive years of lower abundance followed until a time-series high was reached in 2012. In 2013 overall spring abundance decreased somewhat but was still the second highest value in the series then fell again in 2014 and rose moderately in 2015 and 2016. Until approximately 2012, fall abundance indices followed a different pattern than did those from spring trips but in recent years spring and fall abundances seem to vary in similar patterns. These same patterns hold true for age-specific measures of abundance (Table 39, Figure 109).

Kingfish between about 8cm and 40cm TL are captured by the survey, with most individuals measuring between about 12cm and 30cm. Length frequency histograms reveal that during spring surveys generally at least two size cohorts are present, with the smallest cohort likely representing fish which were spawned during the previous calendar year. In most years, it is less obvious whether size cohorts (presumably age classes) are present in specimens captured during fall surveys (Figure 110).

Among those fish for which sex can be readily determined, males are predominate in the mid sizes (17-22cm) and females tend to be more abundant in size groups of 22cm and greater (Figure 110). However, sexual maturity rates are nearly identical with both sexes being 50% sexually mature at 20-21cm and 95% mature at 30cm (Figure 113).

Little Skate (*Leucoraja erinacea*)

Figure 113. Little Skate biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 40. Little Skate sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 41. Little Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 114. Little Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 115. Little Skate width-frequency distributions, by cruise.

Figure 116. Little Skate width-frequency distributions, by cruise and sex.

Figure 117. Little Skate sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 118. Little Skate maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 119. Little Skate diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Little Skate are most abundant in tows conducted in the northern portion of the survey range but are also well represented in more southern locations, especially during spring (Figure 113). Capture rates are similar for both spring and fall surveys though they are typically slightly more abundant in spring than fall, both in numbers and biomass (Table 40).

For the spring surveys, abundance measured as either numbers or biomass has been exhibited a downward trend when considering all survey years. In the fall, after an initial moderate value in 2007, abundance increased through 2009, followed a three-year decline to a time-series low in 2012. Since 2013 indices have fluctuated but have followed a rising trend back to moderate levels (Table 41, Figure 114).

Width-frequencies are remarkably similar in each year and between seasons with specimens generally ranging in size from 16-30cm DW (Figure 115). Similarly, sex-specific width frequency histograms exhibit no particular differences in growth between males and females (Figure 116). Up to about 45cm size-specific sex ratios vary a bit but hover right around 1:1. The largest specimens above 47cm are all males, though the number of specimens examined is very small (Figure 117).

From NEAMAP SNE/MA samples, 50% of both males and females reach sexual maturity at 22-23cm, though the sizes at 95% maturity differ a bit more (M: 26cm, F: 29cm). The shape of these logistic maturity regressions may be affected somewhat however by the fact that very small specimens of this species and Winter Skate can be hard to distinguish and NEAMAP SNE/MA records these non-identifiable individuals using a separate species identifier (Figure 118).

Given the relatively small body size and bottom-hugging habit of this species it is not surprising that the diet is dominated by small crustaceans (59% by %W, 72% by %N), predominantly amphipods, cumaceans, and small shrimps and crabs. However, molluscs (mainly small clams), worms, and fishes also constitute significant portions of the overall food habits (Figure 119).

Longfin Inshore Squid (*Doryteuthis pealeii*)

Figure 120. Longfin Inshore Squid biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 42. Longfin Inshore Squid sampling rates for each NEAMAP SNE/MA cruise.

Table 43. Longfin Inshore Squid geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 121. Longfin Inshore Squid geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 122. Longfin Inshore Squid length-frequency distributions, by cruise.

Figure 123. Longfin Inshore Squid length-frequency distributions, by cruise and sex.

Figure 124. Longfin Inshore Squid sex ratio, by length group, for all cruises pooled, 2013-2016.

Figure 125. Longfin Inshore Squid maturity classification by season and sex, 2013 – 2016.

In both the spring and fall 2015 surveys, the numbers of Longfin Inshore Squid (commonly called *Loligo* though the scientific name was recently changed) collected were the second-lowest of the time series. In spring 2016 numbers rebounded moderately high catch rates but remained quite low during the 2016 fall trip (Table 42). In the spring 2016 survey the species was collected in low numbers throughout the survey area in approximately equal numbers on a tow-to-tow basis. In the fall survey many more squid were captured in the northern regions than in the south (Figure 120). This pattern has been observed in other years as well.

Abundance indices for *Loligo* squid generally followed similar patterns as overall catches both in terms of number and biomass (Table 43, Figure 121). Indices for the spring followed a declining trend between 2008 and 2011 but reached a high in 2012 (twice the previous high value) then fell to a time-series low in 2013 and have slowly increased in succeeding years. Note that the very high value in 2012 corresponded with very high fishery abundance later that summer and the low index in spring 2013 likewise foreshadowed low fishery abundance observed by the commercial sector during summer 2013. Fall numerical indices varied year by year with perhaps a decreasing trend between 2009 and 2012 but with marked increases in 2013 and 2014 and a decrease to a mid-level values in 2015 and 2016.

With respect to the sizes of specimens collected, squid caught on the spring cruises ranged from 1cm mantle length (ML) to 29cm ML (Figure 122). Most of the *Loligo* collected in fall surveys are less than 15cm while many larger specimens tend to be captured in the spring though this pattern was broken in fall 2013 when some of the largest specimens seen by the survey were quite abundant. Examination of the length frequencies reveals apparent cohorts within our catches but no attempt has yet been made to develop a distinct YOY index for NEAMAP SNE/MA. This may be possible with additional research. NEAMAP SNE/MA began recording sex (and measuring certain internal organs to determine maturity) on a subsample of specimens in 2013. Sex-specific length-frequencies show that at least for these recent survey years, male Longfin Squid are more numerous in survey tows than are females (Figure 123, Figure 124).

As stated above, in 2013 NEAMAP SNE/MA began recording measurements on individual specimens which allow for assignment (during post processing of data) of those specimens to one of four maturity stages. These data reveal that during spring nearly all female Longfin Squid captured and a large majority of males were sexually mature. In the fall, again most females were mature but among males a definite pattern is revealed of increasing maturity at increasing size with 50% maturity at about 16cm and nearly 100% maturity at 25cm (Figure 125).

Sandbar Shark (*Carcharhinus plumbeus*)

Figure 126. Sandbar Shark biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

Table 44. Sandbar Shark sampling rates for each NEAMAP cruise.

Table 45. Sandbar Shark geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Figure 127. Sandbar Shark geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Figure 128. Sandbar Shark length-frequency distributions, by cruise.

Figure 129. Sandbar Shark length-frequency distributions, by cruise and sex.

Figure 130. Sandbar Shark sex ratio, by length group, for all cruises pooled, 2007-2016.

Though never captured in large numbers by NEAMAP SNE/MA (0-7 in spring surveys between 2008 and 2016; 5-81 during fall surveys beginning in 2007; Table 44) this species is thought to be an important predator in the Mid Atlantic Bight and worthy of species-specific analyses. As noted, very few specimens were captured during any NEAMAP SNE/MA spring surveys and this was true in 2016 (2 individuals); and while in numbers relatively few Sandbars are captured during fall surveys (13 in 2016) the total biomass represented by the species (high value of 202kg in 2010, 44kg in 2016) would rank high 'Priority A' species. Most of this biomass was accounted captures at several stations just south of the mouth of Chesapeake Bay (Figure 126).

Validation of survey abundance indices for this species has not yet been attempted (the VIMS Multispecies Research Group also conducts the VIMS shark longline survey so the data to support such validation may exist within the group) but are shown here regardless. The species appears to have following a generally increasing pattern in abundance through 2014 but with 2015 and 2016 being found as 'down' years (Table 45, Figure 127).

Most specimens captured by the survey ranged between 40-80cm PCL and no length cohorts were observed. In fall 2013 the largest specimen yet captured (132cm, 52kg) was captured in southern North Carolina (Figure 128). No pattern of sexual dimorphism was observed either in sex-specific length-frequencies (Figure 129) or in size-specific sex ratio data (except in size classes with extremely low sample sizes; Figure 130).

All Sandbar Sharks captured are processed quickly, tagged, and released alive so no food habits data are recorded for this species.

Scup (*Stenotomus chrysops*)

Figure 131. Scup biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 46. Scup sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 47. Scup geometric mean indices of abundance, for all specimens captured by number and biomass and by age-class for spring and fall NEAMAP surveys.

Figure 132. Scup geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.

Figure 133. Scup length-frequency distributions, by cruise

Figure 134. Scup age-frequency distribution, by cruise.

Figure 135. Scup catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 136. Scup sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 137. Scup maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 138. Scup maturity at age, by sex for all cruises pooled, 2007-2016.

Figure 139. Scup diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Scup were collected in consistent numbers from throughout the survey area during the spring 2016 cruise and were highly abundant in RIS and BIS. During the fall 2016 survey the total number of Scup captured was below average, with the largest catches in RIS and BIS and nearly absent in tows south of mid-New Jersey (Figure 131, Table 46).

The overall abundance indices for Scup (both spring and fall) showed large declines between the first two survey years (2007-2008 for fall, 2008-2009 for spring) followed by a leveling off or small decline through 2011. In 2012 the spring and fall indices followed divergent paths with the spring index being the second highest for the series and that for fall remaining at the low level seen in the previous 3-4 years. The spring index fell again in 2013 and 2014 to approximately the same levels observed in 2009-2011, then rose modestly in 2015 and jumped to a time-series high value in 2016. The fall index fell to a time-series low value in 2013 but ticked up modestly in 2014 and 2015 but falling again in 2016 (Table 47, Figure 132). As is true for several species, NEAMAP SNE/MA Scup abundance indices are likely to be highly influenced by availability of this species in the sampling area. Scup move inshore to spawn during the spring, and their migration is likely triggered by temperature. In varying portions of the survey area in each year, water temperatures remained cold (see Figure 3), throughout the time of the survey and may have affected catch rates for this species. Age-specific indices generally follow the patterns exhibited for overall abundance though the decline in fall indices is not as steep for older fish (age-2+) as for younger fish.

Scup sampled during the fall cruises ranged from 3cm to 41cm FL (Figure 133). As noted above (and below), a majority of fish collected during the fall surveys were YOY individuals. Generally, a broader size range and somewhat more even distribution of specimens is seen in spring surveys and a significant number of larger individuals ranging up to 43cm FL were captured. Age frequency plots (Figures 134, 135) confirm this pattern.

No particular trends were evident in the sex ratio of Scup by size class (Figure 136). The largest specimens collected were mainly female, but sample sizes of the biggest fish are relatively small, so it would be necessary to collect additional information prior to drawing any conclusions.

Males and females appear to have very similar maturity schedules reaching the 50% and 95% maturity thresholds at about 15cm and 21cm respectively (Figure 137). These sizes correspond to ages 2.1 and 3.4 (based on a 1 January birthdate; Figure 138).

Crustaceans accounted for about 60% of the Scup diet composition by weight and 64% by number (Figure 139). Amphipods and small, shrimp-like animals were the dominant prey types within this category. Of the remaining identifiable prey categories, worms accounted for roughly 16% by %W and 13% by %N of the diet, with fishes and molluscs at about 5% or less.

Silver Hake (*Merluccius bilinearis*)

Figure 140. Silver Hake biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 48. Silver Hake sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 49. Silver Hake geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured.

Figure 141. Silver Hake geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 142. Silver Hake length-frequency distributions, by cruise

Figure 143. Silver Hake sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 144. Silver Hake maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 145. Silver Hake diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Total abundance of Silver Hake during NEAMAP SNE/MA cruises varies widely both between seasons and among years within seasons. Total numbers range from 4,843 (2013) to 35,837 (2012) for spring cruises and 132 (2016) to 3,125 (2008) during the fall. Catches during 2016 were moderate during the spring cruise and very low during the fall. During the spring 2016 survey specimens were captured from Cape Cod, MA all the way south to North Carolina. During fall 2016 the catch-range was compressed with no fish captured south of Atlantic City, NJ (Figure 140, Table 48).

Despite the variability in total catch rates, spring abundance indices varied within a fairly narrow range, with the exception of 2012 when the index peaked at a value 2-3 times that of previous and subsequent years. Fall survey indices are more variable though it is noted that the 2011 figure was the highest of the time series and may represent the same specimens subsequently observed in spring 2012. Otoliths for this species have not yet been analyzed so age-specific abundances were calculated based on single-value length cutoffs and therefore may not be as reliable as those for other species (Table 49, Figure 141).

Length-frequency histograms reveal distinct length cohorts which presumably represent age-classes. Those specimens presumed to be age-0 in the fall are 17cm FL and smaller while during the same season those larger than 17cm are assumed to represent age-1 fish. During the spring, the age-0s from the previous fall have been promoted to age-1 and lie between 6cm and 20cm. Those larger than 20cm are assigned to age-2+ (Figure 142).

Up to about 15cm FL large numbers of the specimens examined to determine sex cannot be assigned based on gross examination. Between 15cm and 25cm there is approximately a 1:1 sex ratio but above that size most specimens were identified as being females (Figure 143). Sexual maturity rates are similar for males and females with 50% of both sexes being mature at 19-20cm and 95% being mature at 27-29cm (Figure 144).

As has been observed in other studies, the diets of SNE silver hake are dominated by crustaceans (70.1% by %W, 85.2% by %N) with amphipods, mysids and various small shrimp species being predominate. Fishes make up another 27.6% by %W and 12.8% by %N. Other taxa are represented in very small amounts (Figure 145).

Smooth Butterfly Ray (*Gymnura micrura*)

Figure 146. Smooth Butterfly Ray biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

Table 50. Smooth Butterfly Ray sampling rates for each NEAMAP cruise.

Table 51. Smooth Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Figure 147. Smooth Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Figure 148. Smooth Butterfly Ray length-frequency distributions, by cruise.

Figure 149. Smooth Butterfly Ray sex ratio, by length group, for all cruises pooled, 2007-2016.

This species is not currently under management and is not usually sought by recreational or commercial fisheries. However, in terms of biomass (individual captured specimens have ranged from 0.1kg to 127kg and total biomass up to 580kg) it consistently ranks high in the list of species captured in the survey and should be considered as an important member of the ecosystem. A VIMS graduate student within the Multispecies Research Group has taken on both this species and the congeneric Spiny Butterfly Ray to better define the biology and the ecological role of these species.

Smooth Butterfly Rays are normally captured only in the Virginia and North Carolina portions of the NEAMAP SNE/MA survey and this was the case in 2016 (Figure 146). Very few (0-16) individuals were captured during spring surveys but up to almost 300 specimens have been sampled in the fall (total weight 557kg; Table 50). Only 13 specimens were captured during the fall 2016 survey.

Due to the near absence of this species during spring surveys, abundance indices are calculated only for the fall season. With the exception of a single above average year in 2008 abundance has bounced around a fairly steady mean value, but with a very low value in 2016 (Table 51, Figure 147).

Specimens between 25cm DW and almost 2m DW have been captured in survey tows. Examination of length frequency plots reveals what appears to be a fairly consistent cohort below a disk width of about 75cm (Figure 148). Whether this group represent a particular age class will have to be determined from samples now being taken. Of specimens smaller than 50cm, 60% to 90% have been identified as males while nearly 100% of specimens larger than 55cm are females (Figure 149).

Smooth Dogfish (*Mustelus canis*)

Figure 150. Smooth Dogfish biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 52. Smooth Dogfish sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 53. Smooth Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured (fall only).

Figure 151. Smooth Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 152. Smooth Dogfish length-frequency distributions, by cruise.

Figure 153. Smooth Dogfish length-frequency distributions, by cruise and sex.

Figure 154. Smooth Dogfish sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 155. Smooth Dogfish maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 156. Smooth Dogfish diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Figure 157. Smooth Dogfish reproductive data by season; A – frequency histogram of number of embryos found in females, B – frequency histogram of embryo stages, C – length-frequency histogram of embryos.

This species is normally captured consistently throughout the survey range with local concentrations often occurring at the mouths of the major estuaries. This pattern held for both surveys during 2016, with the most consistent high catch rates occurring near the mouth of Delaware Bay during both seasons (Figure 150). The total numbers and biomass captured during each season/survey varies within a fairly narrow range, though it may be declining. Spring 2012 saw the smallest number (and biomass) of Smooth Dogfish captured during any single NEAMAP SNE/MA survey but the quantity recovered in 2013 to approximately the same levels as seen in 2010 and 2011, and has stayed relatively stable since. During fall surveys the largest numbers of specimens were captured in 2007 and 2009 with all other years falling within a narrow range. Only 224 fish were captured during the fall 2016 survey, which is the lowest value on record for that season (Table 52).

These patterns in overall catch are matched by the abundance index calculations with the spring survey following a nearly straight-line decline between 2007 and 2012 with nearly level values since. Indices from the fall survey bounced up and down between 2007 and 2010 then staying within a narrow range in succeeding years until exhibiting a substantial drop in 2016 (Table 53, Figure 151).

Smooth Dogfish between 25cm PCL and almost 120cm PCL have been measured by the survey (Figure 152). Distinct size cohorts are evident in the fall catches with the cohort falling below the 47cm cutoff corresponding to age-0 fish as described by Conrath et al. (2002).

In the spring, NEAMAP SNE/MA catches are predominantly (~60%) male for specimens up to about 85cm with a preponderance of females at larger sizes. In the fall, the sex ratio is about 50-50 up to 80cm, with females again primarily abundant in larger size classes (Figures 153, 154). Consistent with those findings, it appears that males mature at slightly smaller sizes than do females with 50% of males reaching sexual maturity at about 64cm while females reach that level at 73cm. Ninety-five percent maturity rates are reached at 76cm and 85cm for males and females respectively (Figure 155).

Based on analysis of 3,436 individual stomachs (representing 1,582 ‘clusters’ of samples), the diet of Smooth Dogfish was dominated by crustaceans (72% by %W, 63% by %N), followed by molluscs, fish, and worms. Nearly all of the identifiable crustaceans represented several different species of crabs. This diet is in sharp contrast to this species’ close namesake (though taxonomically somewhat distantly related) species, Spiny Dogfish, which consists primarily (~50% by %W) of several species of fish (Figure 156).

NEAMAP SNE/MA records several additional data elements on the reproductive status of female Smooth Dogfish. Specifically, a subsample of specimens (the same subsample examined for individual length, weight, sex, maturity, age, diet) is dissected and the numbers and stages of embryos/pups are logged and any pups present are measured (PCL). Between 0 and 20 embryos were observed in individual specimens. For all spring surveys combined, about 30% of these fish contained no embryos while in fall that number is about 14%. For both seasons, among those specimens containing embryos most specimens carried between 8 and 12 pups (Figure 157-A). Again among those individuals which contained embryos small numbers were at the egg stage and the remainder were pups (Figure 157-B). In terms of length, smaller pups were observed during fall surveys with a peak at about 125mm but these pups had approximately doubled in length by spring when the peak modal size was about 250mm (Figure 157C).

Spanish Mackerel (*Scomberomorus maculatus*)

Figure 158. Spanish mackerel biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 54. Spanish mackerel sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 55. Spanish mackerel geometric mean indices of abundance, by number and biomass, for fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 159. Spanish mackerel geometric mean indices of abundance, by number and biomass, for fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 160. Spanish mackerel length-frequency distributions, by cruise.

Figure 161. Spanish mackerel diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Due to the fast swimming pelagic nature of Spanish Mackerel, the NEAMAP SNE/MA survey is not considered to be an efficient platform for gathering high quality data on this species. However, this species is classified as a Priority A species and therefore what data exists will be reported.

No Spanish Mackerel have ever been captured during spring NEAMAP SNE/MA surveys. Total capture rates during fall surveys has ranged between 0 (in 2014 and 2015) and 161 (in 2007; Table 54) but specimens are rarely captured outside of Regions 14-15 (Figure 158).

While sample sizes are extremely small and the quality of data is undetermined, abundance indices for fall surveys reveal high variability but with values at or near zero for the past several years (Table 55, Figure 159).

Spanish Mackerel specimens captured by the survey have ranged between 8-44cm FL. During years in which higher numbers of individuals where encountered a cohort between about 20-28cm appears to consistently be present (Figure 160). This cohort corresponds to age-0 fish (Gaichas 1997).

Though sample sizes are very small, food habits analyses for this species coincide with other studies which report that this species is highly piscivorous. Among the major taxa, only fishes have been found in the stomachs sampled by NEAMAP SNE/MA. Bay Anchovy constitute about two-thirds of the diet by either %W or %N with Silver Anchovy, Striped Anchovy, and unidentified Anchovies accounting for the vast majority of the diet (Figure 161).

Spiny Butterfly Ray *(Gymnura altavela)*

Figure 162. Spiny Butterfly Ray biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance

Table 56. Spiny Butterfly Ray sampling rates for each NEAMAP cruise.

Table 57. Spiny Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Figure 163. Spiny Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Figure 164. Spiny Butterfly Ray length-frequency distributions, by cruise.

Figure 165. Spiny Butterfly Ray sex ratio, by length group, for all cruises pooled, 2007-2016.

Like the very similar congeneric Smooth Butterfly Ray this species is not currently subjected to any management measures and is not sought by either the commercial or recreational sectors. Again with its cousin however, even though survey catch in numbers is relatively small the total biomass represented is often within the top tier within the survey. Therefore data results will be reported.

Spiny Butterfly Rays are rarely captured in spring NEAMAP SNE/MA surveys. Fall catch rates have varied between 21 (in 2016) and 133 (in 2007) specimens, or approximately 113-1,360kg (Table 56). Specimens are typically captured in Regions off the coast of Virginia and North Carolina though individuals have been caught north of those areas (Figure 162).

Fall abundance indices have so far varied in two-to-three year cycles, declining between 2007 and 2008, then rising until 2011, subsequently falling in 2012 and 2013 then rising again in 2014, with declines in 2015 and 2016 somewhat disrupting the previous 3-year cycle. Depending upon the size of the individuals captured in any given year the indices by number vs. weight can differ substantially, though trends between the two measures are very similar (Table 57, Figure 163).

Spiny Butterfly Rays ranging between 25cm and 235cm DW have been observed in the survey. Most specimens have measured 40cm to 140cm. Though capture rates were likely not sufficient to make a firm determination, there appears to be a cohort with a maximum size of about 100cm which may correspond to an age-class (Figure 164).

Though the proportion of males to females within size groups varied somewhat (likely due to small sample sizes), overall there does not appear to be any trend in sex ratios over the range of sizes observed by the survey (Figure 165).

Spiny Dogfish *(Squalus acanthias)*

Figure 166. Spiny Dogfish biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 58. Spiny Dogfish sampling rates and preserved specimen workup status for each NEAMAP SNE/MA cruise.

Table 59. Spiny Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 167. Spiny Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 168. Spiny Dogfish length-frequency distributions, by cruise.

Figure 169. Spiny Dogfish length-frequency distributions, by cruise and sex.

Figure 170. Spiny Dogfish sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 171. Spiny Dogfish maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 172. Spiny Dogfish diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Figure 173. Spiny Dogfish reproductive data by season; A – frequency histogram of number of embryos found in females, B – frequency histogram of embryo stages, C – length-frequency histogram of embryos.

In most years, the seasonality of the NEAMAP SNE/MA collections of Spiny Dogfish is consistent with the accepted migratory patterns of this species. These fish congregate in Mid-Atlantic waters in winter and early spring, and then migrate north in the late spring and summer. By fall, the southern extent of this species' range only overlaps with the most northeastern reaches of the NEAMAP SNE/MA sampling area (i.e., RIS and BIS).

The catch distribution of Spiny Dogfish from the 2015 and 2016 NEAMAP SNE/MA survey cruises however differed from this general pattern. During spring 2015/16 Spiny Dogfish were captured in the large majority of tow in all Regions except 14 and 15 (NC) and likewise in the fall, between Montauk, NY and Wachapreague, VA.

Catches of Spiny Dogfish by the NEAMAP SNE/MA Trawl Survey varied seasonally, and within seasons annual variability is high; spring collections consistently exceeded fall catches (Table 58). Approximately 1,300 specimens, with a gross weight between 3,300 kg and 3,600 kg, were sampled during the spring cruises in 2008 and 2009 but only 249 and 180 individuals (804 kg, 548 kg) were captured in spring 2010 and 2011 respectively. Spring catch numbers varied without trend between 2012 and 2015 but rose to a very high number in spring 2016 due to extraordinary numbers of specimens being captured in the 20cm-25cm range. Catches during the second and third fall surveys exceeded those on the first by an order of magnitude in terms of number and by two orders of magnitude with respect to weight but were almost nonexistent (4 and 40 specimens respectively) in fall 2010, 2011, and 2012 but rose again to 477 specimens (993kg) in 2013 before moving close to zero in 2014 and recovering in fall 2015 to 545 fish and again to a record high value of 2,027 specimens in fall 2016.

Likewise, the abundance indices for Spiny Dogfish, both in terms of number and biomass, showed a slight increase between the 2008 and 2009 spring surveys before falling considerably in 2010 and 2011 but recovering in 2012 and 2013 but falling to moderate number in 2014 and 2015. In spring 2016 there is a large divergence between the abundance index trend lines by number and biomass due to the very large number of small individuals captured during that cruise (Table 59, Figure 167). For the fall surveys, abundance with respect to both numbers and biomass generally increased between 2007 and 2009 and, similarly to the spring survey, fell dramatically in 2010 and remained close to zero between 2011 and 2015 before rising again in 2016. These fluctuations, especially as measured by the fall survey, are as likely to be due to variability in annual migration patterns and availability to the survey as to real changes in stock size and must be used in consideration with data from other surveys.

Based on the length-frequency distributions, it appeared that both juvenile and adult dogfish were collected on most NEAMAP SNE/MA surveys (Figure 168). Fish sampled on the first fall survey ranged from 63cm to 88cm pre-caudal length (PCL). Those collected during the fall 2008 cruise were from 21cm to 78cm PCL, but two very distinct modal size groups were present (21cm to 36cm PCL and 52cm to 78cm PCL). These modal size groups represented the juvenile and adult fish. The length distribution documented during the fall 2009 cruise was similar, however the size range of the smaller modal group was slightly larger (i.e., 29cm PCL to 40cm PCL) that that observed in 2008. Length data for fall 2010 through 2012 was generally uninformative due to very small sample sizes and that for 2013 was similar to those in 2008 and 2009 though at a lower level. Dogfish collected on the spring 2008 survey ranged from 18cm to 87cm PCL, and two distinct modal groups were again observed. Juvenile fish, while present, were much less abundant on the spring 2009 cruise. For both spring surveys, the size range of most of the adults collected was between 55cm and 80cm PCL. Specimens collected in spring 2010 and spring 2011 had a similar length distribution but generally compacted due to a considerably smaller sample size. The earlier pattern of a small number of juvenile fish and larger numbers of specimens ranging 50cm-85cm was observed during spring 2012 and was especially prominent in 2013. In spring 2014 a cohort of fish between 44cm and 62cm, which was not generally observed in previous years, was fairly abundant.

Spiny Dogfish are known to school by sex, with males most often found in offshore waters and females typically inhabiting shallower waters. NEAMAP SNE/MA sex ratio by size data were consistent with this pattern; nearly all of the Spiny Dogfish collected except at the very small sizes were female (Figures 169, 170). Female Spiny Dogfish are known to grow to larger sizes than do males (Campana et al. 2009) and this is reflected in the sex-specific length frequencies, sex ratios at size, and in the maturity schedules (though as stated previously the sample sizes for male dogfish are small; Figure 171).

About half of the Spiny Dogfish diet by both weight and number was fishes (Figure 172). The largest ‘prey type’ within this category was unidentifiable fish followed by a combination of many species, each of which individually contributed a small amount to the dogfish diet. Atlantic Menhaden, Striped Bass, Butterfish and Scup comprised between 2% and 9% of the diet by weight. Of the remaining prey categories, molluscs (primarily *Loligo* squid) accounted for the greatest percentage of the diet of Spiny Dogfish.

Beginning with the spring 2010 survey cruise, data on the reproductive status of spiny (and smooth) dogfish have been recorded on specimens sampled for 'full workup.' These data include number of embryos/pups present, the development stage ('candle', embryo, pups with yolk sac, pups without yolk sac) and gross weights and individual lengths of any pups present. For 2010 through 2016 combined, the number of pups present in female Spiny Dogfish ranged from 0 to 11 with the non-zero peak being between 4 and 6. About 93% of females (spring and fall combined) were gravid (Figure 173A). Contrary to earlier studies (Hisaw & Albert, 1947) who (in the vicinity of Woods Hole, MA) observed gravid females with only Stages A (candle) and C (pups with yolk sac) during the spring and only Stages B (embryo) and D (pups without yolk sac) during the fall, NEAMAP SNE/MA routinely observes all four stages during both seasons in similar seasonal proportions (though sample sizes during the fall are small; Figure 173B). Length frequencies of pups exhibit two distinct modal groups during both spring and fall (unlike for the Smooth Dogfish this does not appear to merely represent growth between seasons). This is consistent with observations that Spiny Dogfish gestate for nearly two years, meaning that one group of measured pups is in their first year of gestation and another group is in their second year (Figure 173C).

Spot (*Leiostomus xanthurus*)

Figure 174. Spot biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 60. Spot sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 61. Spot geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and by age class.

Figure 175. Spot geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys and by age class.

Figure 176. Spot length-frequency distributions, by cruise.

Figure 177. Spot sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 178. Spot maturity at length, by sex for all cruises pooled, 2007-2016.

While traditionally thought of as a southern or Mid Atlantic species, Spot are captured throughout the range of the NEAMAP SNE/MA survey, even into RIS and BIS, though the largest and most consistent catches are normally in Virginia and North Carolina (Figure 174). As noted earlier in this report, during spring 2013 a Spot and an Atlantic Cod were captured during the same tow in Region 5 (NY Harbor area).

Spot are typically one of the most numerous species in NEAMAP SNE/MA cruises with numbers ranging from 1,600 to 29,600 during spring surveys and 1,000 to 210,000 in the fall. A time-series high number captured during fall 2012 was followed by season-specific record numbers in spring 2013 (Table 60). Catches during the fall 2013 cruise were considerably smaller and reached a time-series low value in fall 2014 followed by an ever lower value in fall 2015 but rising modestly in 2016. However, as with many species abundance as measured by NEAMAP SNE/MA could be largely affected by environmental factors such as temperature.

With the exception of the very large numbers seen in fall 2012 and spring 2013, abundance indices have varied within a fairly narrow range during both seasons. Age-specific indices may not presently be as reliable as for Spot as for some other species as the age-length keys used to assign age classes use data borrowed from another survey. When the ageing process has been completed for this lower-urgency species NEAMAP SNE/MA-specific ALKs will be developed (Table 61, Figure 175).

Spot captured in NEAMAP SNE/MA tows generally range between 10-20cm FL. Likely due to their reasonably fast growth during their first year, to the relatively small maximum size, and to a normally short life span (about 4 years maximum), length frequencies normally do not exhibit obvious size/age cohorts (Figure 176).

Except at small and large size categories, at which very few specimens have been examined, the sex ratio for Spot tends to be about 1:1 (Figure 177). Both sexes are 50% sexually mature at about 17cm and 95% mature at 23.5cm (Figure 178).

Striped Anchovy (*Anchoa hepsetus*)

Figure 179. Striped Anchovy biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 62. Striped Anchovy sampling rates for each NEAMAP SNE/MA cruise.

Table 63. Striped Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 180. Striped Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 181. Striped Anchovy length-frequency distributions, by cruise.

Though most abundant in the southern half of the NEAMAP SNE/MA range (especially in spring), Striped Anchovy are seen in most survey Regions. Overall abundance varies over a wide range both within and between seasons. After reaching time series high values in both spring and fall 2012, in spring 2013 this species was nearly absent from survey tows and fell further to just 7 individuals in spring 2014 before recovering to more normal values in 2015 and 2016 (577 and 3,068, respectively). Total numbers captured are always significantly higher during fall cruises than those in the spring, ranging between about 10,000 and 290,000 (131kg – 3,000kg). Catch during the most recent years fall in the middle of the range of values (Figure 179, Table 62).

The changes in total numbers captured are reflected in the survey abundance indices. The spring index is likely to be highly influenced by water temperatures and with the exception of the high value in 2012 is typically at a low value. The fall index generally declined between 2007 and 2010, rose dramatically in 2011 and 2012 but then fell again in 2013 to near the low values observed in 2009 and 2010 and have remained relatively flat in succeeding years (Table 63, Figure 180).

As this species is both quite small (maximum size about 18cm) and short lived, length frequency histograms are consistent year-to-year and generally do not exhibit evidence of size cohorts (Figure 181).

Striped Bass (*Morone saxatilis*)

Figure 182. Striped Bass biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 64. Striped Bass sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 65. Striped Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 183. Striped Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 184. Striped Bass length-frequency distributions, by cruise.

Figure 185. Striped Bass length-frequency distributions, by cruise and sex.

Figure 186. Striped Bass sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 187. Striped Bass maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 188. Striped Bass maturity at age, by sex for all cruises pooled, 2007-2016.

Figure 189. Striped Bass diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

While currently abundant and reasonably susceptible to capture by trawls, due to its particular migratory patterns and to the timing of both the spring and fall NEAMAP SNE/MA surveys Striped Bass are generally not well sampled by the survey. During spring surveys the species generally is found in its spawning aggregations in upper estuaries. After migrating well northward in late spring, most individuals/schools have yet to begin their fall southward migration during the time of the fall survey. That said, the survey does sometimes capture appreciable numbers of Striped Bass and while the abundance indices may be of questionable value some of the biological data can be useful for assessment and management.

Normally more Striped Bass are captured during fall surveys than during the spring though this pattern was reversed in 2014 and 2016, with very few (4 each) found in either survey during 2015. Abundance is usually highest in the northern portions of the survey range but significant numbers can be captured elsewhere as happened in fall 2013 when a moderately large catch of Striped Bass occurred in Region 8 (southern New Jersey; Figure 182, Table 64).

For both seasons, abundance indices have generally alternated direction up and down on an annual basis, though with a declining trend through 2015 and a significant uptick in spring 2016. Again however the value of NEAMAP SNE/MA abundance indices for this species must be examined further before being used as reliable estimates of true abundance (Table 65, Figure 183).

Most Striped Bass captured were between 55-85cm FL though both very large and much smaller specimens have been sampled (Figure 184). Though this species is known to exhibit sexually dimorphic growth patterns at the moderate sizes which dominate NEAMAP SNE/MA samples little evidence of this is found, except for those relatively few fish in the largest size categories, which are dominated by females (Figure 185, Figure 186). For specimens examined by NEAMAP SNE/MA, 50% of Striped Bass of both sexes reach sexual maturity at about 34cm-35cm FL (age-3.0 to 3.3). Both sexes achieve the 95% sexual maturity rate at 53-56cm (age-5.4; Figure 187, Figure 188).

Striped Bass sampled by the survey are highly piscivorous with 92.0% by %W and 86.3% by %N of the diets consisting of fish. Bay Anchovy constitute 40%-50% of the diet, with Sand Lances, Butterfish, Scup, and Bluefish also present in significant quantities. Notably, Atlantic Menhaden constitute only about 2% of the diet. Crustaceans and molluscs make up most of the rest of the food items found in NEAMAP SNE/MA samples (Figure 189).

Summer Flounder (*Paralichthys dentatus*)

Figure 190. Summer Flounder biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 66. Summer Flounder sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 67. Summer Flounder geometric mean indices of abundance, for all specimens captured (by number and biomass) and by age-class for spring and fall NEAMAP SNE/MA surveys.

Figure 191. Summer Flounder geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys.

Figure 192. Summer Flounder length-frequency distributions, by cruise.

Figure 193. Summer Flounder length-frequency distributions, by cruise and sex.

Figure 194. Summer Flounder age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 195. Summer Flounder catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 196. Summer Flounder sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 197. Summer Flounder maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 198. Summer Flounder maturity at age, by sex for all cruises pooled, 2007-2016.

Figure 199. Summer Flounder diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Summer Flounder were collected nearly throughout the NEAMAP SNE/MA survey range on each of the 2016 cruises (Figure 190). For both of the survey cruises, Summer Flounder the highest catches occurred in the northern portion of the sampling area (i.e., off of the coast of Long Island and in BIS and RIS). Small but consistent catches of Summer Flounder were encountered throughout the rest of survey area during both 2016 surveys.

It is apparent that the NEAMAP SNE/MA survey gear samples this species well.
Catches of Summer Flounder by the NEAMAP SNE/MA Near Shore Trawl Survey were relatively consistent among survey cruises (301 – 1,352 specimens weighing 143 kg to 636 kg; Table 66). In spring 2013 the amounts caught recovered somewhat from the lowest of the time series during 2012, and has stayed nearly the same through 2016; fall 2013 numbers and biomass were the smallest values in the time series for either season and remained low through 2016.

For both spring and fall surveys, overall indices appear to be following a downward trend over the survey years (Table 67 – Figure 190). Abundance indices for young-of-year (fall only) generally mirrored the overall abundance estimates except for a moderate increase during 2014, 2015 and 2016. Indices for the older age groups (both spring and fall) generally followed a similar pattern, indicating that at least to some degree, NEAMAP SNE/MA abundance estimates for this species may be related to availability to the survey as well as to stock size.

A broad range of sizes of Summer Flounder were collected during the all cruises ranging from 12cm to 78cm TL, with several distinct modal size groups normally evident in each survey (Figure 192). The size ranges collected during the spring surveys were similar to those seen during the fall cruises (15cm to 78cm TL, spring; 12cm to 78cm TL, fall). Because the gear used by NEAMAP SNE/MA collects appreciable numbers of Summer Flounder over a broad size range, it is likely that this survey will prove to be a valuable source of information for this species into the future.

As noted in previous project reports, a distinct trend was evident in the sex ratio of Summer Flounder collected by NEAMAP SNE/MA when examined by flounder size (Figures 193, 196). Specifically, the proportion of females in the sample increased with increasing length. Females began to outnumber males at about 35cm TL, and nearly all fish greater than 60cm TL were female.

Specimens between ages 0 and 13 have been collected during the nine NEAMAP SNE/MA surveys to date with the large majority usually aged 3 and younger (Figures 194, 195). Strong vs. weak year classes do not generally propagate themselves in the successive years as is often seen with other species. For example, the large number of age-0 specimens found in fall 2009 is not evident as age-1s in fall 2010, though the number of age-2s in spring 2011 is exceptionally high.

Though, as noted above, this species is known to exhibit sex-specific differences in growth rates, the maturity schedules for males and females in NEAMAP SNE/MA samples are remarkably similar. Both sexes achieve the 50% maturity at 27-28cm TL (age 1.3 assuming a 1 January birthdate) and reach the 95% level at 36-38cm (age 2.8 and 3.4 for males and females, respectively; Figure 197, Figure 198).

Summer Flounder are known piscivores, and the diet of flounder collected by NEAMAP SNE/MA confirmed this classification (Figure 199). Specifically, fishes accounted for 58% of the Summer Flounder diet by weight and 48% by number; a wide array of species comprised this category. Crustaceans (mostly small, shrimp-like animals) and molluscs (mainly *Loligo* squid) composed the remainder of the diet. A similar feeding ecology was recently documented for Summer Flounder in Chesapeake Bay. *Loligo* squid were absent from flounder stomachs collected in the bay, however, likely due to the relative absence of this prey from this estuary.

Tautog (*Tautoga onitis*)

Figure 200. Tautog biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

Table 68. Tautog sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Table 69. Tautog geometric mean indices of abundance, for all specimens captured for spring and fall NEAMAP surveys.

Figure 201. Tautog geometric mean indices of abundance, for all specimens captured for spring and fall NEAMAP surveys.

Figure 202. Tautog length-frequency distributions, by cruise.

Figure 203. Tautog length-frequency distributions, by cruise and sex.

Figure 204. Tautog maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 205. Tautog diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016.

Due to the species' tendency to be associated with structure, trawls are not a highly efficient gear with which to sample Tautog. However, the species is a NEAMAP SNE/MA Priority A species and so what data are available will be reported.

Total survey catches have ranged from 2 to 137 specimens (2.3 – 59.2kg). With such low capture rates it is difficult to summarize location-specific abundance tendencies but generally the species is captured within the northern two-thirds of the survey range (Figure 200, Table 68).

Again due to the low sampling rate abundance indices may not be good indicators of true abundance. However, a comparison of trend lines between spring and fall surveys indicates general agreement between the two with low values early in the survey, relatively higher values in 2008-2010, followed by a general but erratic decline in ensuing years (Table 69, Figure 201).

Despite the small numbers, Tautog have been captured over a fairly broad size range (14-65cm TL) with no apparent differences between spring and fall surveys (Figure 202). There does not appear to be a preponderance of either sex either overall or by size category when length frequencies are plotted separately by sex (Figure 203).

The maturity schedule for Tautog estimates that females reach 50% maturity at a slight smaller size (23cm) than do males (26cm) and this pattern continues through the 95% maturity rate (Males: 30cm, Females: 36cm).

Among specimens sampled by the survey, about 45% by %W and 50% by %N of the diet of Tautog consists of crustaceans, mainly a variety of crab species. Molluscs, mainly clams and other bivalves, constitute nearly an equal amount (43% by %W and 35% by %N) with unidentified material (likely originally matter which was once one of the other two categories) the only other prey type of significance (Figure 204).

Weakfish (*Cynoscion regalis*)

Figure 206. Weakfish biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 70. Weakfish sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 71. Weakfish geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP SNE/MA surveys.

Figure 207. Weakfish geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys.

Figure 208. Weakfish length-frequency distributions, by cruise.

Figure 209. Weakfish length-frequency distributions, by cruise and sex.

Figure 210. Weakfish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 211. Weakfish catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 212. Weakfish sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 213. Weakfish maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 214. Weakfish maturity at age, by sex for all cruises pooled, 2007-2016.

Figure 215. Weakfish diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

In spring 2016 weakfish were mostly throughout the survey ranges though catch rates were highest in Regions 10-15. In the fall of 2016 this species was captured in every survey Region though with only modest concentrations in RIS and BIS (Figure 206).

Catches during fall cruises are consistently higher than during the spring. The largest spring total catch was in 2008, followed by the smallest in 2009, then with moderate values in 2010 and 2011 and low catches during 2013-2015. The spring 2016 survey however captured the third highest number during the time series. Numbers captured during fall surveys have followed an up and down pattern with the largest number taken in fall 2011 but declining significantly in 2012 and 2013 then rising again to mid-range levels in 2014. Total numbers and biomass were the highest of the survey time series in fall 2015 and this high catch rate was followed by a moderately large total catch in fall 2016 (Table 70).

Overall abundance indices for spring surveys declined sharply between 2008 and 2009 and rose modestly in 2010 and 2011 (2008 indices were heavily influenced by a small number of very large catches) before reaching a high value in 2012 then falling somewhat in 2013 and falling to a time-series low value in 2014. The spring 2015 index rose moderately but the 2016 values for both numbers and biomass are the highest of the series by almost a factor of two. Until 2013 fall indices have alternately risen and fallen each year but declined in both 2012 and 2013 then rose again modestly in 2014, increased again in 2015 and declined slightly in 2016. As the survey catches are dominated by age-0 and age-1 fish, the age-specific indices generally follow the patterns seen for the total catch. Spring and fall trend lines seem to follow opposite patterns of up and down years but upon further examination this may actually reveal a consistency. The young weakfish captured during fall surveys would be the same year classes captured during the following spring, so if the pattern were offset by one calendar year there would actually be good agreement in the patterns between the two time series (Table 71, Figure 207).

Weakfish have been captured at sizes ranging between 5cm and 64cm. Examination of length frequencies reveals apparent length (likely age) groups but with significant overlap among modal groups. Considering the known historical size range for this species the observed length frequencies are considerably compressed with the vast majority of specimens captured at less than 30cm (Figure 208). Inspection of sex-specific length frequencies (Figure 209) reveals no apparent pattern of sexually dimorphic growth.

As with the length frequency examination, cruise-by-cruise age-frequencies exposes a stock that appears to be both size and age compressed. In all cruises the large preponderance of captured specimens are between ages 0 and 2. However, it is noted that in fall 2012 more age-3 specimens were captured (based on the expanded subsample) than in any previous cruise and in both spring and fall 2013 more age-4 weakfish (again, as based on the expanded subsample) than in any previous year, though the numbers were still very small. These are the survivors of what was apparently a successful year class in 2009 (Figure 210, Figure 211).

At most size classes NEAMAP SNE/MA captured weakfish show a preponderance of female fish at approximately a 60:40 ratio (Figure 212). It is unknown whether this is true for the entire stock or whether this is a survey-specific phenomenon.

Weakfish (both males and females) achieve a 50% maturity rate at 18-19cm TL and are 95% at 24cm (females) and 28cm (males; Figure 211). These values correspond to ages 1.1 (females) and 1.3 (males) at 50% maturity and 2.0 (females) and 2.8 (males) at 95% mature specimens (Figure 213, Figure 214). This relatively large difference in age at maturity bears further investigation though it must be noted that the value for female 95% maturity is estimated only from graphical examination because the algorithm used to calculate this value does not converge based only on the raw data.

Weakfish are known to be significantly pisciverous. While this is confirmed (Figure 215) from examination of stomachs sampled by NEAMAP SNE/MA (49% by weight, 33% by number, dominated by species of anchovies), at the sizes of fish generally sampled by NEAMAP SNE/MA thus far crustaceans actually contribute at least as much to the diet of this species as do fishes (44% by weight, 62% by number, primarily mysids).

White Shrimp (*Litopenaeus setiferus*)

Figure 216. White Shrimp biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 72. White Shrimp sampling rates for each NEAMAP SNE/MA cruise.

Table 73. White Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 217. White Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 218. White Shrimp length-frequency distributions, by cruise.

Though also caught almost exclusively during fall NEAMAP SNE/MA surveys, White Shrimp are generally more abundant in the survey than are Brown Shrimp and their range within the survey area is somewhat larger (Figure 216). Total catches in spring surveys have ranged from 0 (four years) to just 109 (in 2013) while those in the fall have varied between 16 specimens (2011) to over 44,000 (2016). Expressed numerically, the 44,074 White Shrimp captured in fall 2016 was by far the highest of the survey time series and expressed in terms of biomass, the 594kg total in fall 2015 was almost seven times larger than the 87kg captured in fall 2010 (Table 72).

Abundance indices are highly variable and are without apparent trend but with high values in 2016 (Table 73, Figure 217). Length frequencies likewise are somewhat variable as they can be skewed when catch rates are low. When survey abundance is higher, the survey appears to capture the entire size range of the fishable stock (Figure 218).

Windowpane Flounder (*Scopthalmus aquosus*)

Figure 219. Windowpane Flounder biomass (kg) collected at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 74. Windowpane Flounder sampling rates for each NEAMAP SNE/MA cruise.

Table 75. Windowpane Flounder geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 220. Windowpane Flounder geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 221. Windowpane Flounder length-frequency distributions, by cruise.

Figure 222. Windowpane Flounder length-frequency distributions, by cruise and sex.

Figure 223. Windowpane Flounder sex ratio, by length group, for all cruises pooled, 2012-2016.

Figure 224. Windowpane Flounder maturity at length, by sex for all cruises pooled, 2012-2016.

Figure 225. Windowpane Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2012-2016.

Windowpane Flounder are captured consistently and over a broad geographic range within the survey area. The species is managed within the NEFMC's groundfish complex and is thought to be a potential 'choke species' which could prevent fishing for other more valuable species. It was not originally a NEAMAP SNE/MA Priority A species but because it is a managed species with important potential management implications, VIMS promoted it to 'A' status in 2012.

In spring 2016 Windowpane Flounder were captured in all survey Regions north of North Carolina but at consistently higher along the southern coast of Long Island and to a lesser extent in RIS and BIS. During the fall 2015 survey catch rates followed a similar pattern (Figure 219). Total number and biomass sampled during surveys is of the same magnitude in both spring and fall and has varied within relatively narrow bounds (Table 74).

Spring abundance indices have followed a moderate but steady declining trend over the survey time series. Those for the fall have been more variable with higher values during

2009-2011 and a descending pattern during recent years (2013-2016), reaching the time series low value in 2016 (Table 75, Figure 220).

Length frequency histograms provide evidence of a small (likely young-of-year) cohort in survey samples, especially during the spring. When age structures analysis is complete this can be verified and appropriate age-specific indices will be provided (Figure 221). Little evidence is seen of the sexual dimorphism that is common among other flatfishes (Figure 222, Figure 223). Similarly, males and females reach sexual maturity at remarkably similar sizes; 50% are sexually mature at 19cm TL and 95% at 27cm (Figure 224).

Windowpane diets consist nearly exclusively (about 82% by %W and 90% by %N) of small crustaceans, primarily mysids, sand shrimp, and cumaceans (Figure 224). Fishes (15% by %W, 7% by %N), primarily bay anchovy constitute the largest portion of the remainder of the diets.

Winter Flounder (*Pseudopleuronectes americanus*)

Figure 226. Winter Flounder biomass (kg) collected at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 76. Winter Flounder sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise strata used for calculation of abundance indices.

Table 77. Winter Flounder geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP SNE/MA surveys.

Figure 227. Winter Flounder geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys.

Figure 228. Winter Flounder length-frequency distributions, by cruise.

Figure 229. Winter Flounder length-frequency distributions, by cruise and sex

Figure 230. Winter Flounder age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 231. Winter Flounder catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 232. Winter Flounder sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 233. Winter Flounder maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 234. Winter Flounder maturity at age, by sex for all cruises pooled, 2007-2016.

Figure 235. Winter Flounder diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Winter Flounder are nearly always captured in the largest numbers in RIS, BIS and along Long Island and this pattern held in 2016 (Figure 226). In spring however, this species was consistently captured down to the New Jersey coast and specimens have been captured well south of the ‘index’ regions.

While significant numbers of Winter Flounder are seen in both spring and fall surveys, total numbers captured in spring are typically three to four times higher than in the fall. While natural variations are observed, over the survey time series thus far, catch rates for this species have been relatively constant within the seasonal surveys. Though the 2013-2015 spring catch rates were the lowest of the time series, total catches during spring 2016 recovered to earlier levels. This pattern also held for the fall cruises, though offset by one year (Table 76).

For the first four spring survey years (2008-2011) Winter Flounder abundance indices for all specimens combined were relative stable. However the index declined by roughly one-half for the years 2012-2015, but rebounded significantly in spring 2016. Fall indices have been somewhat more variable but appear to be on a downward trajectory overall. Due to the considerably smaller number of specimens captured in the fall compared to spring, age-specific indices are limited to ages 1 through 4+ for the fall whereas they can be distinguished with some level of confidence for ages 1 through 7+ (which matches the current assessment practice) for the spring (Table 77, Figure 227).

A wide range of sizes of Winter Flounder (7cm – 50cm) have been captured. Length frequency figures typically exhibit a pattern with obvious modal groups, presumably age classes, and the pattern is typically more pronounced in the fall than in the spring (Figure 228).

As is typical of many Pleuronectiform fishes, sexually dimorphic growth, with females typically growing faster and to larger maximum sizes, is seen in examination of sex-specific length frequencies (Figure 229) and sex ratios by size group (Figure 232).

Winter Flounder between ages 0 (a single specimen) and 19 (2 specimens) have been captured during NEAMAP SNE/MA cruises. Most specimens captured are younger than age-6 or age-7. Examination of age-frequency distribution reveals that it does appear that stronger and weaker year-classes can be observed working their way through the stock (Figures 230, 231).

Although, as previously mentioned, this species exhibits sexually dimorphic growth patterns the sizes and ages at maturity for the two sexes are very similar. Males and females both reach the 50% maturity rate at 22cm-23cm TL and 95% at about 31cm. These sizes correspond to about ages 1.9-2.0 for both sexes and 3.3 (for females) or 3.8 (for males) assuming a 1 January birthdate (Figure 233, Figure 234).

Together, various worms and small crustaceans constitute 70% of Winter Flounder diets by weight and 82% by number. Amphipods constitute the largest identifiable prey type at 30% by weight and 54% by number (Figure 235).

Winter Skate (*Leucoraja ocellata*)

Figure 236. Winter Skate biomass (kg) at each sampling site for 2016 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 78. Winter Skate sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 79. Winter Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 237. Winter Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 238. Winter Skate length-frequency distributions, by cruise.

Figure 239. Winter Skate length-frequency distributions, by cruise and sex.

Figure 240. Winter Skate sex ratio, by length group, for all cruises pooled, 2007-2016.

Figure 241. Winter Skate maturity at length, by sex for all cruises pooled, 2007-2016.

Figure 242. Winter Skate diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2016.

Winter Skate occurrences in NEAMAP SNE/MA are typically concentrated in the more northern survey Regions but are often quite widely distributed, especially in spring. As with other recent years, this was true in spring 2016 when water temperatures throughout the survey range were cool and this species was captured in the vast majority of tows in every single Region. A more normal pattern was seen in fall 2016 but even then Winter Skate were captured as far south as Chesapeake Bay (Figure 236).

While somewhat more Winter Skate are usually sampled during spring surveys than during the fall, the total numbers and biomass captured is remarkably stable over the time series (Table 78). Similarly both the spring and fall survey abundance indices are relatively stable over time, though with some year-to-year variability (Table 79, Figure 237).

Specimens have been captured over a relatively wide size range (9 – 75cm DW). Examination of width frequency histograms reveals what may be size cohorts within the overall structure but this can only be determined once ageing samples are processed (Figure 238). Little evidence of sexual dimorphism exists either in sex-specific width-frequencies (Figure 239), size-specific sex ratios (though the very largest specimens to tend to be males; Figure 240), or maturity schedules (Figure 241).

Crustaceans constitute the largest portions of the diet (38% by %W, 55% by %N) with fishes, worms, and molluscs making up very roughly equal portions thereafter (Figure 242).

Yellowtail Flounder (*Pleuronectes ferruginea*)

Figure 243. Yellowtail Flounder biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

Table 80. Yellowtail Flounder sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Figure 244. Yellowtail Flounder length-frequency distributions, by cruise.

Figure 245. Yellowtail Flounder length-frequency distributions, by cruise and sex.

Figure 246. Yellowtail Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016.

As is the case with Atlantic cod, due to the general distribution and habits of Yellowtail Flounder, the number of Yellowtail Flounder captured during NEAMAP SNE/MA cruises is so small that meaningful abundance indices cannot be calculated. However, as this is a Priority A species, other biological data summaries are presented.

Small numbers of Yellowtail Flounder (0-52) have been captured during spring surveys but nearly none have been observed during fall cruises (Figure 243, Table 80). Those captured have been between 13cm to 40cm TL but most fall in the range of 30cm to 44cm (Figure 244). From the limited number of specimens observed it appears that as with many Pleuronectiform species there is a tendency for larger size classes to be dominated by female fish (Figure 245).

Amphipod crustaceans account for about 75% by %W and 84% by %N of Yellowtail Flounder diets. Mysids account for another 3%-4% with the remainder being accounted for by worms and clams (Figure 246). As sample sizes are small, these proportions may change significantly as additional specimens become available.

Public Outreach

In an effort to share survey information with interested parties, such as fishery managers, fishermen and those involved in support industries, other scientists, political figures, students, and the general public, NEAMAP SNE/MA staff use a multi-faceted approach. The centerpiece of these efforts is the survey 'demonstration tows', where guests are invited to observe sampling operations first hand, either in port or for a few hours at sea. During these events, past project reports, current data summaries, and informational brochures are available. Demonstration tows have been conducted during layovers in New Bedford, Massachusetts, Point Judith, Rhode Island, Montauk, New York, Cape May, New Jersey and Hampton, Virginia. Demonstrations in New Bedford are typically conducted as part of that city's annual Working Waterfront Festival. With respect to political figures, guests have included U.S. Senator Sheldon Whitehouse and U.S. Senator Jack Reed, both from Rhode Island, and Brent Robinson, a senior staff member of U.S. Representative Rob Wittman from Virginia. Staff from the offices of U.S Senators Mark Warner (VA), Charles Schumer (NY) and Mark Begich (AK), and from U.S Representatives James Langevin (RI), Patrick Kennedy (RI), and Walter Jones (NC), have also attended demonstrations. In all, we estimate that approximately 300 guests have participated in these demonstrations since the inception of the survey in 2007.

A single demonstration tow event was conducted in 2013 and was based out of Point Judith. The number of demonstration tows conducted in recent years has waned (reaching zero in 2014), as extensive efforts put forth in previous years seemed to have satisfied existing demand (i.e., most interested parties have already participated in at least one of these demonstrations). Future demonstration tow events will be conducted as demand reemerges. Outside of the demonstrations, dockside interactions have proven to be an excellent way to share NEAMAP SNE/MA survey data with the fishing communities, and these will continue.

78More formally, the ASMFC maintains the official NEAMAP SNE/MA website (www.NEAMAP SNE/MA.net – referenced in the brochures), which contains an array of background information on the survey and past reports and is expected to offer much more data in the near future. VIMS staff also maintain a site at www.vims.edu/fisheries/neamap. In 2013, PIs and staff made thorough presentations of NEAMAP SNE/MA results at a general meeting of the full Mid-Atlantic Fishery Management Council, the Squid Management Workshop hosted by the Council, an annual meeting of the Commercial Fisheries Research Foundation, the Short-Lived Species Workshop hosted by this Foundation, and annual meetings of the NEAMAP Board and Science and Statistical Committees of the Atlantic States Marine Fisheries Commission New England Fishery Management Council, and ASMFC meetings to date. Further, the lead PI of this program gave a presentation of NEAMAP MA/SNE efforts to the Committee on Natural Resources of the U.S. House of Representatives relative to the upcoming reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act.

Finally, two news articles, one brief and one more in-depth, highlighting the NEAMAP MA/SNE Survey appeared in the June and October issues of the *National Fisherman* in 2013.

Data Utilization/Collaborative Research Efforts

The NEAMAP MA/SNE Trawl Survey has been in operation for 10 years as of the time of this report (May 2017), meaning that nine spring and ten fall cruises have been completed. As such, the time series of relative abundance data generated by the survey is generally to be deemed sufficient to support stock assessment efforts for the MAB and SNE. Specifically, NEAMAP data have been incorporated into the assessments for:

- **American Lobster** – Abundance, distribution, length
- **Atlantic Croaker** – Abundance, distribution, length, sex, maturity, & age
- **Atlantic Mackerel** – Abundance, distribution & length
- **Atlantic Menhaden** – Predator diet data for inclusion in Multispecies VPA
- **Atlantic Sturgeon** – Abundance data for ESA listing and subsequent re-evaluation
- **Black Sea Bass** – Abundance, distribution, length, sex, maturity, & age
- **Bluefish** – Abundance, distribution, length, & age
- **Butterfish** – Abundance, distribution, length, sex, maturity, & age
- **Longfin Squid** – Abundance, distribution, & length
- **River Herring (Alewife & Blueback)** – Abundance, distribution, length, sex, & maturity
- **Scup** – Abundance, distribution, length, sex, maturity, & age
- **Spot** – Abundance, distribution, length, sex, maturity, & age
- **Summer Flounder** – Abundance & age
- **Weakfish** – Abundance, distribution, length, sex, maturity, & age
- **Winter flounder** – Abundance, distribution, length, sex, maturity, & age

In addition, data have been provided but due to the relatively short time series which existed at the time of the assessment, NEAMAP SNE/MA were not incorporated into the assessment for these species:

- **Atlantic Sea Scallop** – Abundance, distribution, & length
- **Black Drum** – Abundance, distribution, length, sex, maturity, & age
- **Horseshoe Crab** – Abundance, distribution, length, sex, & maturity
- **Red Drum** – Abundance, distribution, length, sex, maturity, & age
- **Skate complex (Clearnose, Little, & Winter)** – Abundance, distribution, & length
- **Smooth Dogfish** – Abundance, distribution, length, sex, & maturity
- **Spiny Dogfish** – Abundance, distribution, length, sex, maturity, & diet
- **Striped Bass** – Length, sex, maturity, & age
- **Tautog** – Abundance, distribution, length, sex, & maturity

NEAMAP SNE/MA data have been used to evaluate management alternatives and to set state regulations for:

- **Scup** – State of New York
- **Summer Flounder** – State of New York & Commonwealth of Virginia

Finally, NEAMAP SNE/MA has cooperated with numerous researchers and interstate efforts for the following projects:

- **All species** – sampled for development of genetic library
- **Black sea bass** - ageing exchange with NMFS & Massachusetts DMF.
- **Black sea bass** - hard part (scale/otolith) comparison for ageing.
- **Butterfish** - delineation of preferred habitat with NMFS, Sandy Hook Laboratory.
- **Longfin squid** - began recording sex and maturity data in 2013.
- **Monkfish** - population genetics with the University of Madrid in Spain & Cornell University.
- **Scup** - hard part (scale/otolith) comparison for ageing.
- **Scup** – ageing exchange sponsored by ASMFC.
- **Summer flounder** – supported sampling to quantify first year growth and habitat preferences.
- **Summer flounder** – hard part (scale/otolith) comparison for ageing (ongoing).
- **Summer flounder** – ageing exchange sponsored by ASMFC.
- **Alewife & blueback herring** - collaboration to improve stock assessment with University of New Hampshire.
- **Alewife & blueback herring** - population genetics with University of California, Santa Cruz.
- **Alewife & blueback herring** – ageing exchange sponsored by ASMFC.
- **American lobster** – began sampling hard parts to develop age data for this species.
- **Atlantic croaker & spot** - ageing exchange with ASMFC partners.
- **Atlantic croaker**, **black drum**, **kingfish**, **& spot** - population genetics with South Carolina DNR.
- **Atlantic menhaden** - contaminant analysis in collaboration with Seton Hall University.
- **Atlantic menhaden** – ageing exchange with ASMFC partners.
- **Atlantic menhaden** – gonad sampling to quantify fecundity.
- **Atlantic menhaden** – support the development of a fishery-independent survey specifically targeting this species.
- **Bluefin tuna** - investigation of prey species as a source of contaminant loads.
- **Coastal bats** - delineation of populations with the University of Maryland.
- **Coastal sharks & Atlantic sturgeon** - tagging studies in collaboration with NMFS.
- **Little skate** - population genetics with Boston University.
- **Northern puffer** - population genetics with Texas A&M.
- **Sheepshead** - population genetics with Dauphin Island Sea Lab.
- **Silver hake** - population genetics with colleagues at VIMS.
- **Smooth dogfish** – satellite tagging with Florida State University.

- **Striped bass** - sampling to identify prevalence and severity of Mycobacterium infection in the coastal migratory population.
- **Striped bass** - investigation to quantify predatory impact in collaboration with NEFSC and in response to Congressional inquiry.
- **Striped bass** – collaborative effort with Maryland DNR to quantify fecundity of coastal migrant population
- **Summer Flounder & Black Sea Bass** – support of habitat modelling in collaboration with Stony Brook University
- **Tautog** - population genetics with Virginia Marine Resources Commission.
- **Windowpane Flounder** – provided data to inform the SMAST Bycatch Avoidance System.
- **Winter Flounder** – provided data to inform a SMAST/Coonamesset Farm winter flounder bycatch reduction study.
- **Yellowtail Flounder** – provided data to inform the SMAST Yellowtail Flounder Bycatch Avoidance System.
- Quantified biogeography of Block Island & Rhode Island Sounds with University of Rhode Island to support Marine Spatial Planning efforts (Rhode Island Ocean SAMP).
- Expanded diet sampling to generate coastwide trophic model in collaboration with SEAMAP.
- Began working with Massachusetts DMF, Maine/New Hampshire, and NEFSC Bottom Trawl Surveys to identify and quantify possible shifts in species distributions in Northeast waters.
- Provided data to assist those attempting to quantify populations of both Jonah and rock crabs.
- Initiated efforts to quantify the behavior of fishes (e.g., Longfin squid and flatfishes) relative to the NEAMAP trawl, and in turn develop estimates of capture efficiency/catchability.
- Provided data to better understand fish distribution in collaboration with Northeast Fisheries Science Center for the Northeast Regional Council.
- Played leading role in development of ASMFC Coastwide Ageing Manual
- Received over 650 visits to our online catch and diet databases since initialized in early 2012.
- Provided data in an effort to assist those attempting to quantify Essential Fish Habitat for spiny dogfish, bluefish, scup, summer flounder, and black sea bass.

A complete listing of the ways in which NEAMAP MA/SNE Trawl Survey data have been utilized is given at http://www.vims.edu/fisheries/neamapdatause/index, and this site is typically updated quarterly.

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Figure 1. NEAMAP sampling area including region boundaries and depth strata.

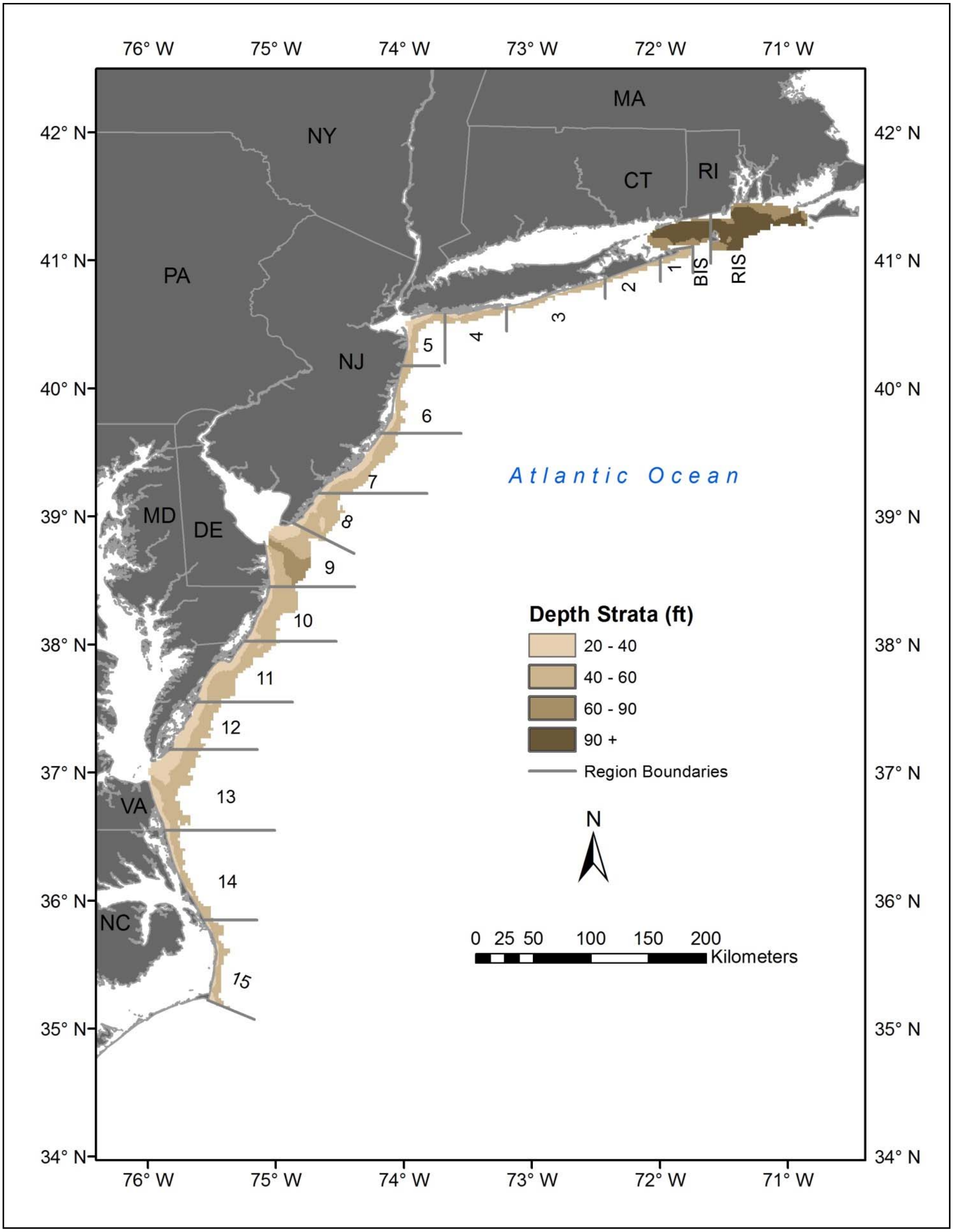
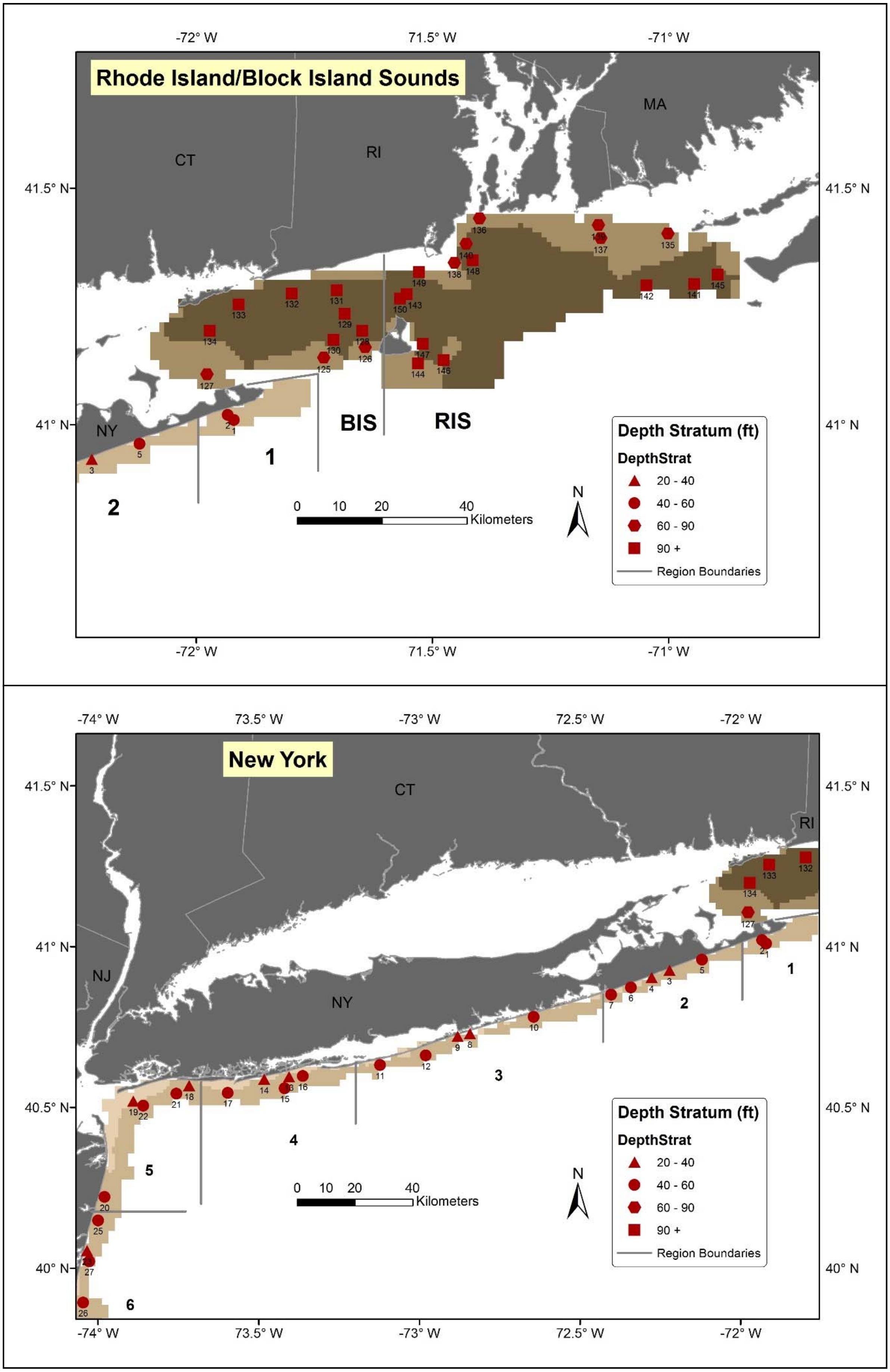


Figure 2A. NEAMAP sampling sites for the spring 2016 cruise. Regional strata are defined by gray lines, while the shapes of the station symbols indicate the depth strata occupied by each.



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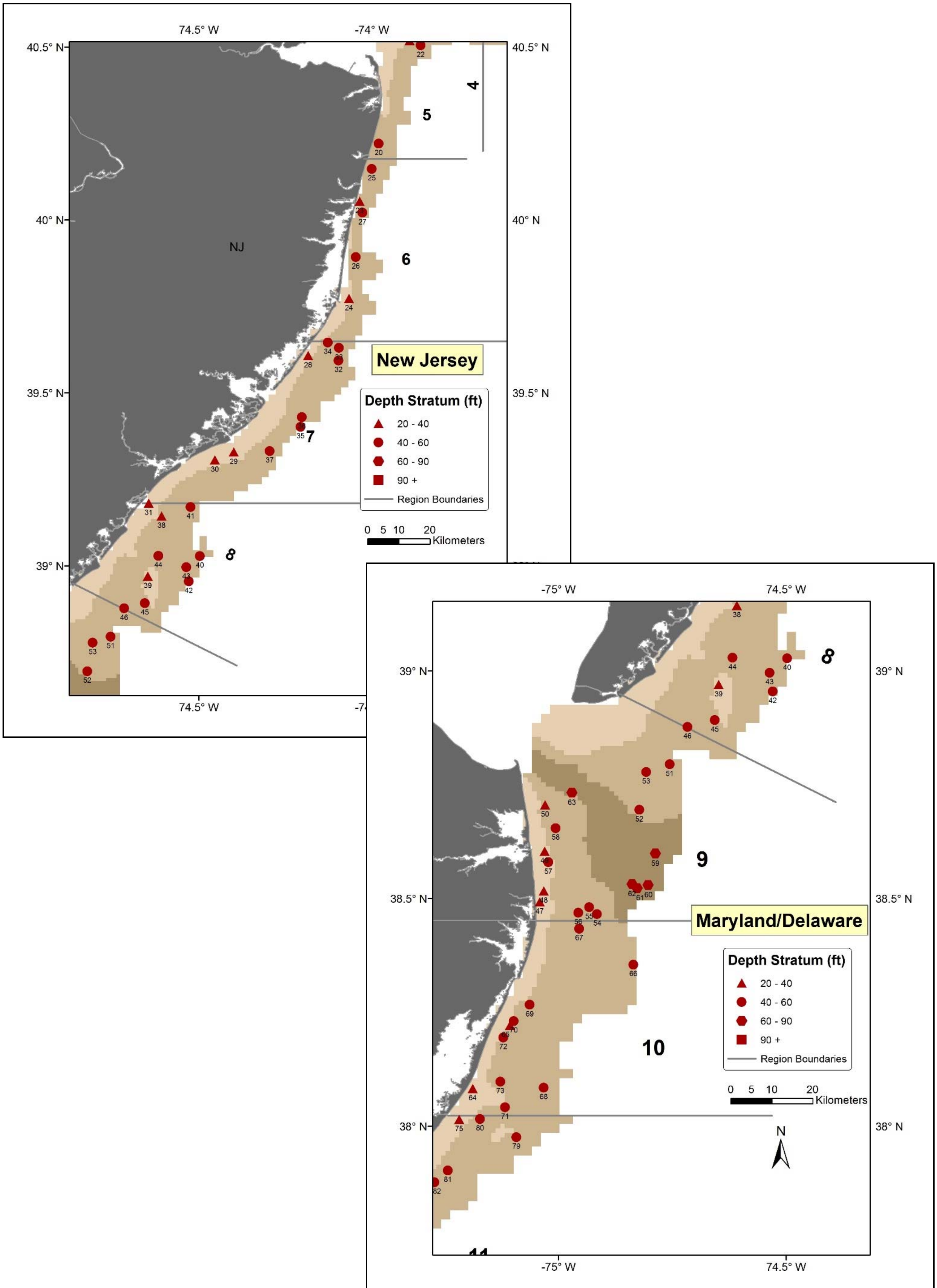

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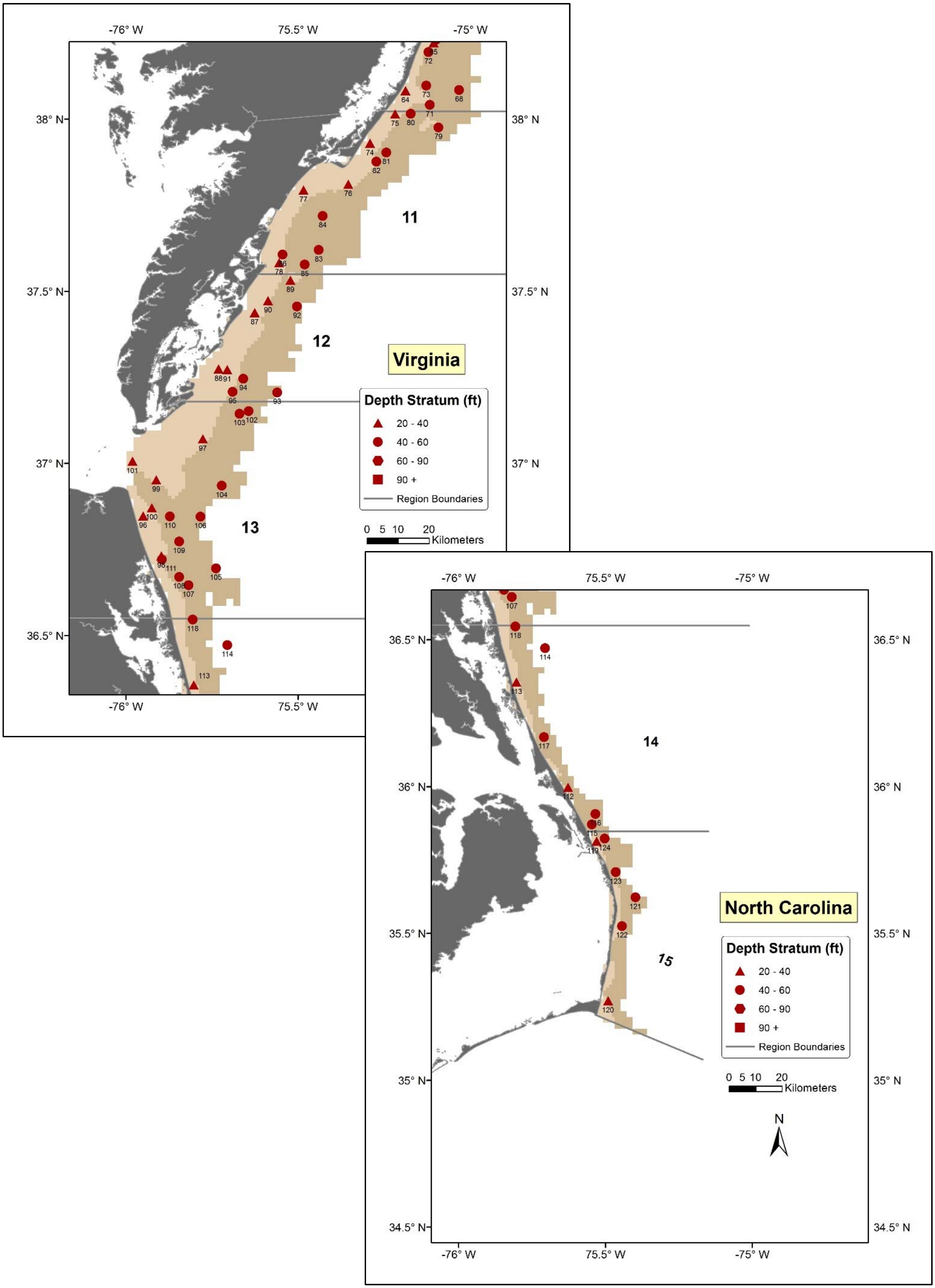
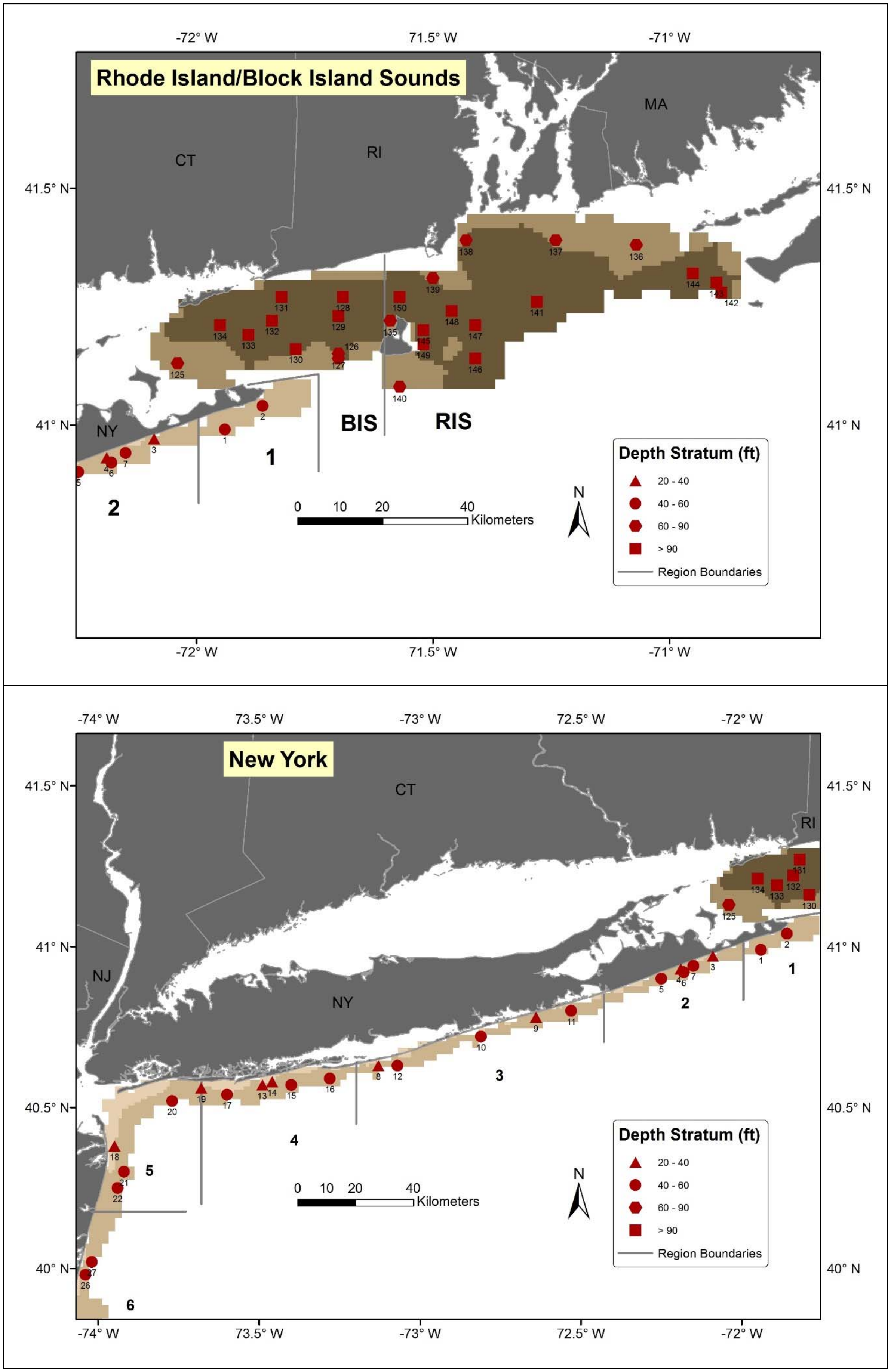


Figure 2B. NEAMAP sampling sites for the fall 2016 cruise. Regional strata are defined by gray lines, while the shapes of the station symbols indicate the depth strata occupied by each.



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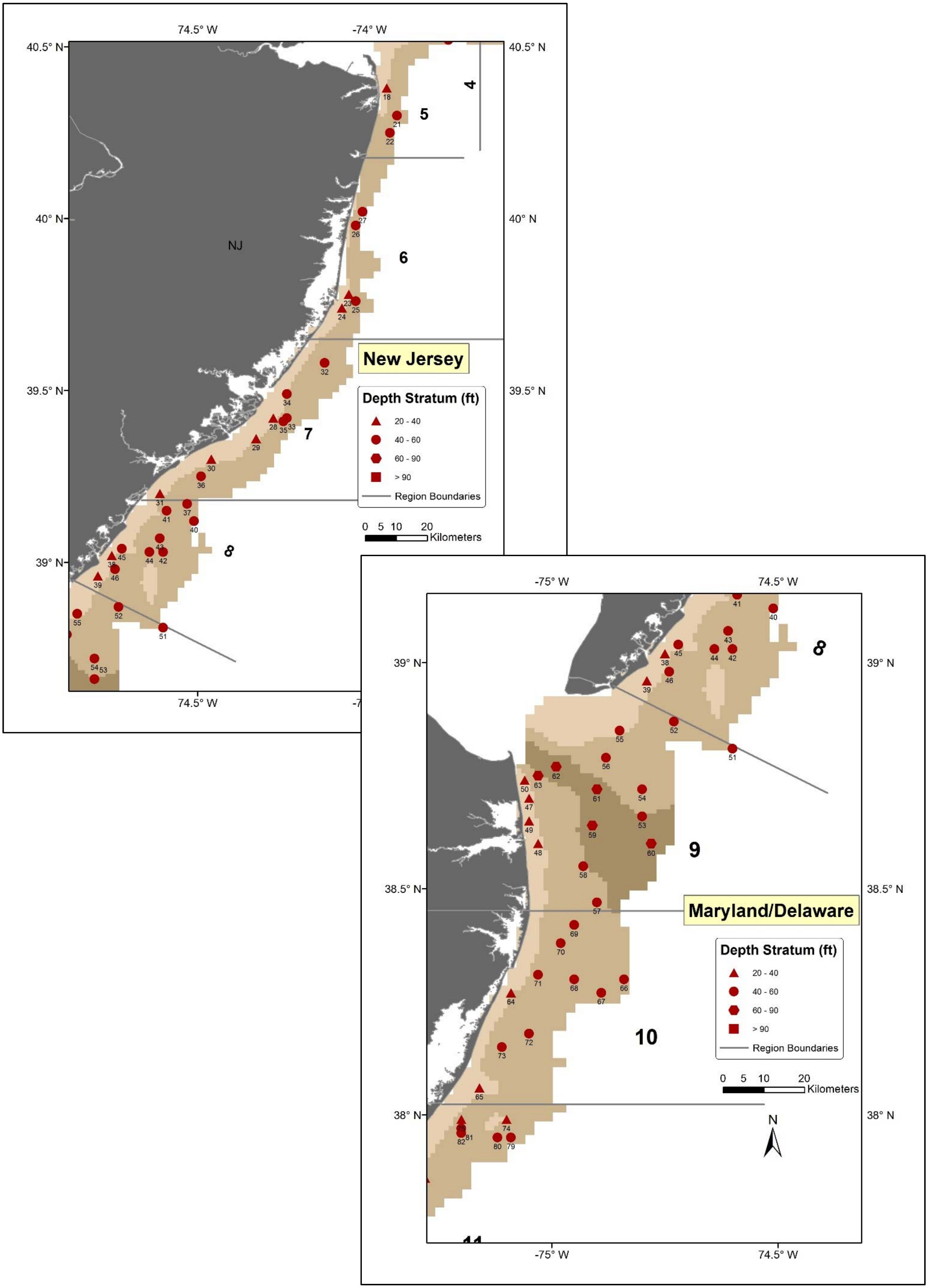

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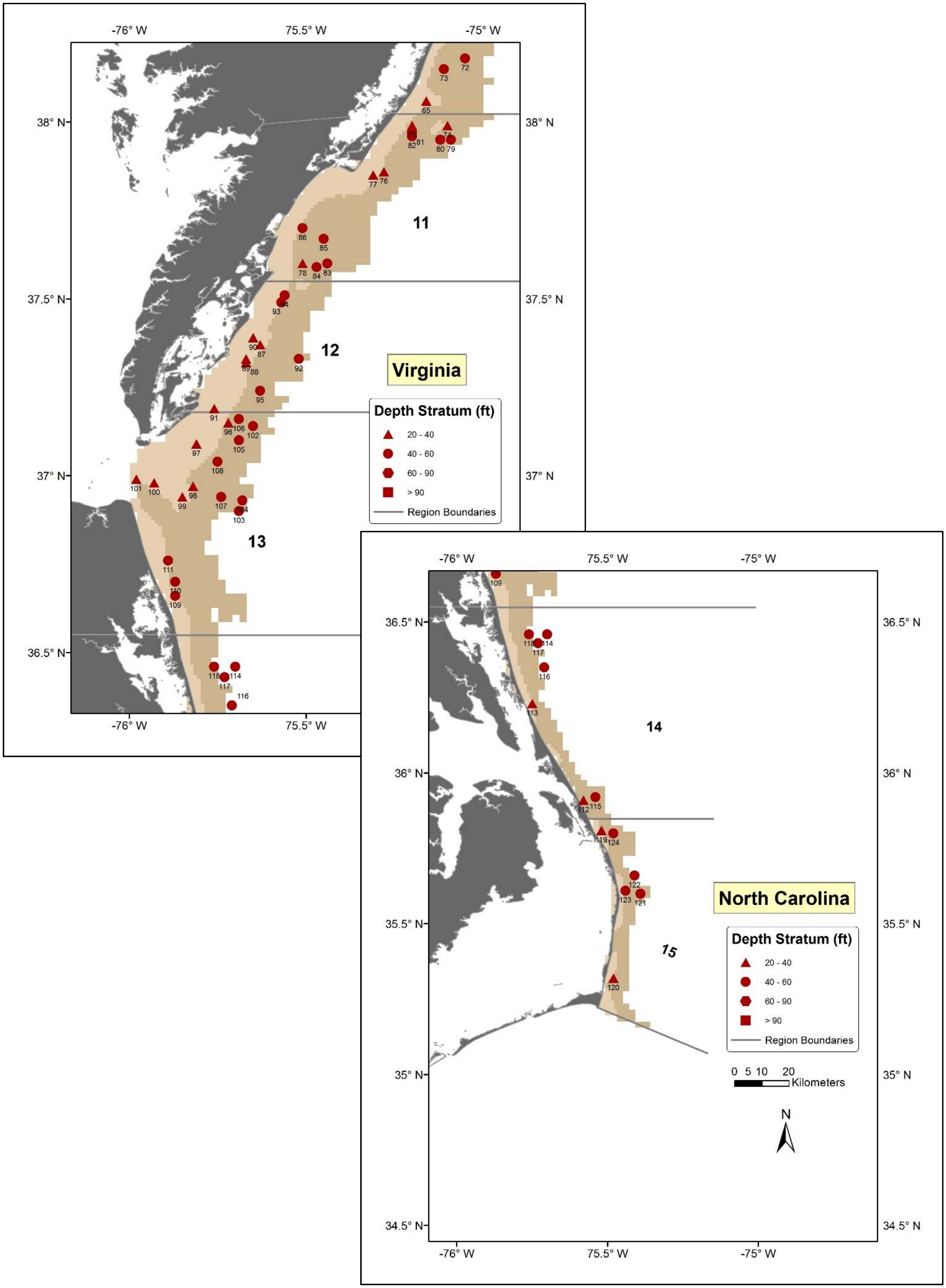


Figure 3A. Bottom temperatures as measured by NEAMAP for spring 2008. (Map ‘a’ represents measured values averaged over all spring cruises between 2008 and 2011 , ‘b’ gives actual values for spring 2008, and ‘c’ represents the difference.)

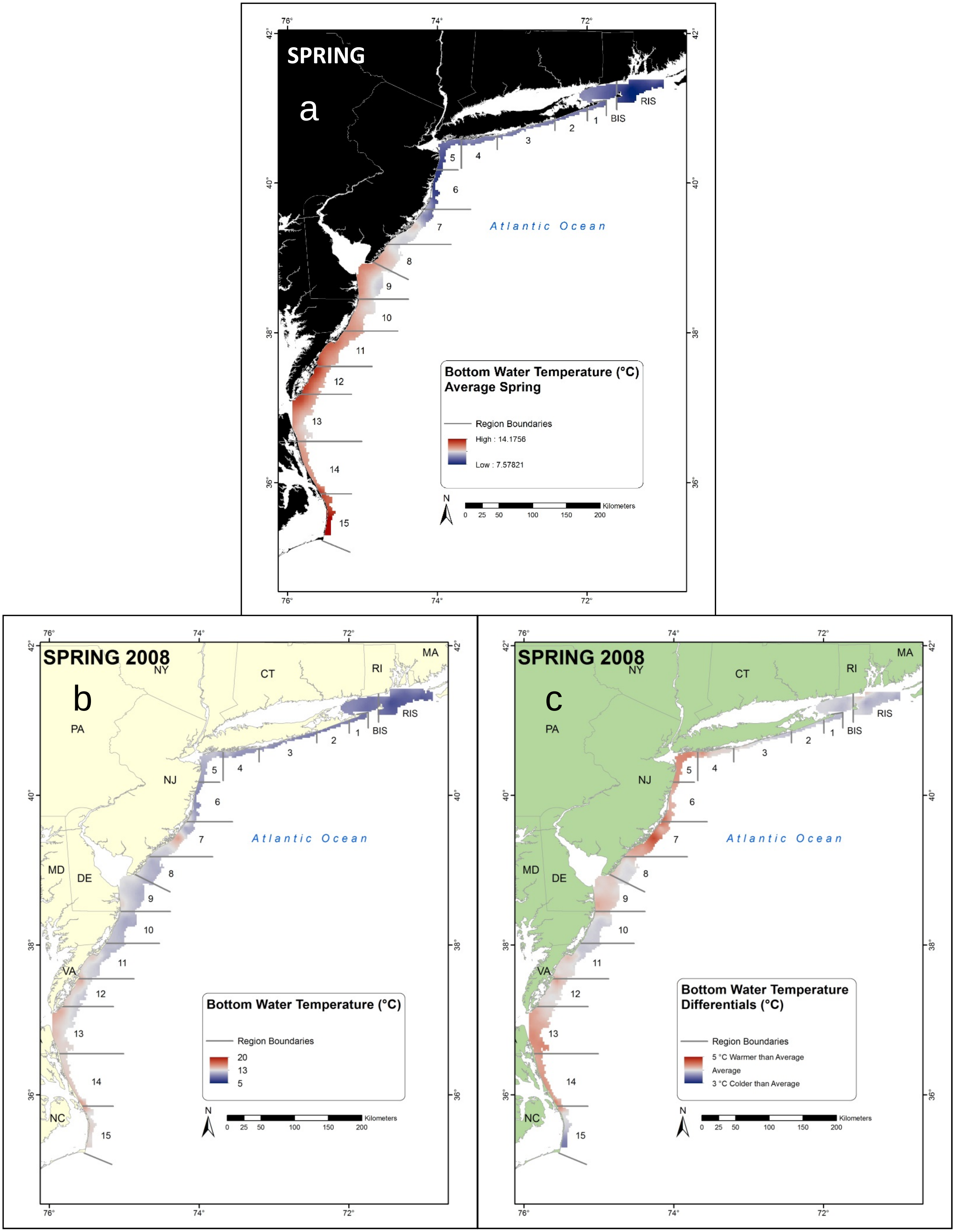


Figure 3B. Bottom temperatures as measured by NEAMAP for spring 2009. (Map 'a' represents measured values averaged over all spring cruises between 2008 and 2011, 'b' gives actual values for spring 2009, and 'c' represents the difference.)

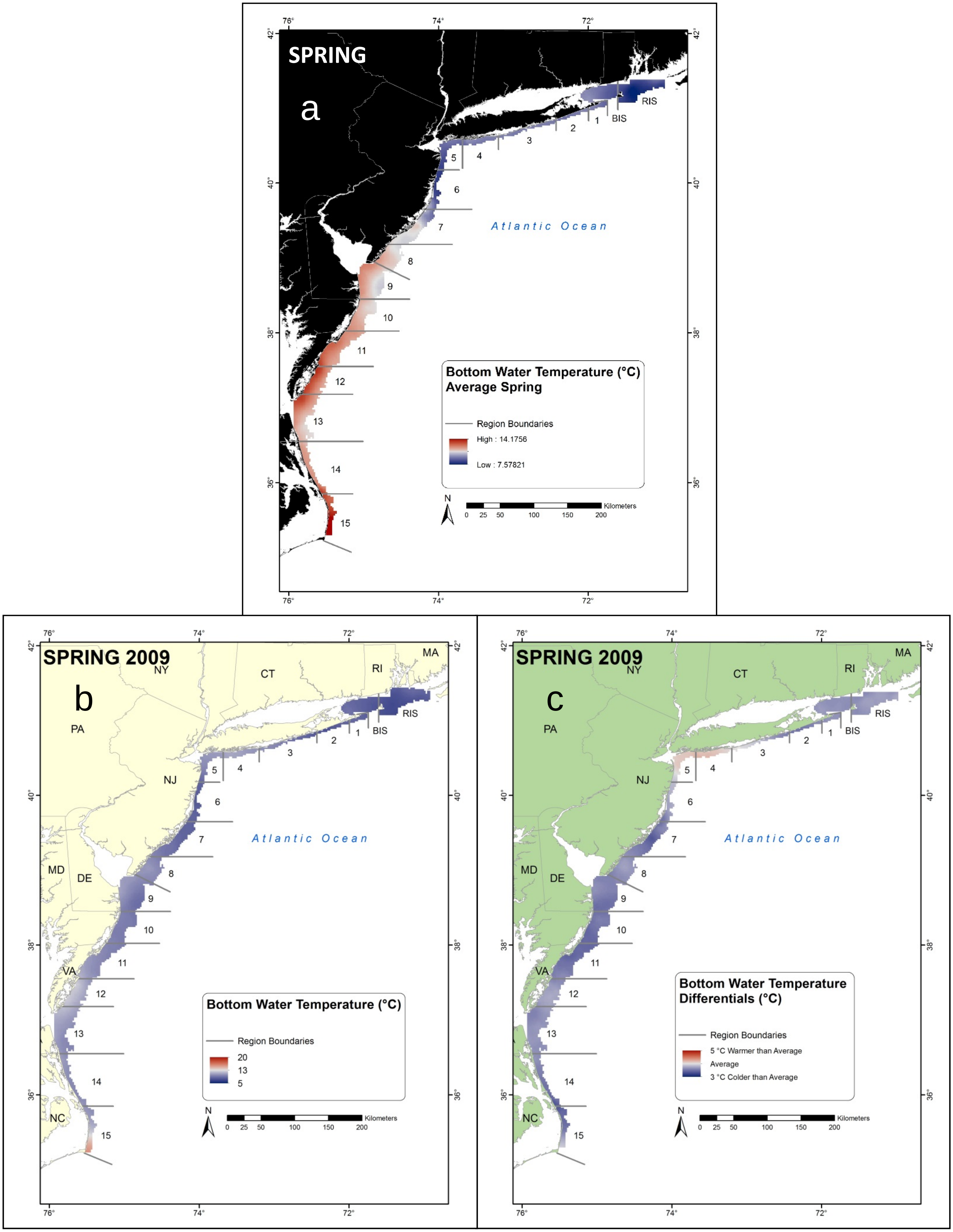


Figure 3C. Bottom temperatures as measured by NEAMAP for spring 2010. (Map 'a' represents measured values averaged over all spring cruises between 2008 and 2011, 'b' gives actual values for spring 2010, and 'c' represents the difference.)

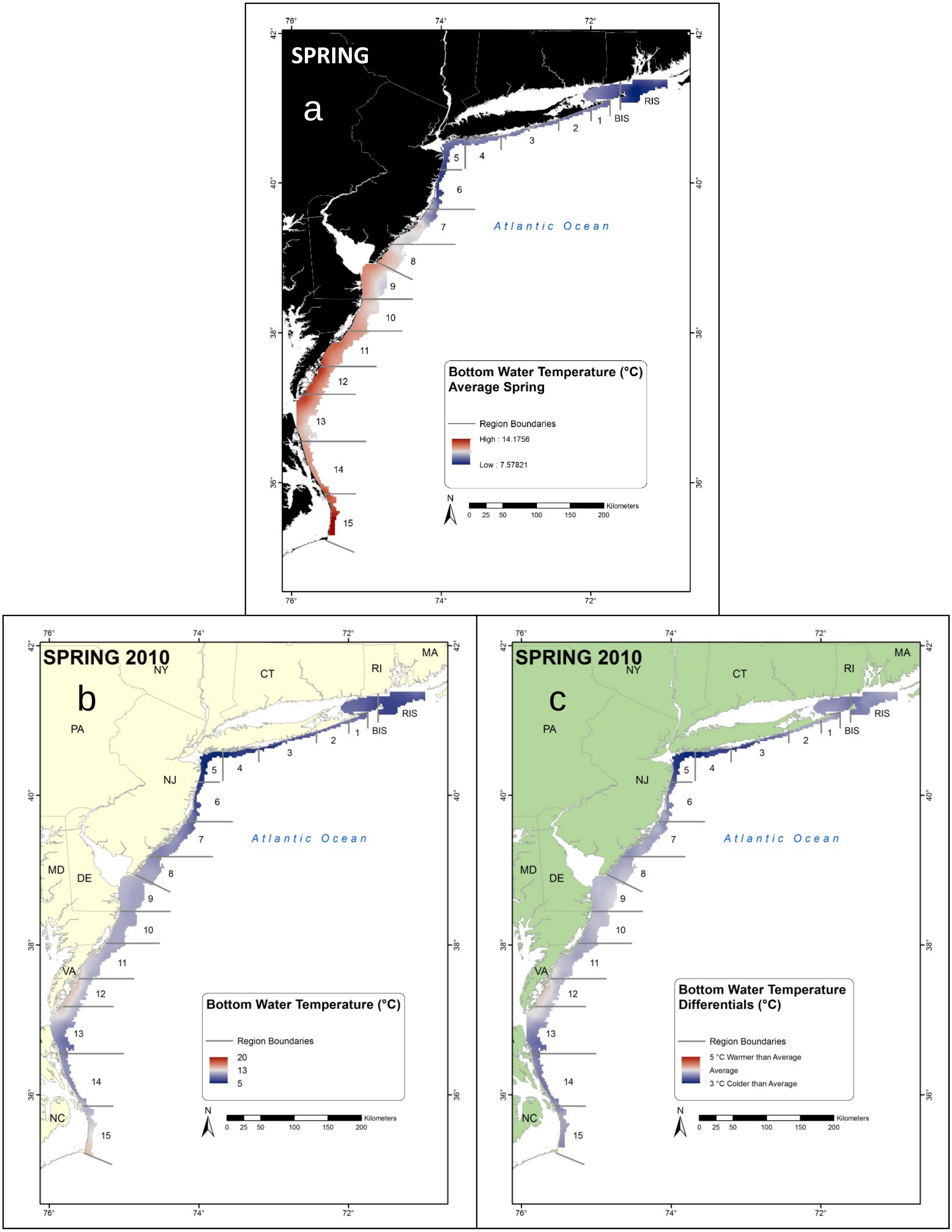


Figure 3D. Bottom temperatures as measured by NEAMAP for spring 2011. (Map 'a' represents measured values averaged over all spring cruises between 2008 and 2011, 'b' gives actual values for spring 2011, and 'c' represents the difference.)

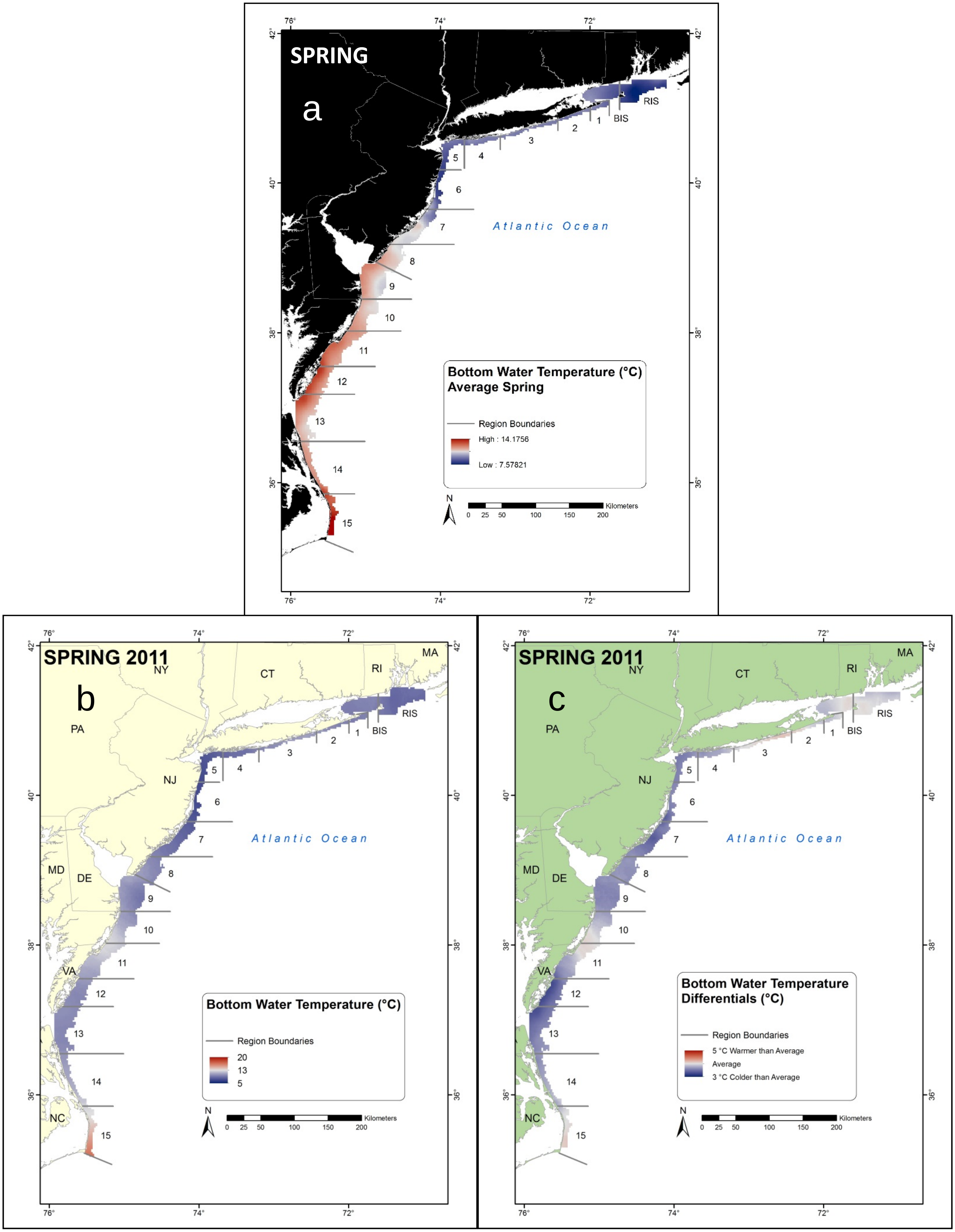


Figure 3E. Bottom temperatures as measured by NEAMAP for spring 2012. (Map 'a' represents measured values averaged over all spring cruises between 2008 and 2012, 'b' gives actual values for spring 2012, and 'c' represents the difference.)

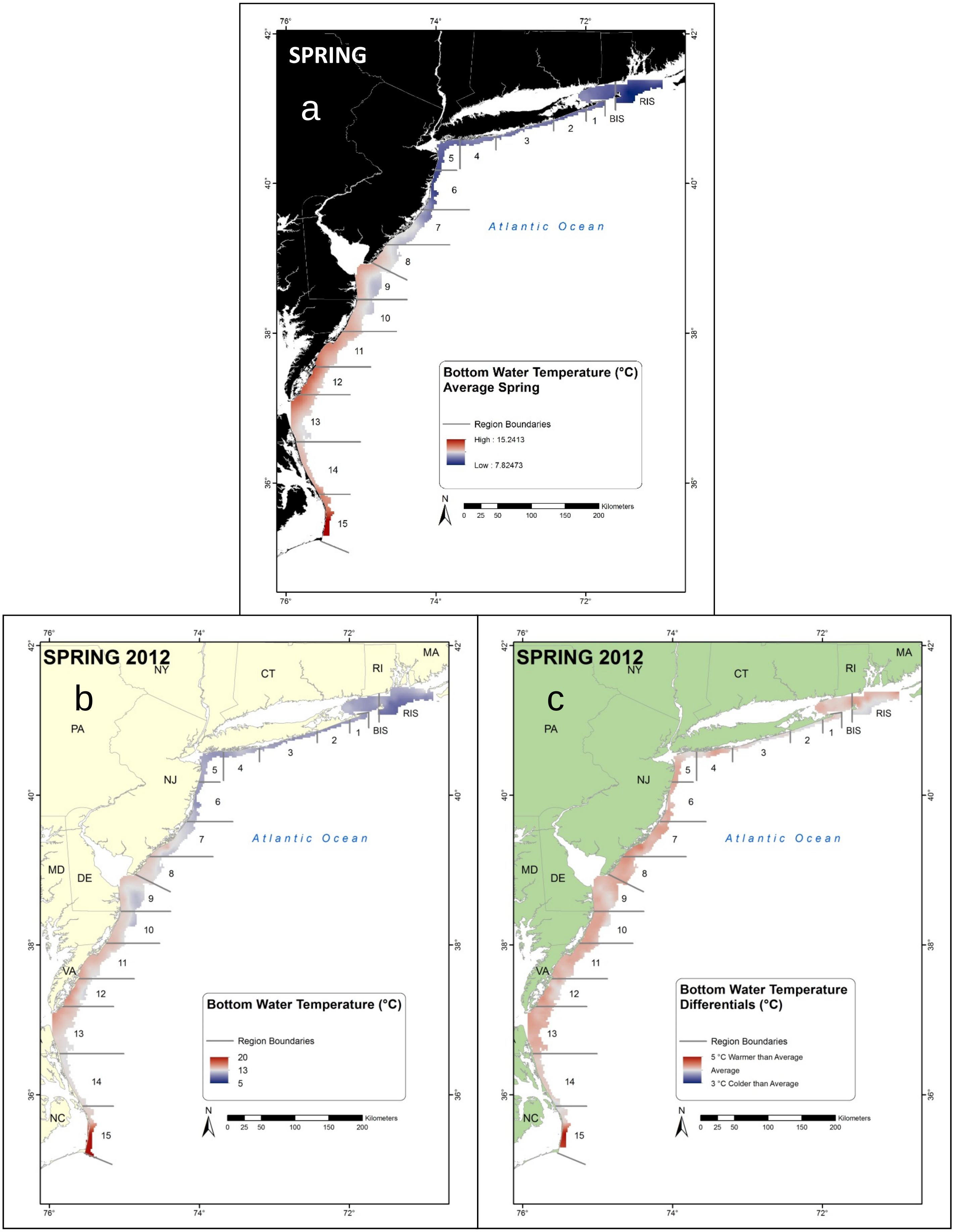


Figure 3F. Bottom temperatures as measured by NEAMAP for spring 2013. (Map 'a' represents measured values averaged over all spring cruises between 2008 and 2013, 'b' gives actual values for spring 2013, and 'c' represents the difference.)

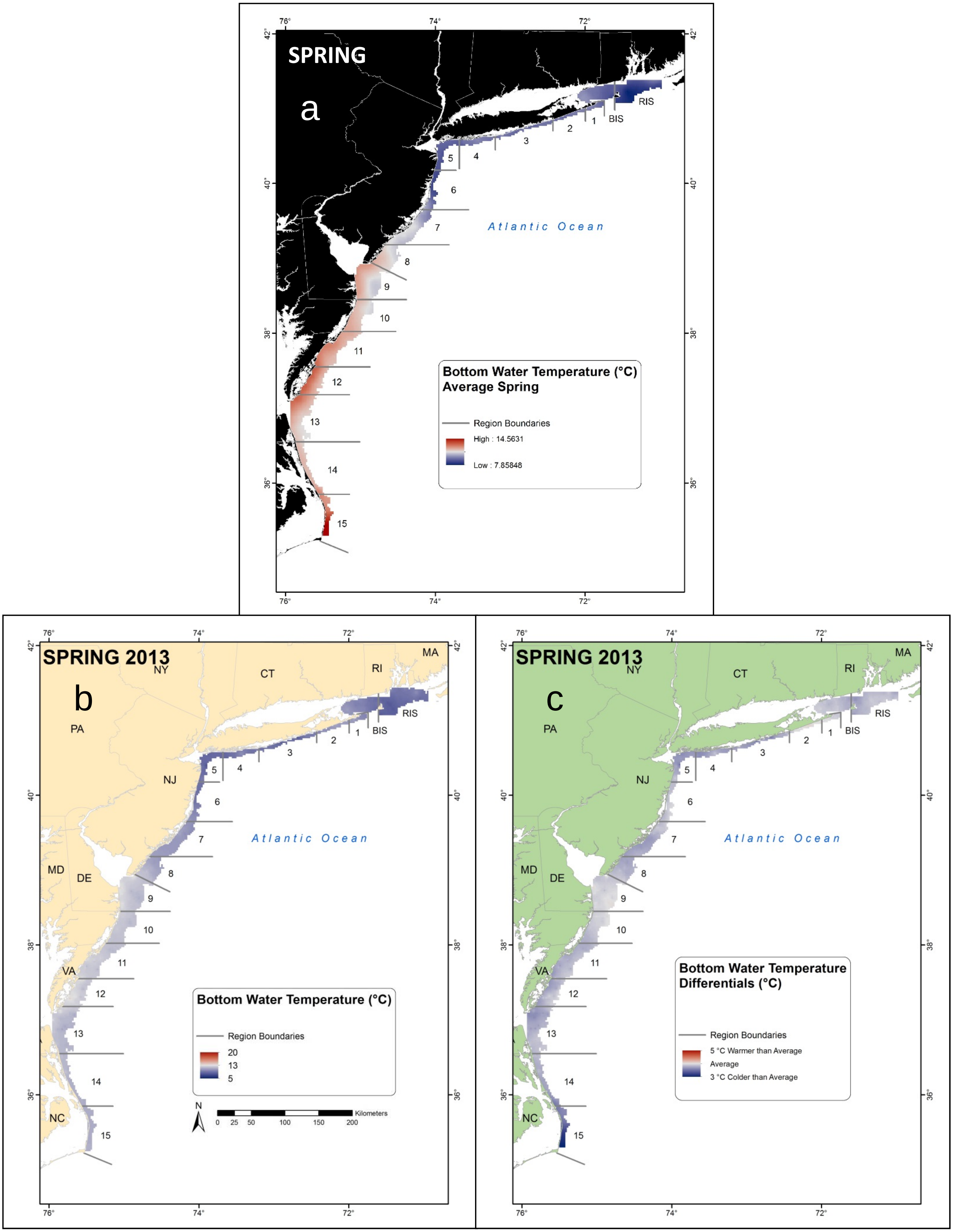


Figure 3G. Bottom temperatures as measured by NEAMAP for spring 2014. (Map 'a' represents measured values averaged over all spring cruises between 2008 and 2014, 'b' gives actual values for spring 2014, and 'c' represents the difference.)

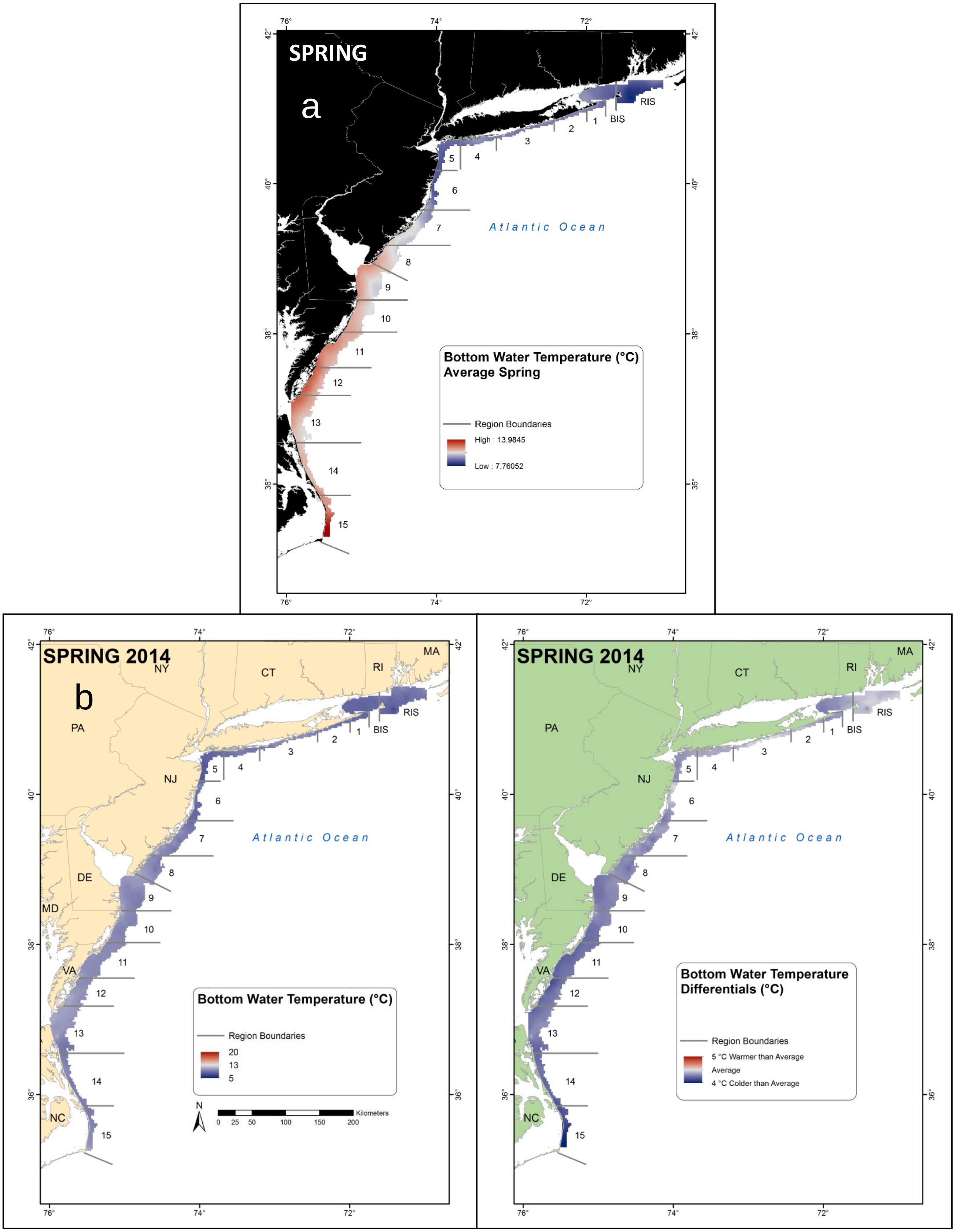


Figure 3H. Bottom temperatures as measured by NEAMAP for spring 2015. (Map 'a' represents measured values averaged over all spring cruises between 2008 and 2015, 'b' gives actual values for spring 2015, and 'c' represents the difference.)

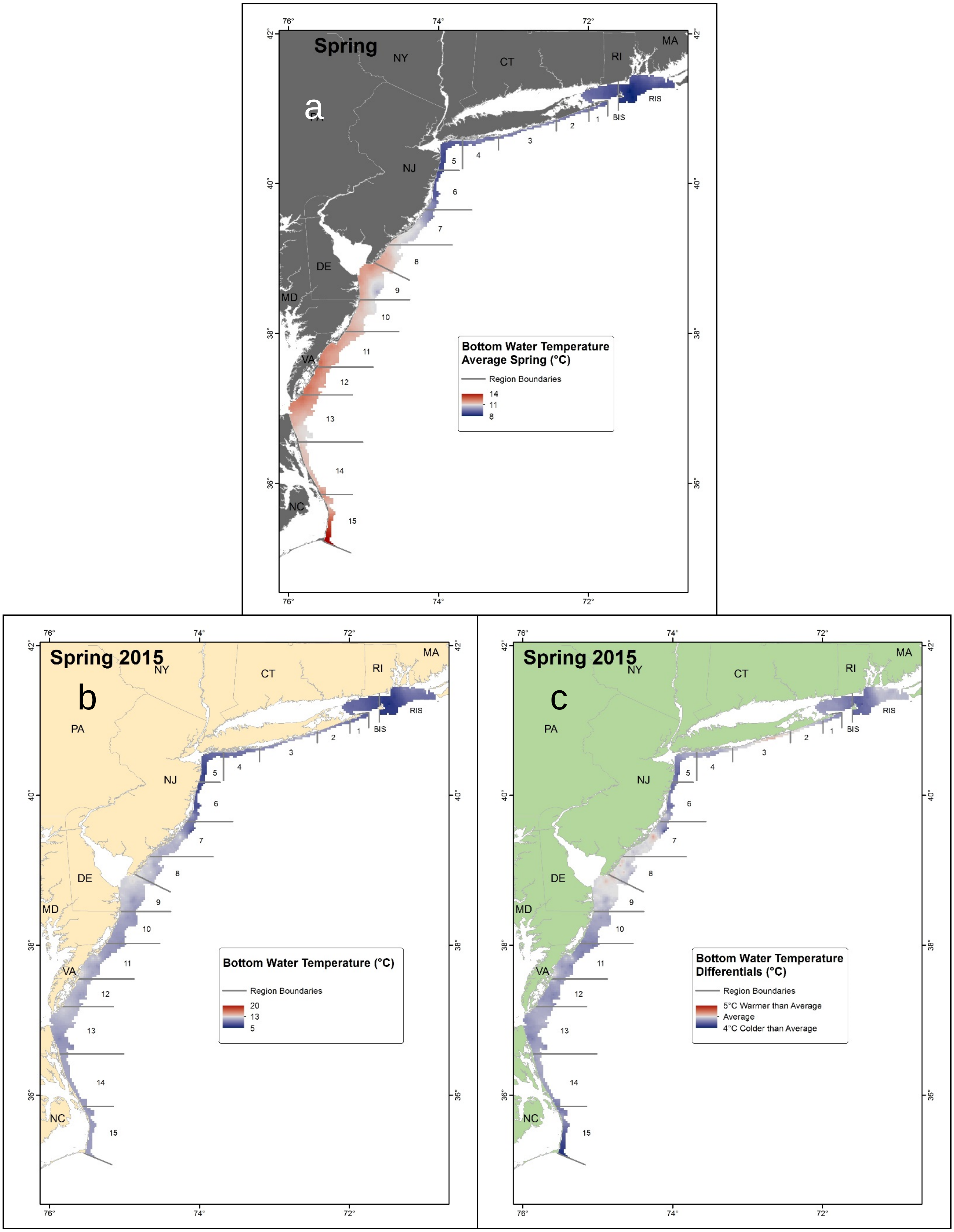


Figure 3I. Bottom temperatures as measured by NEAMAP for spring 2016. (Map ‘a’ represents measured values averaged over all spring cruises between 2008 and 2016, ‘b’ gives actual values for spring 2016, and ‘c’ represents the difference.)

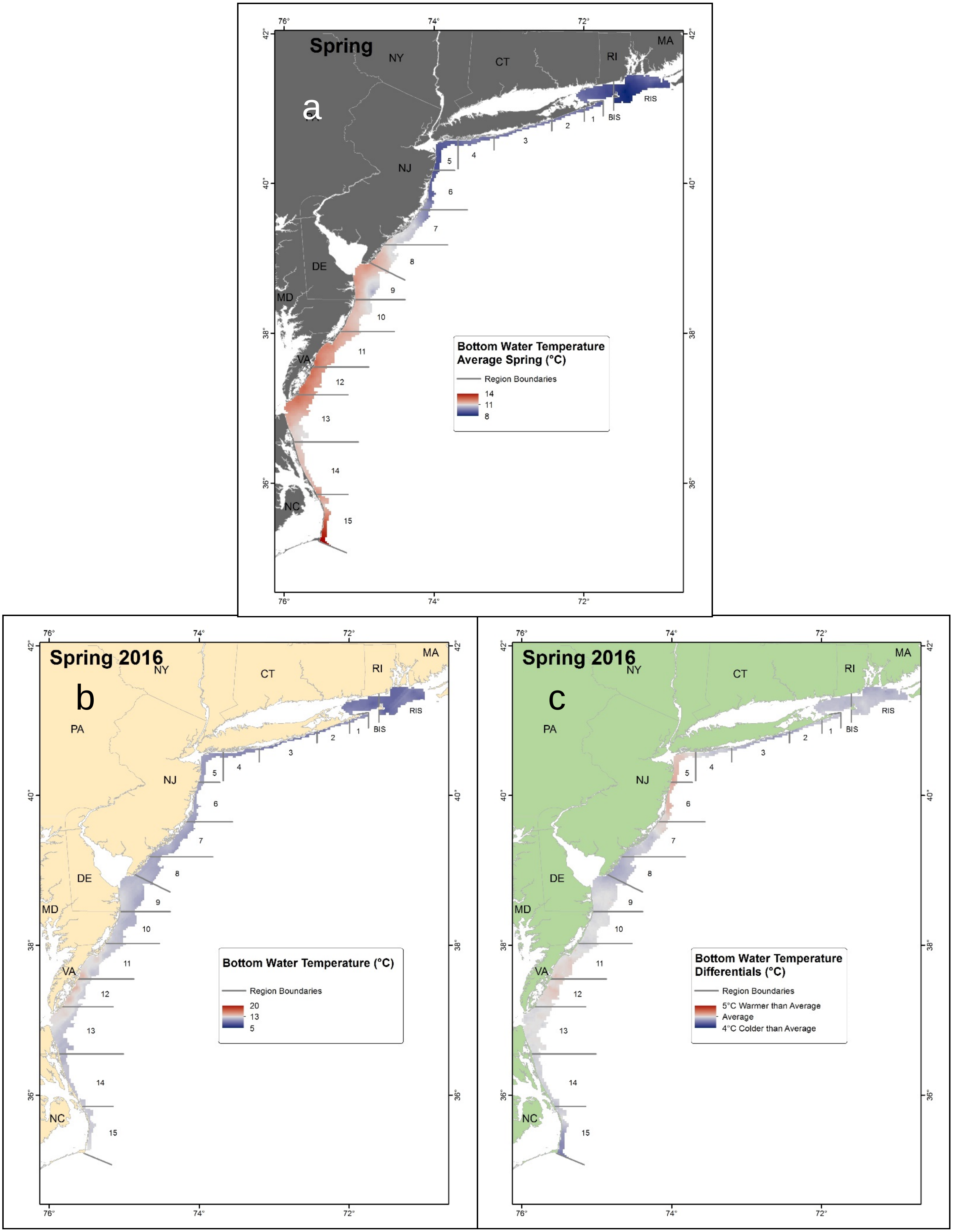


Figure 3J. Bottom temperatures as measured by NEAMAP for fall 2007. (Map 'a' represents measured values averaged over all fall cruises between 2007 and 2011, 'b' gives actual values for fall 2007, and 'c' represents the difference.)

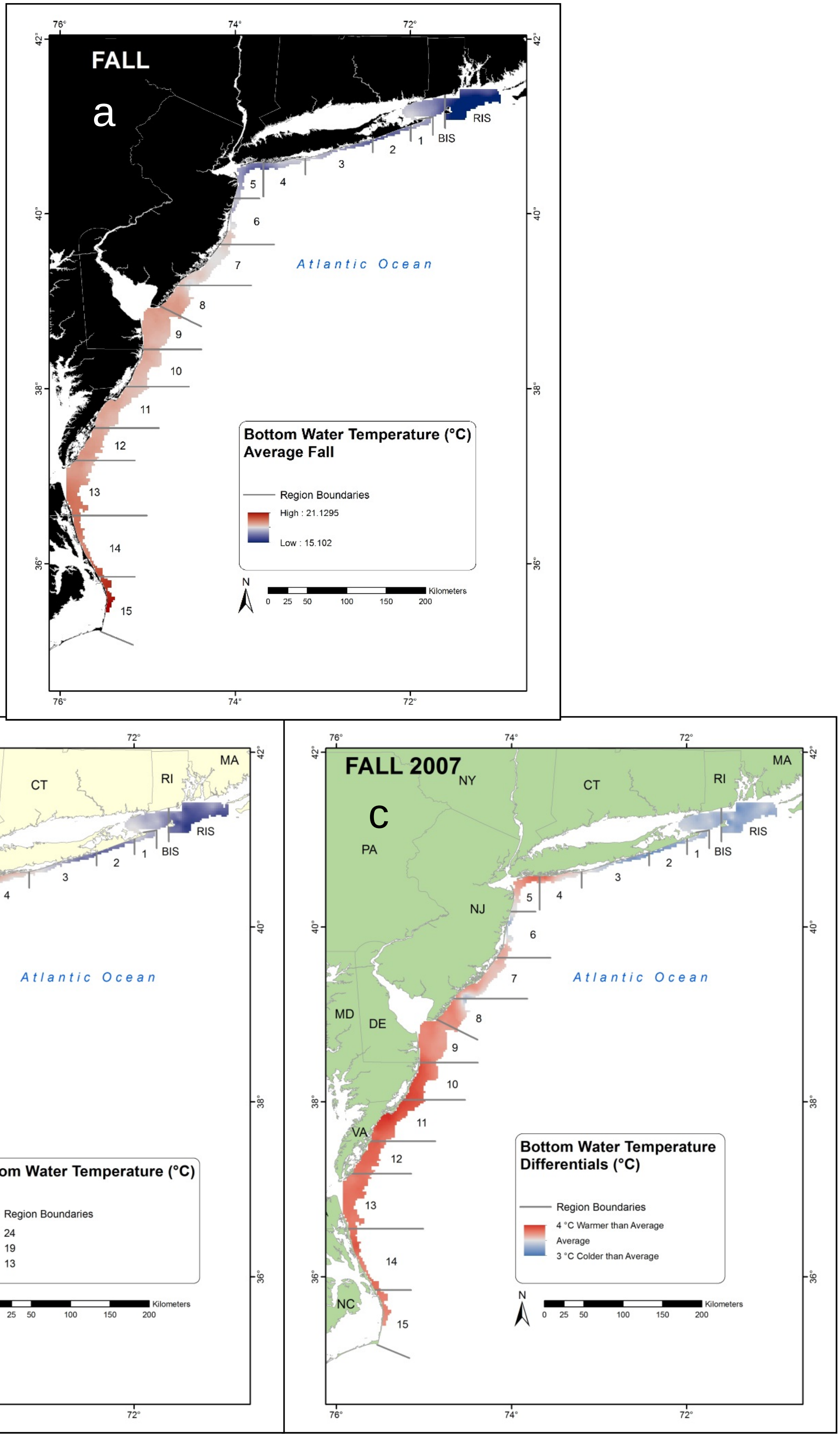


Figure 3K. Bottom temperatures as measured by NEAMAP for fall 2008. (Map 'a' represents measured values averaged over all fall cruises between 2007 and 2011, 'b' gives actual values for fall 2008, and 'c' represents the difference.)

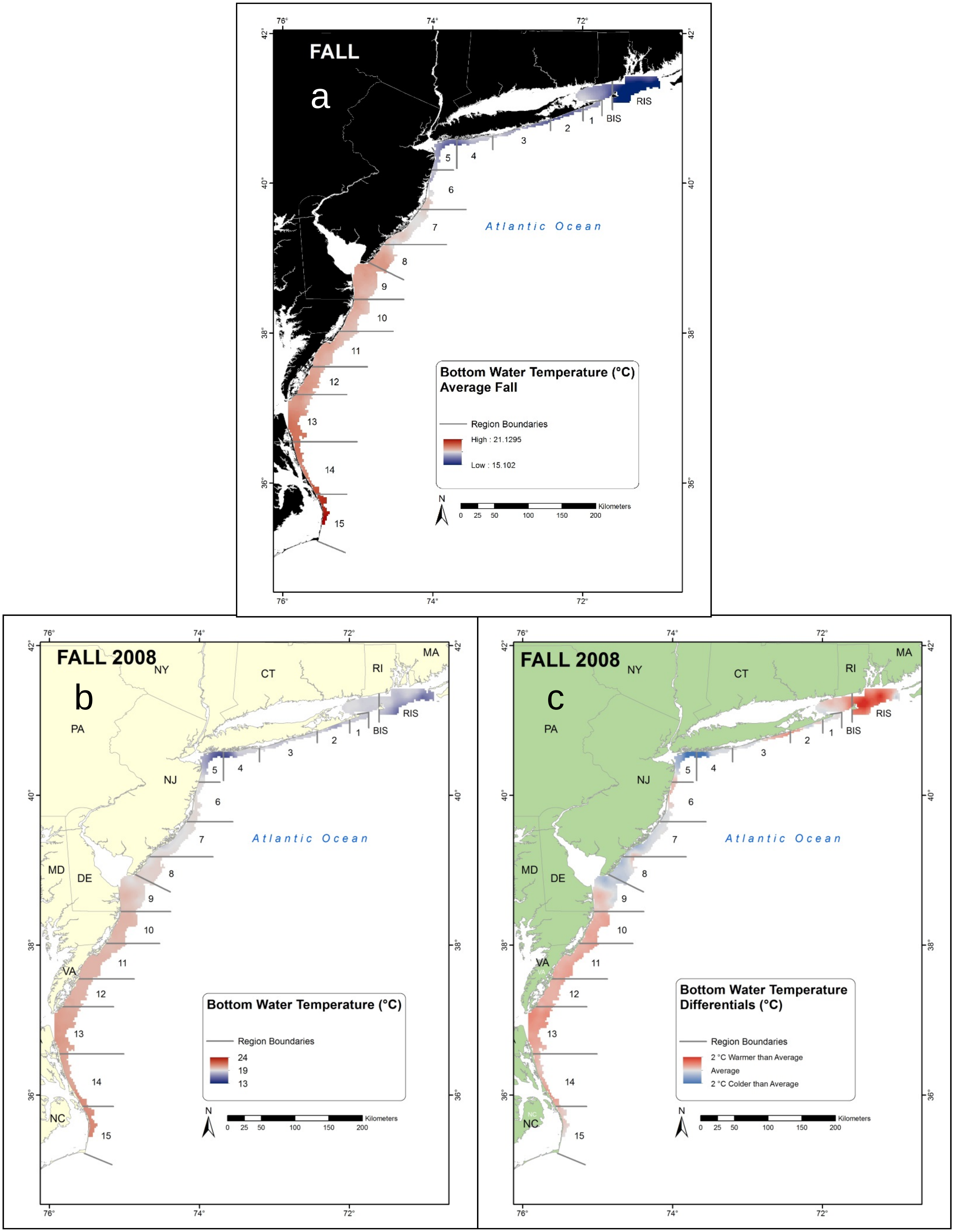


Figure 3L. Bottom temperatures as measured by NEAMAP for fall 2009. (Map 'a' represents measured values averaged over all fall cruises between 2007 and 2011, 'b' gives actual values for fall 2009, and 'c' represents the difference.)

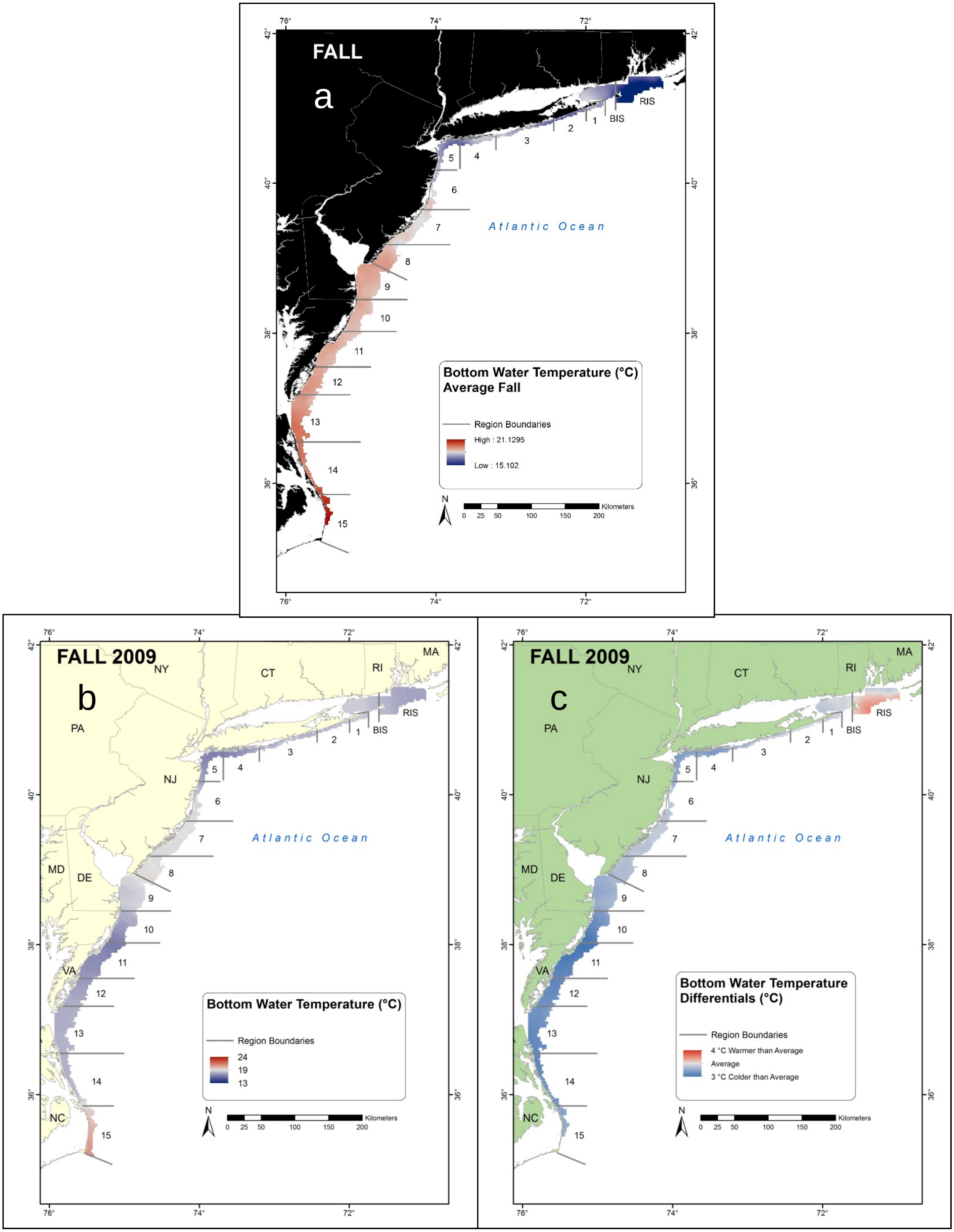


Figure 3M. Bottom temperatures as measured by NEAMAP for fall 2010. (Map 'a' represents measured values averaged over all fall cruises between 2007 and 2011, 'b' gives actual values for fall 2010, and 'c' represents the difference.)

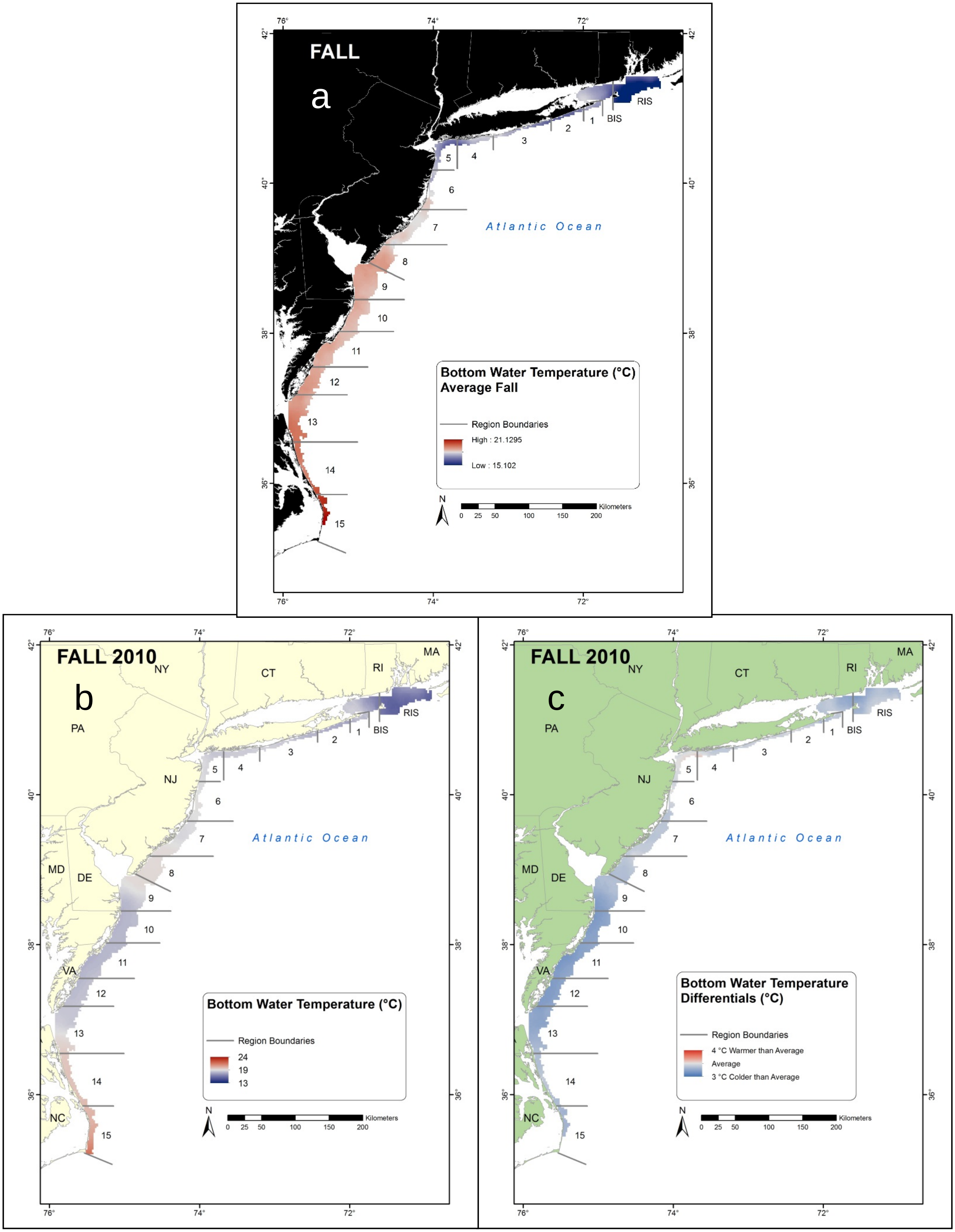


Figure 3N. Bottom temperatures as measured by NEAMAP for fall 2011. (Map 'a' represents measured values averaged over all fall cruises between 2007 and 2011, 'b' gives actual values for fall 2011, and 'c' represents the difference.)

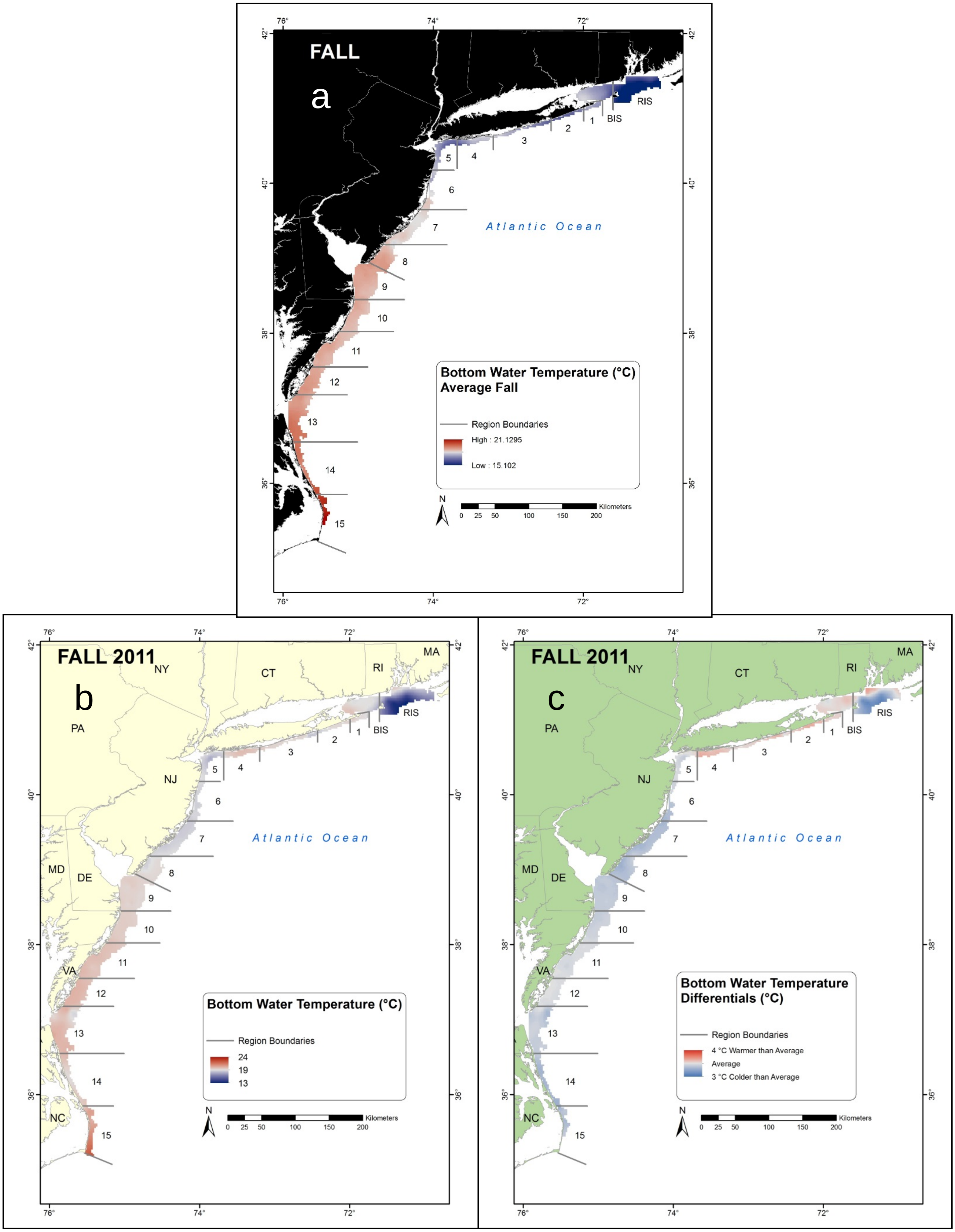


Figure 3O. Bottom temperatures as measured by NEAMAP for fall 2012. (Map ‘a’ represents measured values averaged over all fall cruises between 2007 and 2012, ‘b’ gives actual values for fall 2012, and ‘c’ represents the difference).

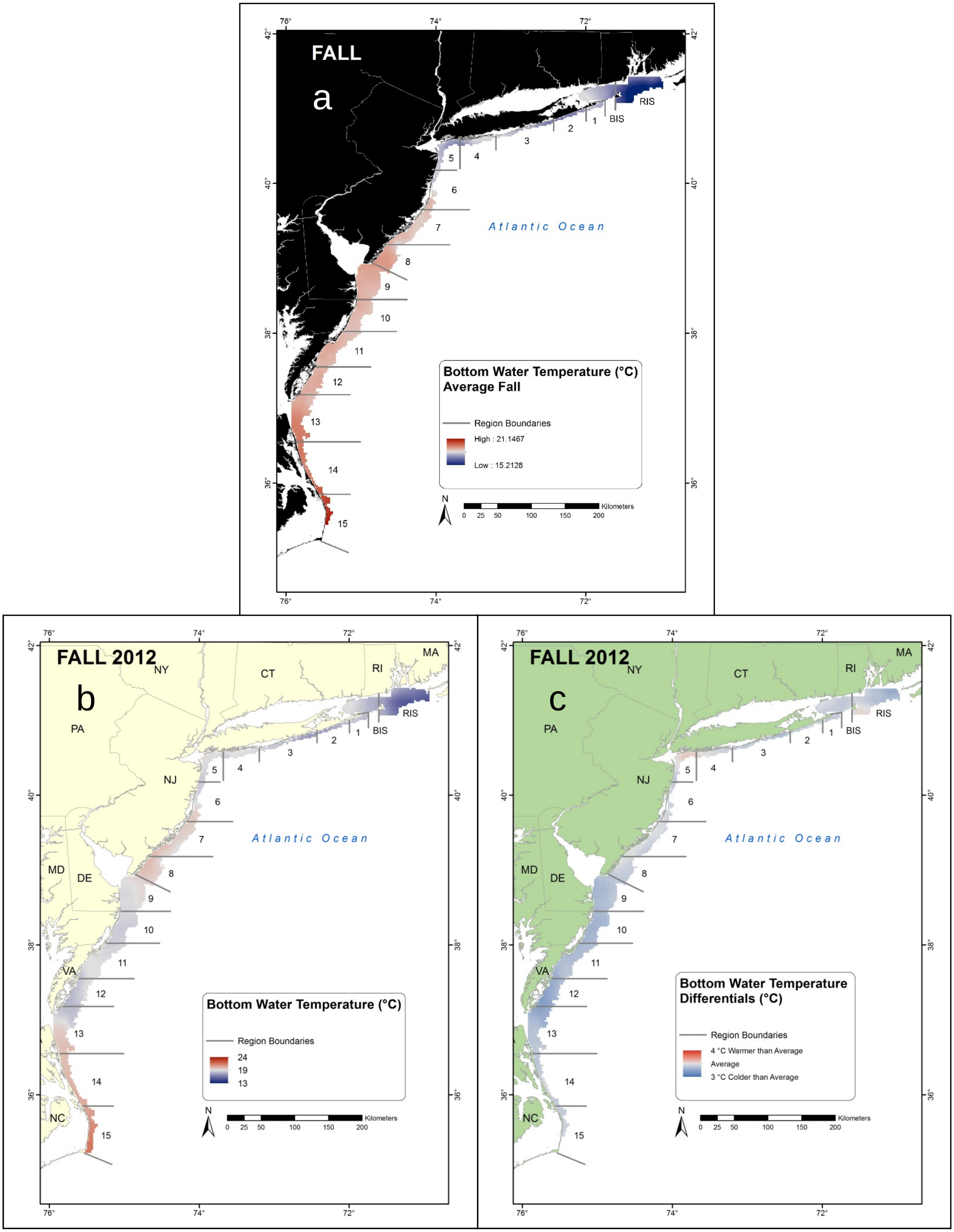


Figure 3P. Bottom temperatures as measured by NEAMAP for fall 2013. (Map 'a' represents measured values averaged over all fall cruises between 2007 and 2013, 'b' gives actual values for fall 2013, and 'c' represents the difference.)

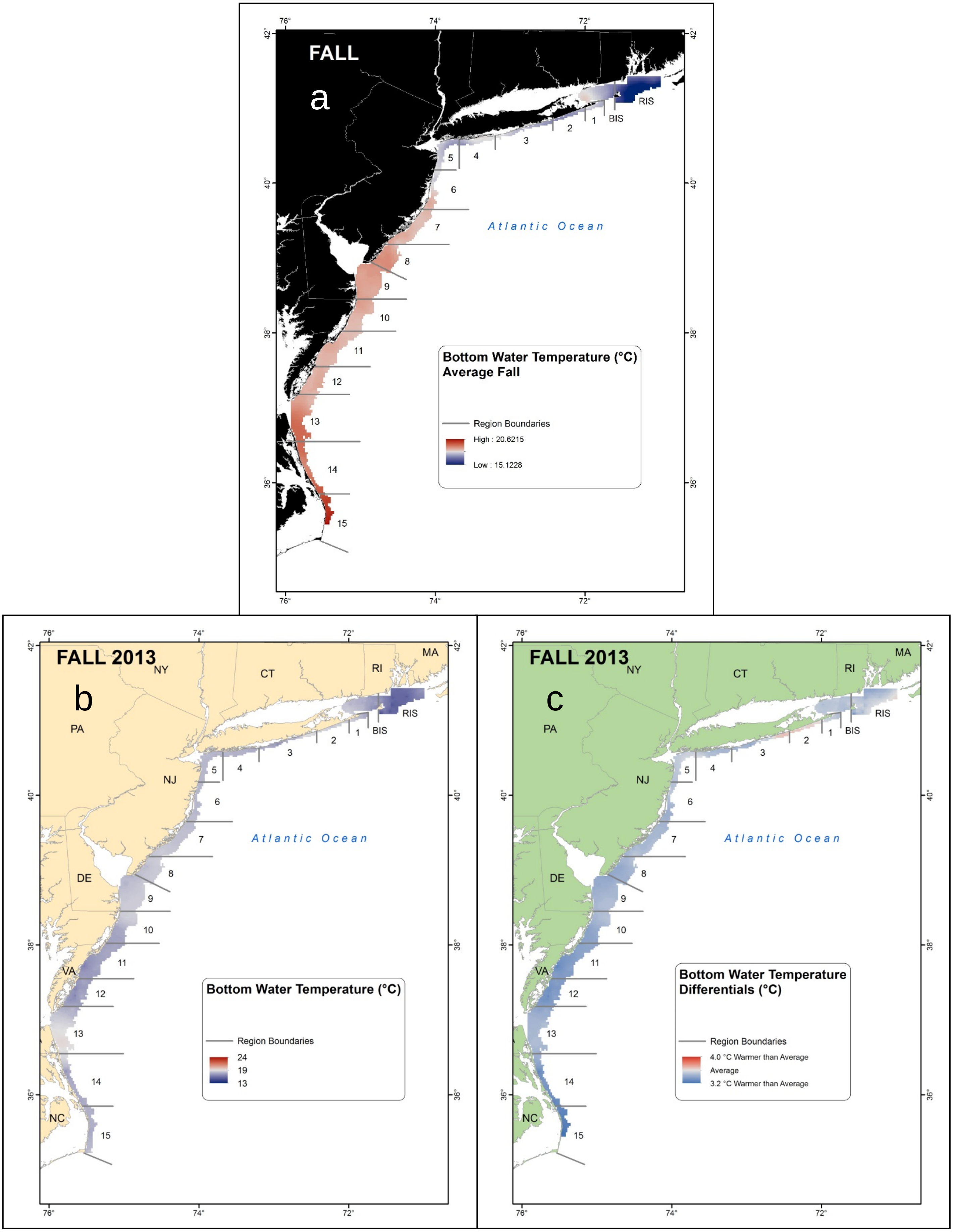


Figure 3Q. Bottom temperatures as measured by NEAMAP for fall 2014. (Map 'a' represents measured values averaged over all fall cruises between 2007 and 2014, 'b' gives actual values for fall 2014, and 'c' represents the difference.)

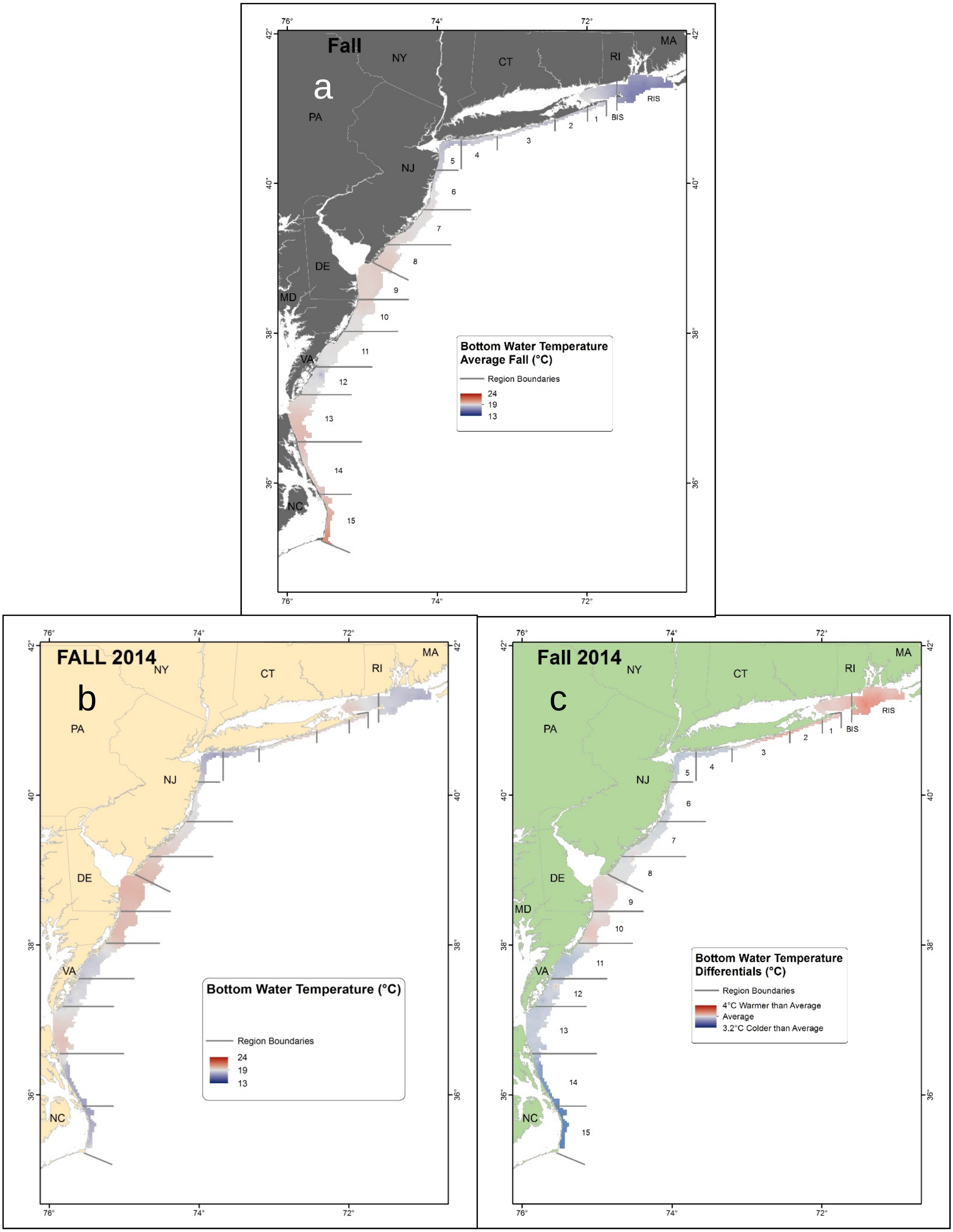


Figure 3R. Bottom temperatures as measured by NEAMAP for fall 2015. (Map ‘a’ represents measured values averaged over all fall cruises between 2007 and 2015, ‘b’ gives actual values for fall 2015, and ‘c’ represents the difference.)

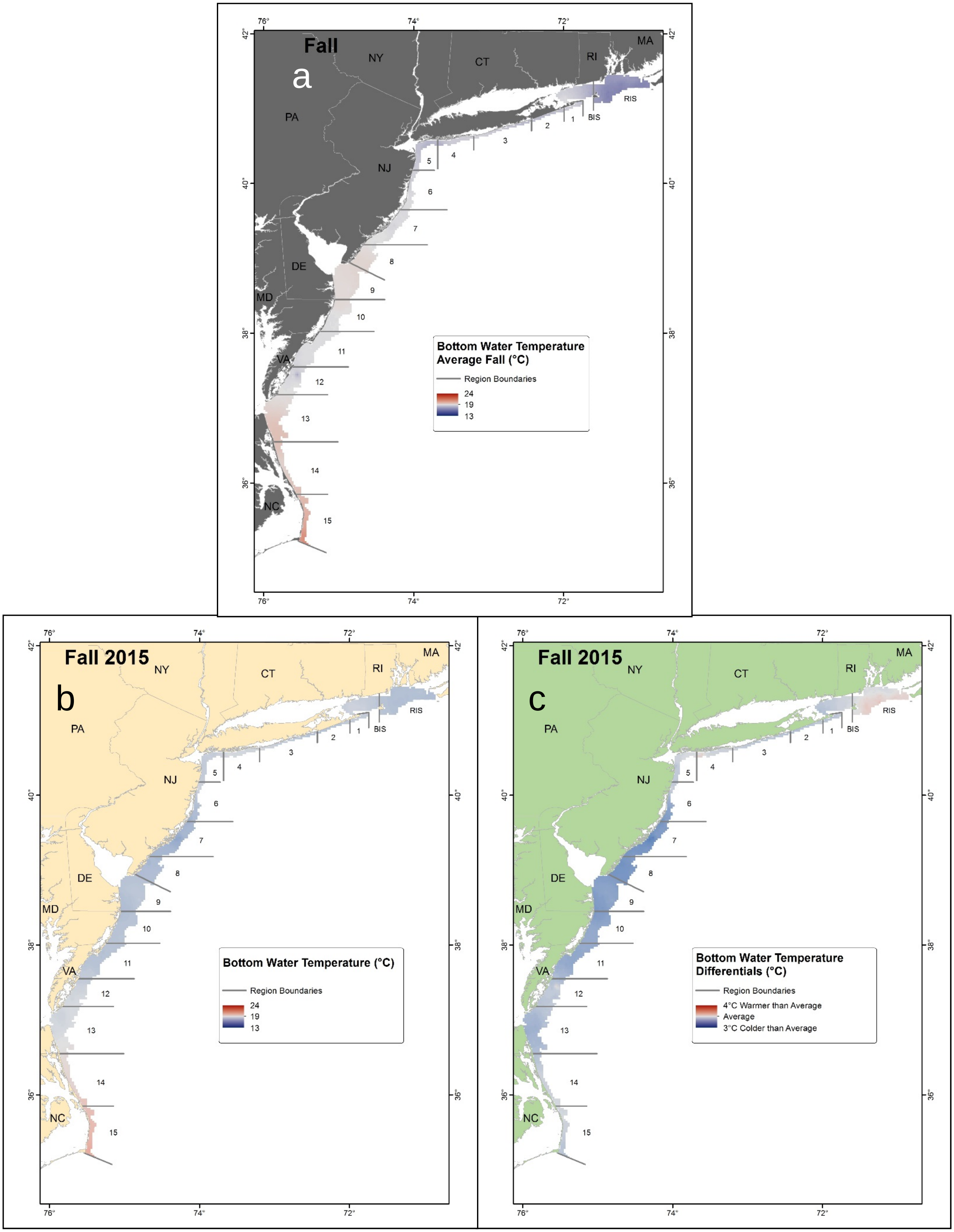


Figure 3S. Bottom temperatures as measured by NEAMAP for fall 2016. (Map ‘a’ represents measured values averaged over all fall cruises between 2007 and 2015, ‘b’ gives actual values for fall 2016, and ‘c’ represents the difference.)

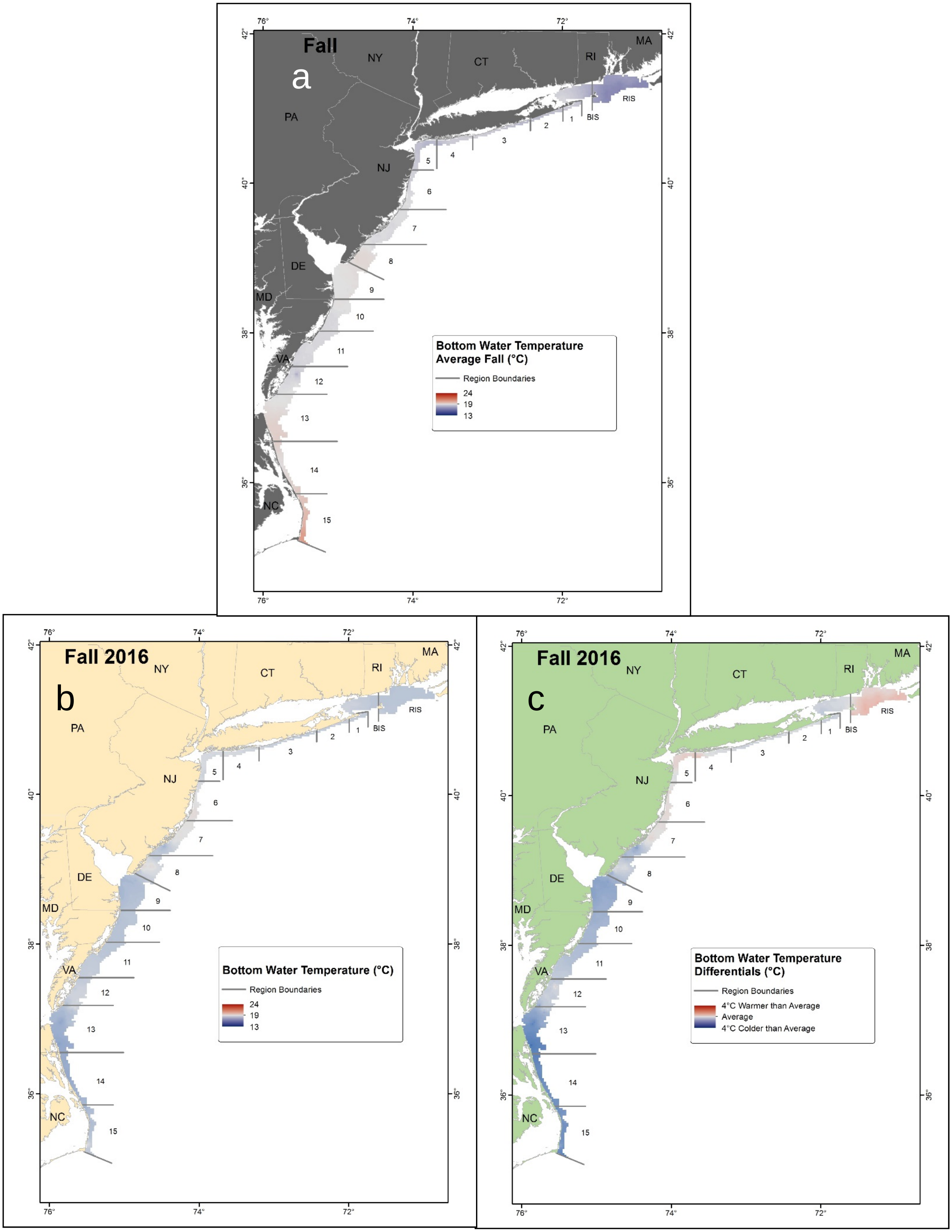


Figure 4A. Water column temperature profiles integrated within defined 'section' boundaries for spring (A) and fall (B) 2013.

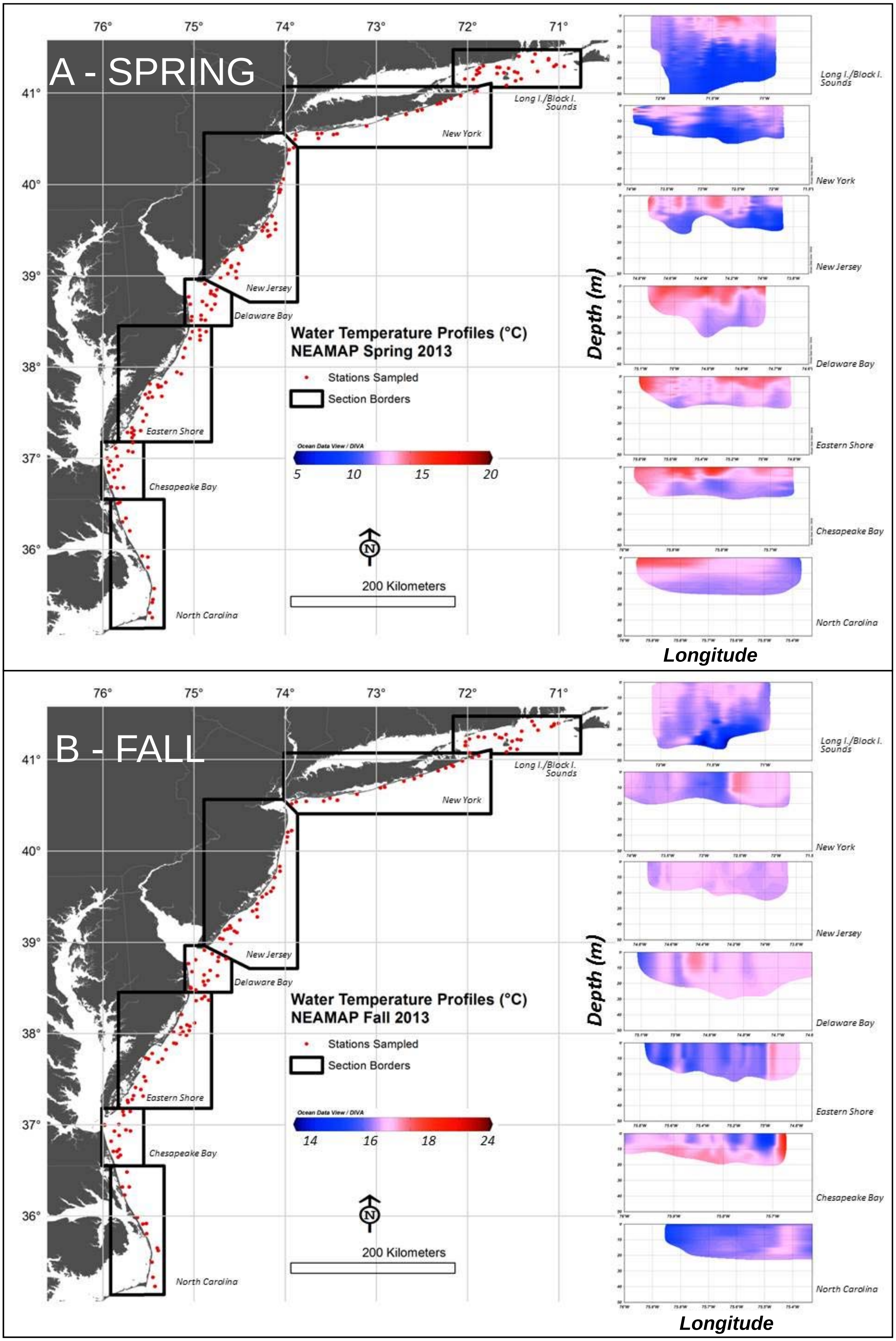


Figure 4B. Water column temperature profiles integrated within defined 'section' boundaries for spring (A) and fall (B) 2014.

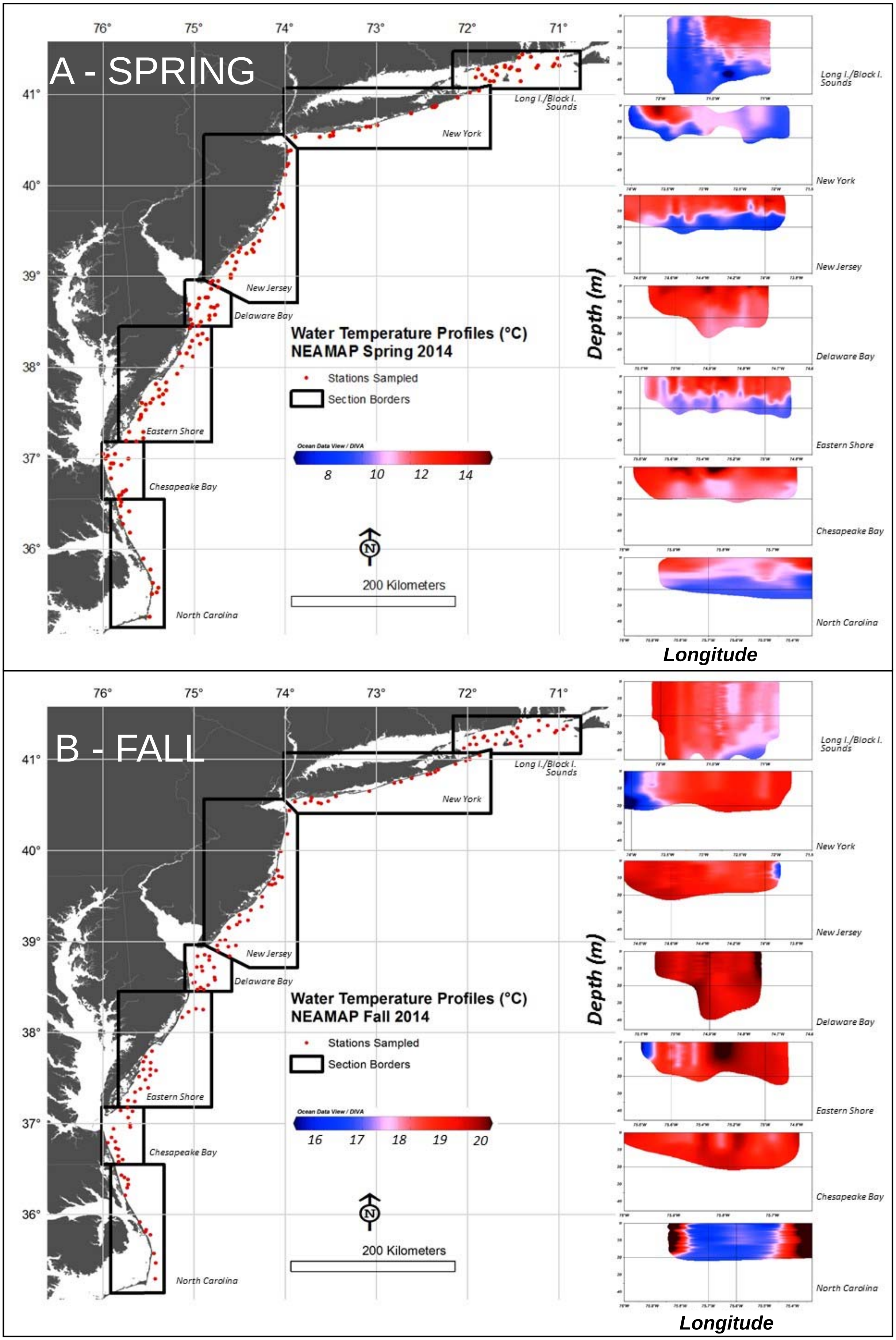


Figure 4C. Water column temperature profiles integrated within defined 'section' boundaries for spring (A) and fall (B) 2015.

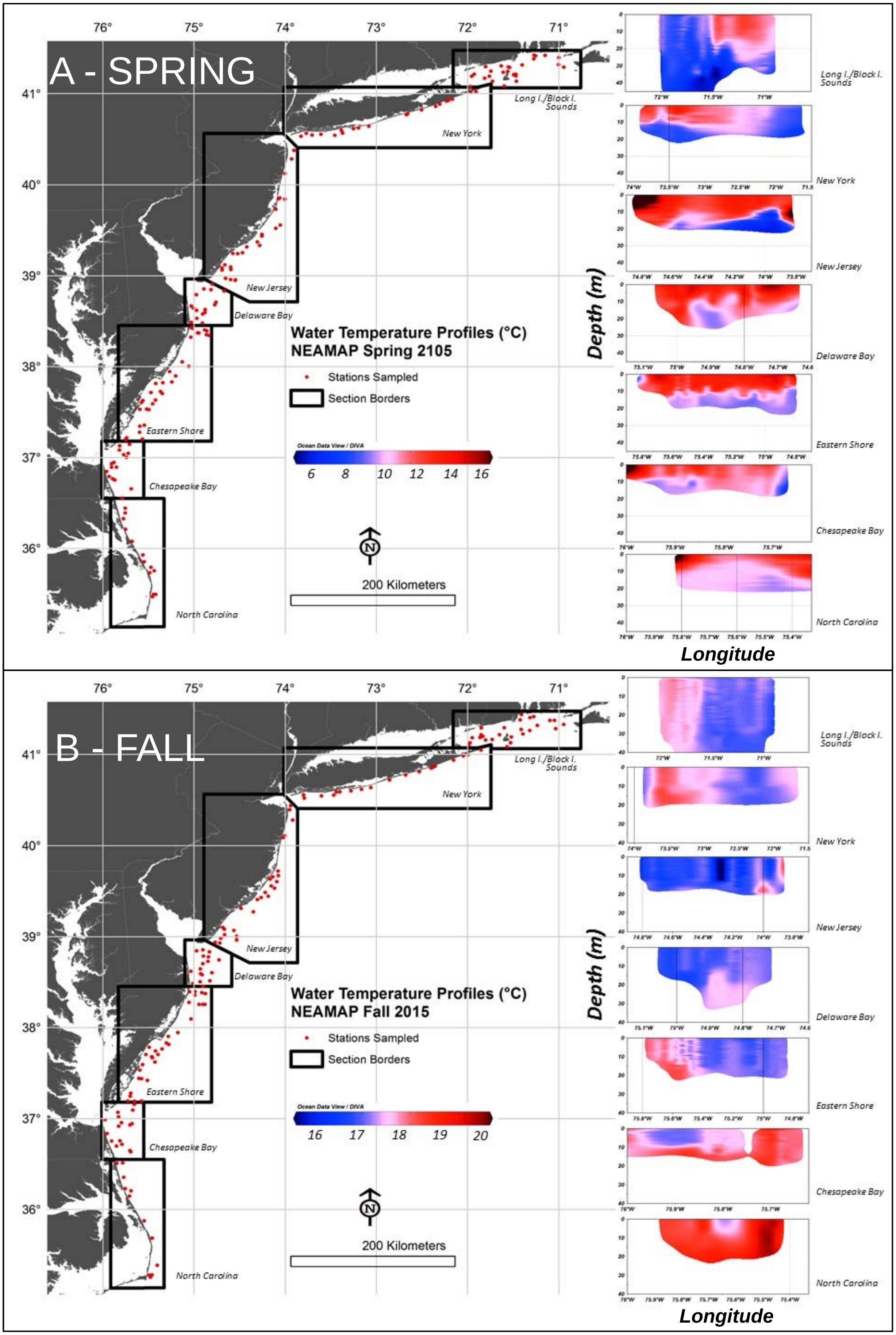


Figure 4D. Water column temperature profiles integrated within defined 'section' boundaries for spring (A) and fall (B) 2016.

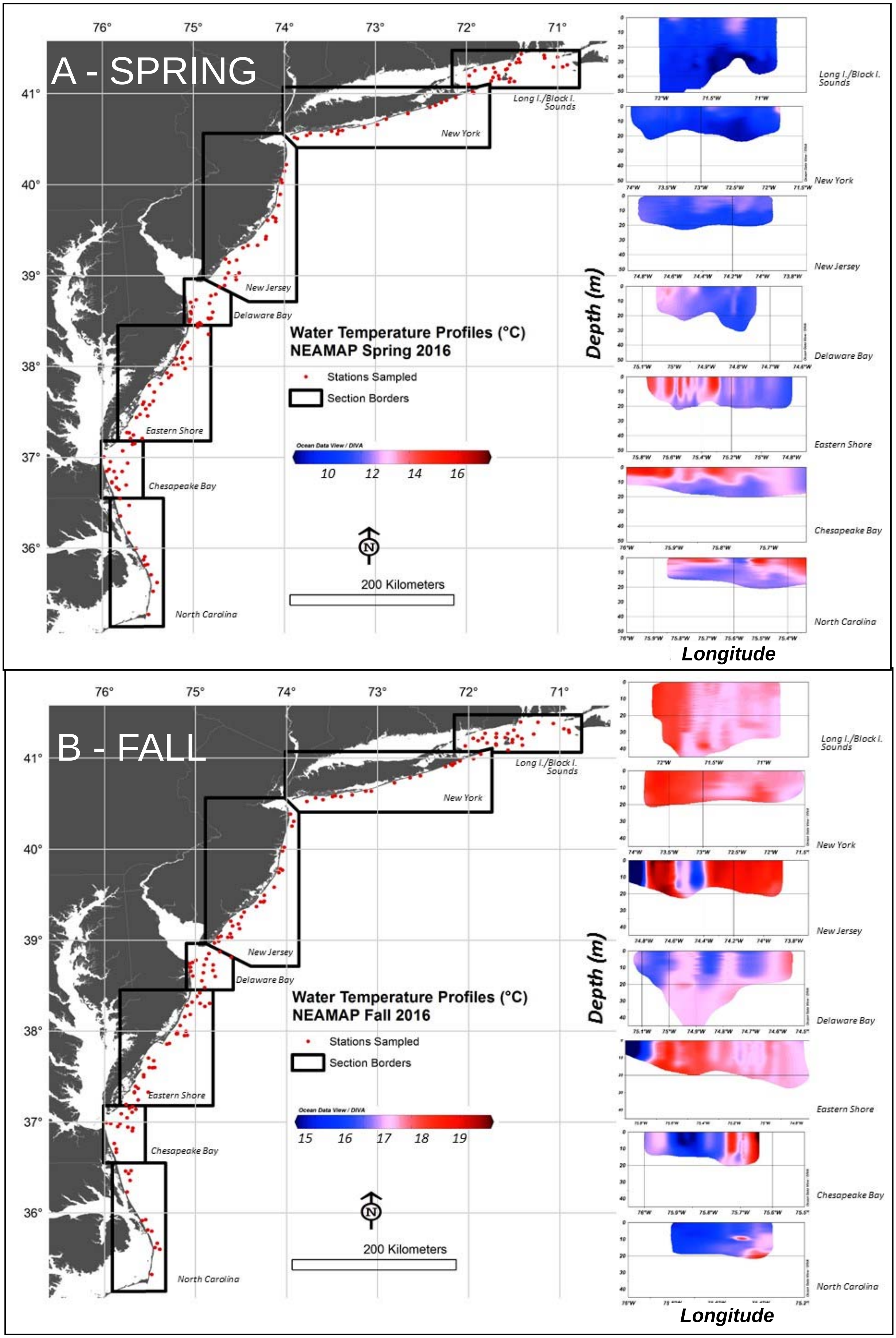
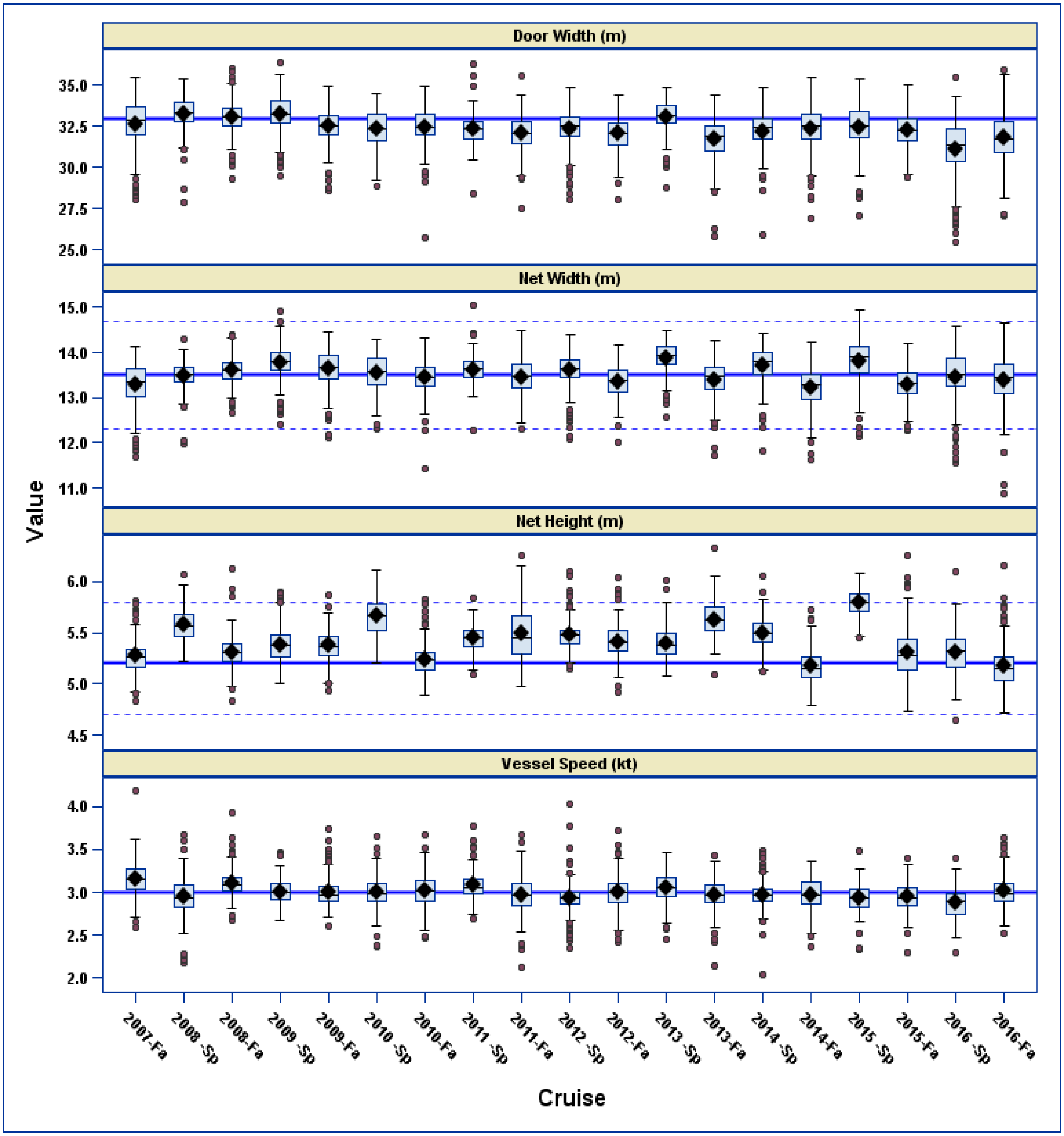


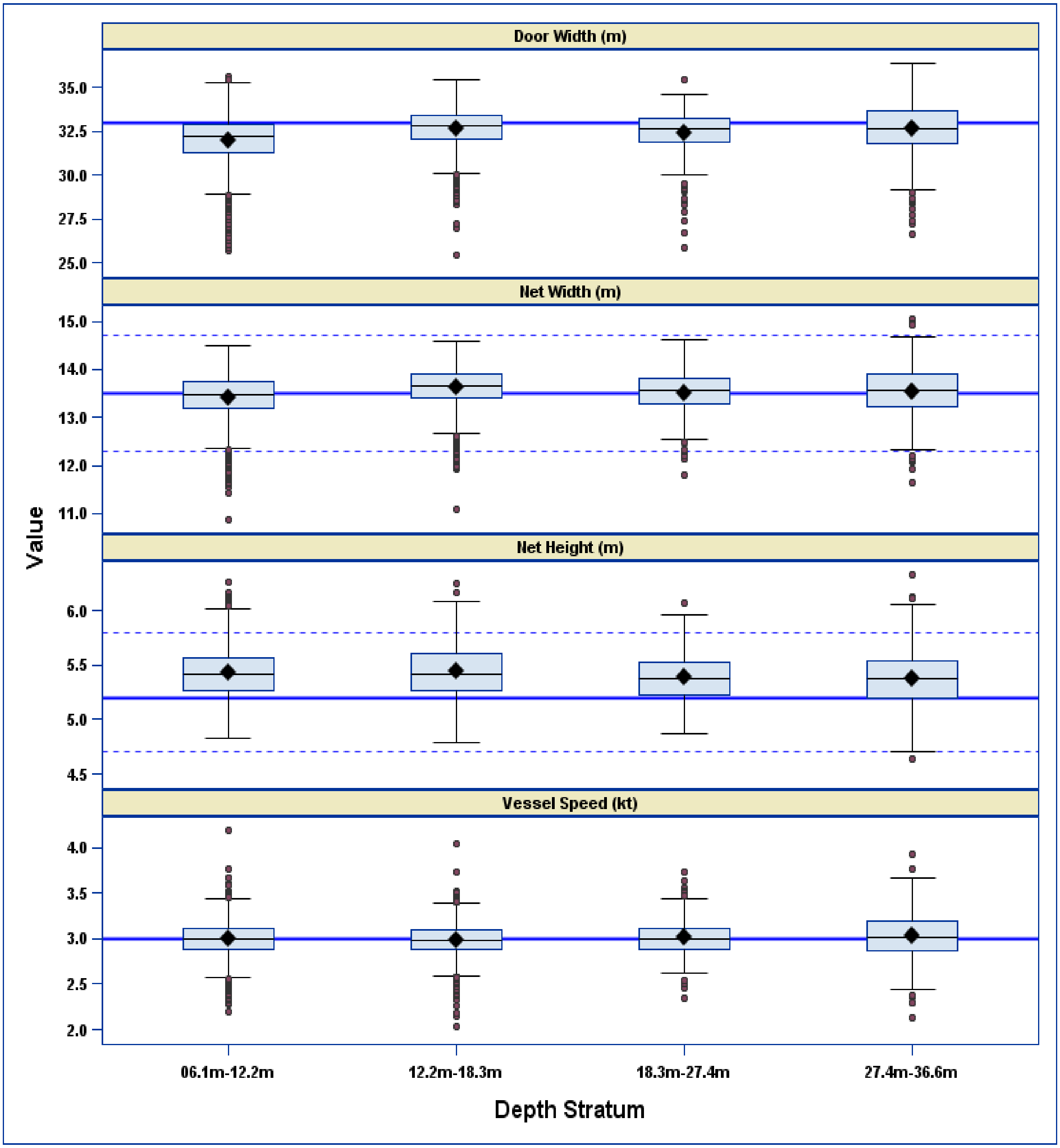
Figure 5A. Performance of the NEAMAP sampling gear for all tows during each research cruise, by cruise*.



* Explanation of the plot:

- Target values for each parameter are represented by the solid blue lines. Optimal door spreads are 32.0 m - 34.0 m, net widths (wing spread) are 13.0 m - 14.0m, headline heights are 5.0 m - 5.5 m. and vessel speeds over ground are 2.9kt - 3.3kt.
- Within each box the diamond represents the mean of all 150 tows and the horizontal line is the median.
- The boxes include the 25th through the 75th percentiles of all tows.
- Horizontal 'whiskers' represent the minimum and maximum values inside the 1.5 interquartile fence.
- Individual circles represent tows lying outside the 'min' and 'max' values above.

Figure 5B. Performance of the NEAMAP sampling gear for all tows during each research cruise, by depth stratum*.



* Explanation of the plot:

- Target values for each parameter are represented by the solid blue lines. Optimal door spreads are 32.0 m - 34.0 m, net widths (wing spread) are 13.0 m - 14.0m, headline heights are 5.0 m - 5.5 m. and vessel speeds over ground are 2.9kt - 3.3kt.
- Within each box the diamond represents the mean of all 150 tows and the horizontal line is the median.
- The boxes include the 25th through the 75th percentiles of all tows.
- Horizontal 'whiskers' represent the minimum and maximum values inside the 1.5 interquartile fence.
- Individual circles represent tows lying outside the 'min' and 'max' values above.

Figure 6A. Catch history for non-index species of interest or concern, Atlantic sturgeon.

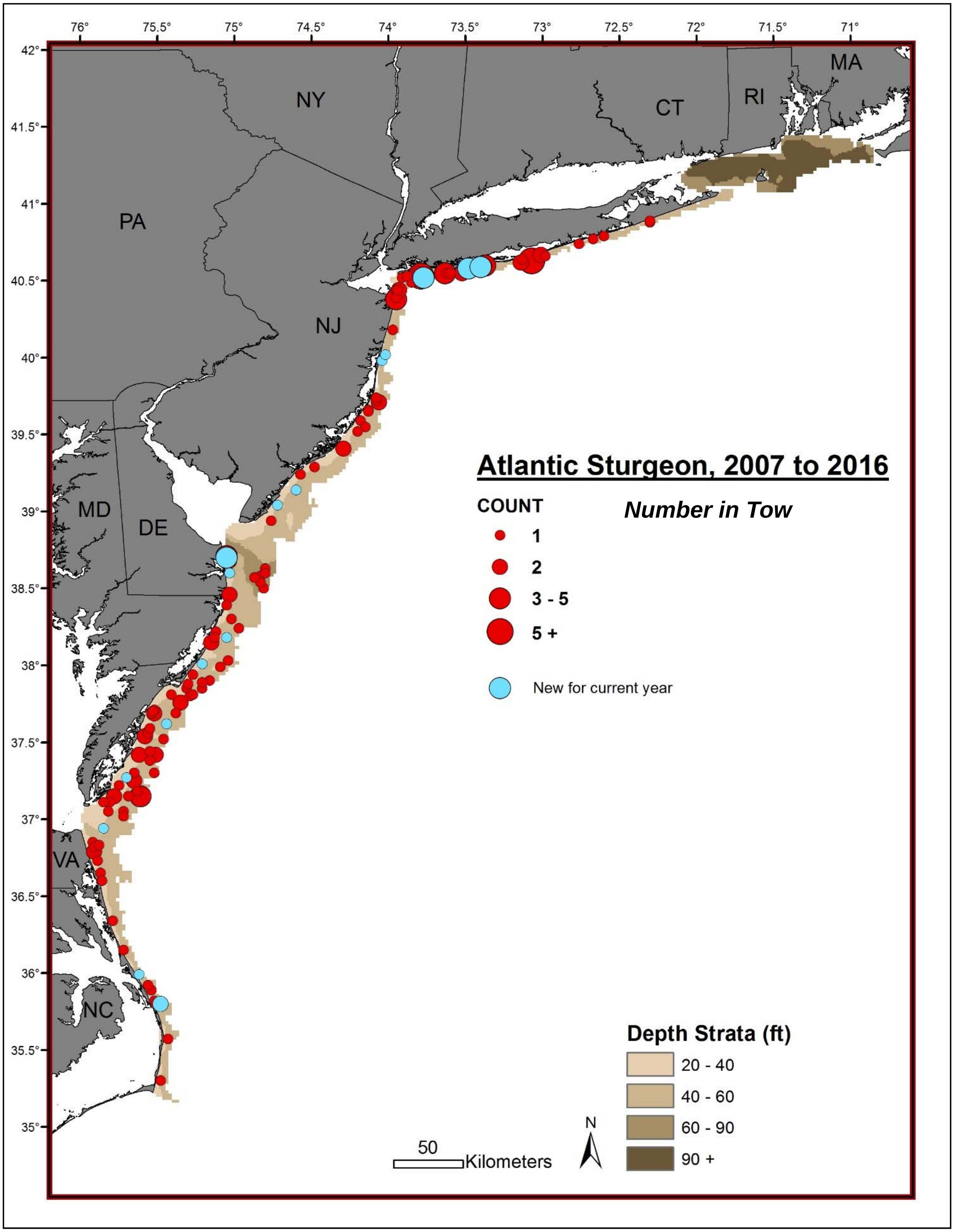


Figure 6B. Catch history for non-index species of interest or concern, sea turtles.

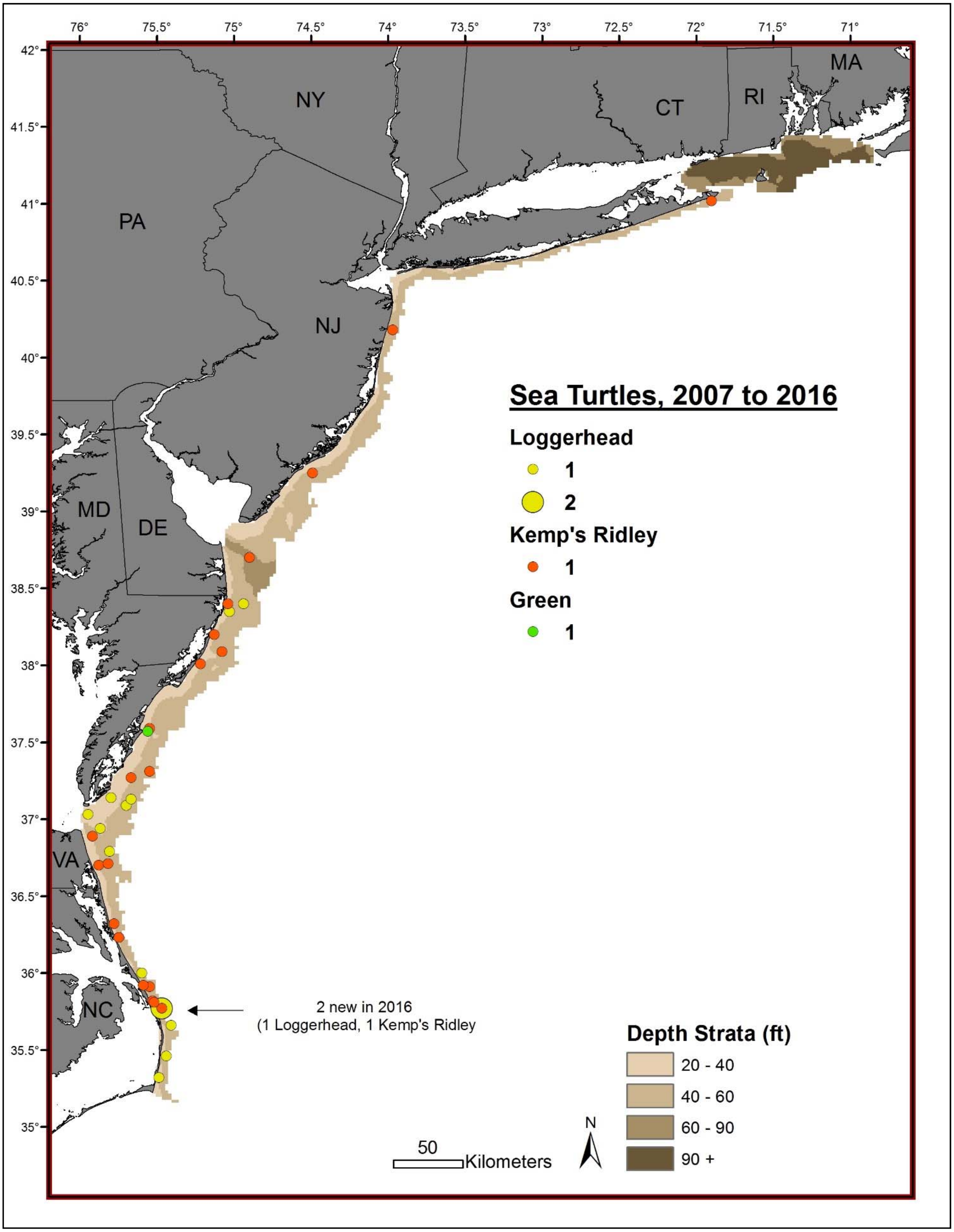
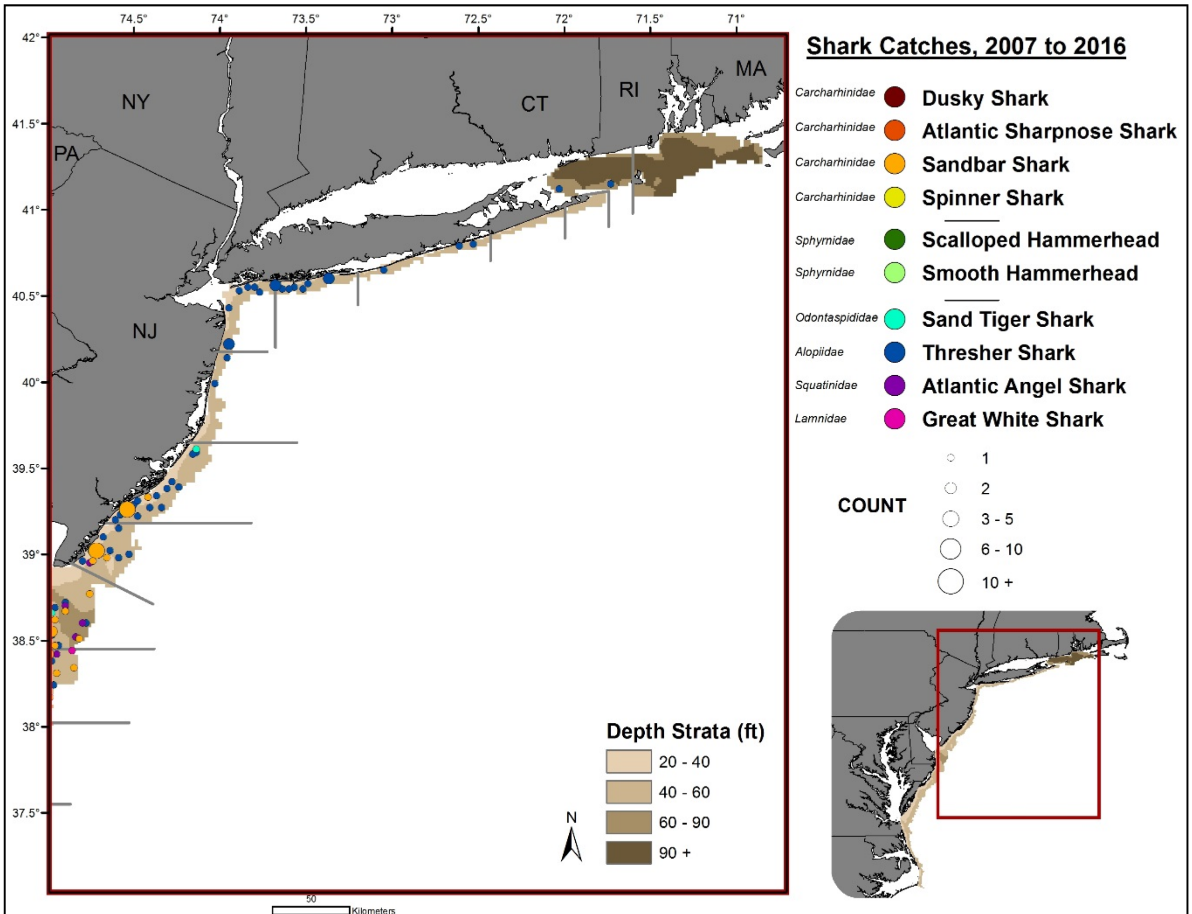


Figure 6C. Catch history for non-index species of interest or concern, coastal sharks.



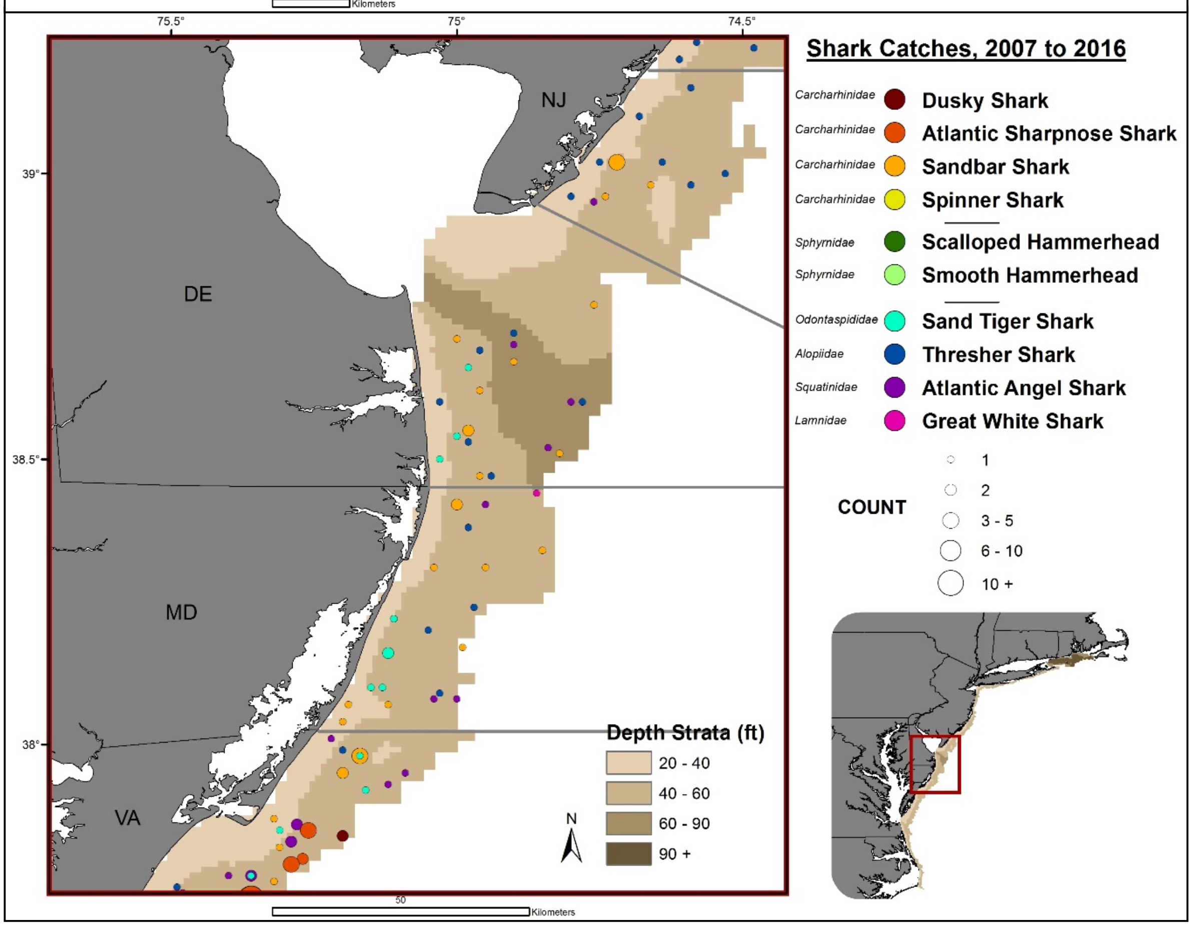
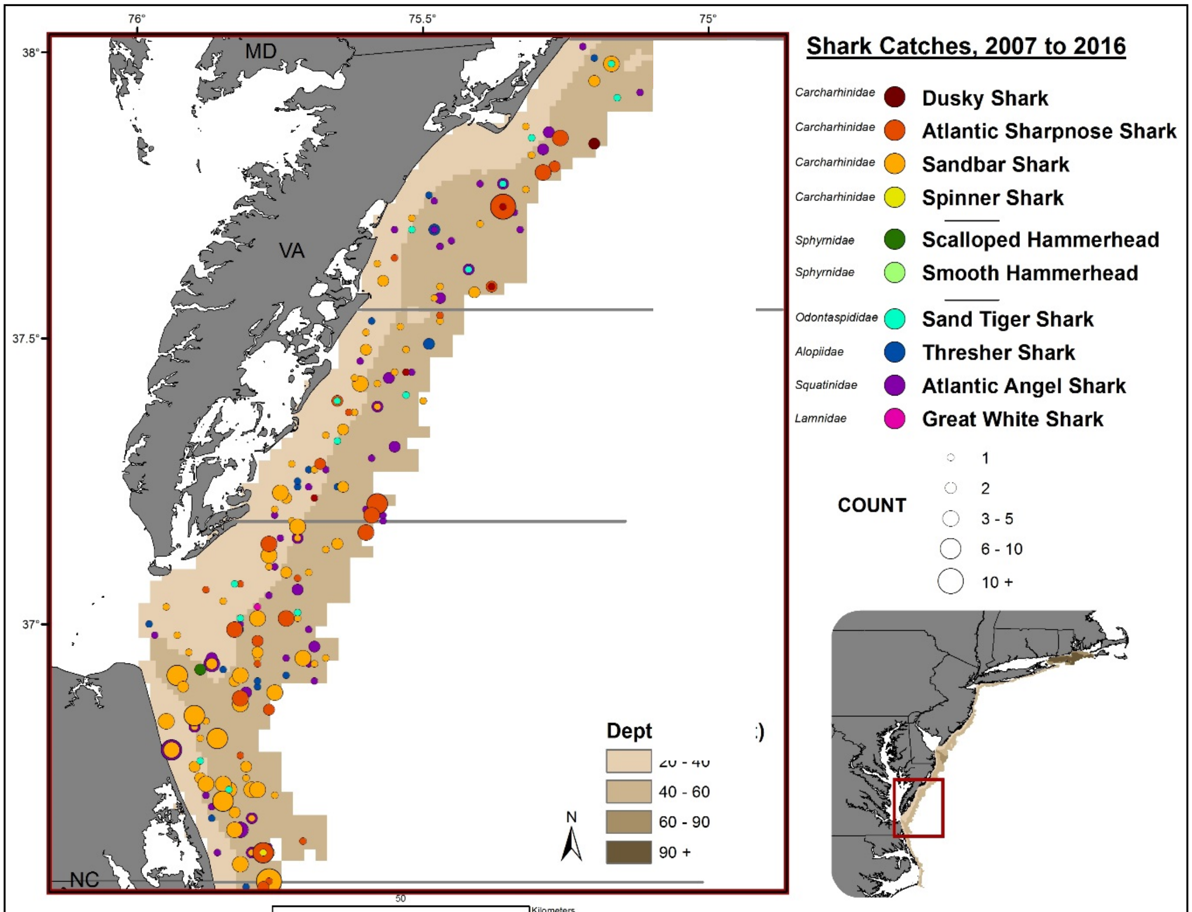
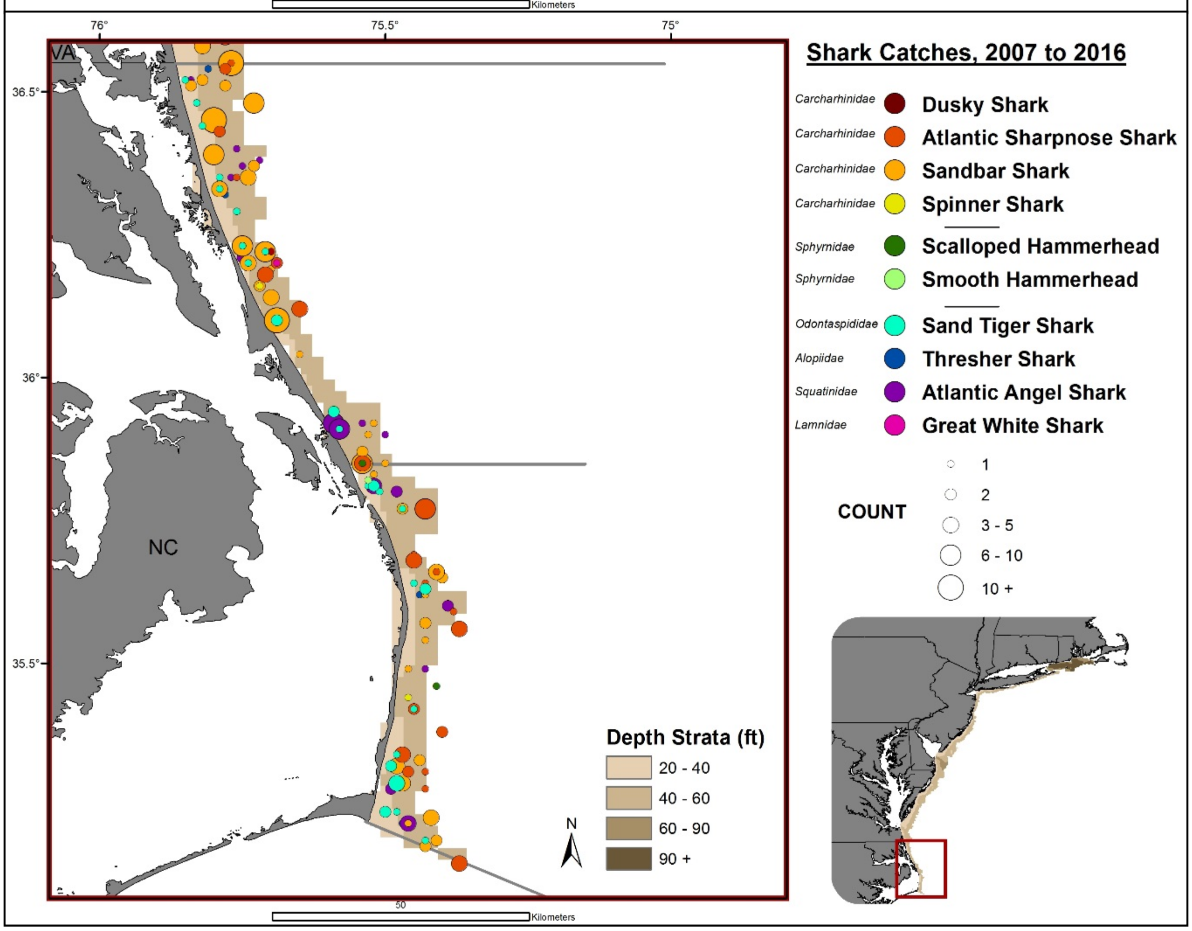


Figure 6C. continued.

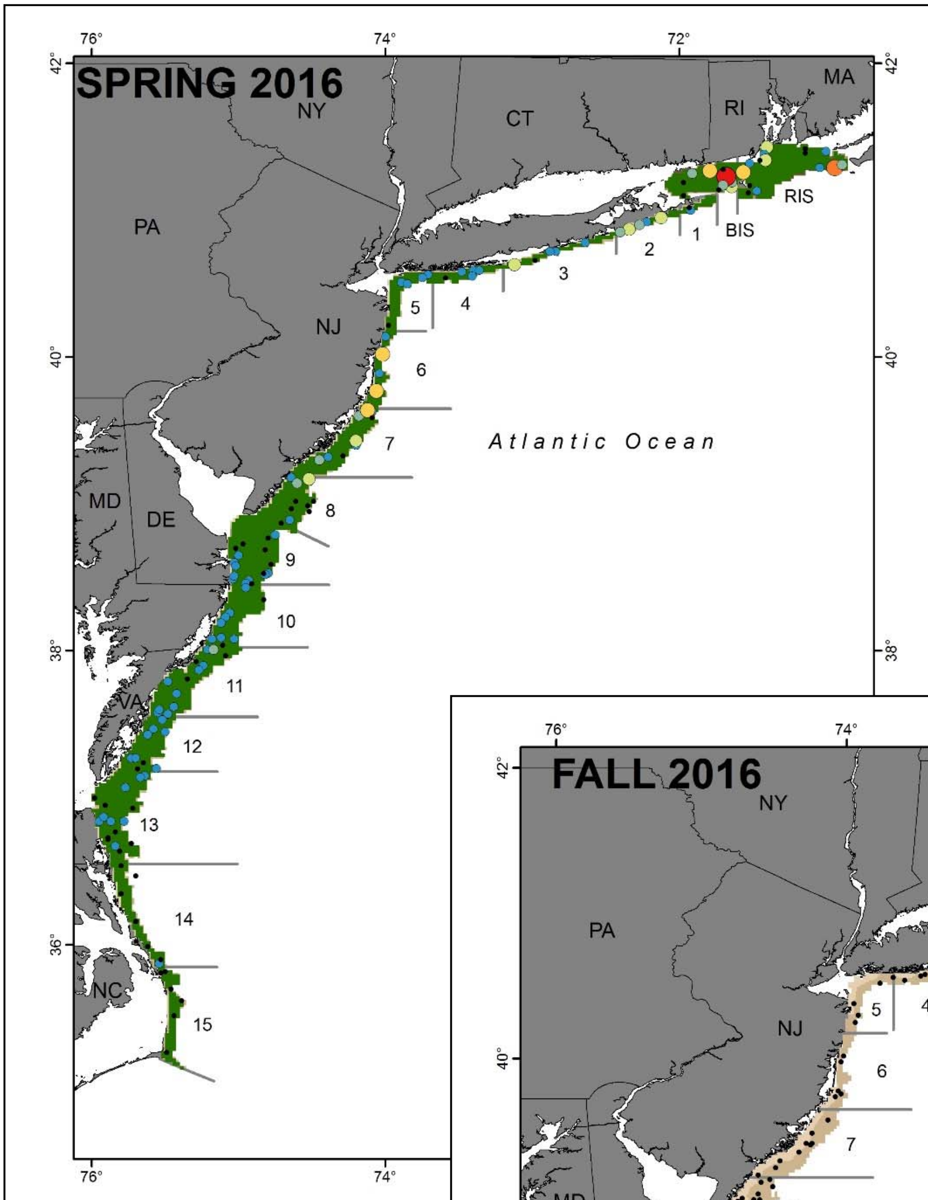


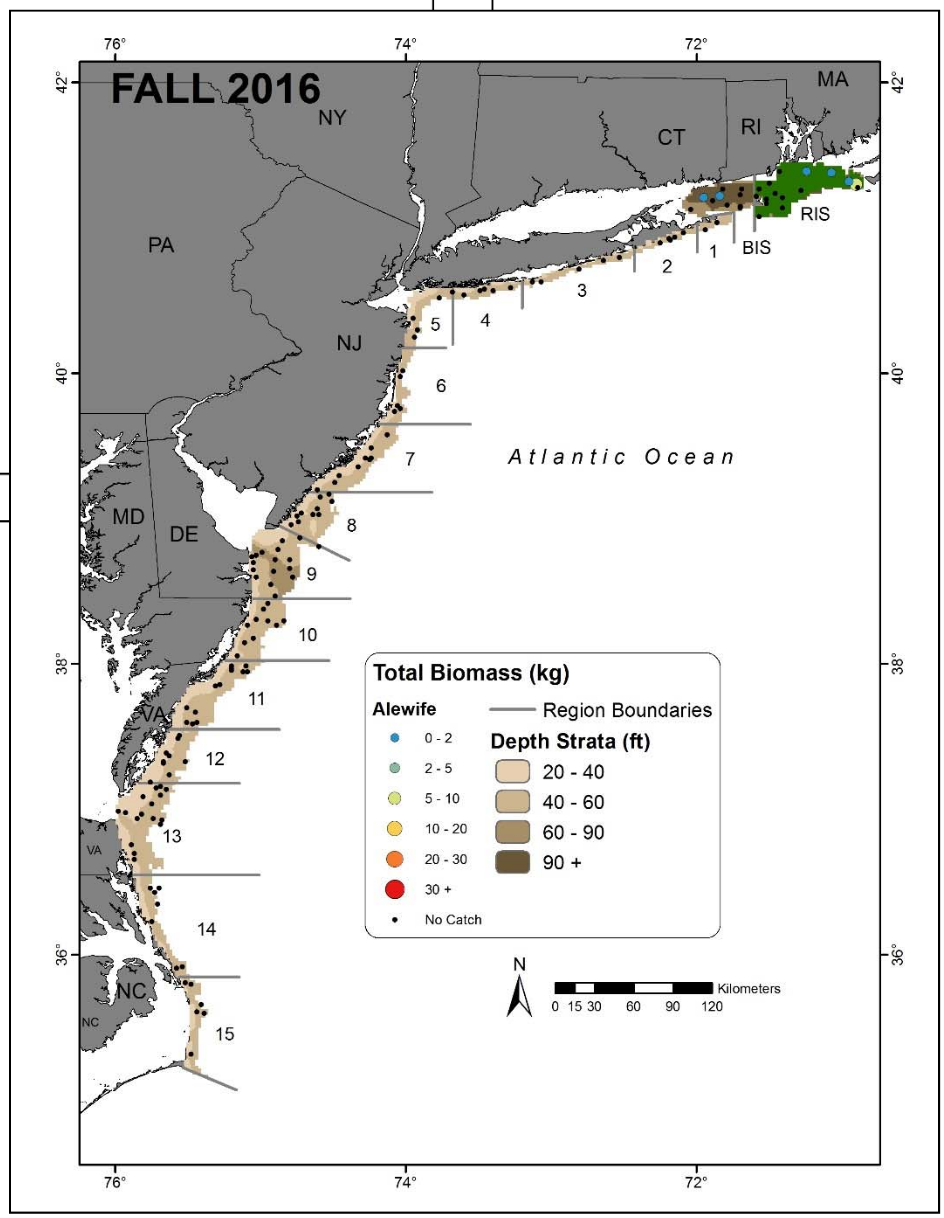


Alewife

Sampling Priority: A

Figure 7. Alewife biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	green	green
		90+	green	green
	BIS	60-90	green	grey
		90+	green	grey
NY	01	40-60	green	grey
	02	20-40	green	grey
		40-60	green	grey
	03	20-40	green	grey
		40-60	green	grey
	04	20-40	green	grey
		40-60	green	grey
	05	20-40	green	grey
		40-60	green	grey
NJ	06	20-40	green	grey
		40-60	green	grey
	07	20-40	green	grey
		40-60	green	grey
	08	20-40	green	grey
		40-60	green	grey
DE	09	20-40	green	grey
		40-60	green	grey
		60-90	green	grey
MD	10	20-40	green	grey
		40-60	green	grey
VA	11	20-40	green	grey
		40-60	green	grey
	12	20-40	green	grey
		40-60	green	grey
	13	20-40	green	grey
		40-60	green	grey
NC	14	20-40	green	grey
		40-60	green	grey
	15	20-40	green	grey
		40-60	green	grey

(green) = used for abundance indices
(grey) = not used for abundance indices

Table 7. Alewife sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	2,419	141.8	58.0	1,572	350	0	344	5
	2009	2,955	233.0	39.3	1,225	235	0	235	4
	2010	3,735	209.7	47.3	1,547	273	0	270	21
	2011	3,373	154.1	47.3	1,828	323	0	315	312
	2012	2,956	88.9	38.7	1,840	210	0	187	186
	2013	1,368	73.1	38.7	1,137	213	0	207	207
	2014	3,125	200.0	36.7	1,360	230	0	170	168
	2015	7,905	368.1	49.3	2,442	318	0	178	169
	2016	6,399	257.5	63.3	3,879	476	0	174	171
Fall	2007	56	3.1	31.3	56	24	0	24	0
	2008	5	0.3	6.3	5	5	0	5	0
	2009	87	3.9	12.5	87	17	0	16	16
	2010	565	13.7	62.5	360	39	0	38	38
	2011	27	1.2	18.8	27	13	0	13	13
	2012	57	3.6	25.0	57	19	0	15	15
	2013	2	0.1	12.5	2	2	0	1	1
	2014	14	0.9	12.5	14	7	0	5	5
	2015	170	6.2	37.5	170	30	0	8	8
	2016	226	10.6	25.0	106	19	0	5	5

Table 8. Alewife geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and for the youngest year class captured .

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	150	1.58	2.15	2.84	0.23	0.34	0.47
	2009	160	0.80	1.15	1.58	0.15	0.27	0.39
	2010	150	0.94	1.42	2.01	0.15	0.27	0.40
	2011	150	1.31	1.86	2.54	0.21	0.31	0.43
	2012	150	0.76	1.12	1.57	0.12	0.20	0.28
	2013	150	0.56	0.84	1.16	0.11	0.18	0.26
	2014	150	0.78	1.27	1.89	0.16	0.31	0.49
	2015	150	1.43	2.16	3.12	0.21	0.36	0.52
	2016	150	3.47	4.97	6.96	0.50	0.73	0.99
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	150	0.87	1.22	1.64	0.10	0.17	0.25
	2009	160	0.47	0.69	0.96	0.07	0.12	0.18
	2010	150	0.71	1.08	1.52	0.09	0.19	0.30
	2011	150	0.84	1.25	1.75	0.11	0.19	0.27
	2012	150	0.49	0.82	1.23	0.06	0.15	0.25
	2013	150	0.34	0.53	0.75	0.04	0.08	0.13
	2014	150	0.54	0.92	1.40	0.07	0.18	0.29
	2015	150	1.17	1.82	2.66	0.13	0.26	0.41
	2016	150	2.47	3.58	5.05	0.25	0.38	0.53

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	17	0.06	0.61	1.46	0.00	0.10	0.24
	2008	16	0.00	0.06	0.19	0.00	0.01	0.02
	2009	16	0.00	0.36	1.31	0.00	0.10	0.34
	2010	16	1.37	5.67	17.80	0.15	0.64	1.33
	2011	16	0.00	0.39	1.14	0.00	0.06	0.18
	2012	16	0.00	0.50	1.44	0.00	0.10	0.27
	2013	16	0.00	0.11	0.28	0.00	0.01	0.03
	2014	16	0.00	0.29	0.89	0.00	0.05	0.16
	2015	16	0.06	1.11	3.18	0.00	0.17	0.38
	2016	16	0.00	0.85	2.87	0.00	0.20	0.62
0	2007	17	0.00	0.00	0.00	0.00	0.00	0.00
	2008	16	0.00	0.00	0.00	0.00	0.00	0.00
	2009	16	0.00	0.09	0.23	0.00	0.01	0.01
	2010	16	0.98	4.69	15.34	0.09	0.46	0.97
	2011	16	0.00	0.23	0.70	0.00	0.03	0.09
	2012	16	0.00	0.00	0.00	0.00	0.00	0.00
	2013	16	0.00	0.00	0.00	0.00	0.00	0.00
	2014	16	0.00	0.00	0.00	0.00	0.00	0.00
	2015	16	0.00	0.45	1.62	0.00	0.09	0.27
	2016	16	0.00	0.25	0.96	0.00	0.06	0.19

Figure 8. Alewife geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

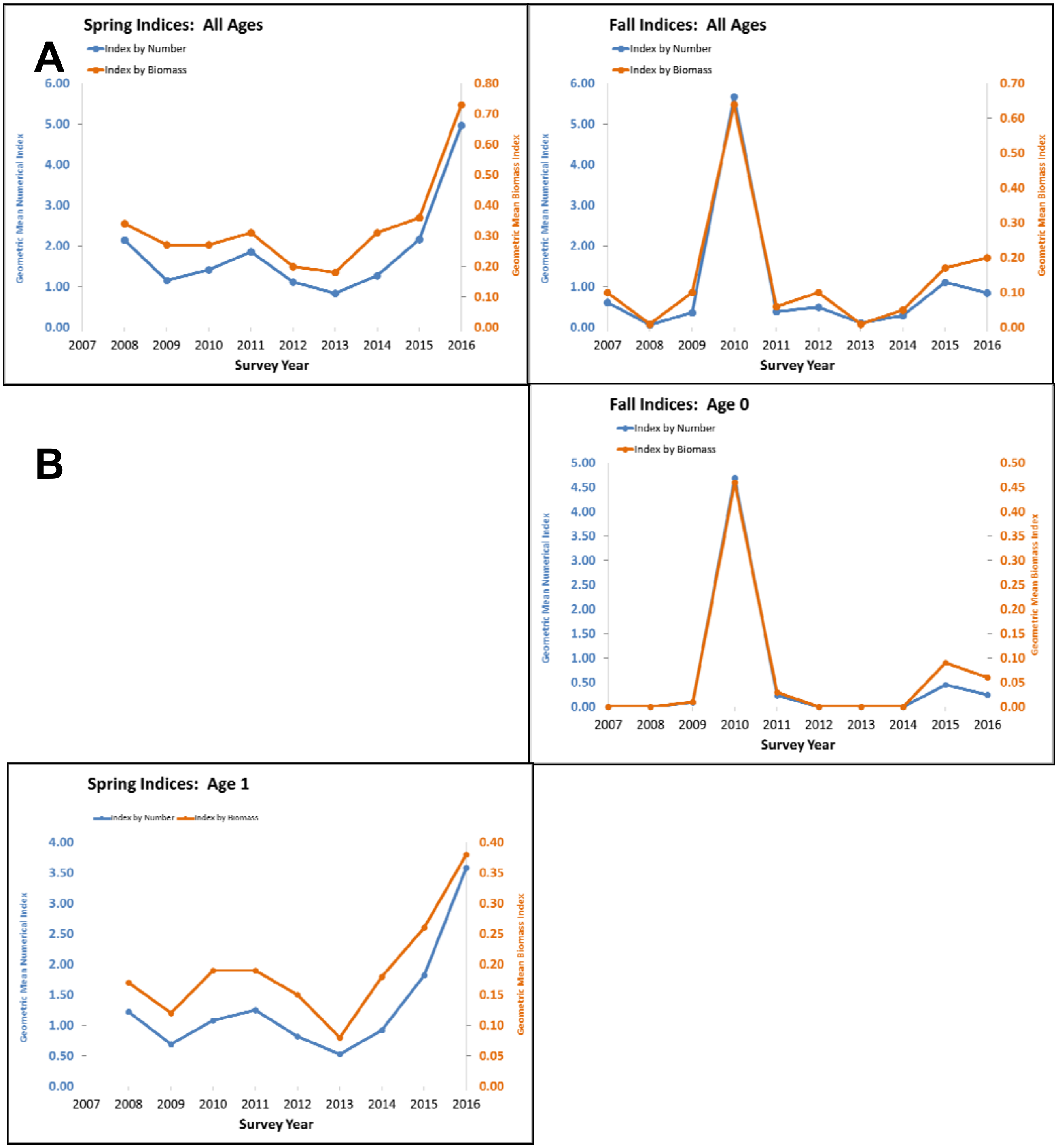


Figure 9. Alewife length-frequency distributions, by cruise (Reference lines are placed at the size cutoff values used to separate recruits from older specimens. Cutoff values - spring 16cm, fall 14cm - estimated by examination of these length frequency figures.).

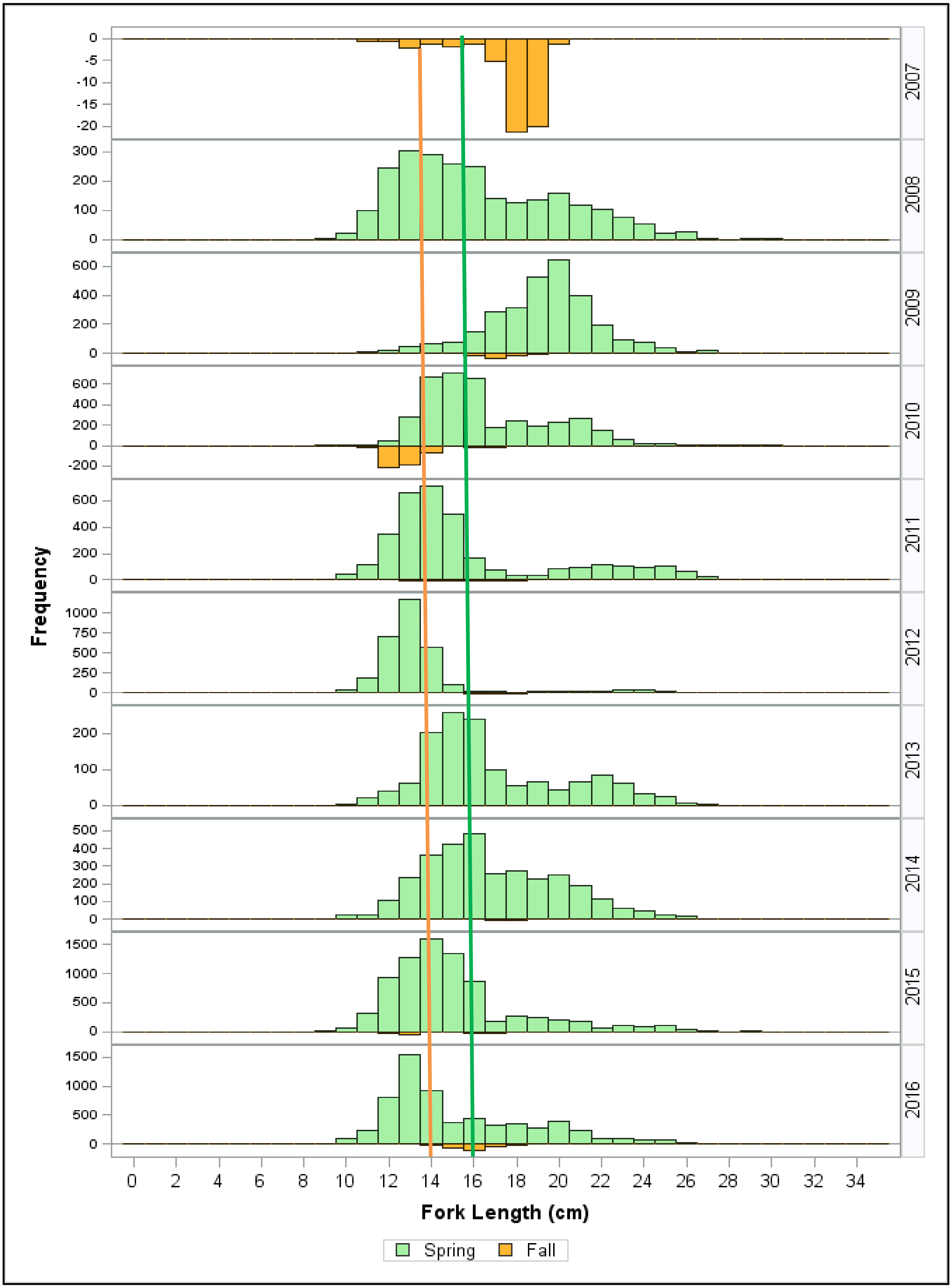


Figure 10. Alewife sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

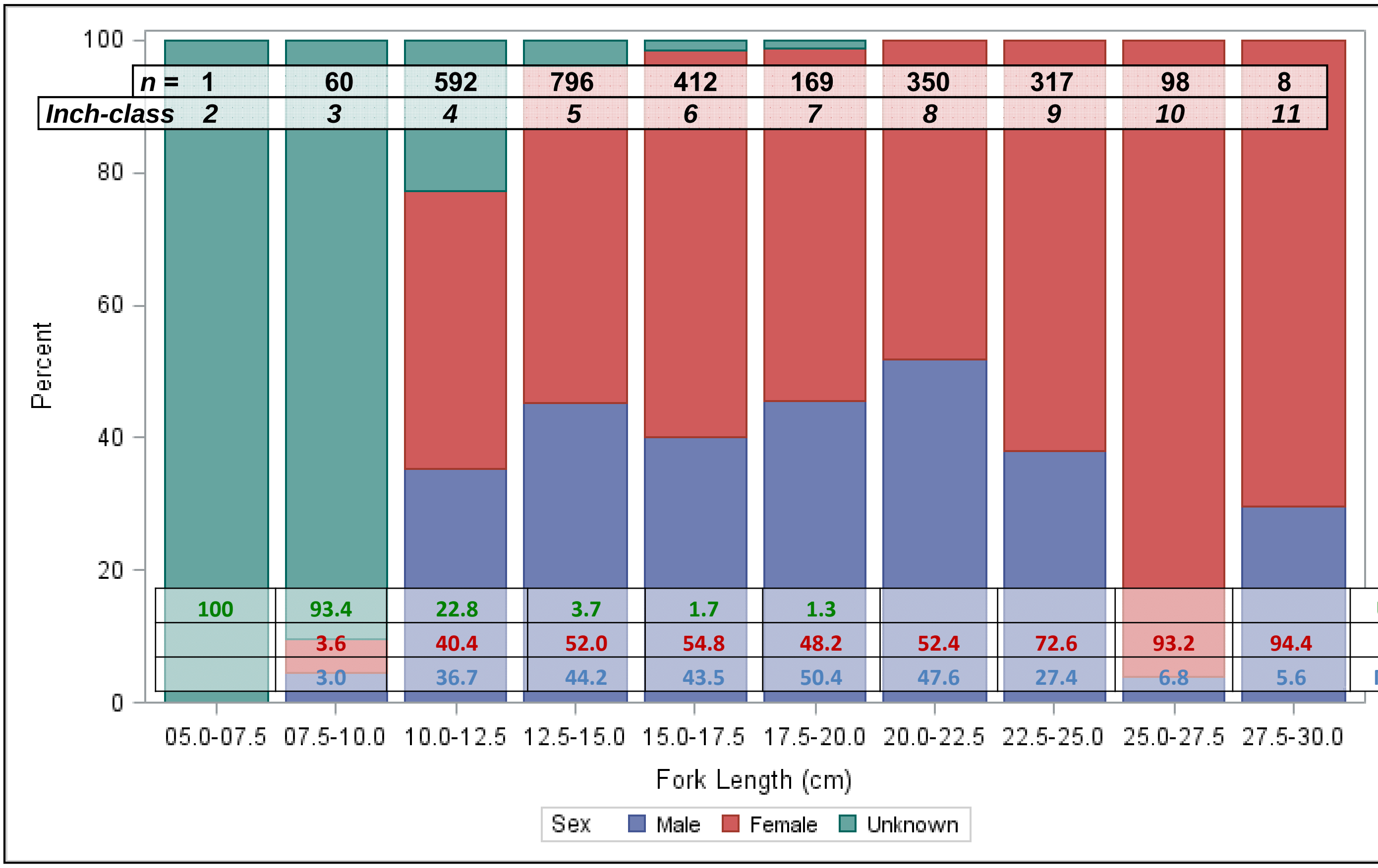


Figure 11. Alewife maturity at length, by sex for all cruises pooled, 2007-2016.

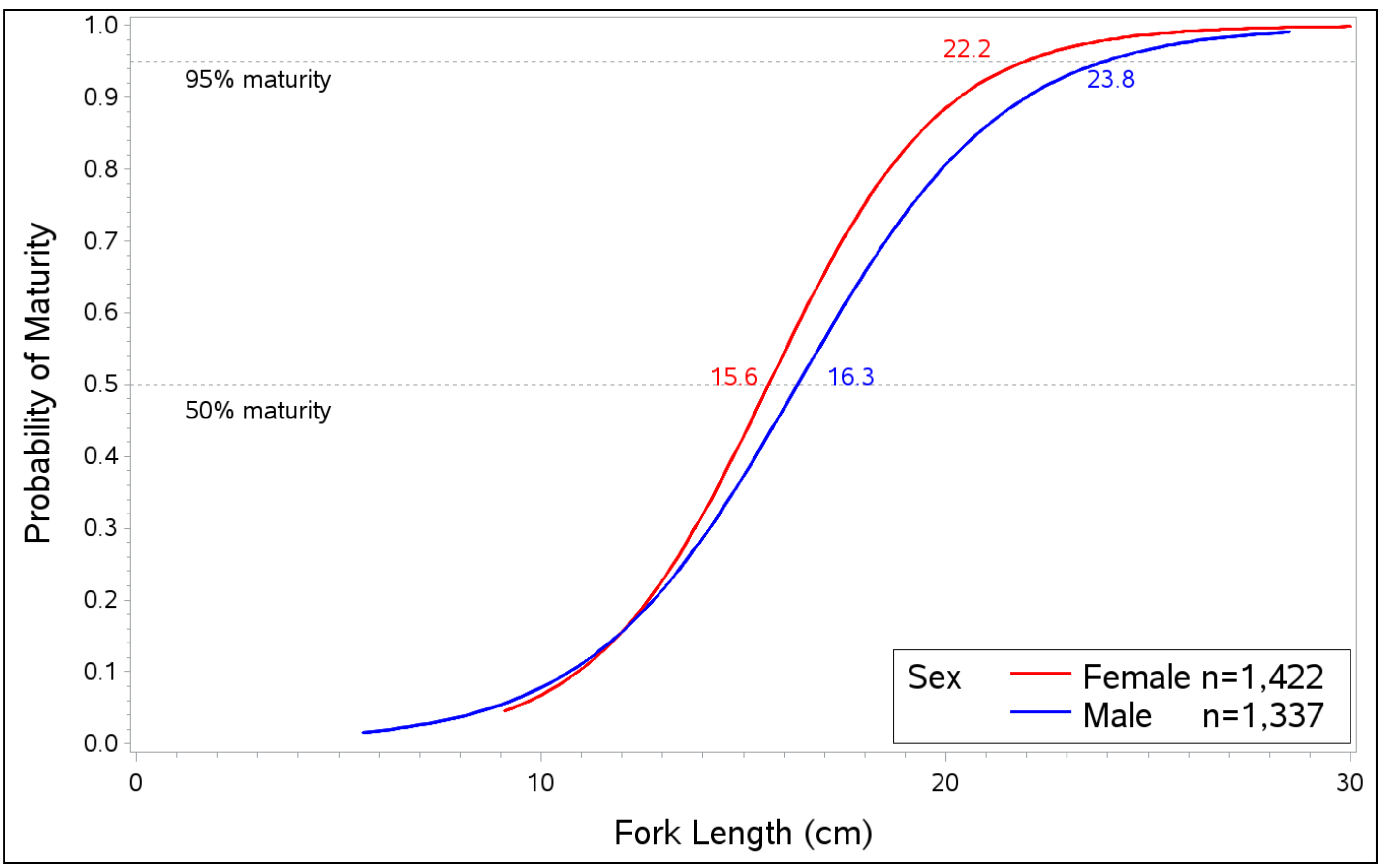
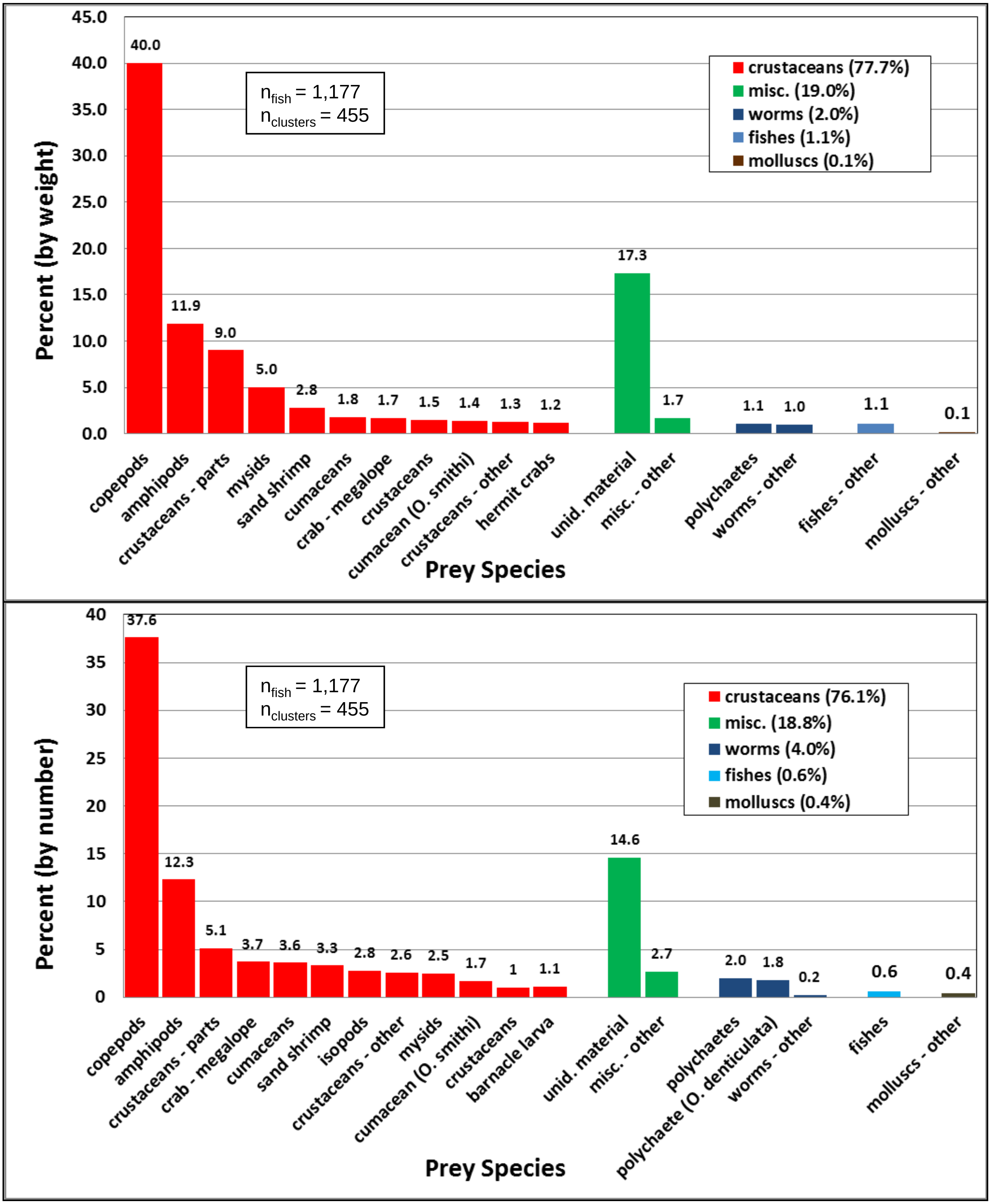


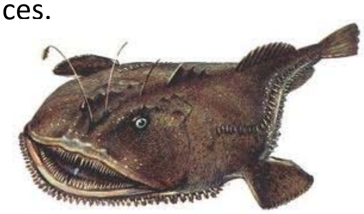
Figure 12. Alewife diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

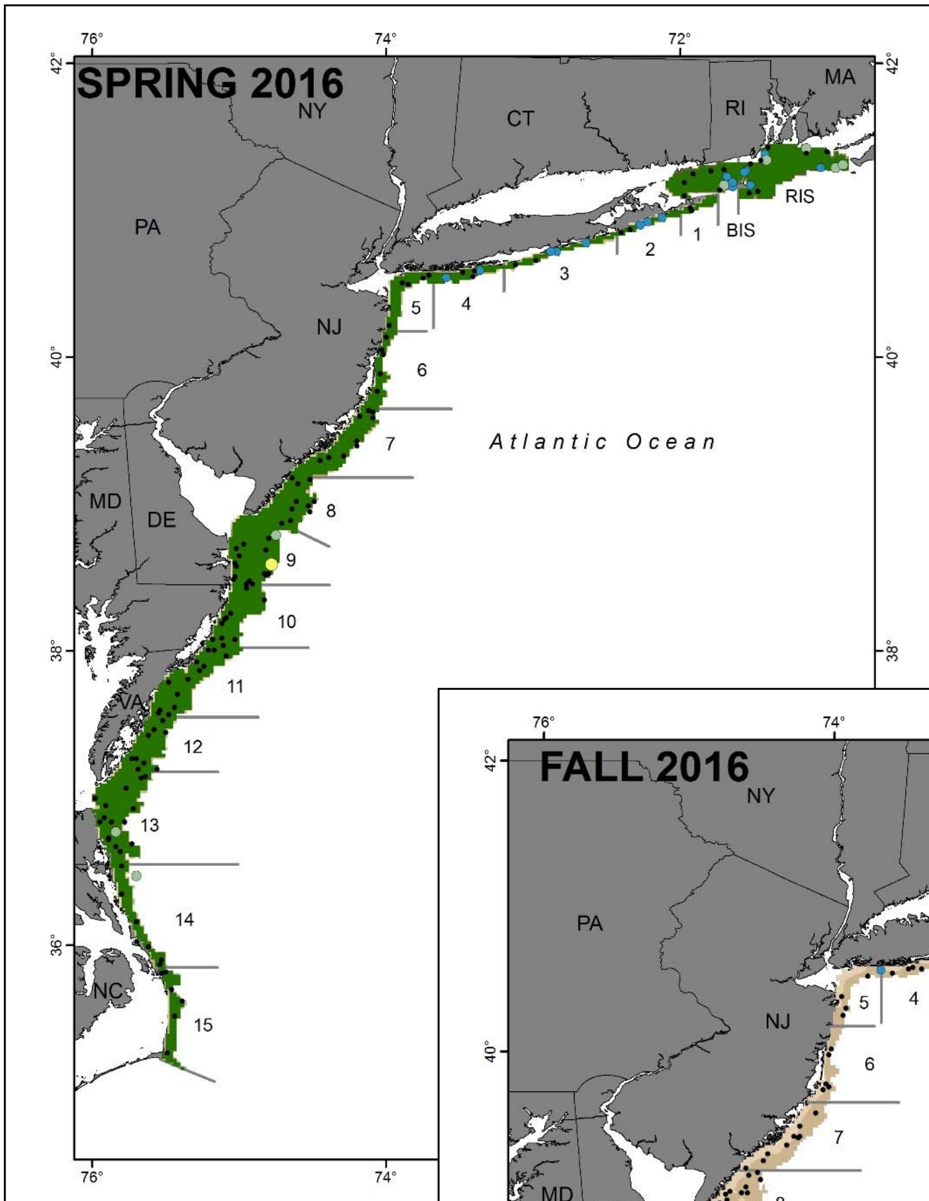


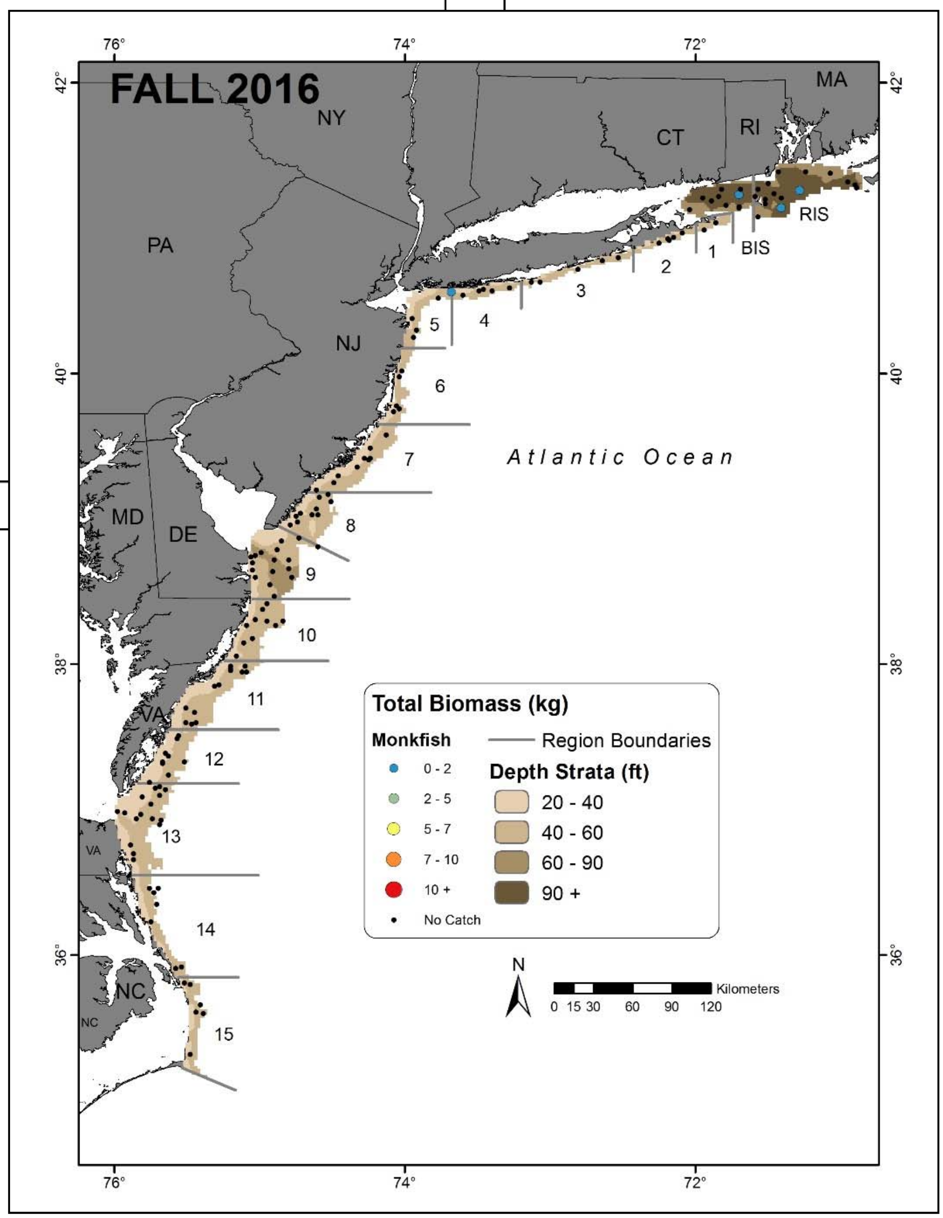
American Goosefish

Sampling Priority: A

Figure 13. American Goosefish biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(grey) = not used for abundance indices

Table 9. American Goosefish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	31	130.8	18.7	31	31	0	23	23
	2009	18	66.0	10.0	18	18	0	10	10
	2010	11	37.4	6.7	11	11	0	7	7
	2011	14	40.4	8.0	14	14	0	10	9
	2012	48	89.1	16.7	48	44	0	30	29
	2013	16	45.6	8.0	16	16	0	11	11
	2014	15	40.1	8.0	15	15	0	7	7
	2015	19	55.7	10.0	19	19	0	12	12
	2016	56	37.0	16.7	56	54	0	35	35
Fall	2007	6	31.2	0.0	6	6	0	6	6
	2008	6	26.2	0.0	6	6	0	6	6
	2009	3	0.6	0.0	3	0	0	0	0
	2010	0	0.0	0.0					
	2011	1	3.2	0.0	1	1	0	1	0
	2012	0	0.0	0.0					
	2013	3	17.1	0.0	3	3	0	2	0
	2014	0	0.0	0.0					
	2015	2	3.1	0.0	2	2	0	2	2
	2016	7	5.6	0.0	7	7	0	4	4

Table 10. American Goosefish geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	150	0.10	0.16	0.22	0.22	0.37	0.54
	2009	160	0.05	0.09	0.14	0.10	0.20	0.30
	2010	150	0.02	0.06	0.09	0.04	0.12	0.20
	2011	150	0.03	0.06	0.10	0.05	0.12	0.19
	2012	150	0.11	0.19	0.27	0.17	0.27	0.38
	2013	150	0.03	0.07	0.11	0.05	0.12	0.20
	2014	150	0.03	0.08	0.12	0.06	0.14	0.23
	2015	150	0.04	0.09	0.14	0.08	0.17	0.27
	2016	150	0.12	0.19	0.27	0.09	0.16	0.23

Figure 14. American Goosefish geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

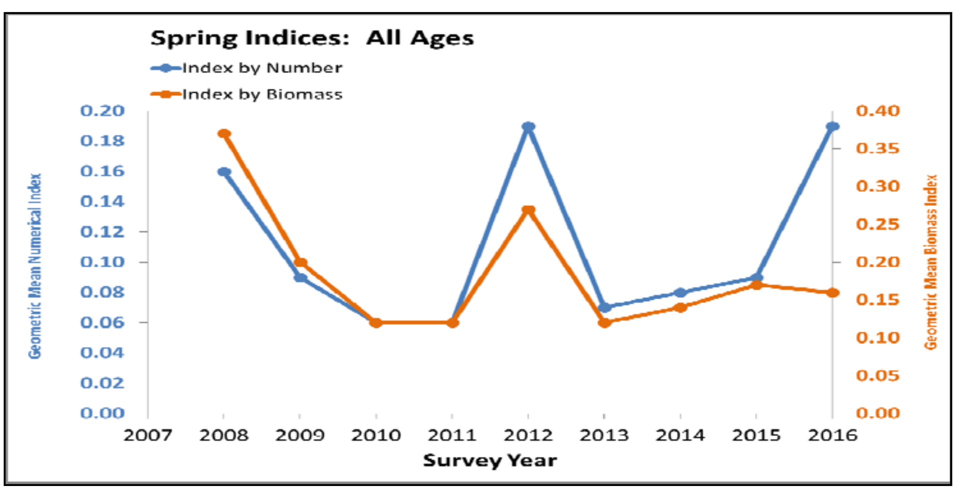


Figure 15. American Goosefish length-frequency distributions, by cruise.

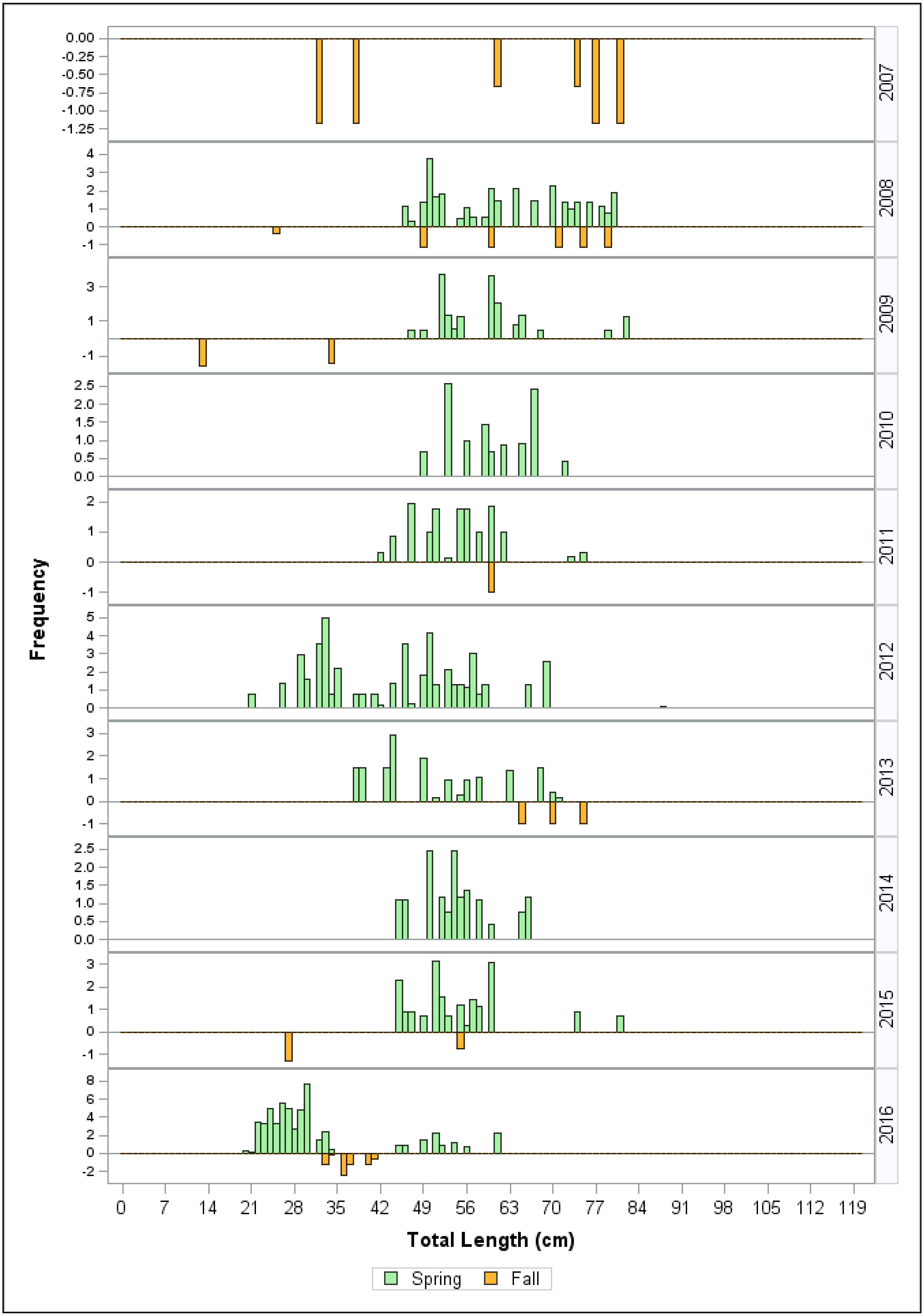


Figure 16. American Goosefish length-frequency distributions, by cruise and sex.

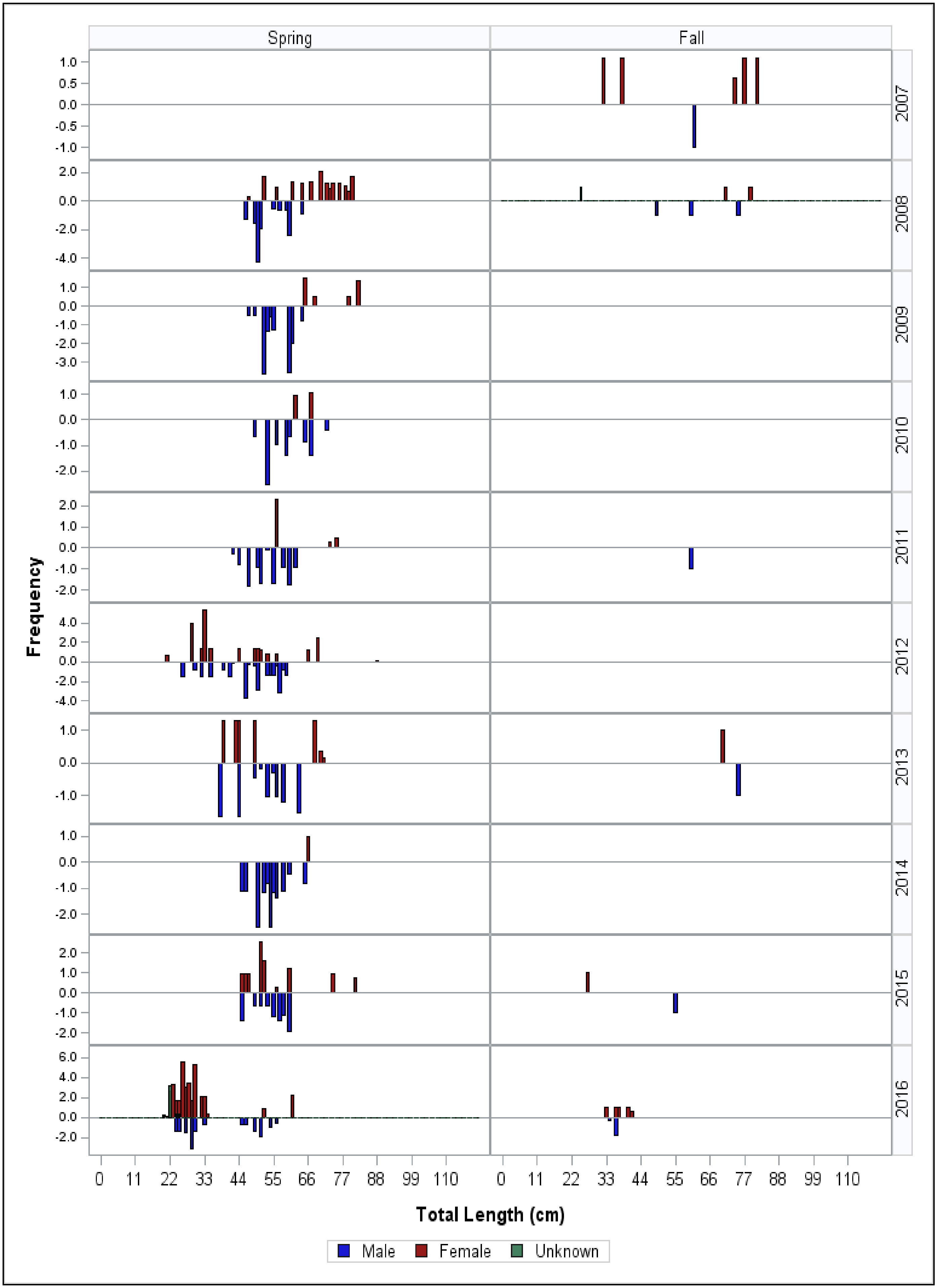


Figure 17. American Goosefish sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

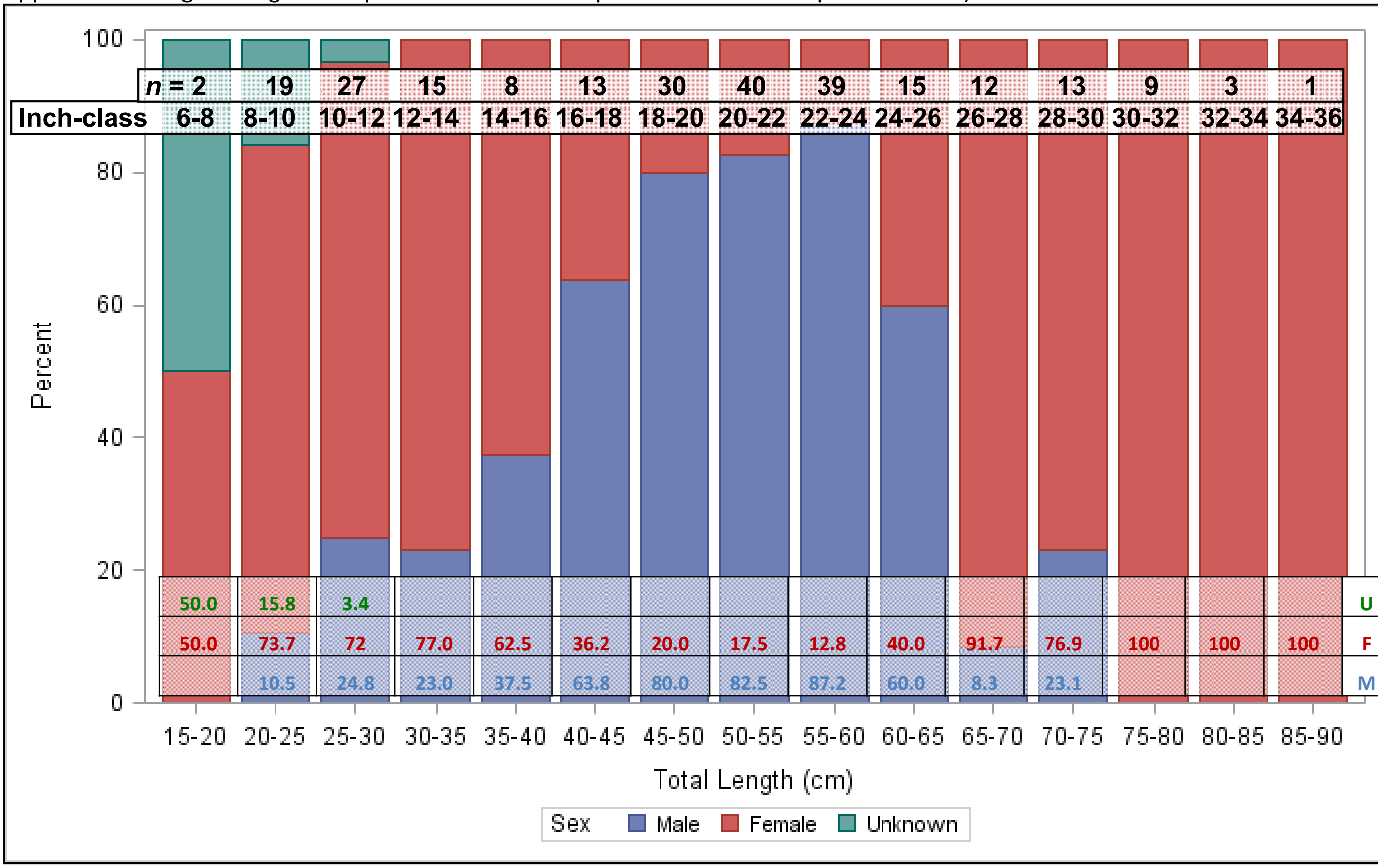


Figure 18. American Goosefish maturity at length, by sex for all cruises pooled, 2007-2016.

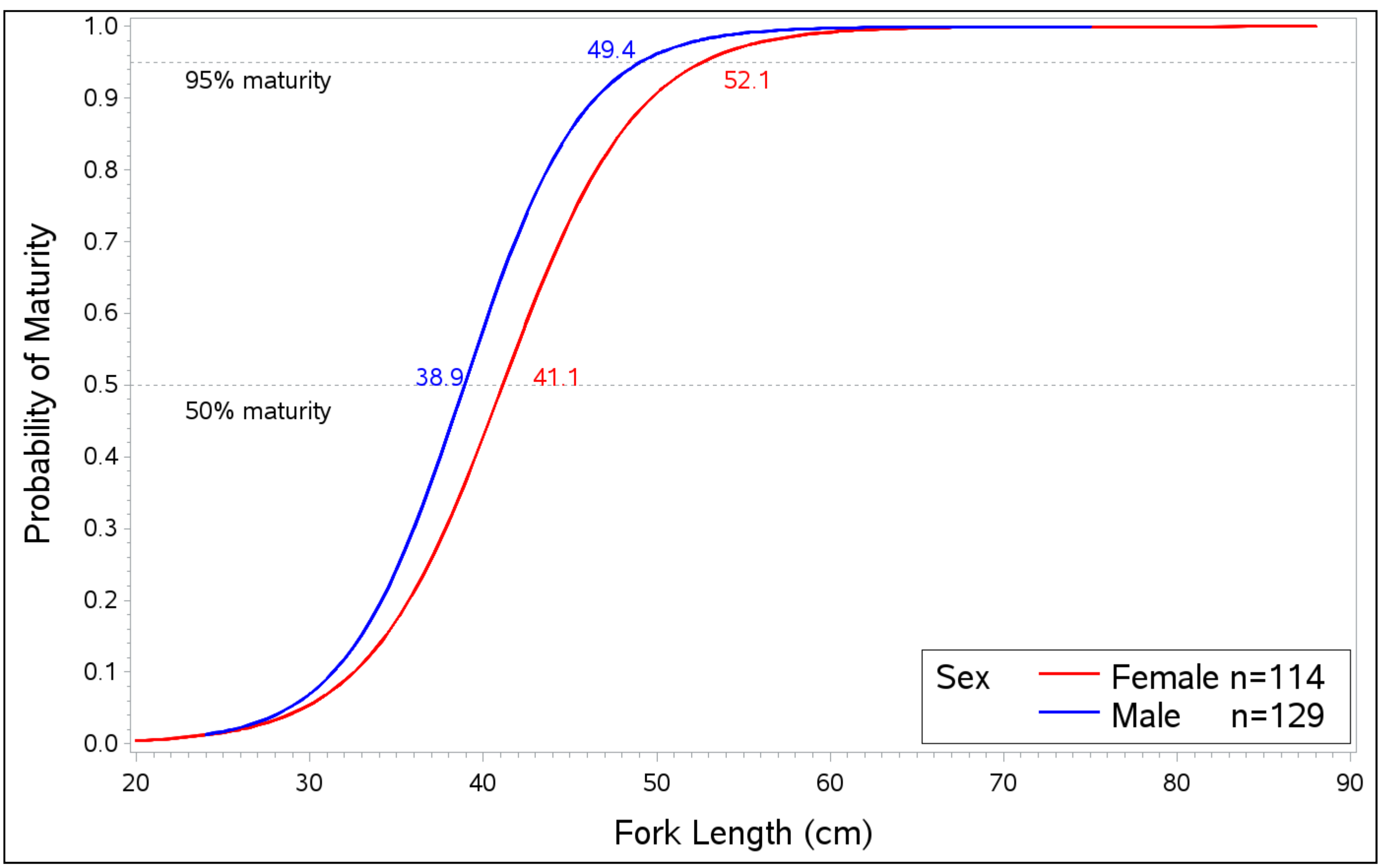
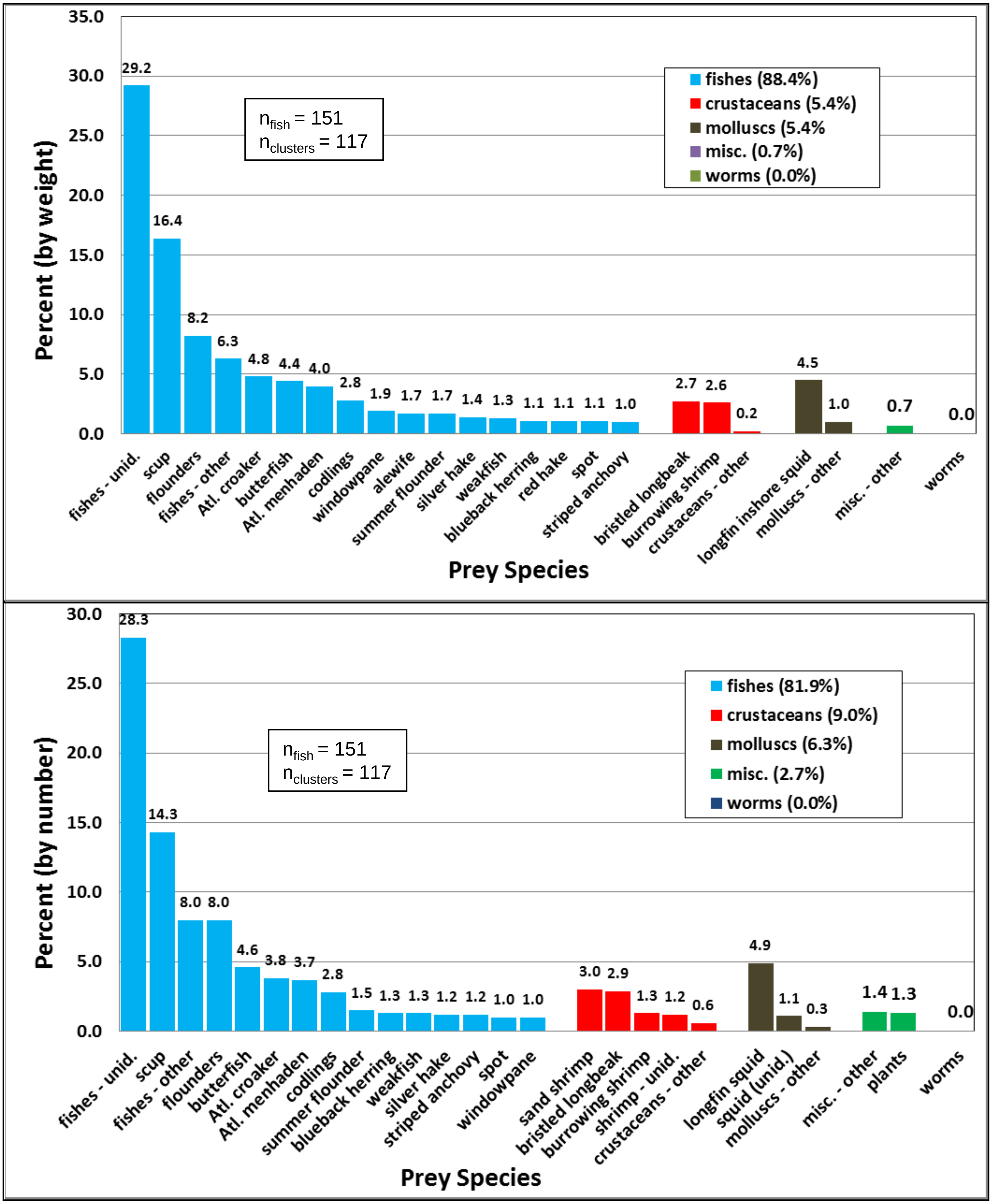
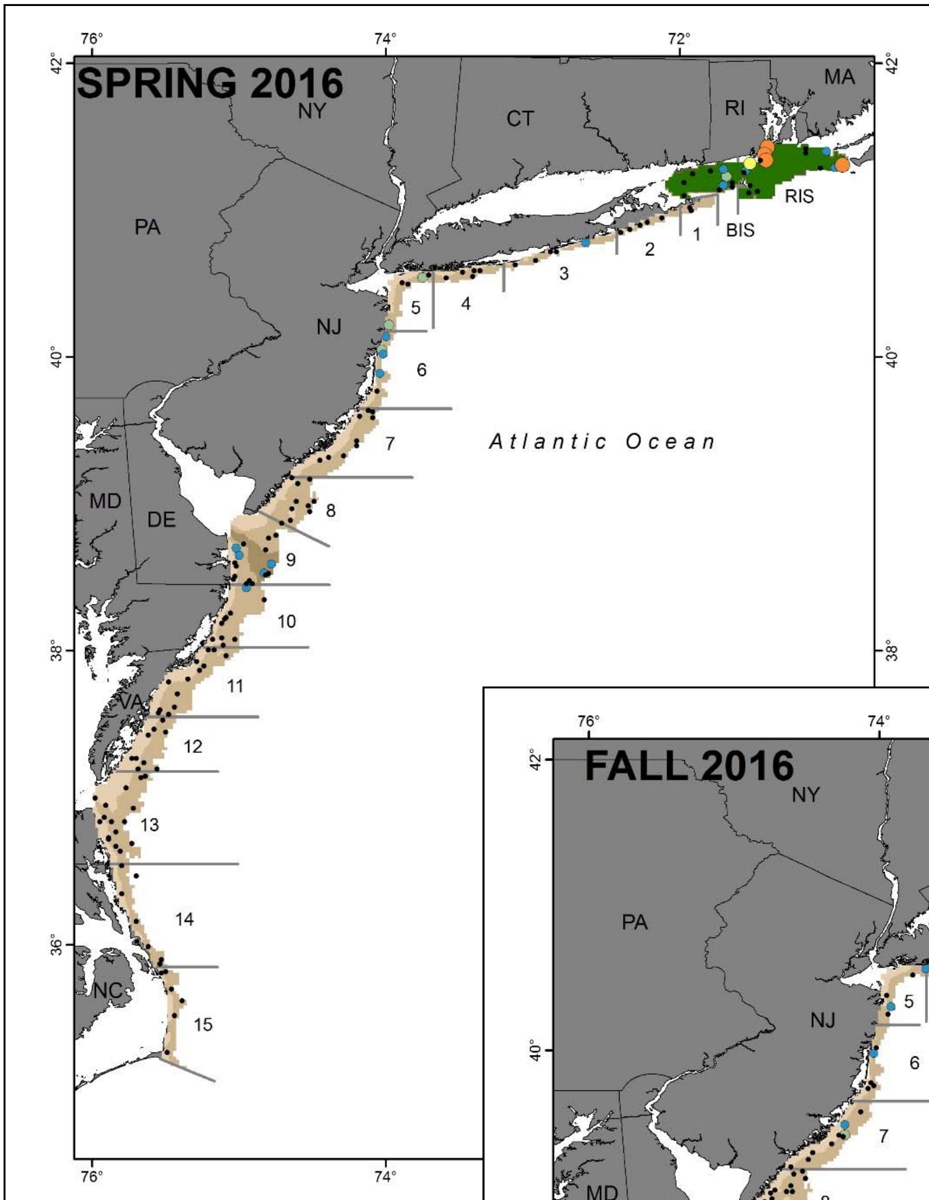


Figure 19. American Goosefish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

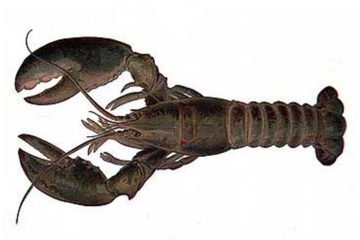


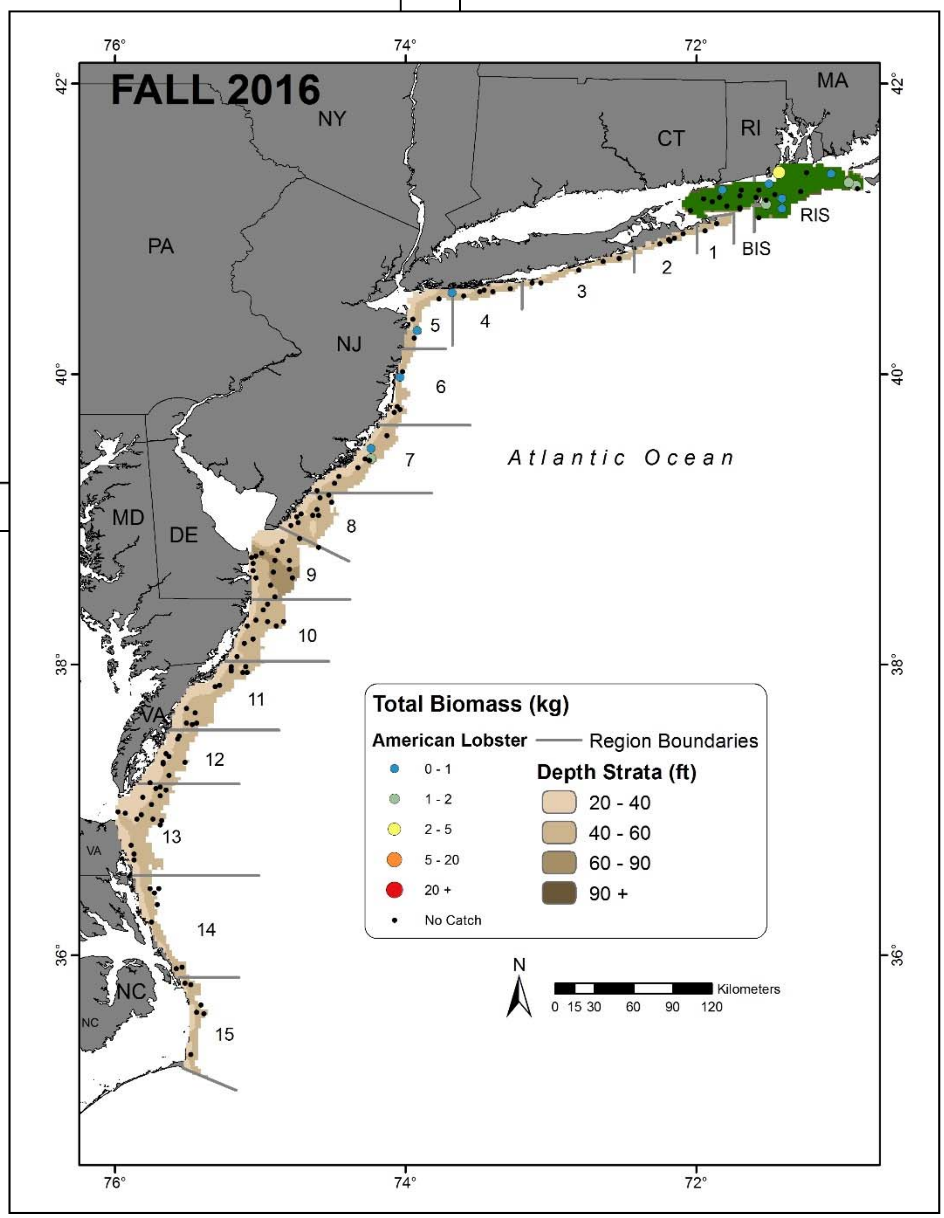


American Lobster

Sampling Priority: E

Figure 20. American Lobster biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(gray) = not used for abundance indices

Table 11. American Lobster sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	519	90.5	80.8	286	N/A	N/A	N/A	N/A
	2009	290	89.9	76.9	248	N/A	N/A	N/A	N/A
	2010	86	24.0	53.8	86	N/A	N/A	N/A	N/A
	2011	216	67.1	69.2	216	N/A	N/A	N/A	N/A
	2012	102	33.2	73.1	102	N/A	N/A	N/A	N/A
	2013	230	67.9	73.1	230	27	0	N/A	N/A
	2014	140	45.0	76.9	140	N/A	N/A	N/A	N/A
	2015	44	24.4	53.8	44	N/A	N/A	N/A	N/A
	2016	195	64.1	42.3	195	N/A	N/A	N/A	N/A
Fall	2007	262	59.1	57.7	262	N/A	N/A	N/A	N/A
	2008	352	80.6	73.1	178	N/A	N/A	N/A	N/A
	2009	89	29.1	69.2	89	N/A	N/A	N/A	N/A
	2010	63	19.4	53.8	63	N/A	N/A	N/A	N/A
	2011	106	28.6	65.4	106	N/A	N/A	N/A	N/A
	2012	127	29.6	38.5	127	N/A	N/A	N/A	N/A
	2013	59	19.7	30.8	59	N/A	N/A	N/A	N/A
	2014	65	18.3	53.8	65	N/A	N/A	N/A	N/A
	2015	179	38.9	65.4	179	N/A	N/A	N/A	N/A
	2016	43	15.1	34.6	43	N/A	N/A	N/A	N/A

Table 12. American Lobster geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by sex.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	27	2.16	4.40	8.20	0.63	1.29	2.21
	2009	26	2.04	3.75	6.42	0.85	1.58	2.60
	2010	26	0.55	1.28	2.38	0.23	0.53	0.92
	2011	26	0.97	2.31	4.57	0.31	0.90	1.76
	2012	26	1.22	2.22	3.67	0.52	0.92	1.43
	2013	26	1.23	2.65	4.97	0.49	1.08	1.91
	2014	26	1.58	2.90	4.89	0.60	1.00	1.50
	2015	26	0.44	0.87	1.43	0.17	0.34	0.54
	2016	26	0.42	1.43	3.16	0.21	0.79	1.65
Female	2007							
	2008	27	1.03	2.30	4.37	0.31	0.74	1.30
	2009	26	1.10	2.26	4.05	0.51	1.07	1.83
	2010	26	0.23	0.70	1.34	0.10	0.32	0.58
	2011	26	0.43	1.23	2.49	0.14	0.55	1.12
	2012	26	0.62	1.31	2.30	0.28	0.60	0.99
	2013	26	0.57	1.37	2.59	0.27	0.69	1.24
	2014	26	0.62	1.19	1.96	0.25	0.46	0.71
	2015	26	0.16	0.39	0.67	0.07	0.18	0.31
	2016	26	0.20	0.80	1.70	0.10	0.44	0.88
Male	2007							
	2008	27	1.21	2.41	4.27	0.31	0.71	1.24
	2009	26	0.90	1.70	2.82	0.32	0.62	0.99
	2010	26	0.29	0.73	1.32	0.10	0.28	0.48
	2011	26	0.59	1.38	2.58	0.16	0.46	0.85
	2012	26	0.52	0.93	1.45	0.19	0.35	0.54
	2013	26	0.64	1.48	2.75	0.20	0.52	0.91
	2014	26	1.04	1.90	3.14	0.33	0.59	0.89
	2015	26	0.24	0.54	0.91	0.08	0.18	0.29
	2016	26	0.22	0.97	2.17	0.10	0.52	1.10

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	26	0.97	2.39	4.83	0.33	0.86	1.61
	2008	26	1.74	3.17	5.34	0.50	1.03	1.76
	2009	26	0.79	1.58	2.74	0.26	0.57	0.96
	2010	26	0.47	1.01	1.74	0.14	0.36	0.63
	2011	26	0.96	1.92	3.35	0.32	0.67	1.12
	2012	26	0.39	1.15	2.32	0.14	0.50	0.98
	2013	26	0.15	0.59	1.20	0.07	0.30	0.59
	2014	26	0.56	1.19	2.09	0.20	0.46	0.77
	2015	26	1.05	1.95	3.25	0.35	0.74	1.23
	2016	26	0.20	0.62	1.19	0.08	0.28	0.52
Female	2007	26	0.55	1.47	2.93	0.15	0.51	0.98
	2008	26	0.83	1.71	3.00	0.27	0.65	1.15
	2009	26	0.21	0.61	1.15	0.07	0.25	0.46
	2010	26	0.12	0.44	0.84	0.03	0.19	0.38
	2011	26	0.47	1.01	1.75	0.14	0.38	0.68
	2012	26	0.20	0.68	1.35	0.08	0.31	0.58
	2013	26	0.00	0.32	0.74	0.00	0.16	0.34
	2014	26	0.13	0.40	0.73	0.05	0.16	0.28
	2015	26	0.08	0.54	1.20	0.02	0.25	0.54
	2016	26	0.05	0.25	0.49	0.02	0.11	0.20
Male	2007	26	0.50	1.32	2.58	0.17	0.49	0.92
	2008	26	0.80	1.72	3.11	0.16	0.54	1.04
	2009	26	0.46	1.00	1.73	0.14	0.35	0.61
	2010	26	0.31	0.64	1.06	0.08	0.19	0.31
	2011	26	0.51	1.11	1.94	0.16	0.35	0.57
	2012	26	0.21	0.77	1.58	0.04	0.31	0.64
	2013	26	0.12	0.40	0.76	0.05	0.20	0.36
	2014	26	0.43	0.95	1.65	0.15	0.36	0.60
	2015	26	0.80	1.53	2.57	0.27	0.58	0.95
	2016	26	0.16	0.49	0.92	0.05	0.21	0.39

Figure 21. American Lobster geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured, and by sex.

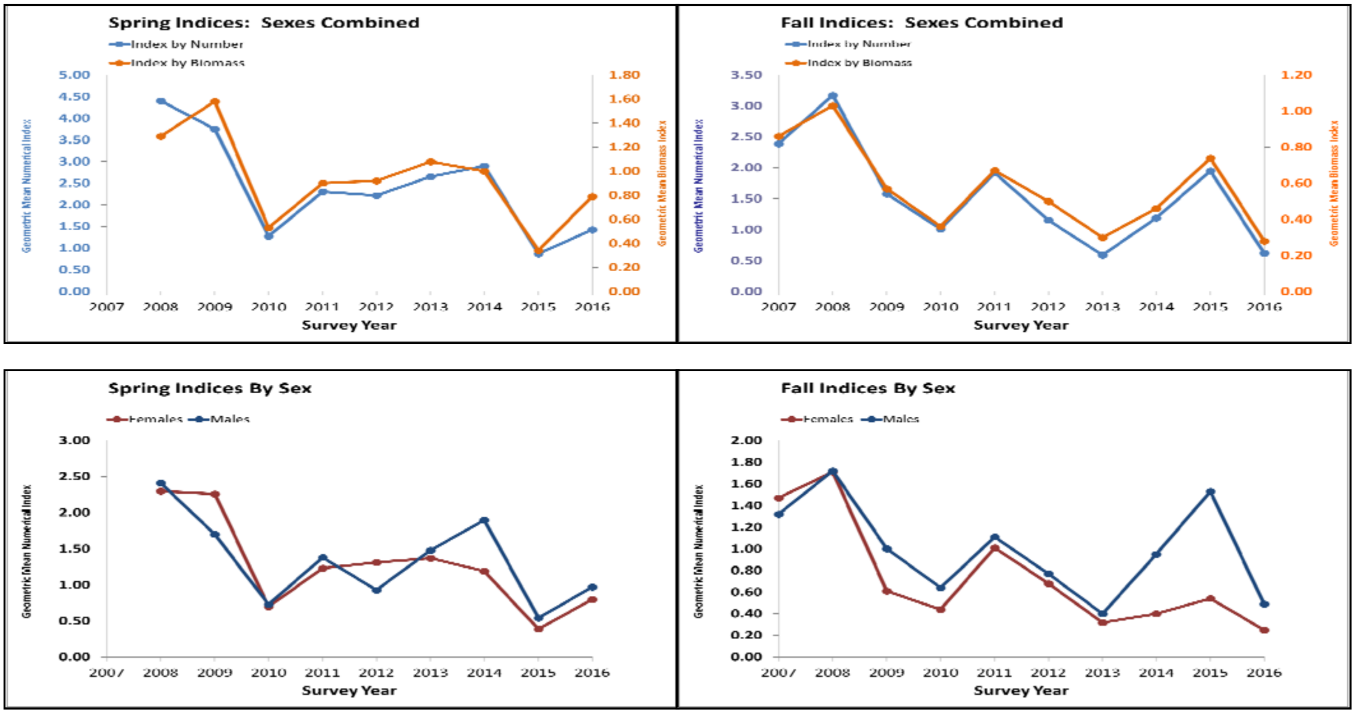


Figure 22. American Lobster length-frequency distributions, by cruise.

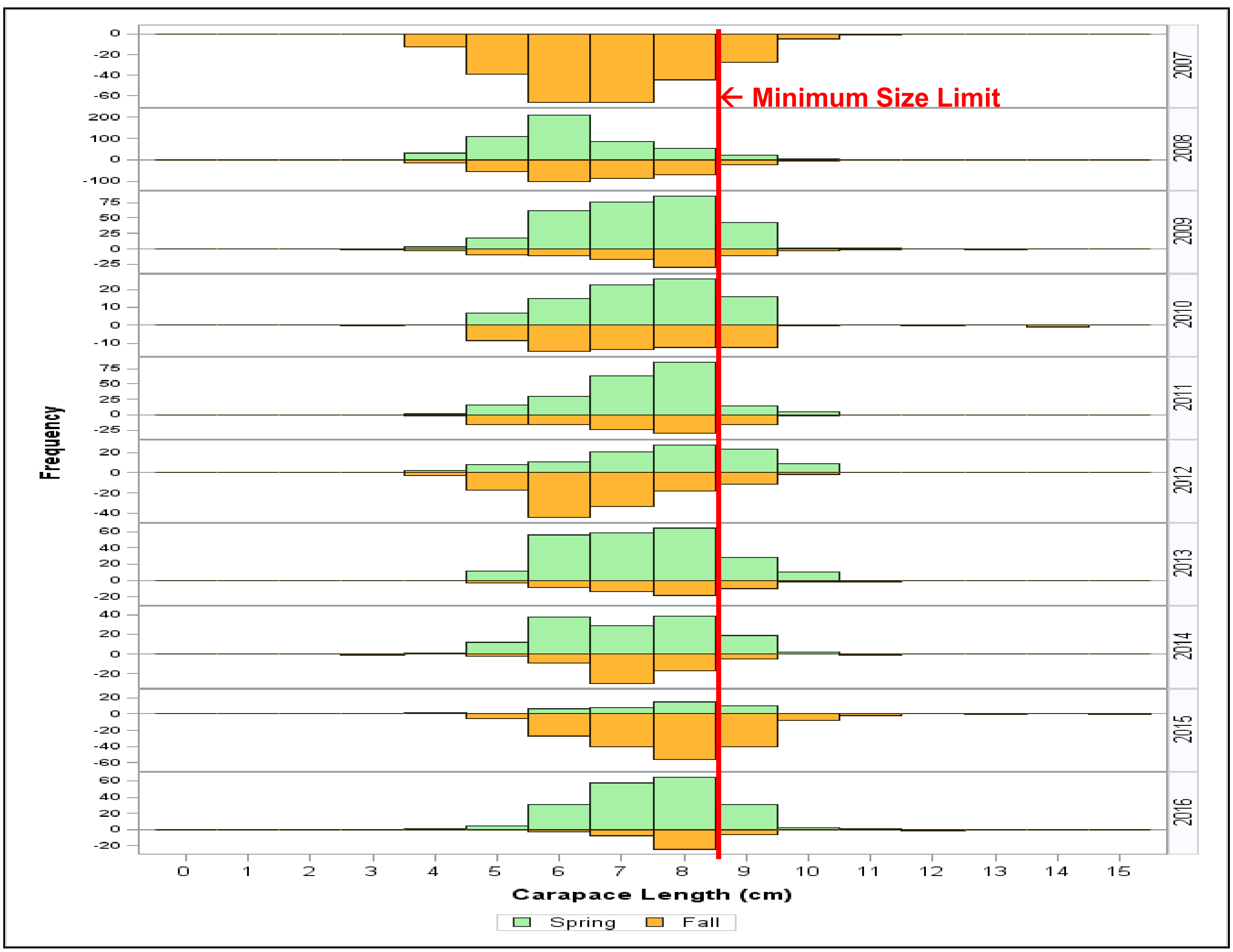


Figure 23. American Lobster length-frequency distributions, by cruise and sex.

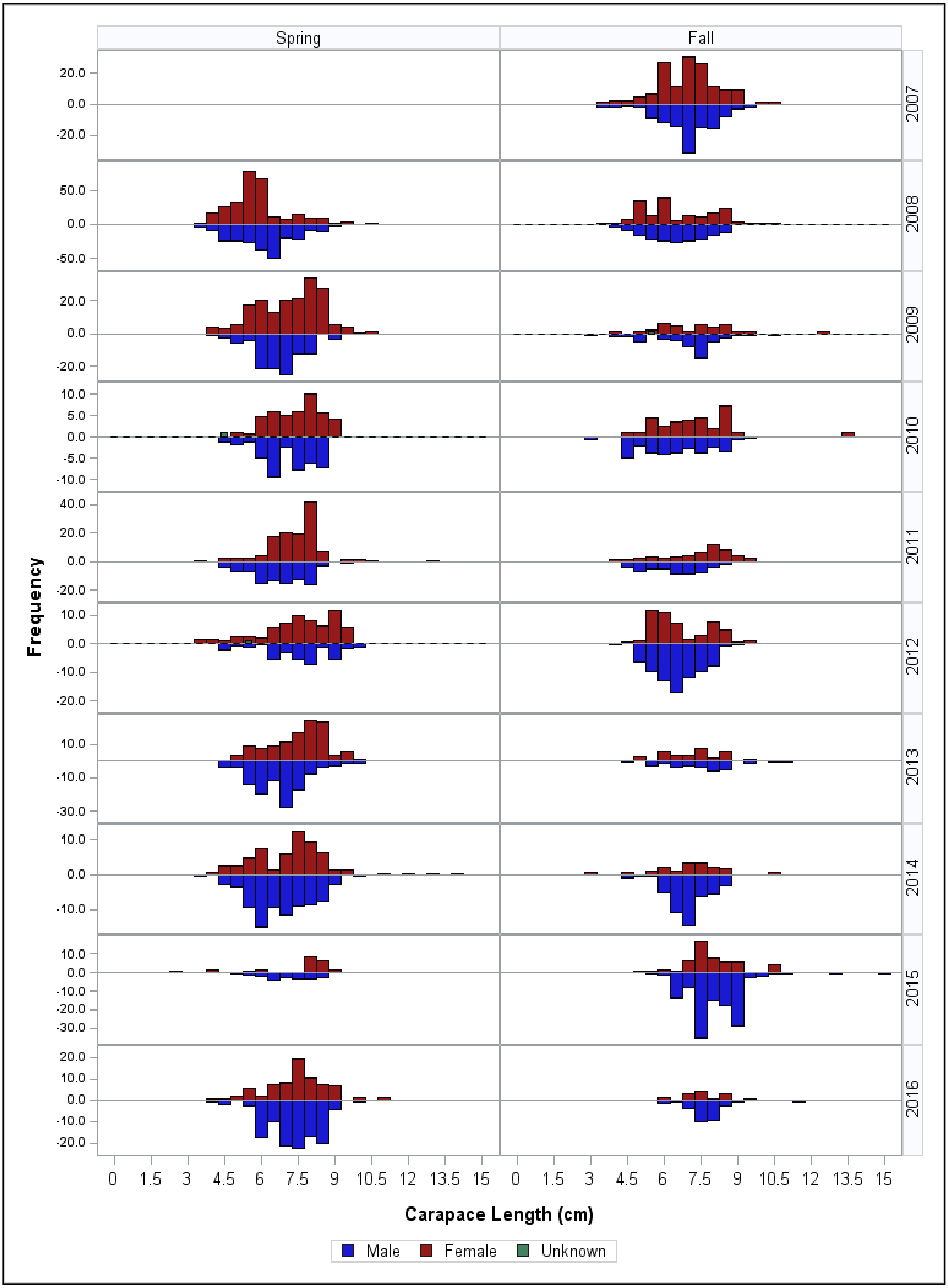


Figure 24. American Lobster sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

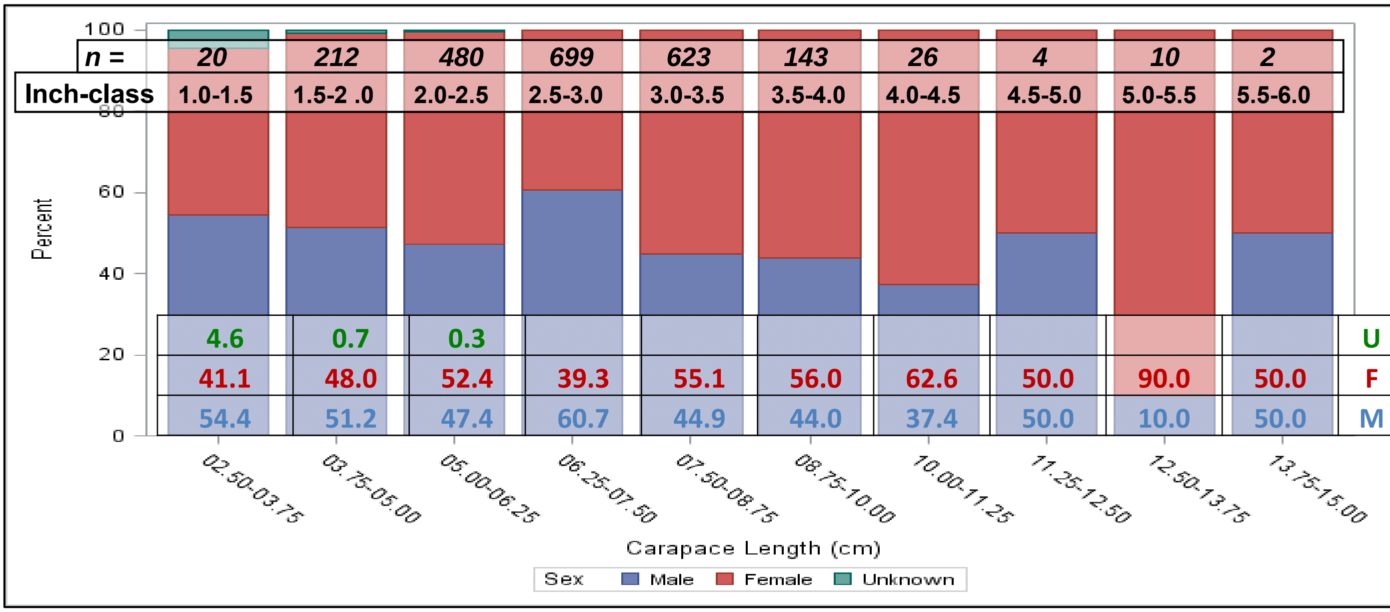


Figure 25. American Lobster disease status (percent positive) by cruise, 2010-2016.

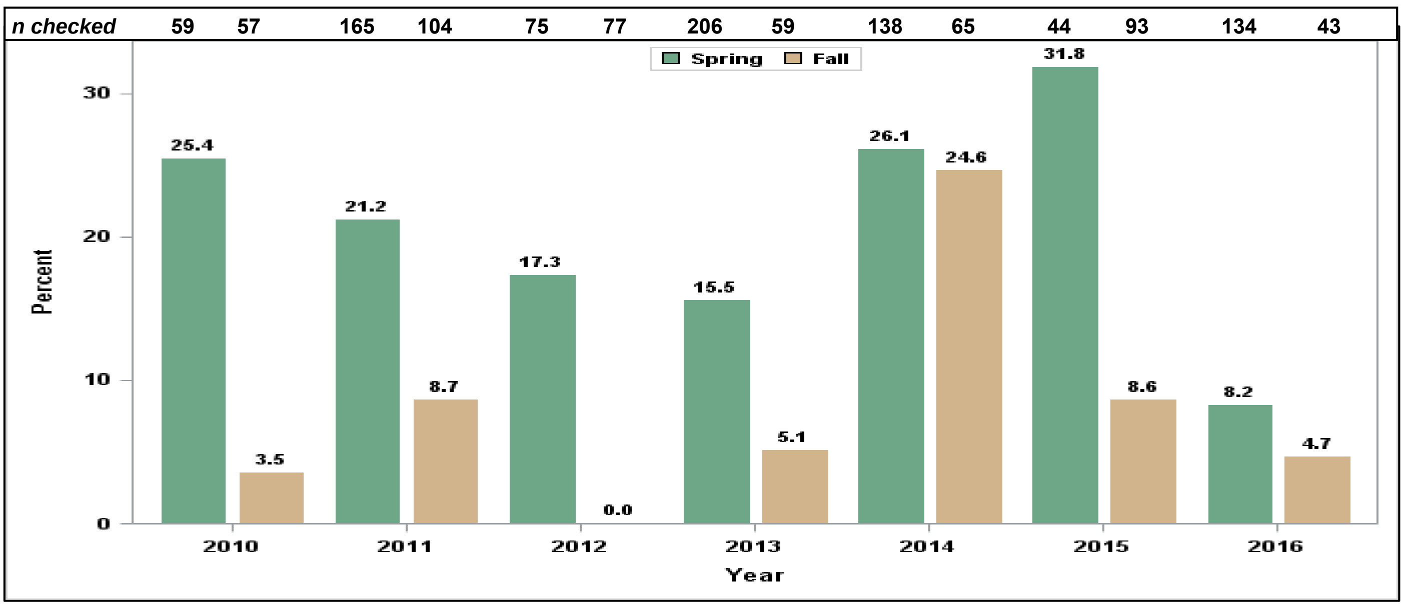
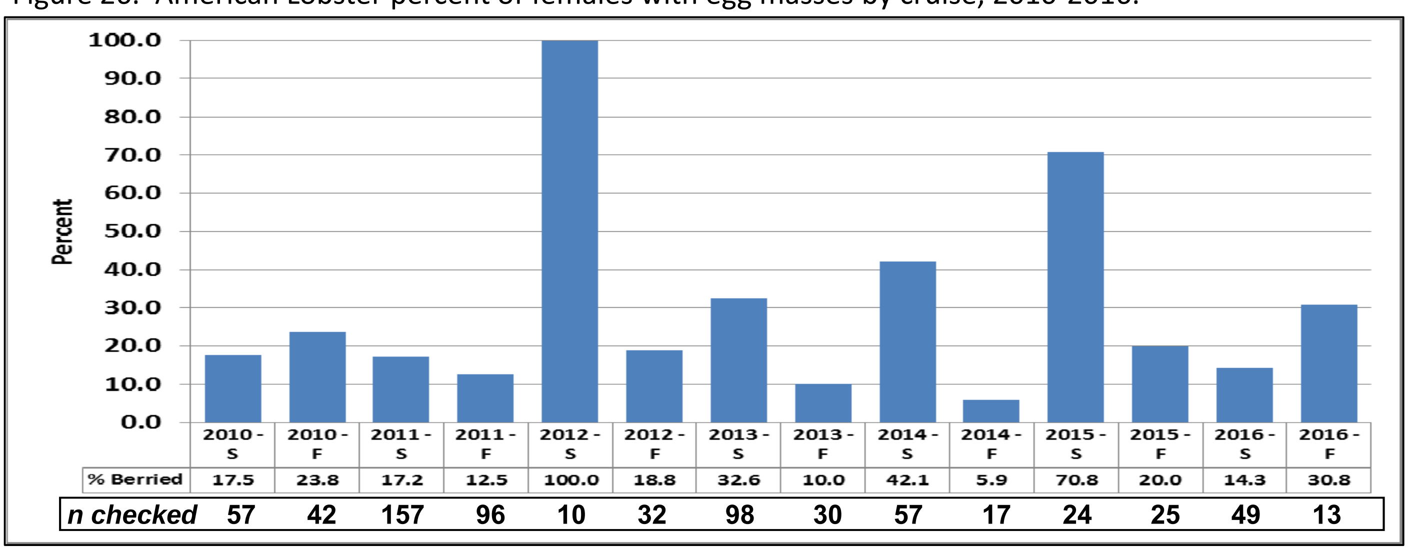
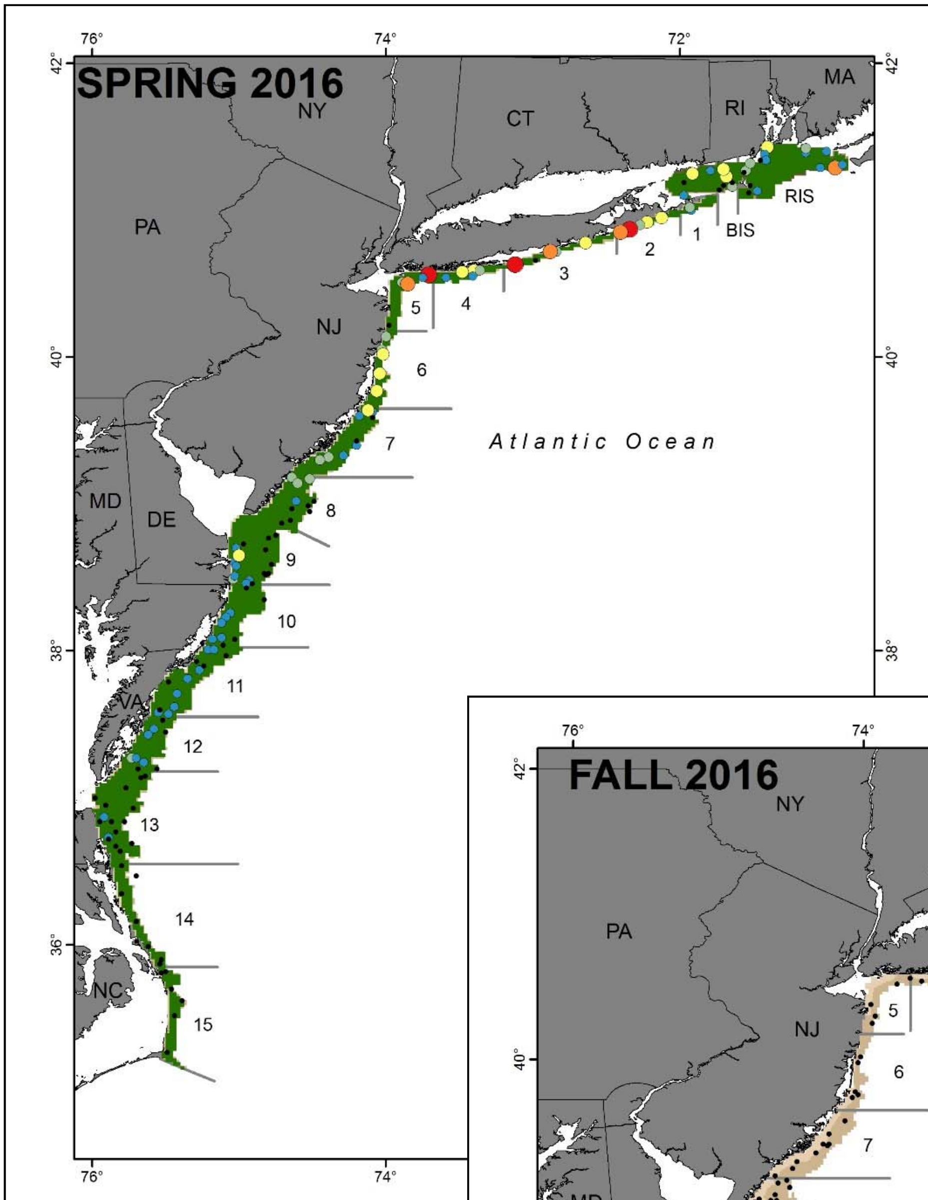


Figure 26. American Lobster percent of females with egg masses by cruise, 2010-2016.





American Shad

Sampling Priority: A

Figure 27. American shad biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(grey) = not used for abundance indices

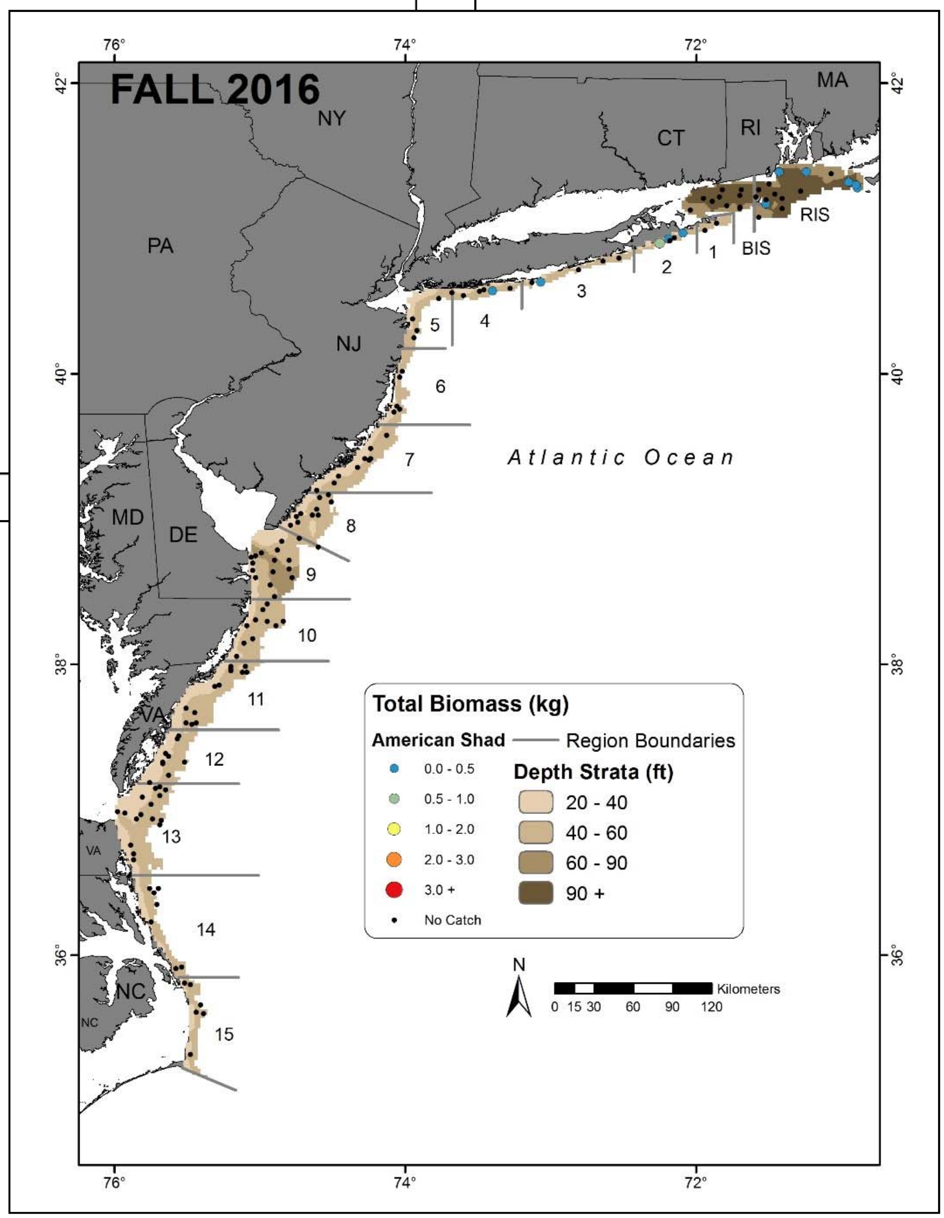


Table 13. American Shad sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1205	40.8	58.0	1,205	327	0	321	0
	2009	1141	33.2	50.0	859	260	0	260	9
	2010	1236	43.8	53.3	942	274	0	273	22
	2011	1712	73.6	40.0	1,418	251	0	250	249
	2012	1193	40.4	52.7	1,193	301	0	297	289
	2013	2755	73.4	60.7	2,210	371	0	369	368
	2014	1619	47.3	40.7	1,619	226	0	184	182
	2015	3343	99.1	49.3	1,638	282	0	192	190
	2016	2051	60.5	55.3	1,929	351	0	215	214
Fall	2007	9	0.8	0.0	9	9	0	9	0
	2008	9	0.5	0.0	9	5	0	5	0
	2009	28	3.1	0.0	28	10	0	10	9
	2010	32	1.1	0.0	6	3	0	3	3
	2011	13	1.3	0.0	13	13	0	13	11
	2012	47	4.6	0.0	47	23	0	20	18
	2013	0	0.0	0.0					
	2014	31	3.1	0.0	31	11	0	9	9
	2015	3	0.2	0.0	3	3	0	1	1
	2016	21	2.1	0.0	21	21	0	7	7

Table 14. American Shad geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

Age	Year	n	Numerical Index			Biomass Index		
			LCI	**Index**	UCI	LCI	**Index**	UCI
All	2007							
	2008	150	1.70	**2.21**	2.83	0.15	**0.19**	0.24
	2009	160	1.02	**1.40**	1.84	0.09	**0.14**	0.19
	2010	150	1.24	**1.68**	2.19	0.11	**0.18**	0.24
	2011	150	1.02	**1.45**	1.97	0.14	**0.21**	0.28
	2012	150	1.34	**1.70**	2.10	0.12	**0.16**	0.20
	2013	150	2.28	**2.97**	3.80	0.18	**0.24**	0.30
	2014	150	0.98	**1.42**	1.96	0.11	**0.18**	0.25
	2015	150	1.37	**1.99**	2.76	0.13	**0.24**	0.35
	2016	150	1.89	**2.48**	3.20	0.20	**0.26**	0.33

Figure 28. American Shad geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

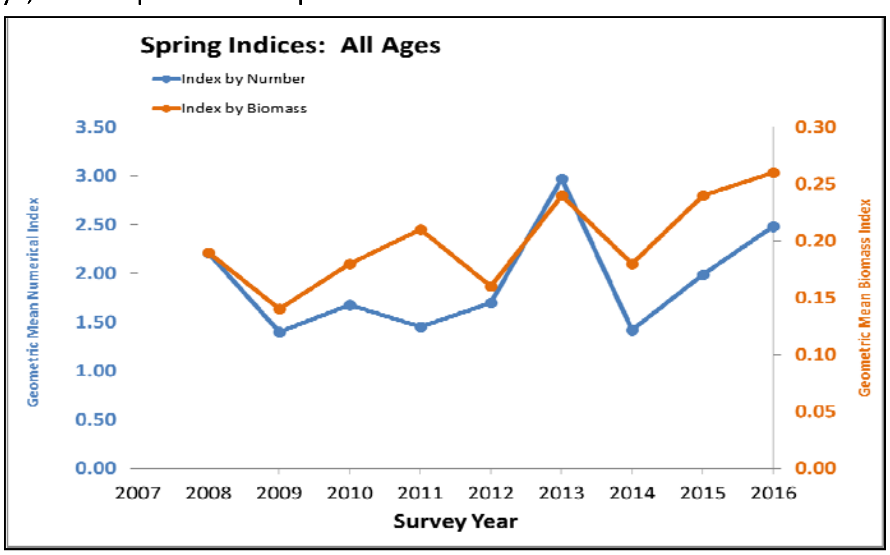


Figure 29. American Shad length-frequency distributions, by cruise.

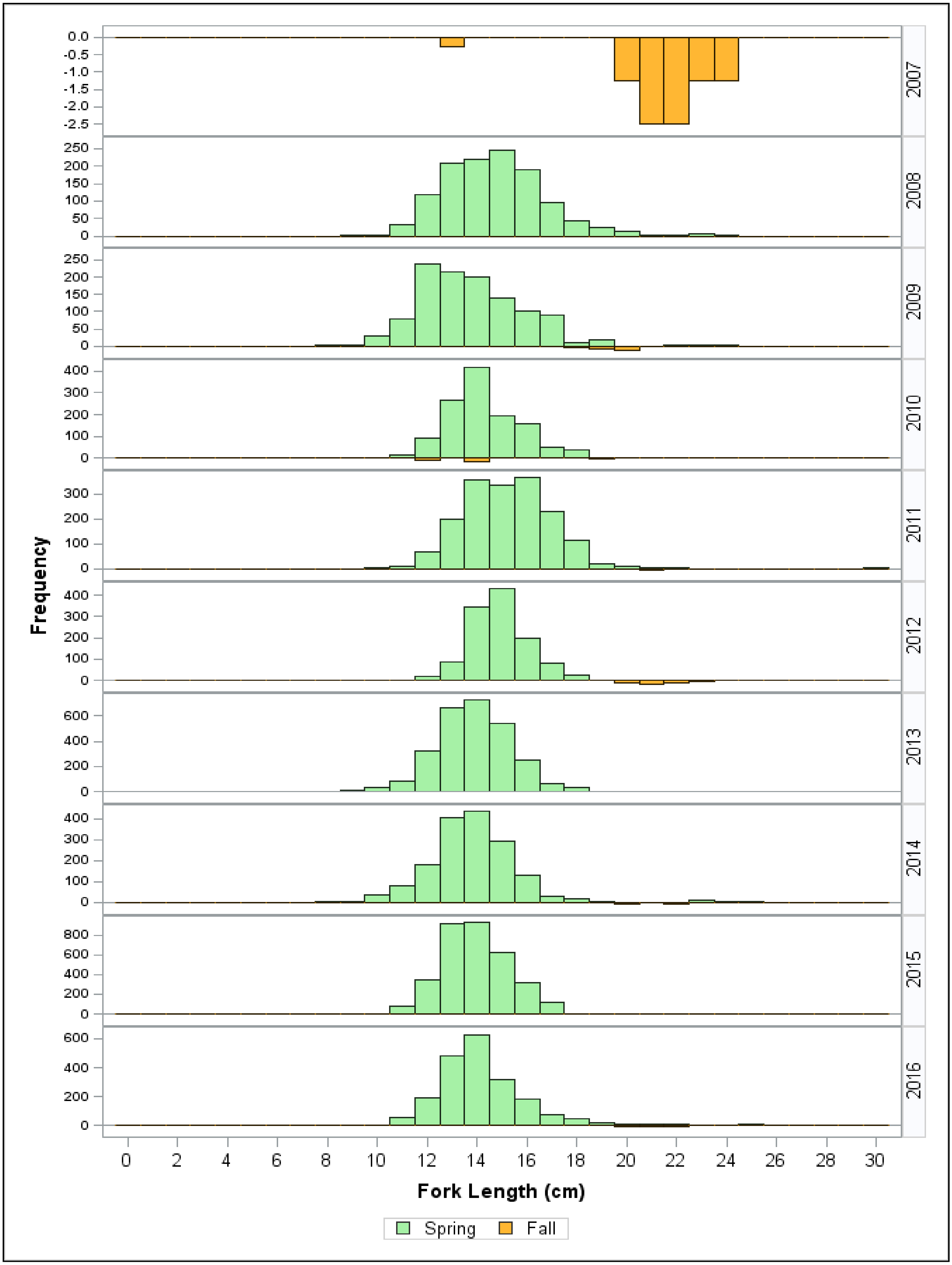


Figure 30. American Shad length-frequency distributions, by cruise and sex.

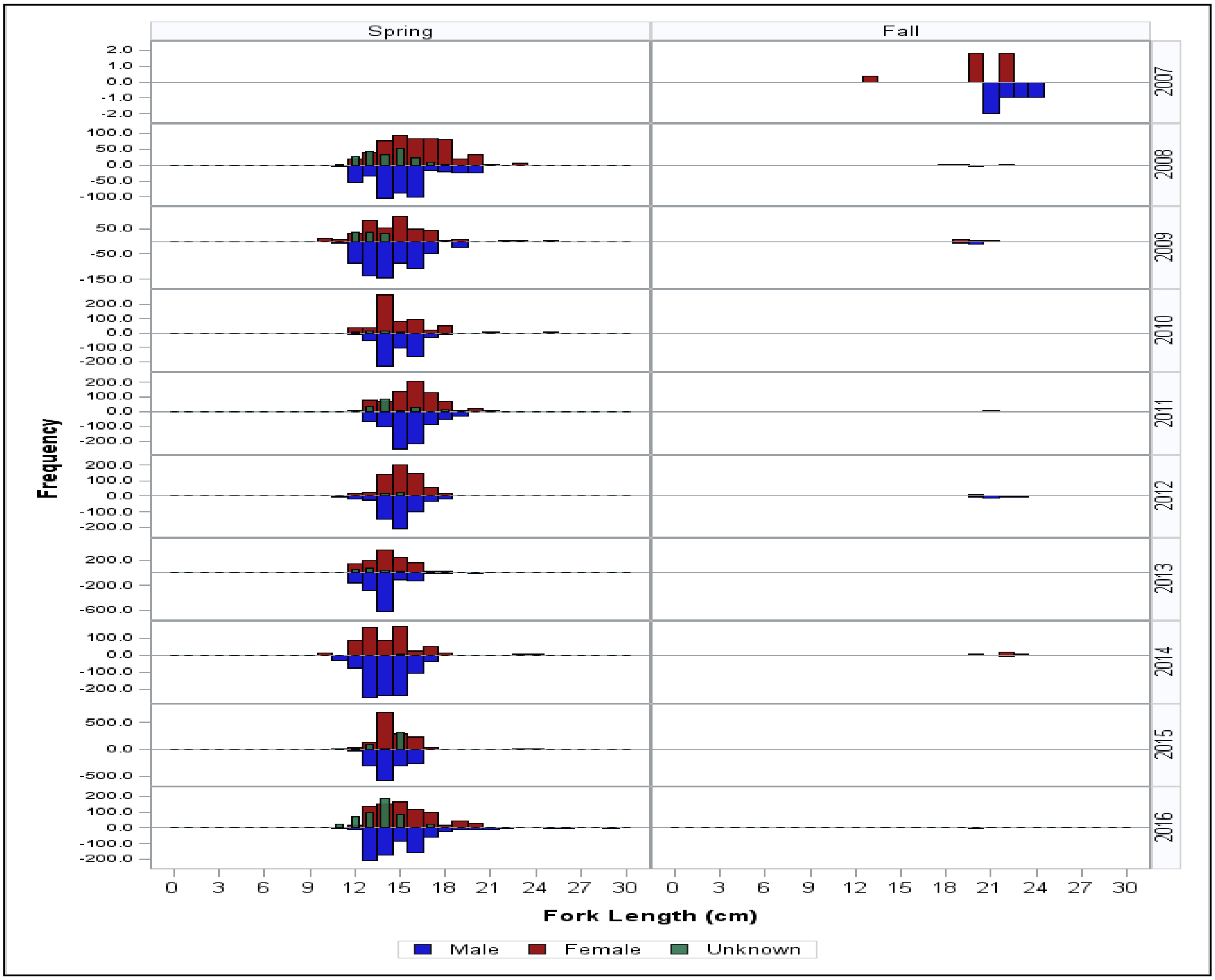


Figure 31. American Shad sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

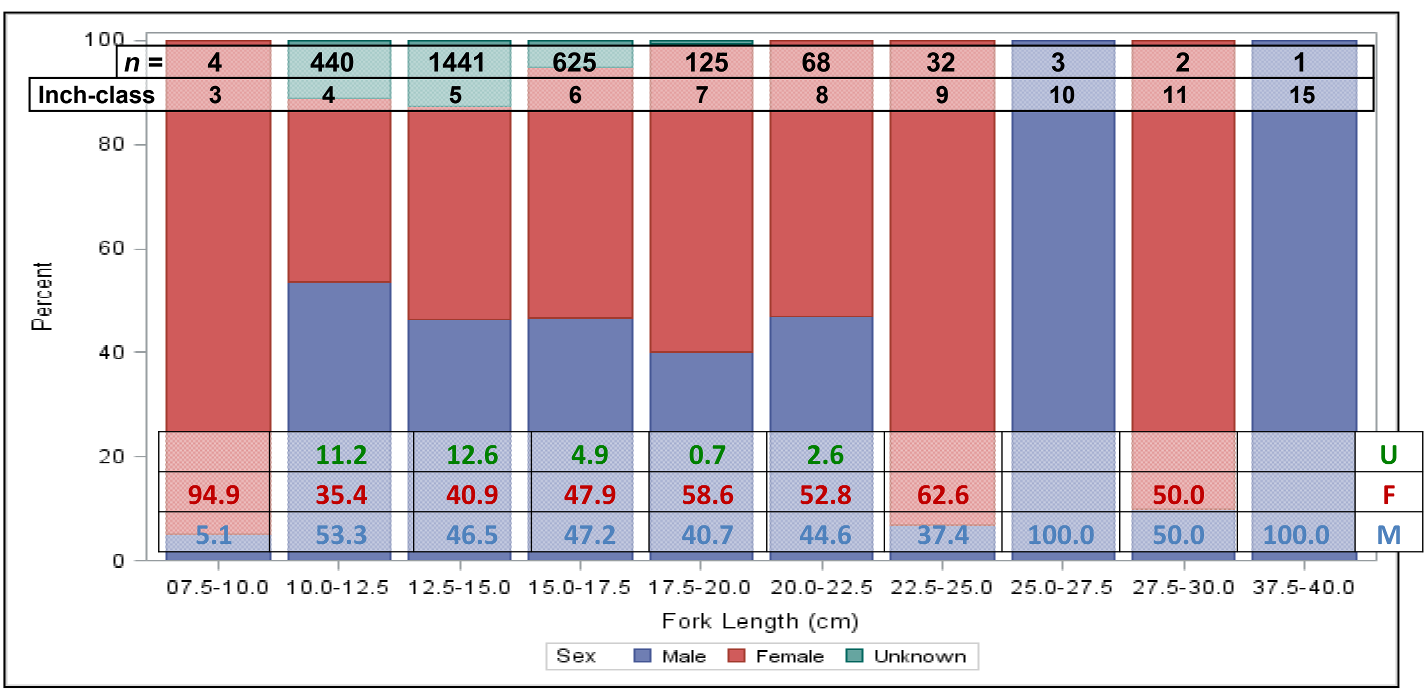
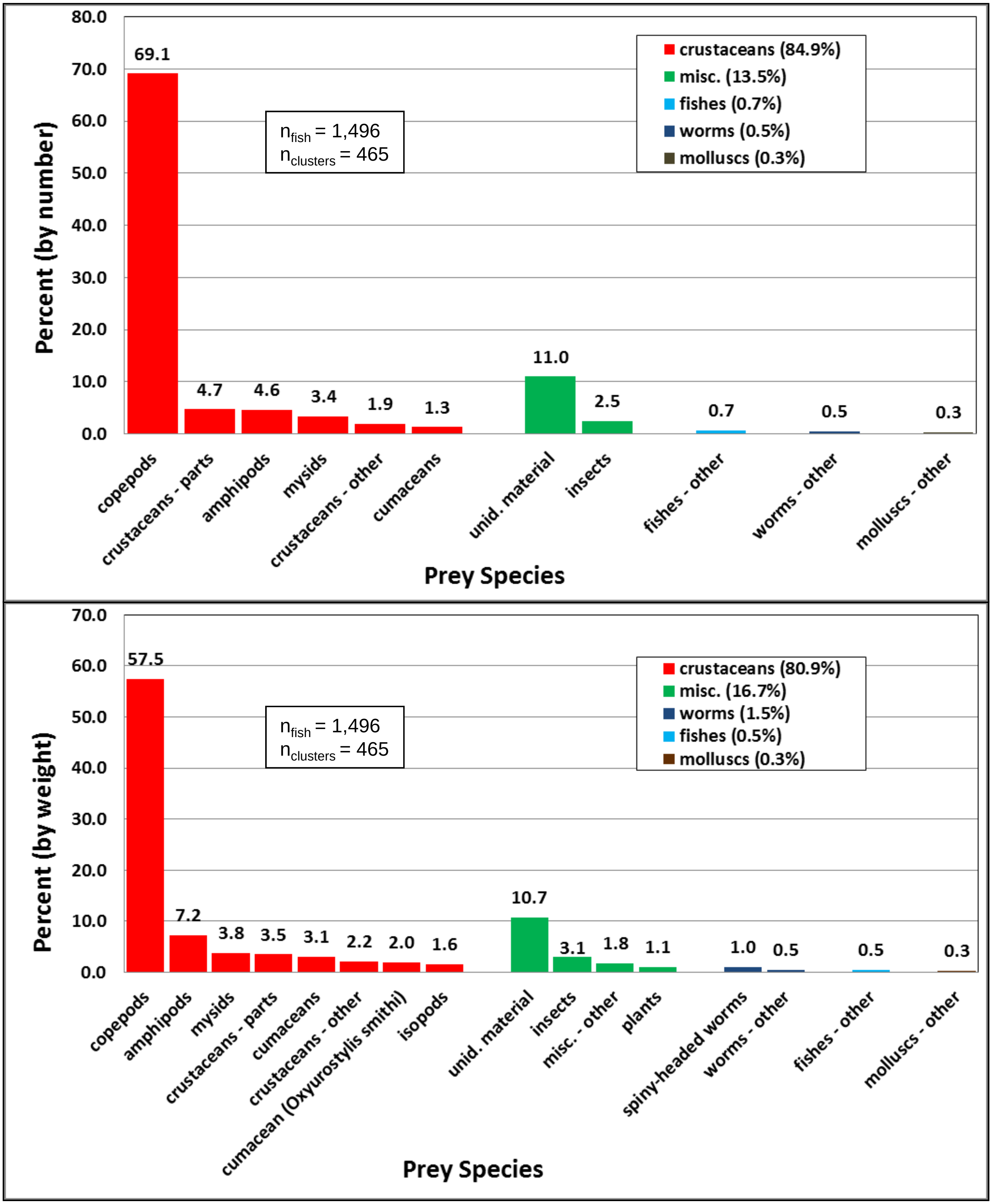


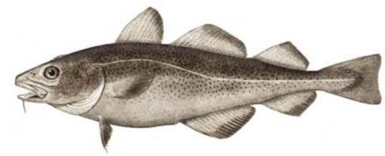
Figure 32. American Shad diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.)

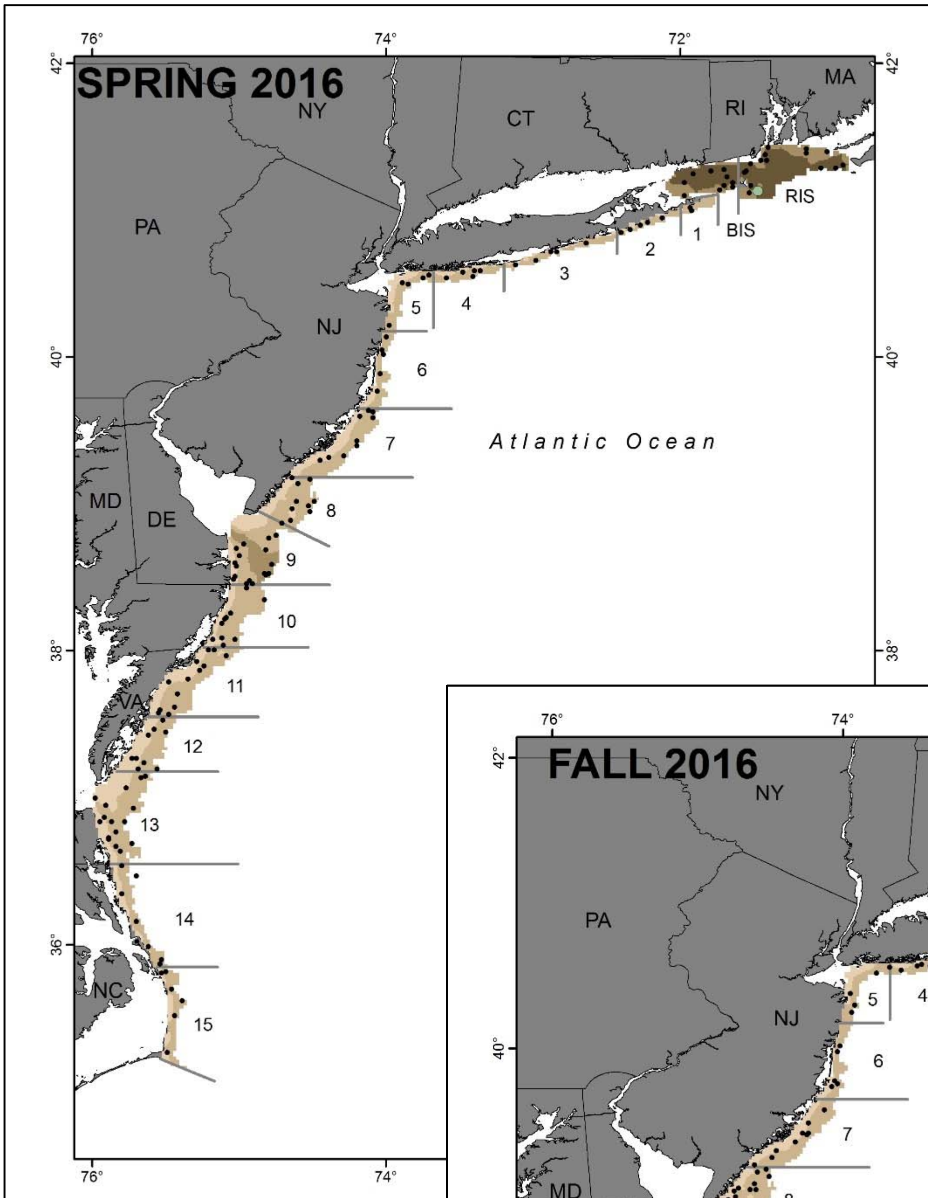


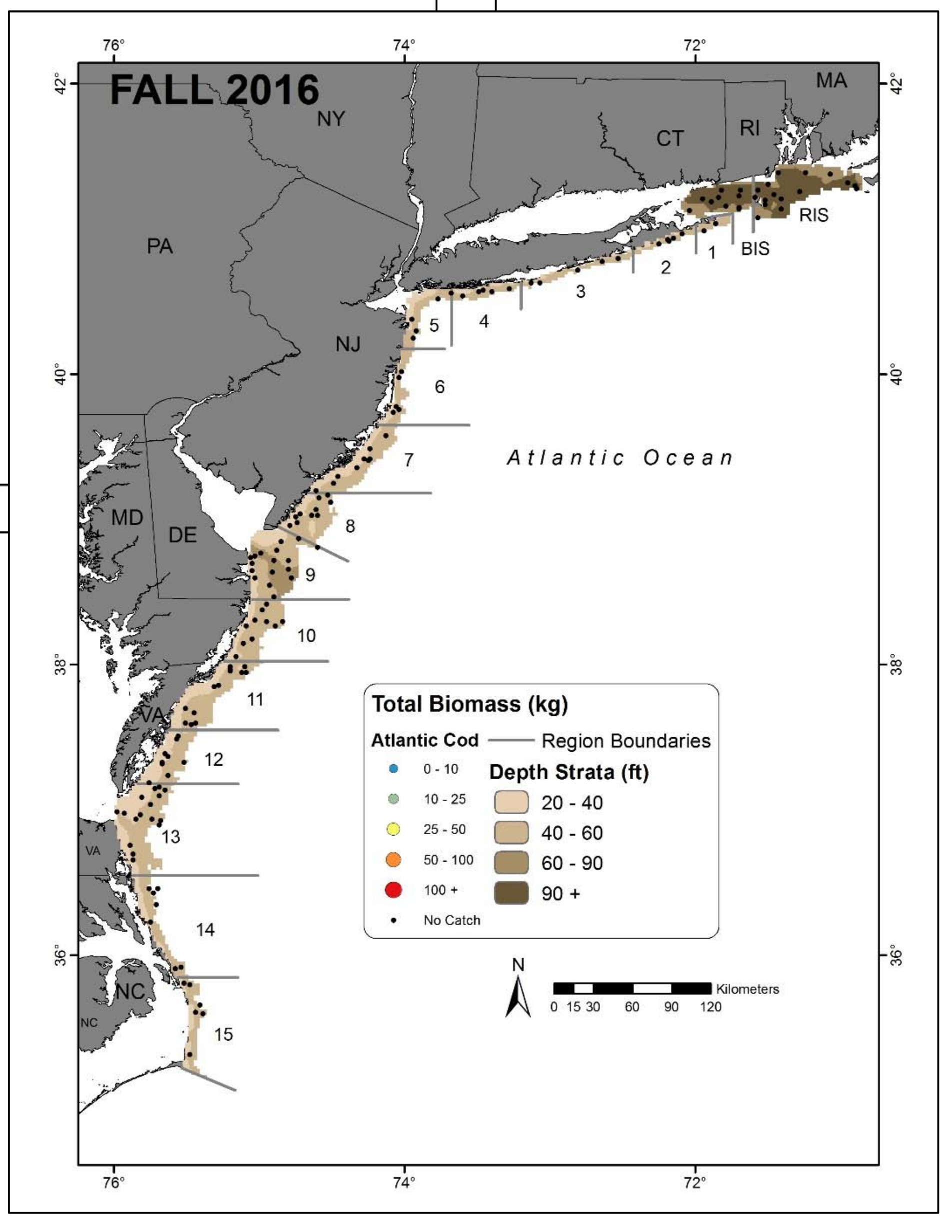
Atlantic Cod

Sampling Priority: A

Figure 33. Atlantic Cod biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices

(gray) = not used for abundance indices

Table 15. Atlantic Cod sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0	N/A	0	0	0	0	0
	2009	2	2.3	N/A	2	2	0	1	1
	2010	0	0.0	N/A	0	0	0	0	0
	2011	15	4.8	N/A	15	15	0	13	13
	2012	6	13.6	N/A	6	6	0	6	6
	2013	3	5.8	N/A	3	3	0	3	3
	2014	1	1.1	N/A	1	1	0	1	1
	2015	3	6.9	N/A	3	3	0	3	3
	2016	1	3.2	N/A	1	1	0	1	0
Fall	2007	0	0.0	N/A	0	0	0	0	0
	2008	0	0.0	N/A	0	0	0	0	0
	2009	0	0.0	N/A	0	0	0	0	0
	2010	0	0.0	N/A	0	0	0	0	0
	2011	0	0.0	N/A	0	0	0	0	0
	2012	0	0.0	N/A	0	0	0	0	0
	2013	0	0.0	N/A	0	0	0	0	0
	2014	0	0.0	N/A	0	0	0	0	0
	2015	0	0.0	N/A	0	0	0	0	0
	2016	0	0.0	N/A	0	0	0	0	0

Figure 34. Atlantic Cod length-frequency distributions, by cruise.

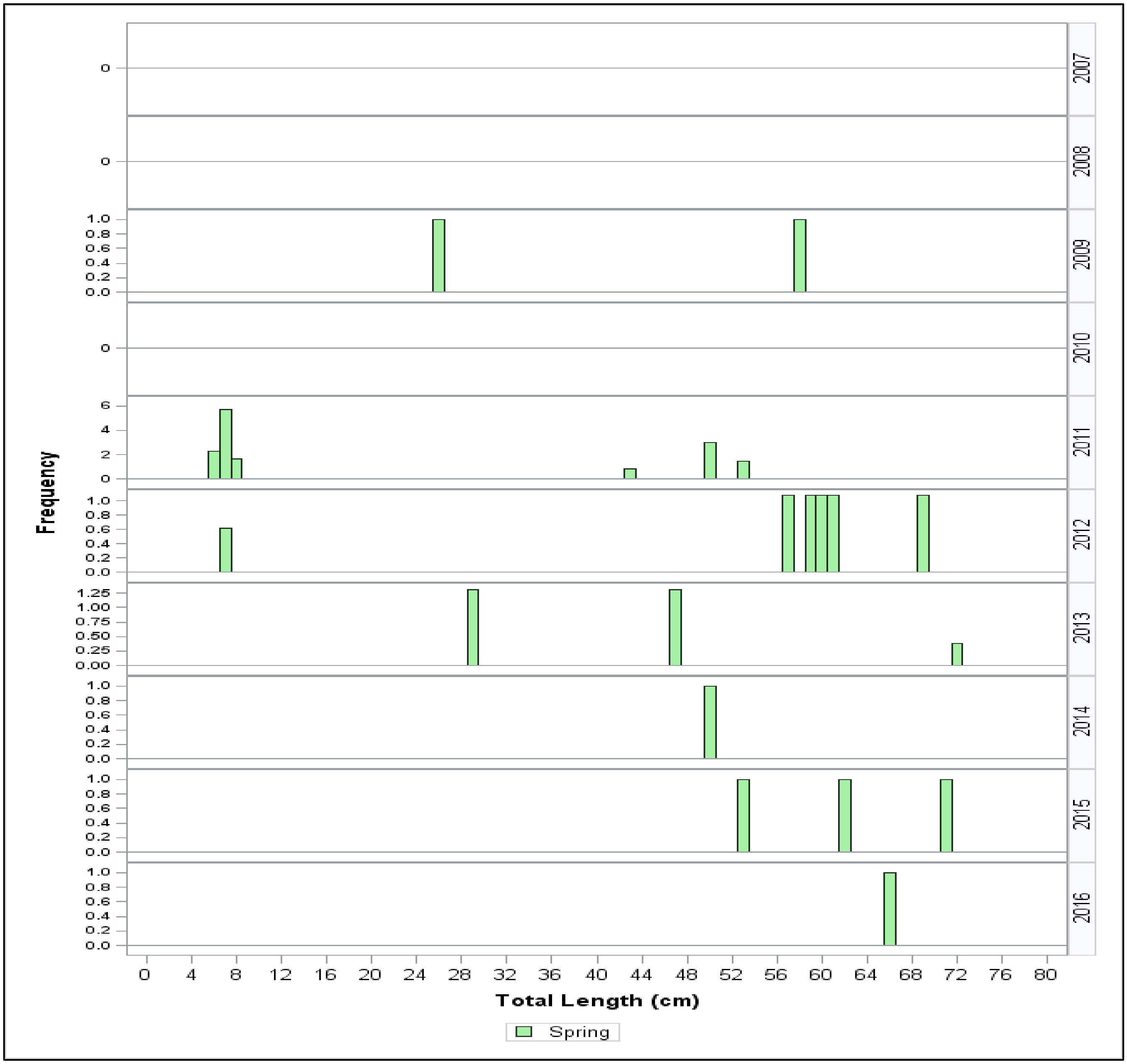
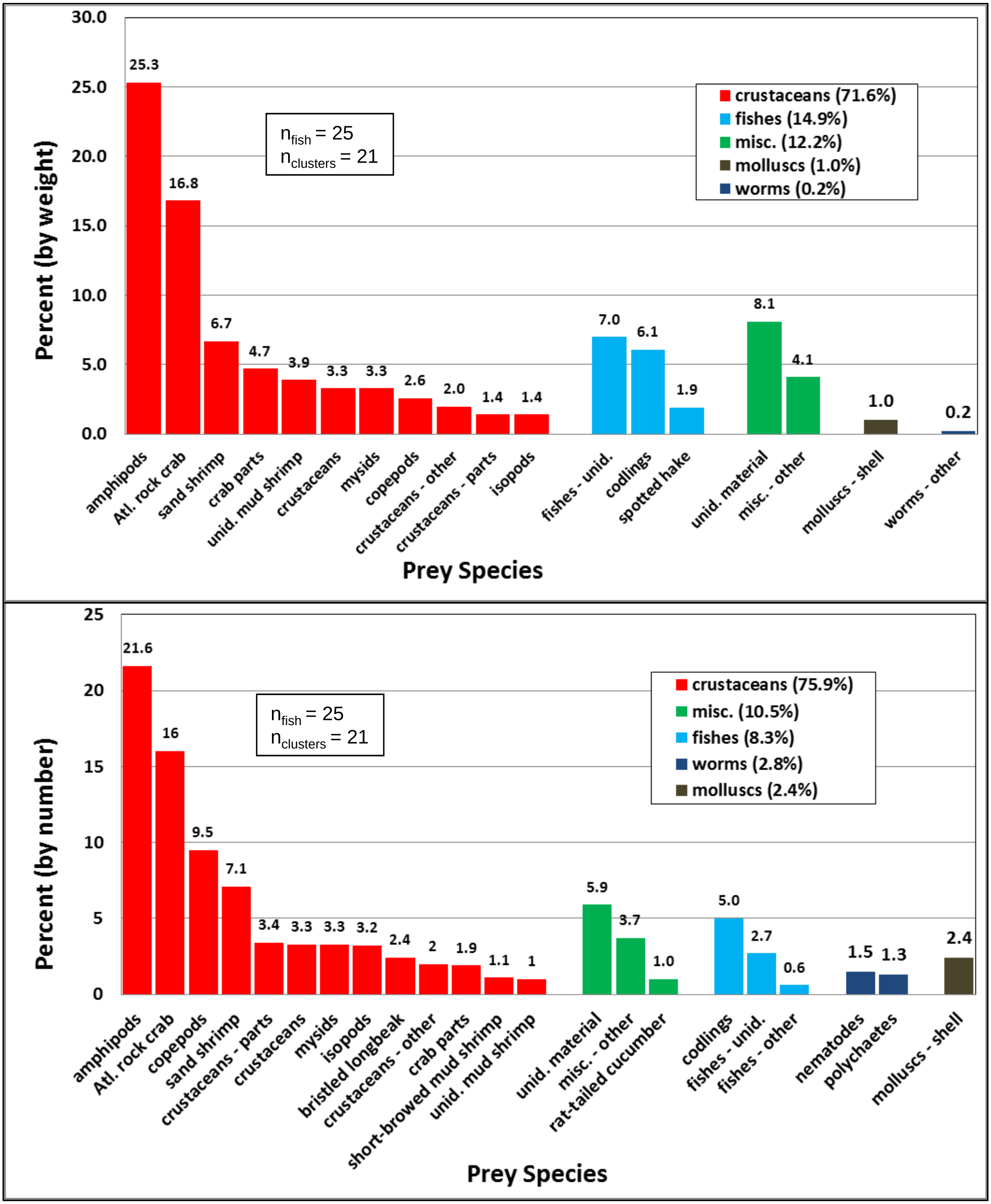


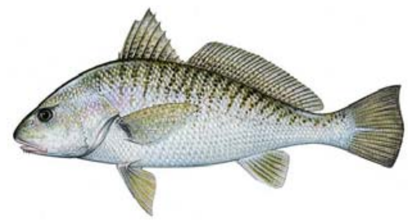
Figure 35. Atlantic Cod diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

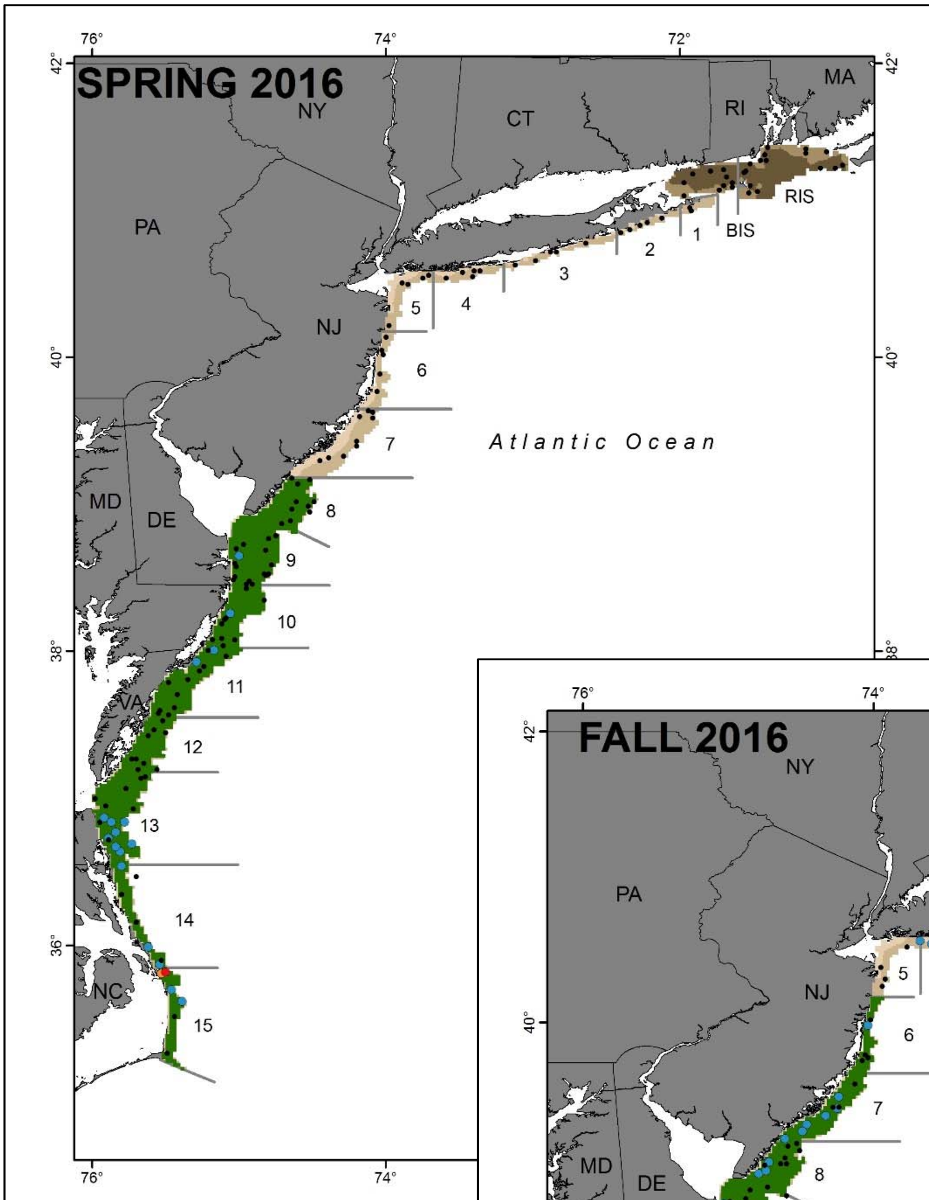


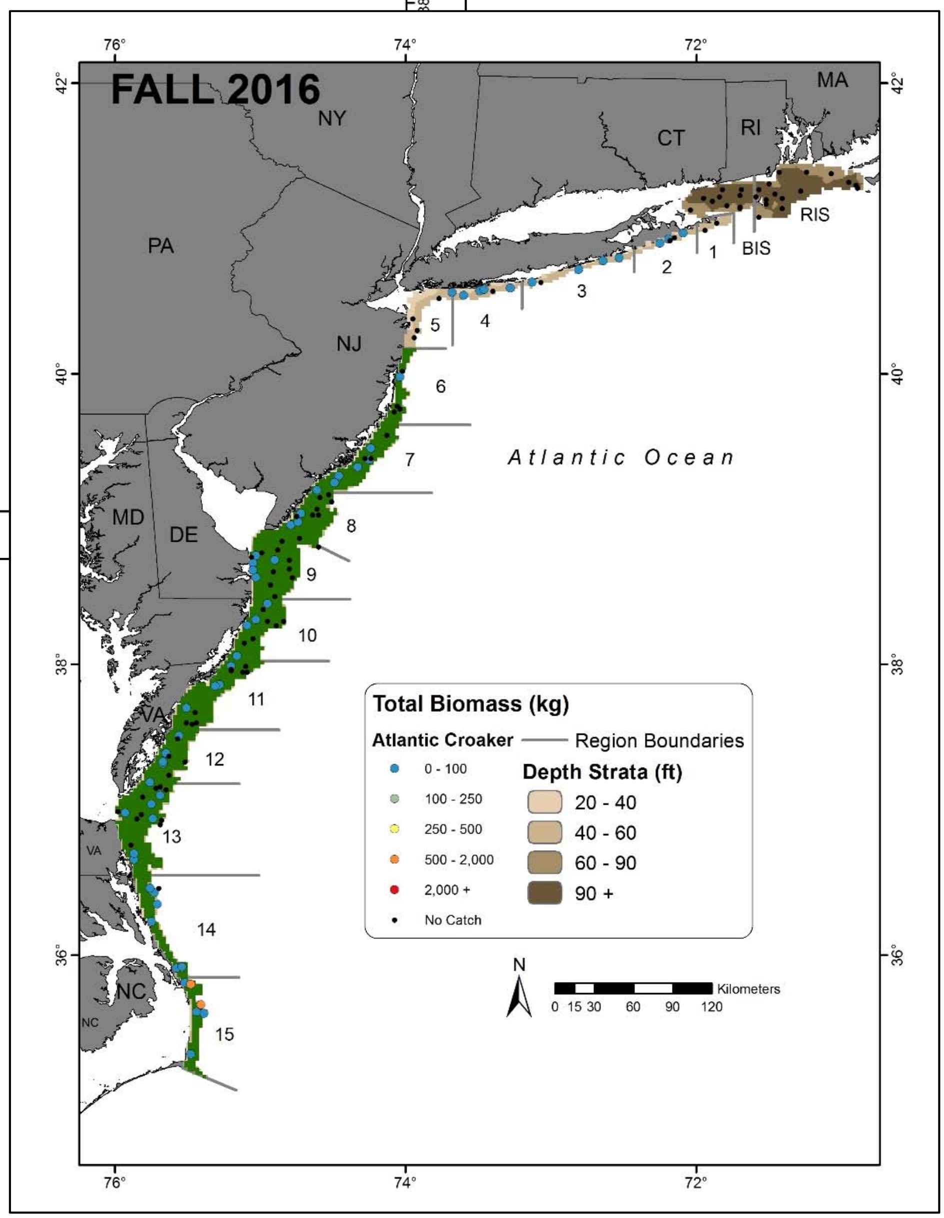
Atlantic Croaker

Sampling Priority: A

Figure 36. Atlantic Croaker biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

	= used for abundance indices
	= not used for abundance indices

Table 16. Atlantic Croaker sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	467	25.0	46.2	212	41	41	38	38
	2009	17,040	1,004.3	76.9	1,225	80	78	66	60
	2010	29,365	1,656.2	76.9	929	49	49	48	13
	2011	10,576	349.2	76.9	890	71	70	62	62
	2012	536	53.5	84.6	347	90	90	75	74
	2013	41,571	3,098.7	100.0	4,487	297	297	201	195
	2014	9,677	788.5	84.6	2,425	238	238	161	158
	2015	4,243	565.0	100.0	1,821	193	193	115	113
	2016	57,287	2,695.7	53.8	1,553	60	60	38	37
Fall	2007	58,763	7,616.5	73.5	2,843	211	211	194	188
	2008	66,823	5,123.2	65.7	3,591	307	307	283	280
	2009	45,730	5,685.3	82.4	5,277	415	414	341	291
	2010	73,685	5,715.1	59.8	4,095	275	271	217	213
	2011	58,671	6,148.1	70.6	5,561	324	323	297	291
	2012	319,363	21,696.4	79.4	21,456	415	415	322	314
	2013	97,463	10,425.9	67.6	8,574	295	295	204	192
	2014	40,543	4,082.5	49.0	5,219	225	225	153	150
	2015	20,839	1,943.8	36.3	1,912	143	143	59	59
	2016	37,127	1,680.9	45.1	2,001	173	173	57	57

Table 17. Atlantic Croaker geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP surveys.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	86	0.21	0.55	1.00	0.02	0.13	0.26
	2009	91	0.56	1.18	2.05	0.18	0.45	0.78
	2010	87	0.12	0.54	1.12	0.00	0.24	0.55
	2011	87	0.42	0.89	1.51	0.12	0.32	0.57
	2012	87	0.51	0.84	1.24	0.07	0.19	0.32
	2013	87	6.72	10.96	17.53	1.59	2.52	3.79
	2014	87	2.51	4.47	7.50	0.68	1.24	1.98
	2015	87	1.86	3.08	4.82	0.49	0.89	1.38
	2016	87	0.23	0.69	1.33	0.05	0.30	0.62
0	2007							
	2008	86	0.00	0.14	0.33	0.00	0.03	0.07
	2009	91	0.00	0.00	0.00	0.00	0.00	0.00
	2010	87	0.00	0.00	0.00	0.00	0.00	0.00
	2011	87	0.19	0.51	0.92	0.05	0.19	0.36
	2012	87	0.02	0.15	0.29	0.00	0.02	0.03
	2013	87	0.79	1.16	1.60	0.15	0.24	0.35
	2014	87	0.00	0.00	0.00	0.00	0.00	0.00
	2015	87	0.07	0.17	0.28	0.01	0.02	0.04
	2016	87	0.00	0.00	0.00	0.00	0.00	0.00
1	2007							
	2008	86	0.02	0.24	0.50	0.00	0.07	0.16
	2009	91	0.53	1.10	1.88	0.16	0.43	0.76
	2010	87	0.06	0.40	0.84	0.00	0.18	0.44
	2011	87	0.32	0.74	1.27	0.10	0.31	0.55
	2012	87	0.21	0.38	0.58	0.02	0.08	0.14
	2013	87	4.74	7.84	12.63	1.30	2.08	3.12
	2014	87	0.85	1.64	2.77	0.23	0.50	0.84
	2015	87	0.30	0.52	0.78	0.05	0.11	0.17
	2016	87	0.02	0.28	0.61	0.00	0.14	0.31
2	2007							
	2008	86	0.08	0.27	0.49	0.00	0.07	0.14
	2009	91	0.18	0.50	0.90	0.03	0.21	0.42
	2010	87	0.06	0.43	0.92	0.00	0.21	0.52
	2011	87	0.17	0.37	0.62	0.05	0.14	0.23
	2012	87	0.24	0.50	0.80	0.02	0.13	0.25
	2013	87	1.28	2.08	3.16	0.36	0.65	1.00
	2014	87	1.93	3.48	5.84	0.53	1.03	1.68
	2015	87	0.51	0.93	1.46	0.12	0.29	0.48
	2016	87	0.06	0.38	0.78	0.00	0.19	0.41
3+	2007							
	2008	86	0.04	0.17	0.32	0.00	0.05	0.10
	2009	91	0.13	0.42	0.78	0.02	0.18	0.38
	2010	87	0.01	0.32	0.72	0.00	0.18	0.45
	2011	87	0.03	0.16	0.30	0.00	0.06	0.14
	2012	87	0.07	0.25	0.46	0.00	0.07	0.17
	2013	87	1.24	2.09	3.26	0.36	0.71	1.15
	2014	87	0.52	0.90	1.38	0.14	0.27	0.43
	2015	87	1.14	2.02	3.26	0.36	0.71	1.16
	2016	87	0.19	0.61	1.18	0.04	0.29	0.60

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	102	11.23	19.37	32.95	4.11	6.55	10.15
	2008	102	6.56	12.31	22.44	1.90	3.32	5.45
	2009	107	17.55	30.41	52.18	4.62	7.35	11.41
	2010	102	4.53	8.29	14.62	1.86	3.16	5.06
	2011	102	12.62	21.50	36.16	3.73	5.86	8.97
	2012	102	45.99	77.18	129.09	8.36	12.88	19.56
	2013	102	6.72	12.61	23.00	1.89	3.35	5.54
	2014	102	5.00	8.60	14.34	1.90	3.03	4.60
	2015	102	1.54	2.82	4.73	0.61	1.13	1.81
	2016	102	1.07	1.63	2.34	0.26	0.53	0.85
0	2007	102	0.98	1.95	3.40	0.43	0.97	1.70
	2008	102	4.21	8.02	14.59	1.64	3.16	5.56
	2009	107	4.32	7.20	11.63	1.38	2.26	3.47
	2010	102	0.62	1.35	2.41	0.25	0.60	1.05
	2011	102	1.35	2.28	3.56	0.48	0.80	1.20
	2012	102	34.83	58.55	97.98	7.19	11.13	16.96
	2013	102	2.14	3.85	6.49	0.69	1.26	2.02
	2014	102	1.57	2.56	3.92	0.62	0.98	1.43
	2015	102	0.32	0.69	1.15	0.15	0.33	0.54
	2016	102	0.74	1.15	1.67	0.18	0.40	0.66
1	2007	102	5.56	9.46	15.67	2.79	4.71	7.61
	2008	102	1.83	3.46	6.04	0.82	1.64	2.84
	2009	107	10.46	17.92	30.23	3.65	5.97	9.47
	2010	102	2.16	4.00	6.90	1.09	1.97	3.21
	2011	102	8.50	14.53	24.36	2.85	4.64	7.27
	2012	102	8.44	12.96	19.64	1.78	2.66	3.81
	2013	102	5.57	10.32	18.52	1.68	3.00	4.98
	2014	102	2.84	4.67	7.40	1.15	1.83	2.74
	2015	102	0.92	1.73	2.87	0.45	0.87	1.41
	2016	102	0.23	0.49	0.82	0.04	0.19	0.37
2	2007	102	3.44	5.70	9.09	1.83	3.06	4.83
	2008	102	1.75	3.20	5.43	0.81	1.59	2.70
	2009	107	2.76	4.27	6.38	1.11	1.72	2.51
	2010	102	2.71	4.76	7.93	1.38	2.36	3.75
	2011	102	4.79	7.60	11.76	1.66	2.60	3.86
	2012	102	6.07	9.42	14.35	1.37	2.12	3.10
	2013	102	1.06	1.88	3.04	0.31	0.63	1.03
	2014	102	3.85	6.48	10.54	1.57	2.54	3.88
	2015	102	0.70	1.29	2.08	0.31	0.61	0.97
	2016	102	0.30	0.59	0.95	0.06	0.22	0.42
3+	2007	102	3.25	4.66	6.53	1.97	2.77	3.80
	2008	102	0.45	0.80	1.22	0.23	0.50	0.83
	2009	107	2.12	3.20	4.67	0.92	1.41	2.03
	2010	102	1.65	2.58	3.83	0.91	1.45	2.14
	2011	102	2.80	4.20	6.12	1.02	1.56	2.23
	2012	102	1.07	1.68	2.47	0.28	0.51	0.80
	2013	102	1.64	2.90	4.74	0.50	0.97	1.57
	2014	102	0.84	1.30	1.87	0.29	0.46	0.66
	2015	102	0.92	1.68	2.74	0.42	0.79	1.26
	2016	102	0.25	0.54	0.89	0.05	0.19	0.35

Figure 37. Atlantic Croaker geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys

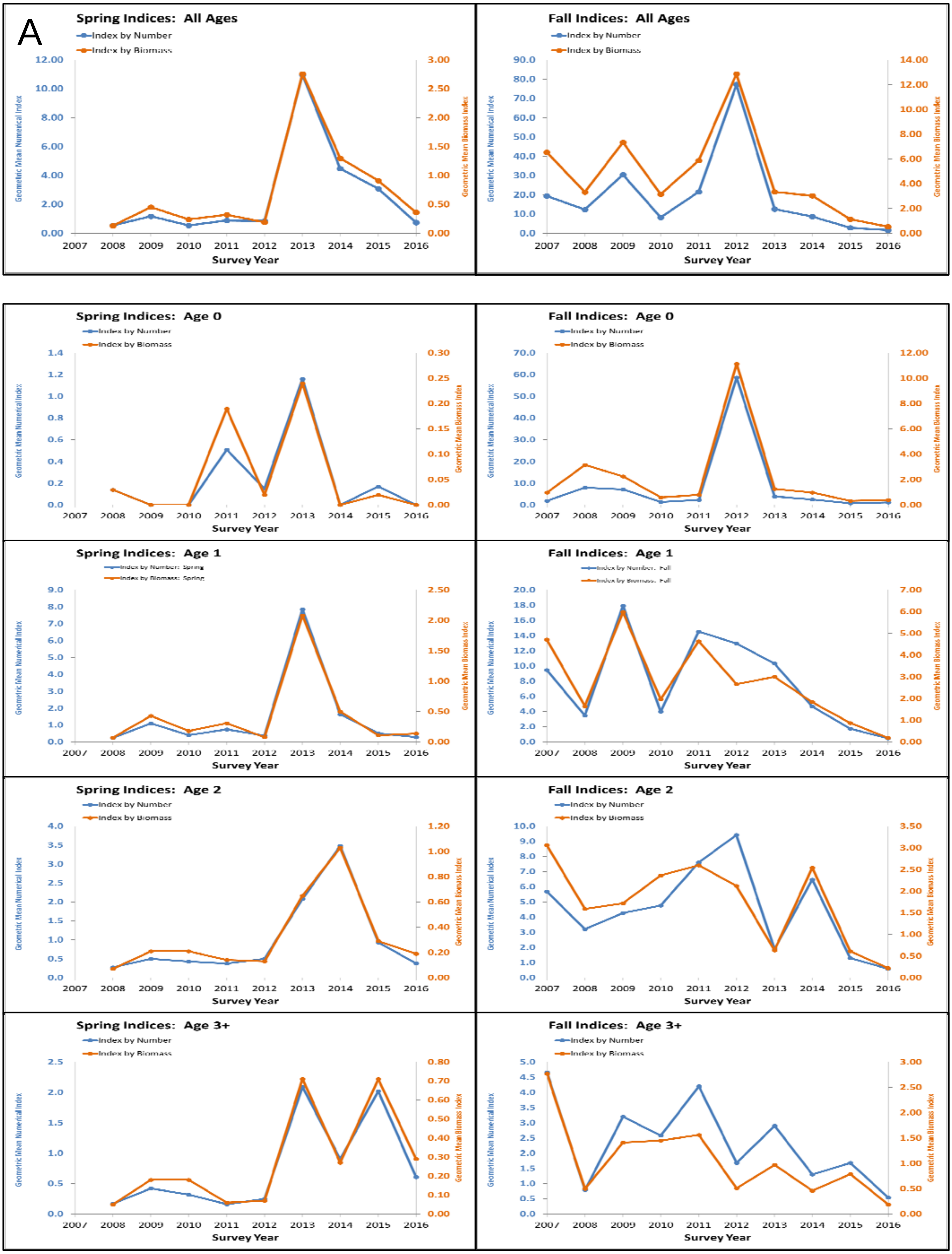


Figure 38. Atlantic Croaker length-frequency distributions, by cruise.

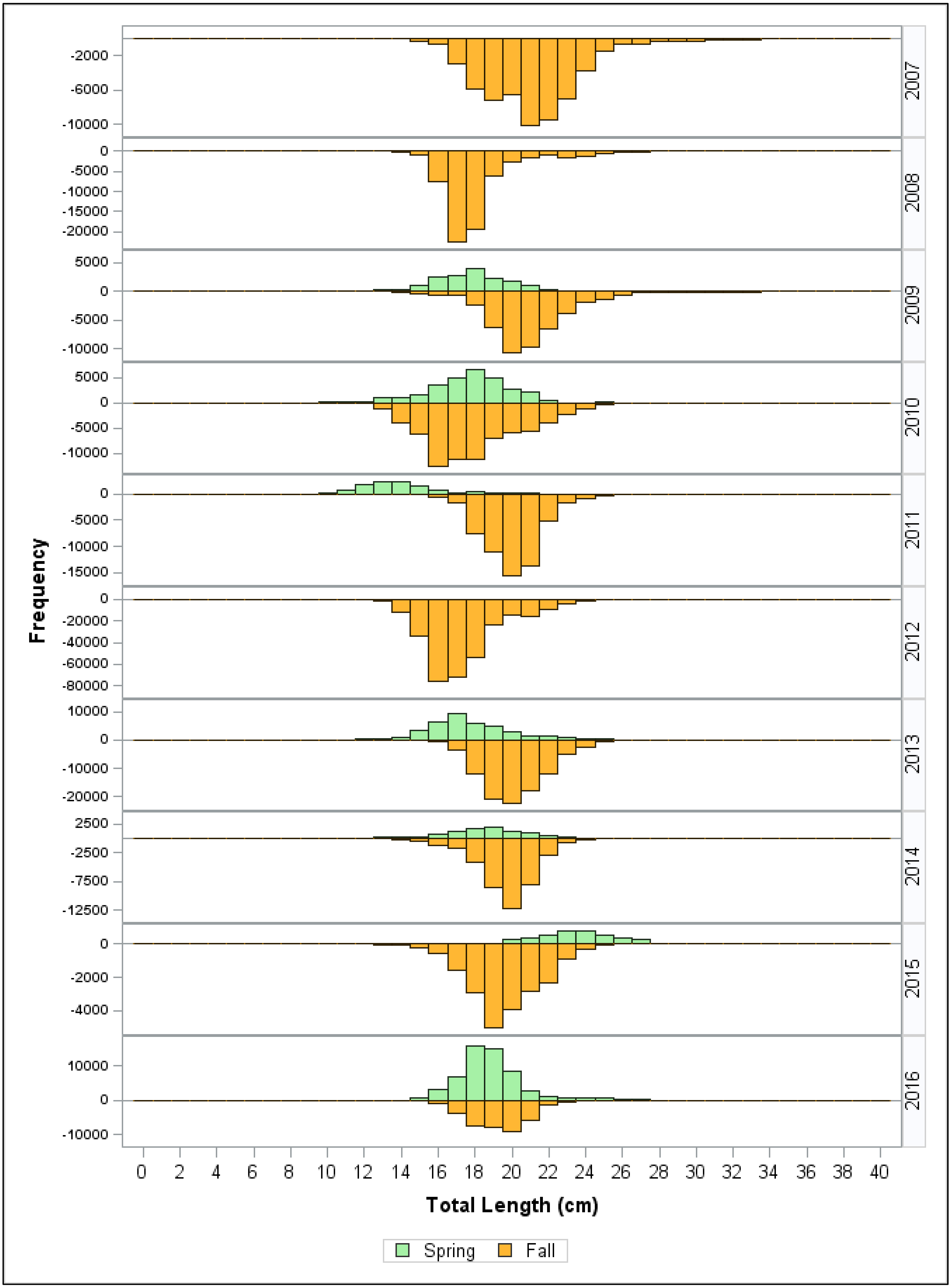


Figure 39. Atlantic Croaker length-frequency distributions, by cruise and sex.

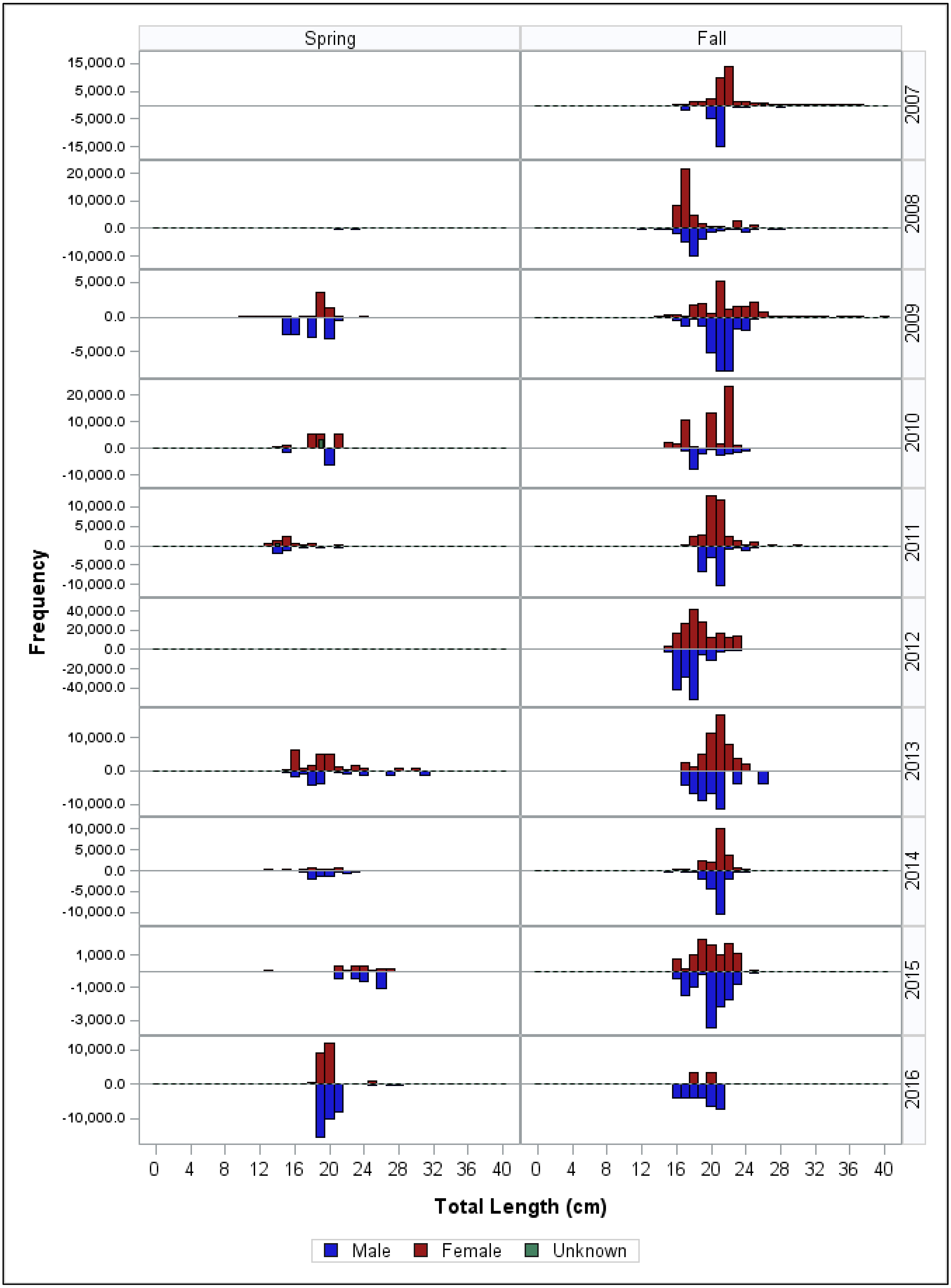


Figure 40. Atlantic Croaker age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

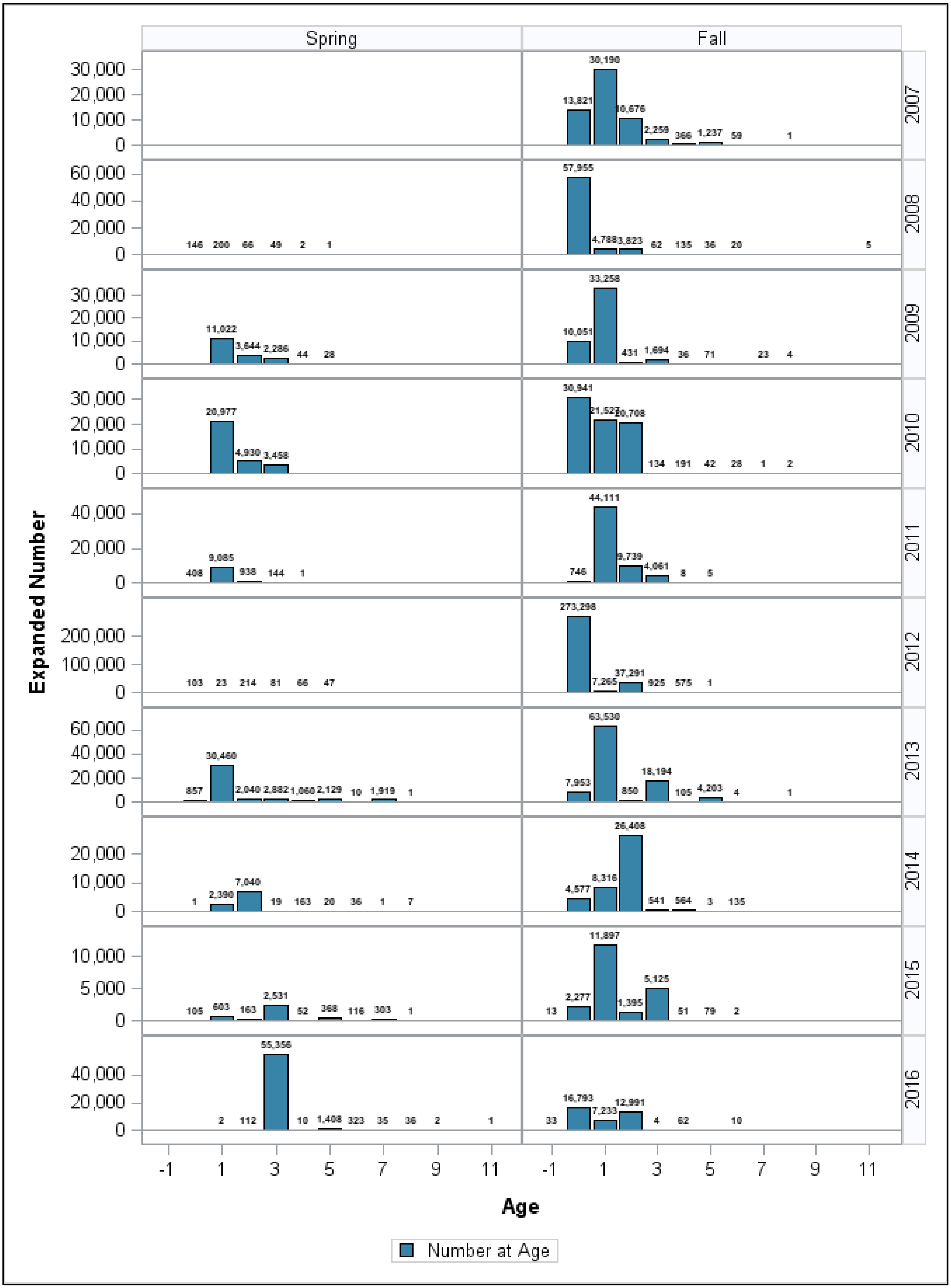


Figure 41. Atlantic Croaker catch-at-age standardized to 3,000 trawl minutes, by cruise.

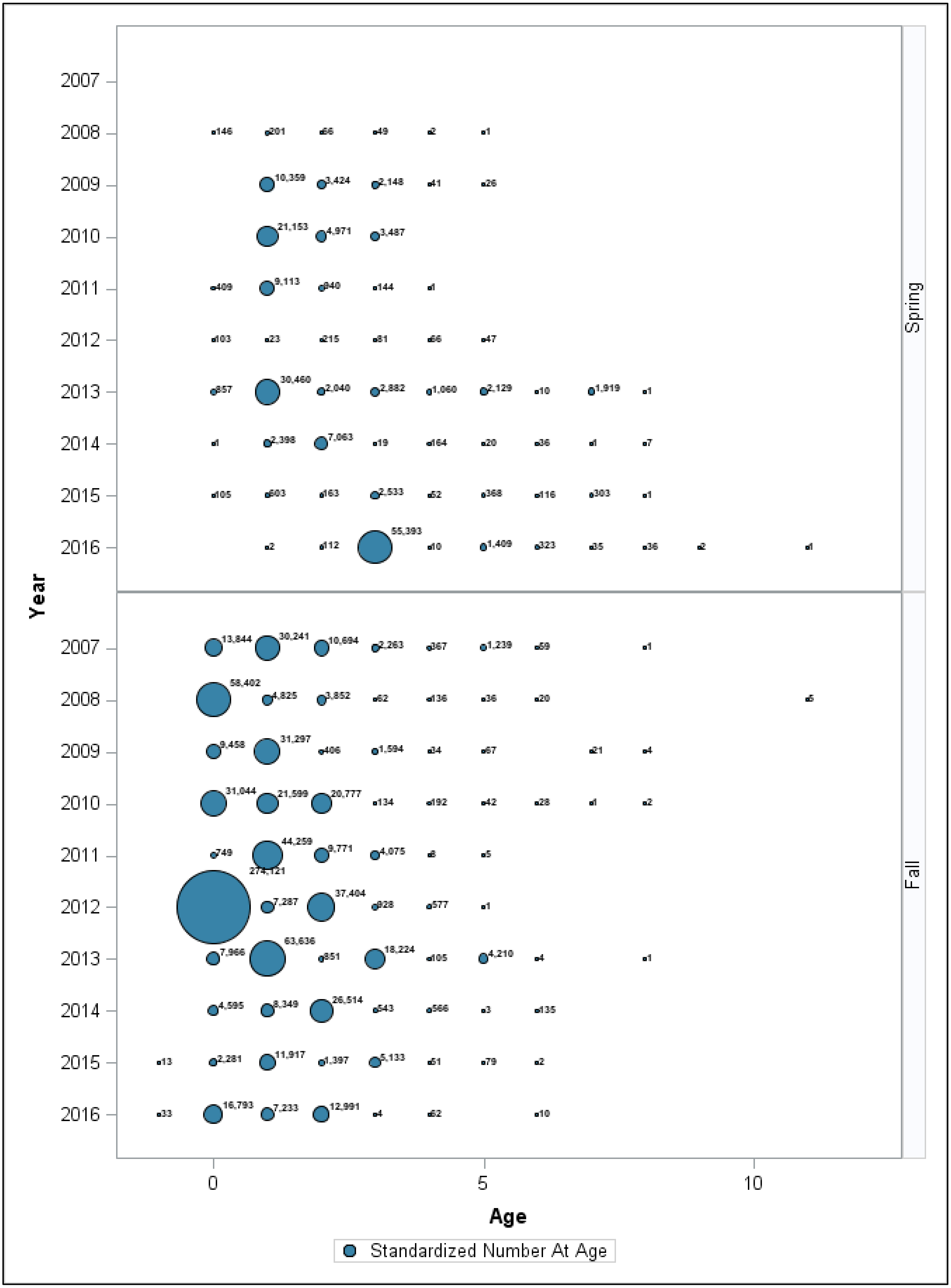


Figure 42. Atlantic Croaker sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

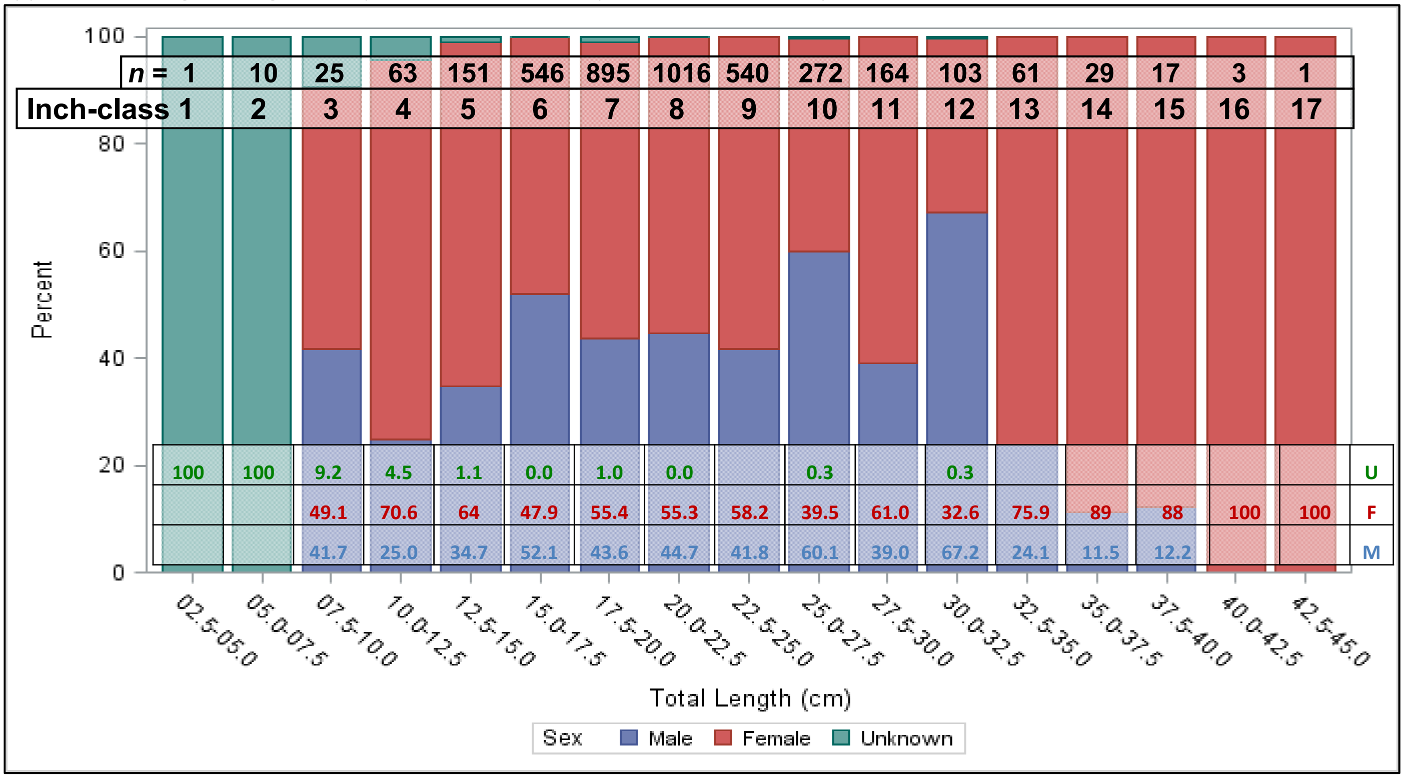


Figure 43. Atlantic Croaker maturity at length, by sex for all cruises pooled, 2007-2016.

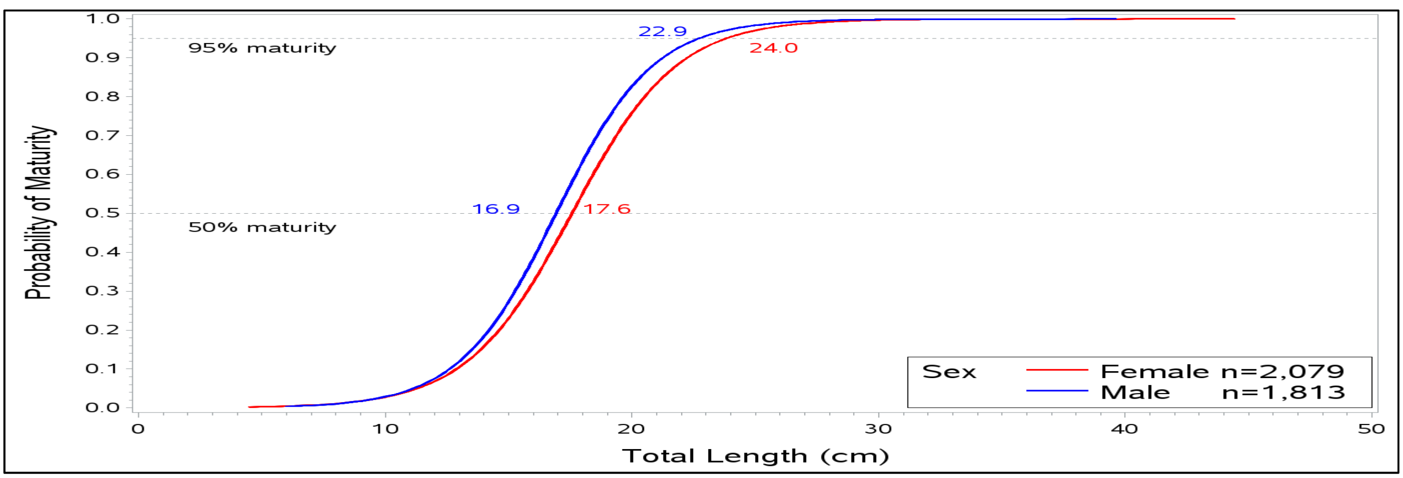


Figure 44. Atlantic Croaker maturity at age, by sex for all cruises pooled, 2007-2016.

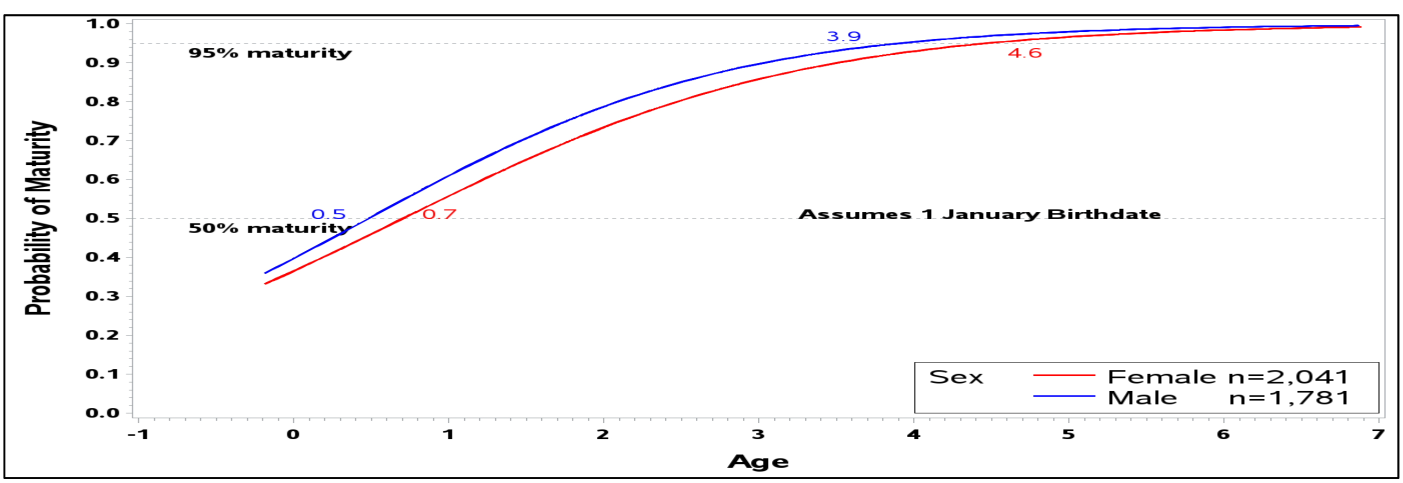
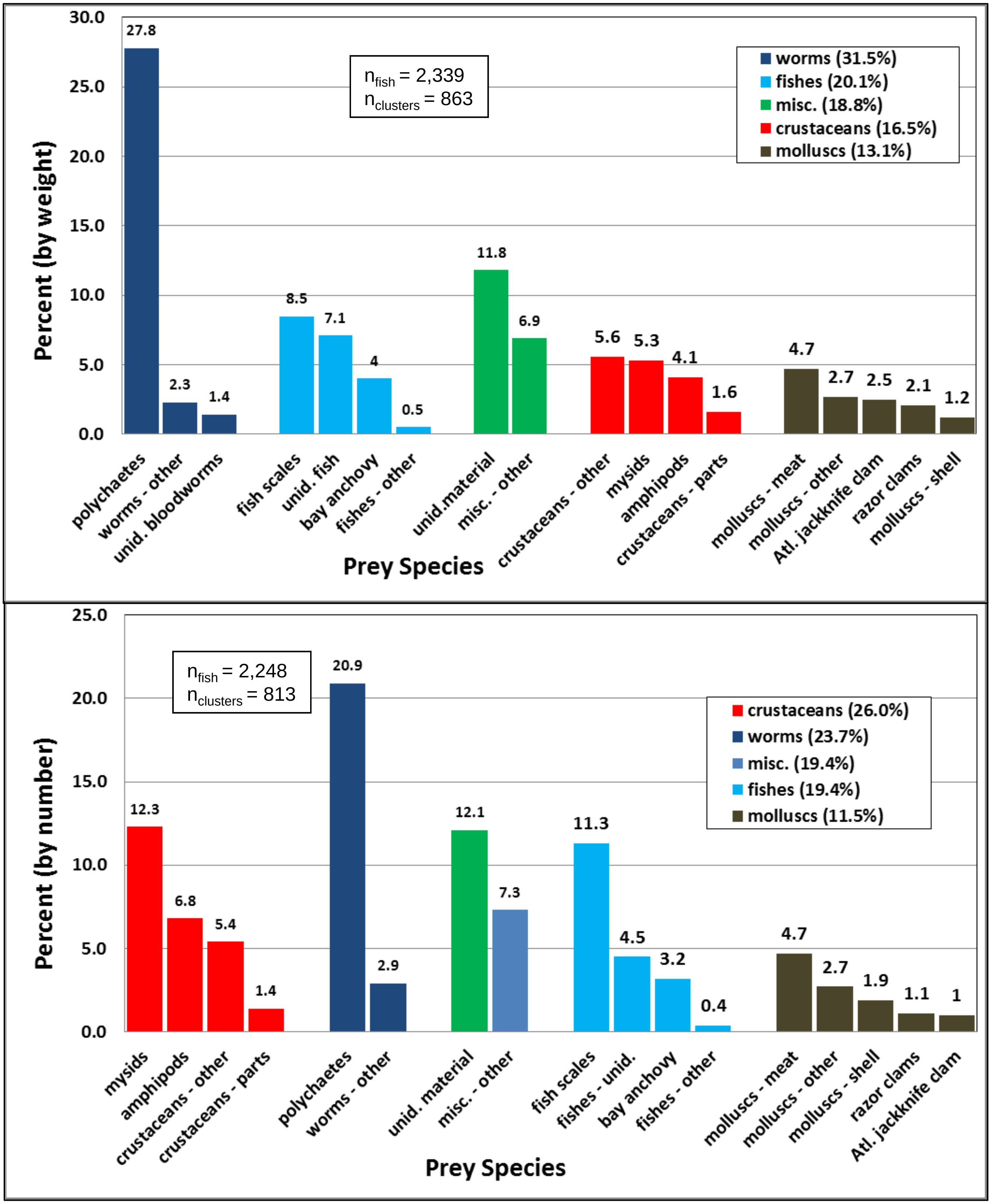


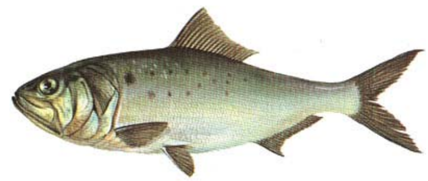
Figure 45. Atlantic Croaker diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016.(The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

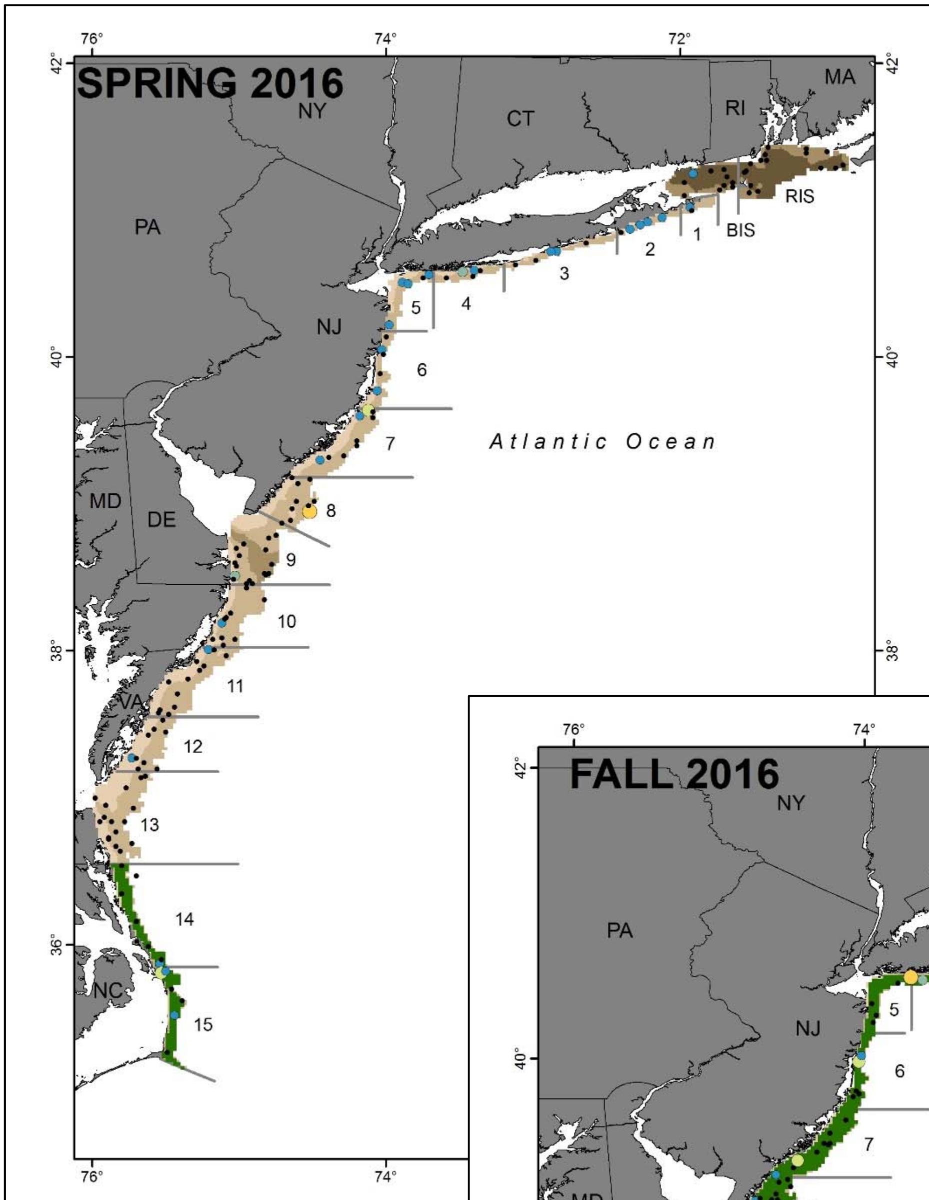


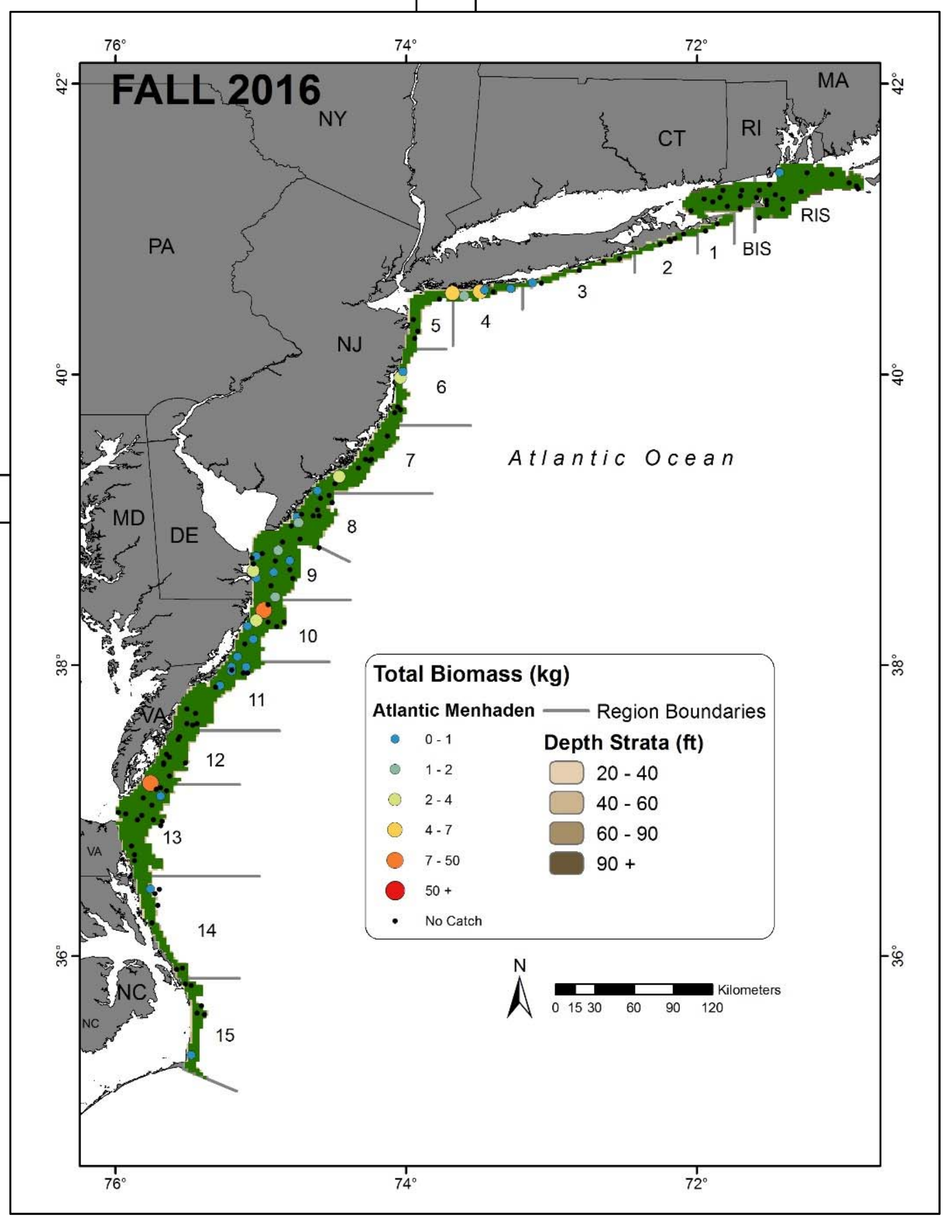
Atlantic Menhaden

Sampling Priority: A

Figure 46. Atlantic Menhaden biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

Table 18. Atlantic Menhaden sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	32	2.0	7.7	32	10	0	10	0
	2009	24,566	786.0	76.9	2,146	78	0	78	0
	2010	8,177	446.1	38.5	224	30	0	30	0
	2011	1,564	59.1	38.5	328	45	0	45	1
	2012	34	11.6	0.0	34	10	0	9	0
	2013	3,181	129.0	100.0	943	133	0	133	0
	2014	15,982	656.1	69.2	1,234	55	0	26	0
	2015	677	28.5	53.8	259	52	0	2	0
	2016	174	17.5	30.8	174	84	0	1	0
Fall	2007	740	30.2	26.0	288	78	0	78	1
	2008	208	25.0	20.0	208	68	0	68	0
	2009	146	11.9	21.0	146	59	0	58	6
	2010	974	29.3	18.0	229	56	0	56	1
	2011	144	19.4	24.0	91	54	0	53	0
	2012	73	21.7	21.0	73	32	0	30	0
	2013	33	8.1	16.0	33	32	0	31	0
	2014	92	20.3	29.0	92	66	0	1	0
	2015	157	44.2	28.0	157	68	0	0	0
	2016	257	48.7	33.0	257	105	0	0	0

Table 19. Atlantic Menhaden geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and for the youngest year class captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	13	0.00	0.25	0.96	0.00	0.08	0.26
	2009	15	4.52	32.00	196.48	0.76	4.41	15.68
	2010	13	0.07	6.75	54.92	0.00	1.91	9.21
	2011	13	0.11	1.22	3.47	0.03	0.31	0.68
	2012	13	0.00	0.00	0.00	0.00	0.00	0.00
	2013	13	9.88	35.31	120.15	0.55	2.62	7.44
	2014	13	0.96	8.77	47.59	0.00	2.10	9.66
	2015	13	0.37	1.95	5.38	0.01	0.30	0.67
	2016	13	0.04	0.71	1.82	0.00	0.12	0.27
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	13	0.00	0.00	0.00	0.00	0.00	0.00
	2009	15	4.10	29.83	185.42	0.79	4.64	16.73
	2010	13	0.07	6.58	52.61	0.00	2.70	15.76
	2011	13	0.07	1.15	3.33	0.02	0.31	0.68
	2012	13	0.00	0.00	0.00	0.00	0.00	0.00
	2013	13	9.52	34.51	118.85	0.59	2.90	8.55
	2014	13	0.96	8.76	47.51	0.00	2.03	8.96
	2015	13	0.37	1.95	5.37	0.02	0.28	0.62
	2016	13	0.00	0.49	1.24	0.00	0.07	0.17

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	150	0.15	0.28	0.44	0.04	0.09	0.15
	2008	150	0.12	0.19	0.27	0.04	0.07	0.10
	2009	160	0.09	0.18	0.27	0.02	0.05	0.08
	2010	150	0.13	0.24	0.37	0.03	0.07	0.12
	2011	150	0.11	0.23	0.35	0.03	0.09	0.15
	2012	150	0.07	0.17	0.27	0.01	0.05	0.09
	2013	150	0.05	0.10	0.16	0.01	0.04	0.06
	2014	150	0.13	0.20	0.27	0.04	0.06	0.09
	2015	150	0.11	0.24	0.38	0.04	0.11	0.18
	2016	150	0.23	0.39	0.57	0.09	0.16	0.23
0	2007	150	0.04	0.14	0.25	0.00	0.02	0.05
	2008	150	0.03	0.08	0.13	0.00	0.02	0.04
	2009	160	0.02	0.08	0.14	0.00	0.01	0.02
	2010	150	0.05	0.14	0.23	0.00	0.04	0.08
	2011	150	0.00	0.07	0.14	0.00	0.01	0.03
	2012	150	0.00	0.02	0.04	0.00	0.00	0.00
	2013	150	0.00	0.02	0.04	0.00	0.00	0.00
	2014	150	0.01	0.04	0.08	0.00	0.00	0.01
	2015	150	0.00	0.02	0.05	0.00	0.00	0.00
	2016	150	0.00	0.04	0.10	0.00	0.00	0.01

Figure 47. Atlantic Menhaden geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

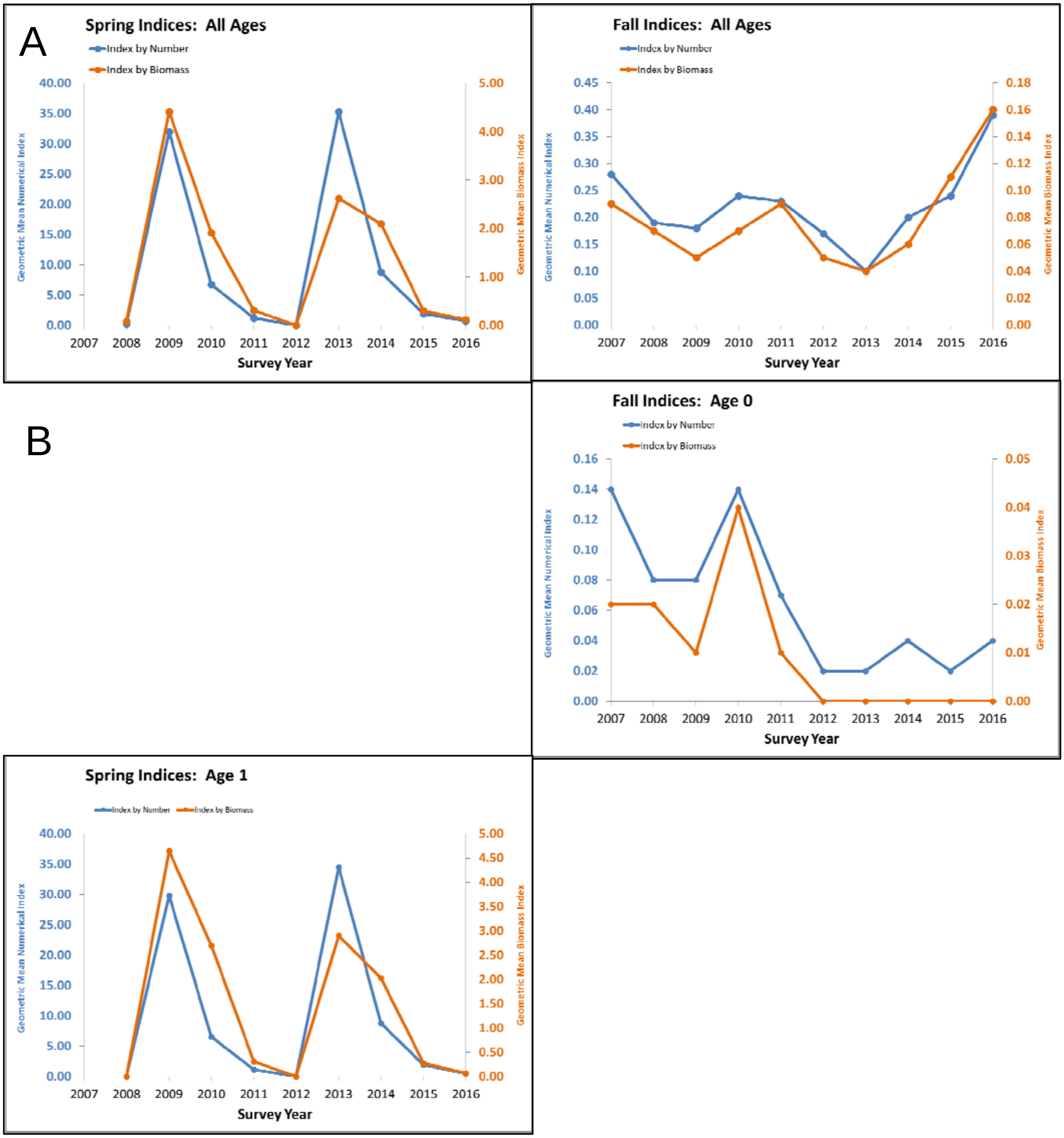


Figure 48. Atlantic Menhaden length-frequency distributions, by cruise (Blue reference lines are placed at the size cutoff values used to separate recruits from older specimens. Cutoff values – spring 17cm, fall 15cm - taken from http://www.asmfc.org/speciesDocuments/menhaden/reports/stockAssessments/04MenhadenPeerReviewReport.pdf.).

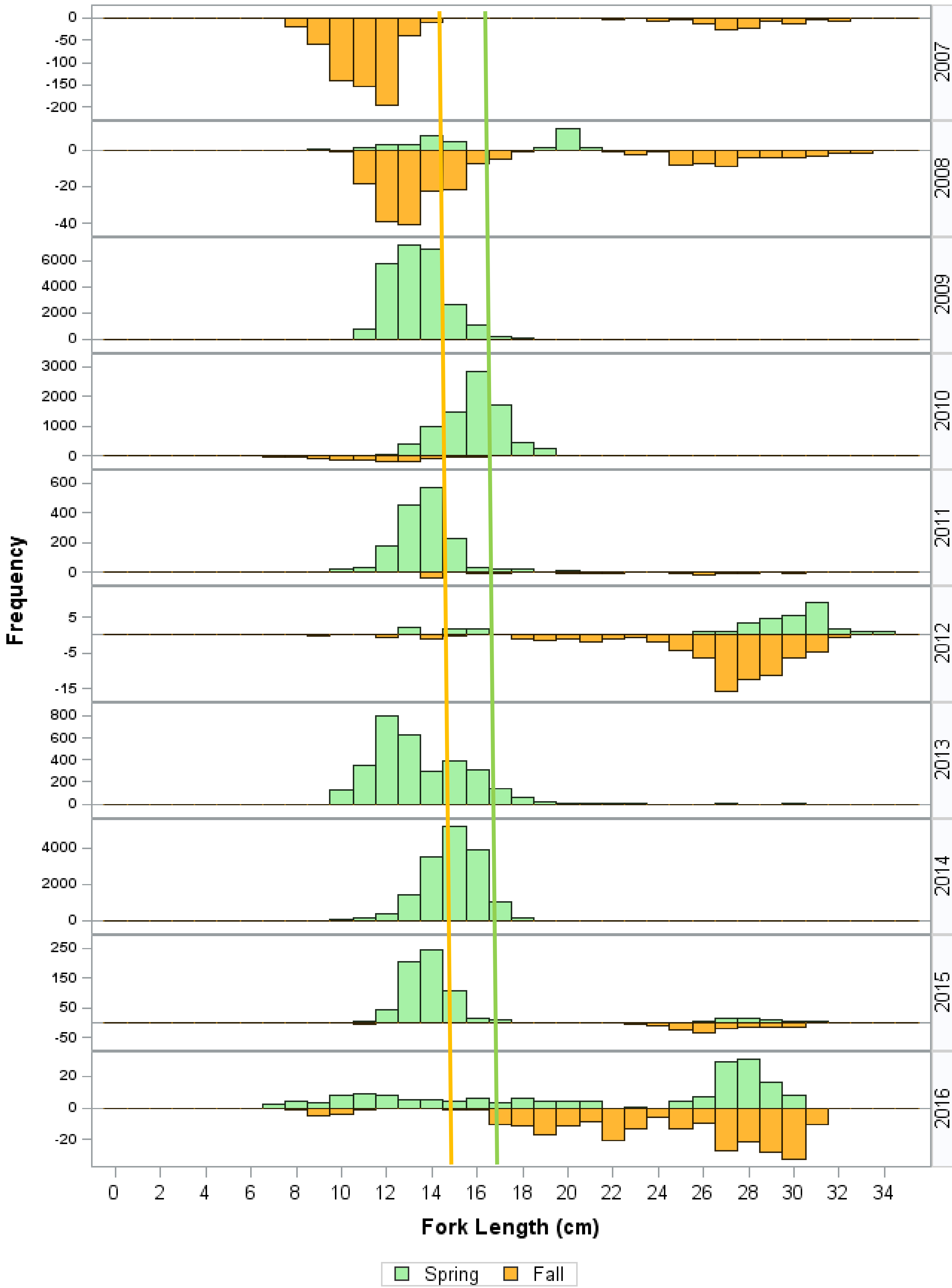


Figure 49. Atlantic Menhaden sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

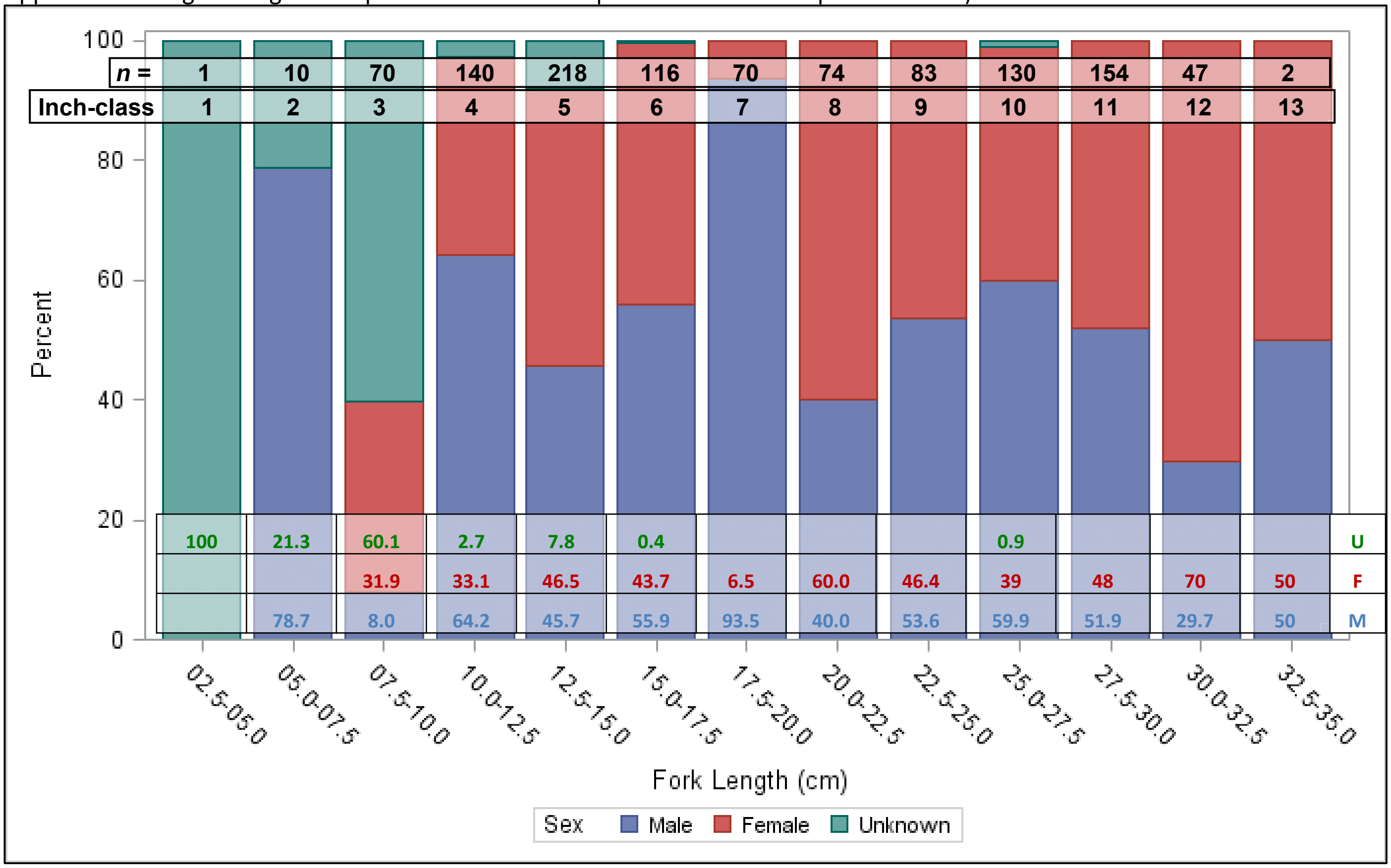
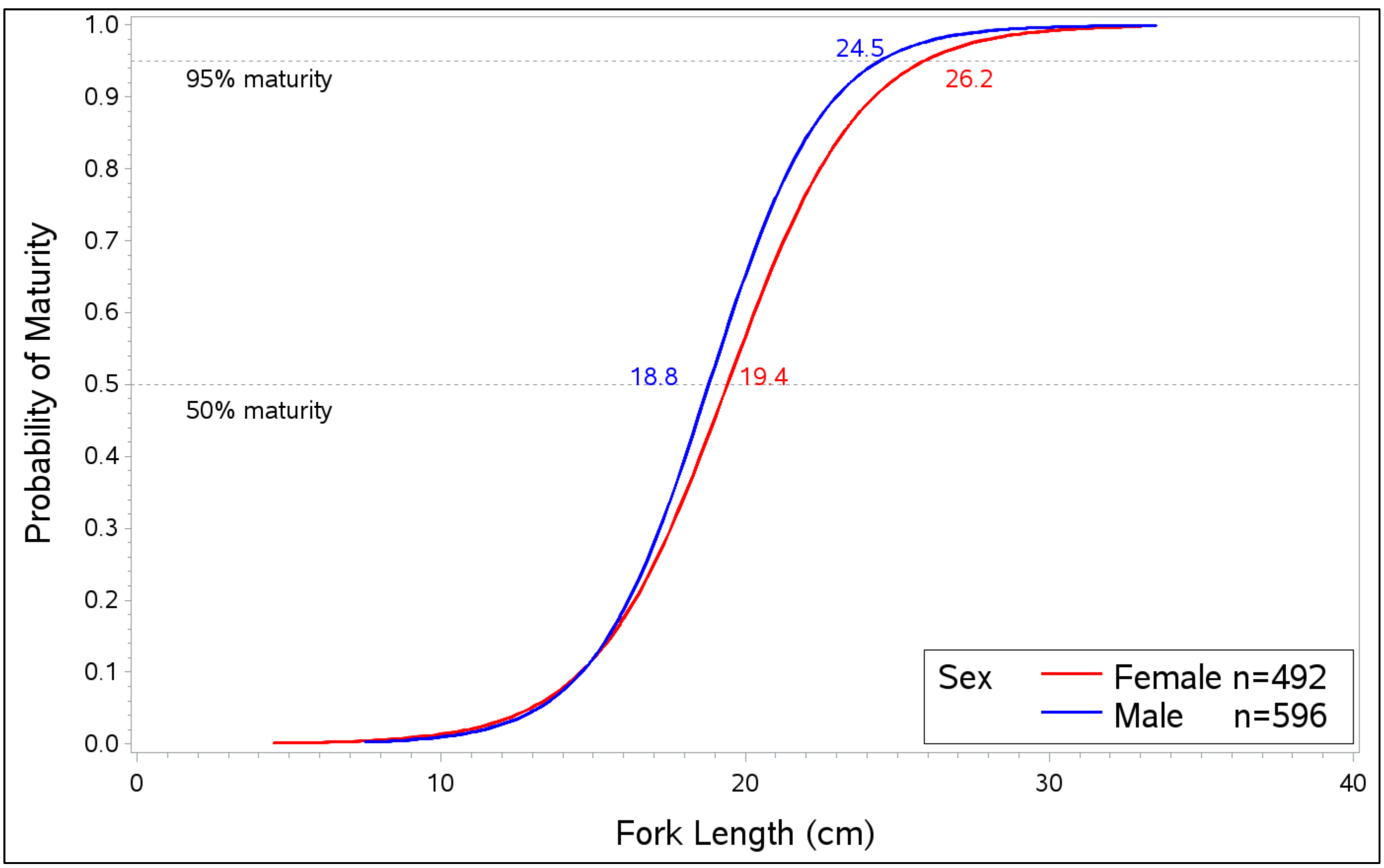
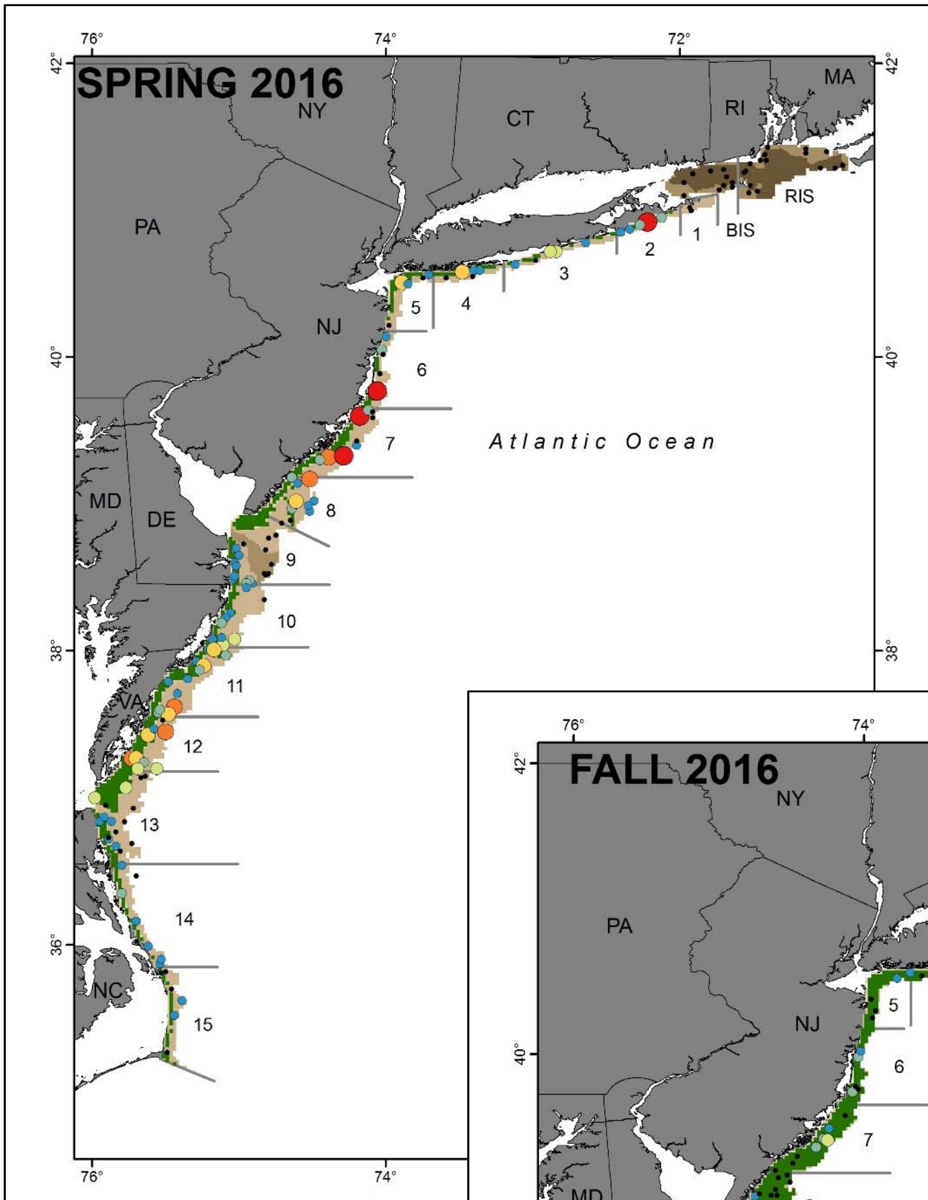


Figure 50. Atlantic Menhaden maturity at length, by sex for all cruises pooled, 2007-2016.

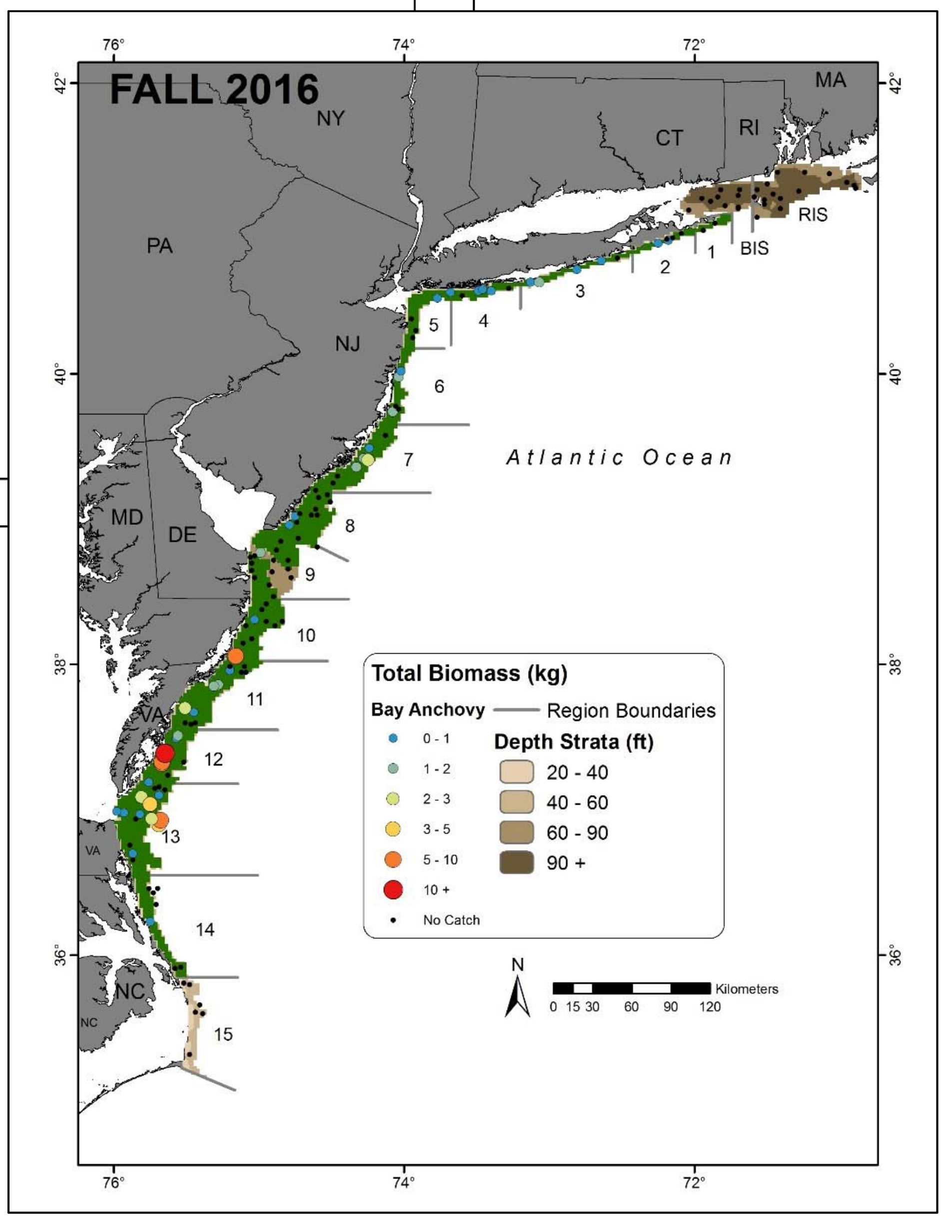




Bay Anchovy

Sampling Priority: D

Figure 51. Bay Anchovy biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	grey	grey
		90+	grey	grey
	BIS	60-90	grey	grey
		90+	grey	grey
NY	01	40-60	grey	green
	02	20-40	green	green
		40-60	grey	green
	03	20-40	green	green
		40-60	grey	green
	04	20-40	green	green
		40-60	grey	green
	05	20-40	green	green
		40-60	grey	green
NJ	06	20-40	green	green
		40-60	grey	green
	07	20-40	green	green
		40-60	grey	green
	08	20-40	green	green
		40-60	grey	green
DE	09	20-40	green	green
		40-60	grey	green
		60-90	grey	grey
MD	10	20-40	green	green
		40-60	grey	green
VA	11	20-40	green	green
		40-60	grey	green
	12	20-40	green	green
		40-60	grey	green
	13	20-40	green	green
		40-60	grey	green
NC	14	20-40	green	green
		40-60	grey	green
	15	20-40	green	grey
		40-60	grey	grey

green = used for abundance indices
grey = not used for abundance indices

Table 20. Bay Anchovy sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	23,926	75.8	53.2	3,838	N/A	N/A	N/A	N/A
	2009	62,807	145.9	55.6	7,112	N/A	N/A	N/A	N/A
	2010	57,202	175.6	49.2	6,143	N/A	N/A	N/A	N/A
	2011	46,807	137.4	41.1	5,212	N/A	N/A	N/A	N/A
	2012	18,330	51.4	39.5	4,381	N/A	N/A	N/A	N/A
	2013	59,250	189.9	66.1	9,775	N/A	N/A	N/A	N/A
	2014	33,988	117.1	36.3	5,602	N/A	N/A	N/A	N/A
	2015	4,830	17.1	23.4	3,141	N/A	N/A	N/A	N/A
	2016	50,810	180.4	69.4	8,356	N/A	N/A	N/A	N/A
Fall	2007	119,741	203.4	48.3	3,961	N/A	N/A	N/A	N/A
	2008	35,557	73.4	44.1	2,362	N/A	N/A	N/A	N/A
	2009	48,934	177.7	52.5	4,527	N/A	N/A	N/A	N/A
	2010	49,991	124.7	53.4	4,614	N/A	N/A	N/A	N/A
	2011	33,401	100.0	38.1	3,311	N/A	N/A	N/A	N/A
	2012	21,796	62.0	22.0	2,519	N/A	N/A	N/A	N/A
	2013	52,635	158.1	46.6	7,631	N/A	N/A	N/A	N/A
	2014	19,487	71.4	22.0	2,947	N/A	N/A	N/A	N/A
	2015	20,568	46.5	29.7	4,217	N/A	N/A	N/A	N/A
	2016	29,579	81.6	40.7	4,272	N/A	N/A	N/A	N/A

Table 21. Bay Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

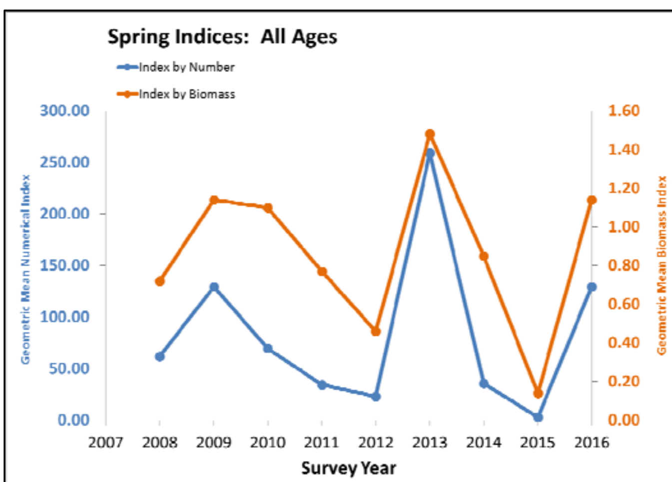
Spring Survey

Age	Year	n	Numerical Index LCI	Numerical Index Index	Numerical Index UCI	Biomass Index LCI	Biomass Index Index	Biomass Index UCI
All	2007							
	2008	43	28.75	61.90	132.01	0.44	0.72	1.04
	2009	51	57.52	129.27	289.01	0.78	1.14	1.57
	2010	42	32.92	69.31	144.74	0.69	1.10	1.60
	2011	42	11.46	34.06	97.60	0.42	0.77	1.21
	2012	42	9.75	22.80	51.69	0.20	0.46	0.77
	2013	43	144.52	259.08	463.84	1.12	1.48	1.90
	2014	43	13.91	35.67	89.21	0.52	0.85	1.24
	2015	42	1.57	2.93	5.01	0.07	0.14	0.21
	2016	42	68.18	129.26	244.29	0.77	1.14	1.59

Fall Survey

Age	Year	n	Numerical Index LCI	Numerical Index Index	Numerical Index UCI	Biomass Index LCI	Biomass Index Index	Biomass Index UCI
All	2007	118	10.19	17.10	28.29	0.50	0.69	0.90
	2008	113	4.85	8.87	15.65	0.20	0.32	0.44
	2009	122	9.62	15.37	24.25	0.38	0.53	0.70
	2010	113	12.91	21.74	36.18	0.42	0.56	0.71
	2011	113	3.44	6.27	10.92	0.23	0.35	0.49
	2012	113	0.95	1.62	2.53	0.09	0.16	0.22
	2013	113	8.45	14.22	23.52	0.42	0.60	0.80
	2014	113	1.24	2.37	4.07	0.12	0.22	0.34
	2015	113	1.66	3.02	5.08	0.12	0.19	0.27
	2016	113	3.93	7.16	12.52	0.20	0.32	0.46

Figure 52. Bay Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.



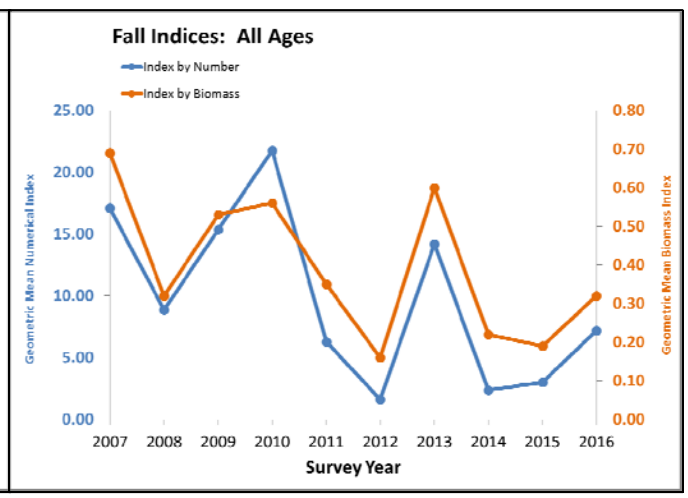
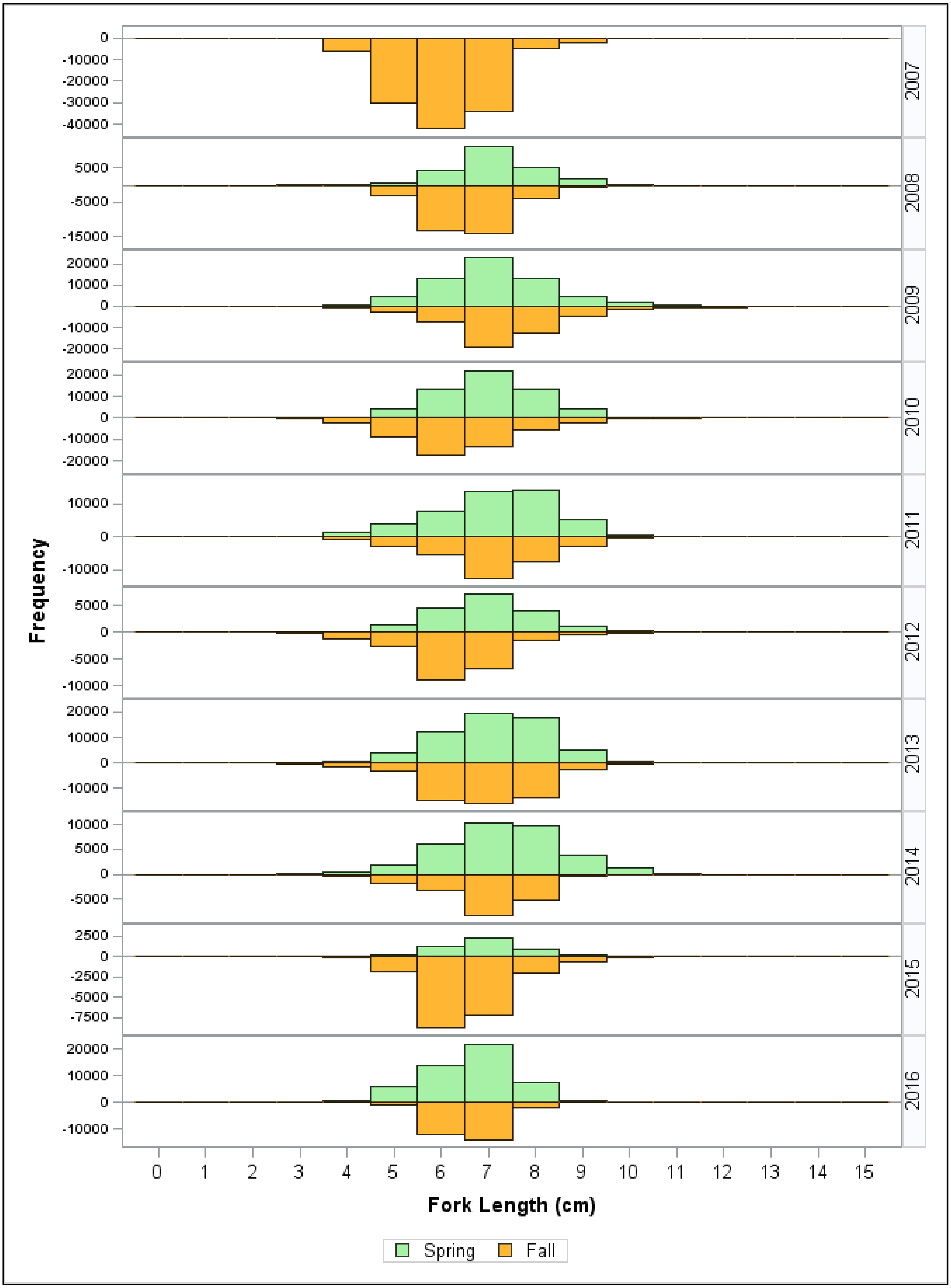


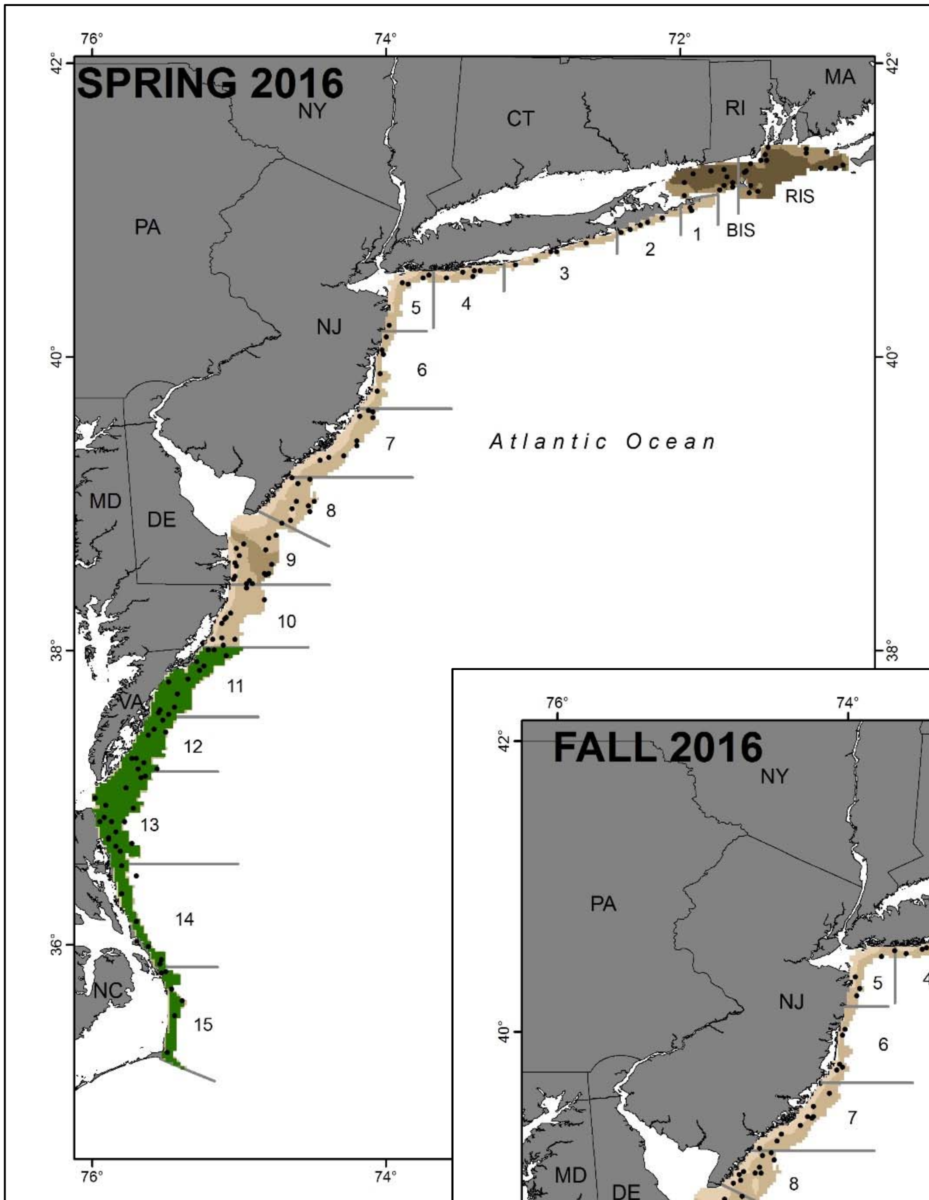
Figure 53. Bay Anchovy length-frequency distributions, by cruise.

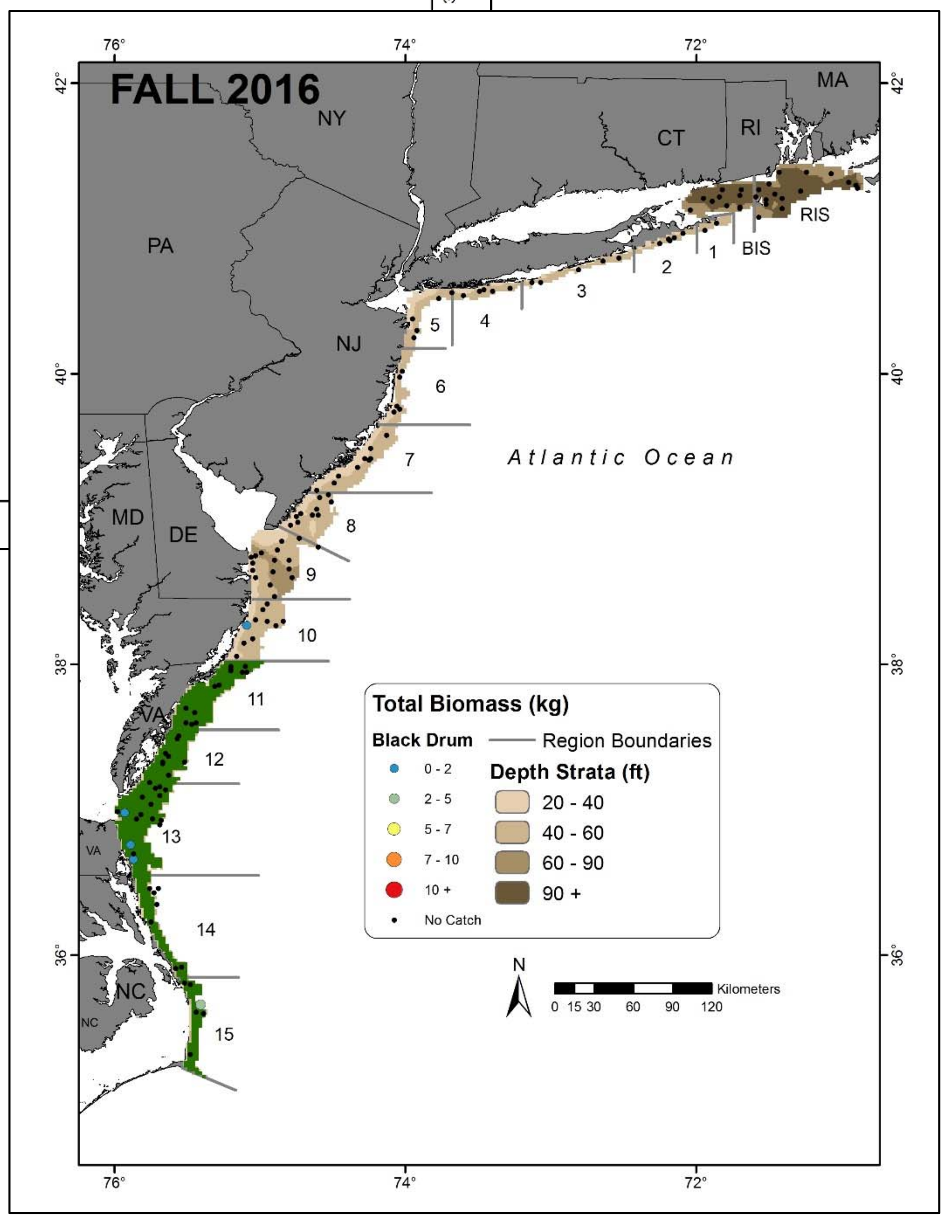


Black Drum

Sampling Priority: A

Figure 54. Black Drum biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(gray) = not used for abundance indices

Table 22. Black Drum sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	5	140.9	5.9	5	5	5	0	0
	2009	0	0.0	0.0					
	2010	0	0.0	0.0					
	2011	0	0.0	0.0					
	2012	1	18.4	0.0	1	1	1	0	0
	2013	2	29.9	2.0	2	2	1	2	1
	2014	0	0.0	0.0					
	2015	2	4.8	3.9	2	2	2	1	1
	2016	0	0.0	0.0					
Fall	2007	35	5.8	17.6	35	33	33	26	24
	2008	25	2.5	11.8	25	22	22	18	18
	2009	66	8.5	43.1	66	63	63	28	27
	2010	12	2.3	11.8	12	11	11	4	4
	2011	50	30.9	19.6	50	48	48	15	15
	2012	15	3.4	11.8	15	15	15	12	12
	2013	19	2.9	19.6	19	19	19	5	5
	2014	91	20.2	13.7	91	25	24	7	7
	2015	74	17.3	17.6	74	33	33	13	13
	2016	6	2.6	7.8	6	6	0	3	3

Table 23. Black Drum geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index LCI	Numerical Index Index	Numerical Index UCI	Biomass Index LCI	Biomass Index Index	Biomass Index UCI
All	2007							
	2008	55	0.00	0.04	0.08	0.00	0.16	0.36
	2009	53	0.00	0.00	0.00	0.00	0.00	0.00
	2010	51	0.00	0.00	0.00	0.00	0.00	0.00
	2011	51	0.00	0.00	0.00	0.00	0.00	0.00
	2012	51	0.00	0.00	0.00	0.00	0.00	0.00
	2013	51	0.00	0.02	0.05	0.00	0.05	0.16
	2014	51	0.00	0.00	0.00	0.00	0.00	0.00
	2015	51	0.00	0.03	0.06	0.00	0.04	0.12
	2016	51	0.00	0.00	0.00	0.00	0.00	0.00

Fall Survey

Age	Year	n	Numerical Index LCI	Numerical Index Index	Numerical Index UCI	Biomass Index LCI	Biomass Index Index	Biomass Index UCI
All	2007	56	0.08	0.17	0.27	0.02	0.04	0.07
	2008	51	0.04	0.16	0.29	0.01	0.03	0.06
	2009	53	0.36	0.50	0.66	0.07	0.10	0.13
	2010	51	0.02	0.08	0.14	0.00	0.02	0.04
	2011	51	0.12	0.26	0.42	0.01	0.15	0.31
	2012	51	0.02	0.08	0.14	0.00	0.02	0.03
	2013	51	0.06	0.18	0.30	0.01	0.04	0.07
	2014	51	0.02	0.17	0.33	0.01	0.09	0.18
	2015	51	0.05	0.31	0.64	0.01	0.15	0.31
	2016	51	0.00	0.07	0.15	0.00	0.04	0.09

Figure 55. Black Drum geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

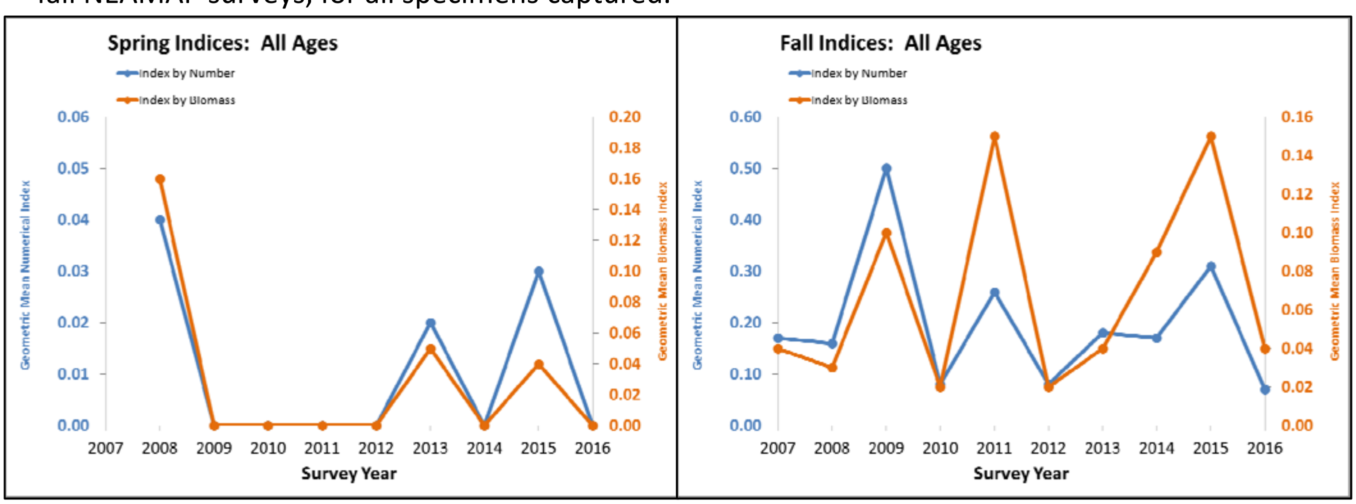


Figure 56. Black Drum length-frequency distributions, by cruise.

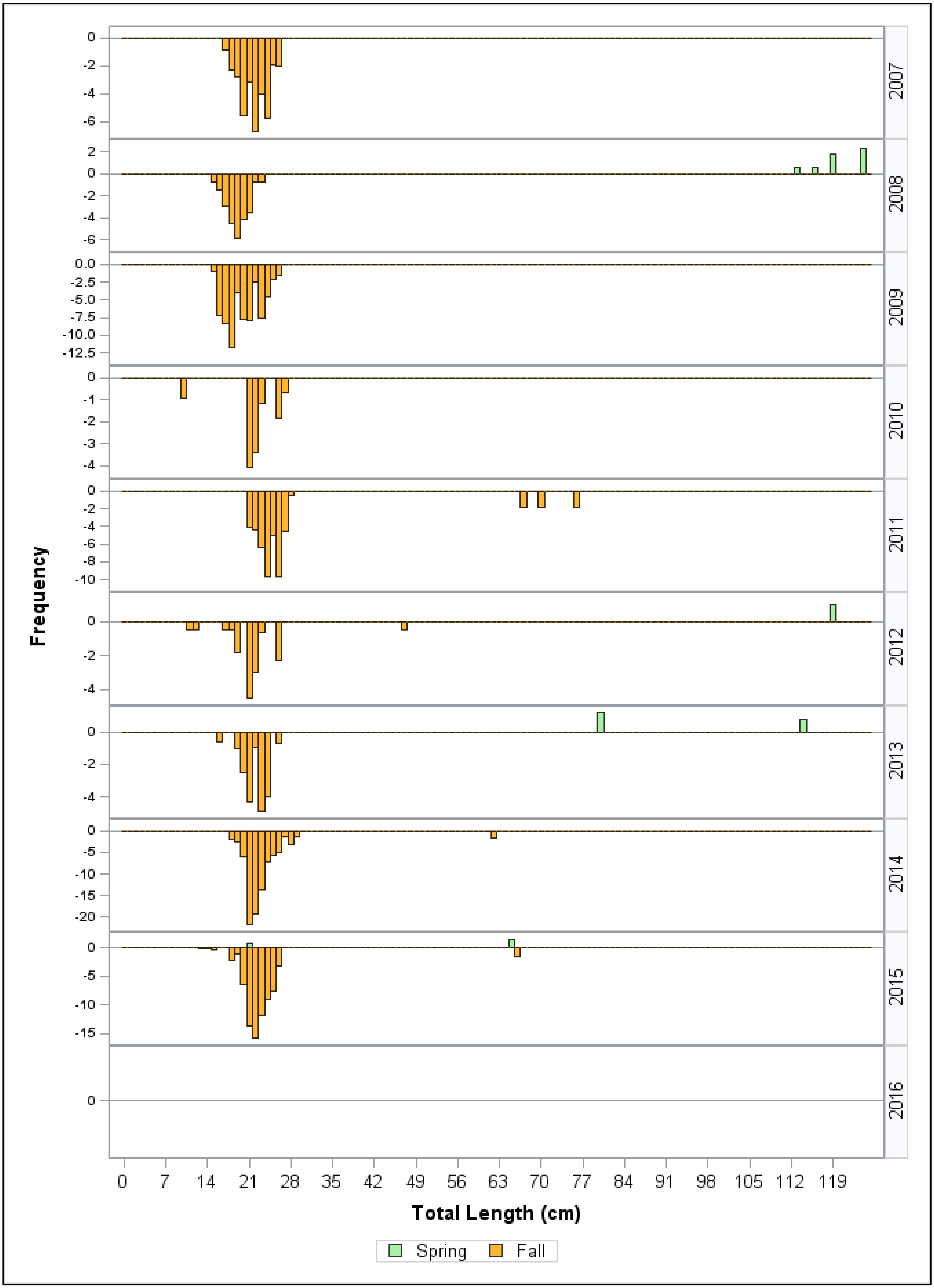
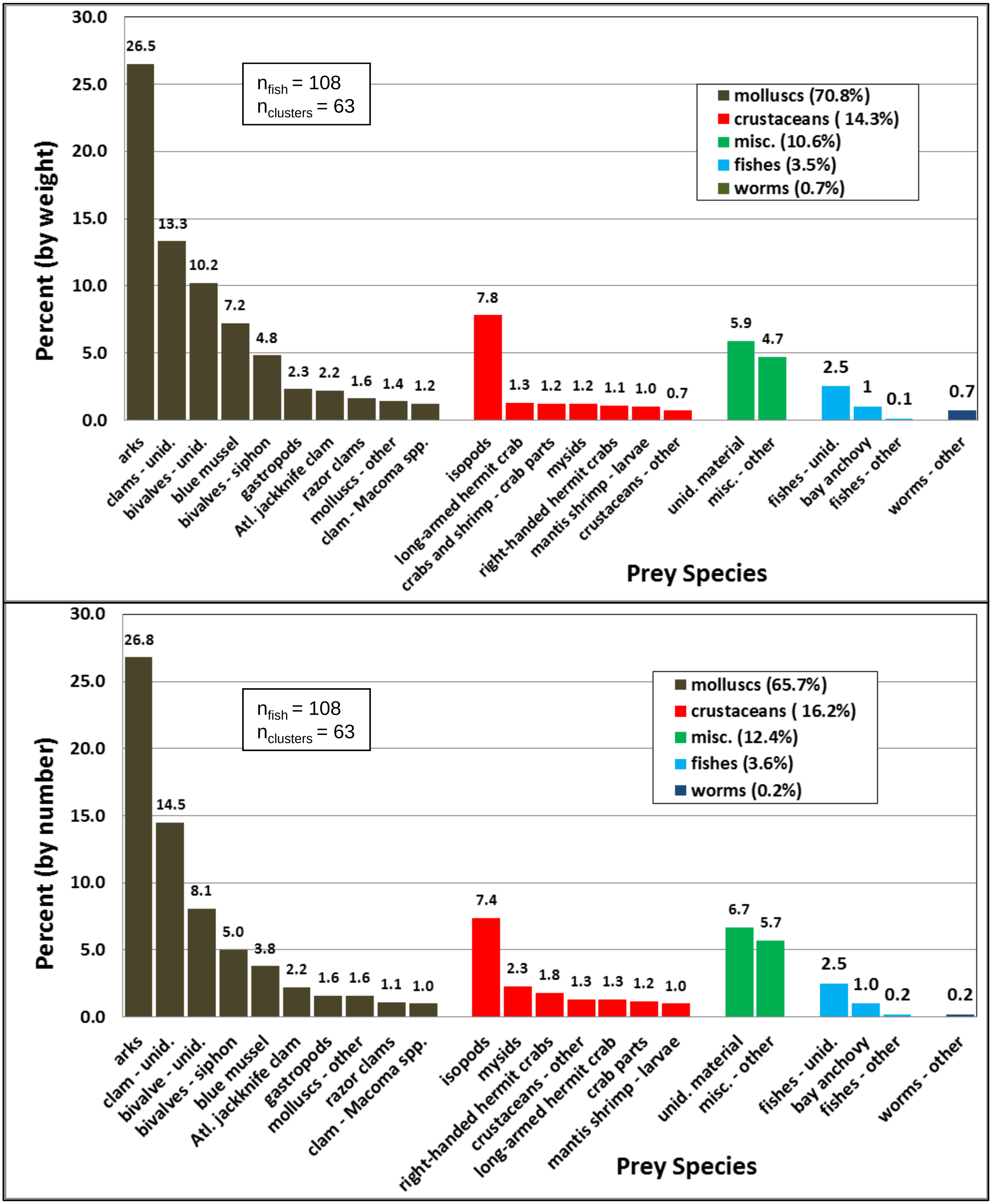


Figure 57. Black Drum diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).



Black Sea Bass

Sampling Priority: A

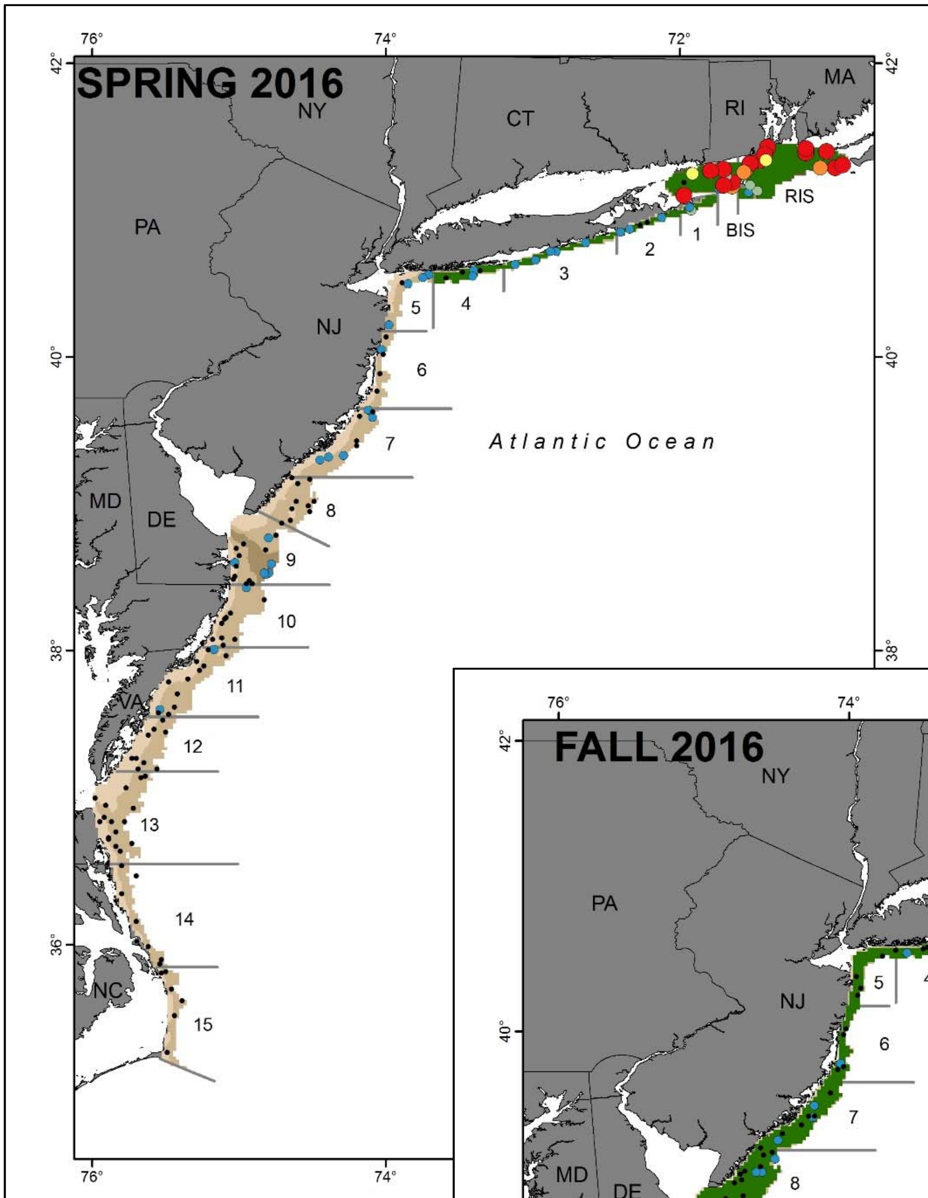
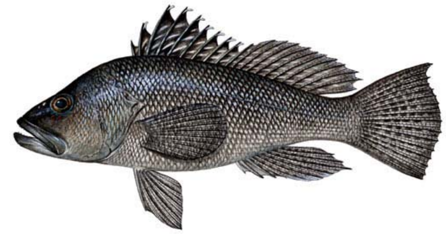
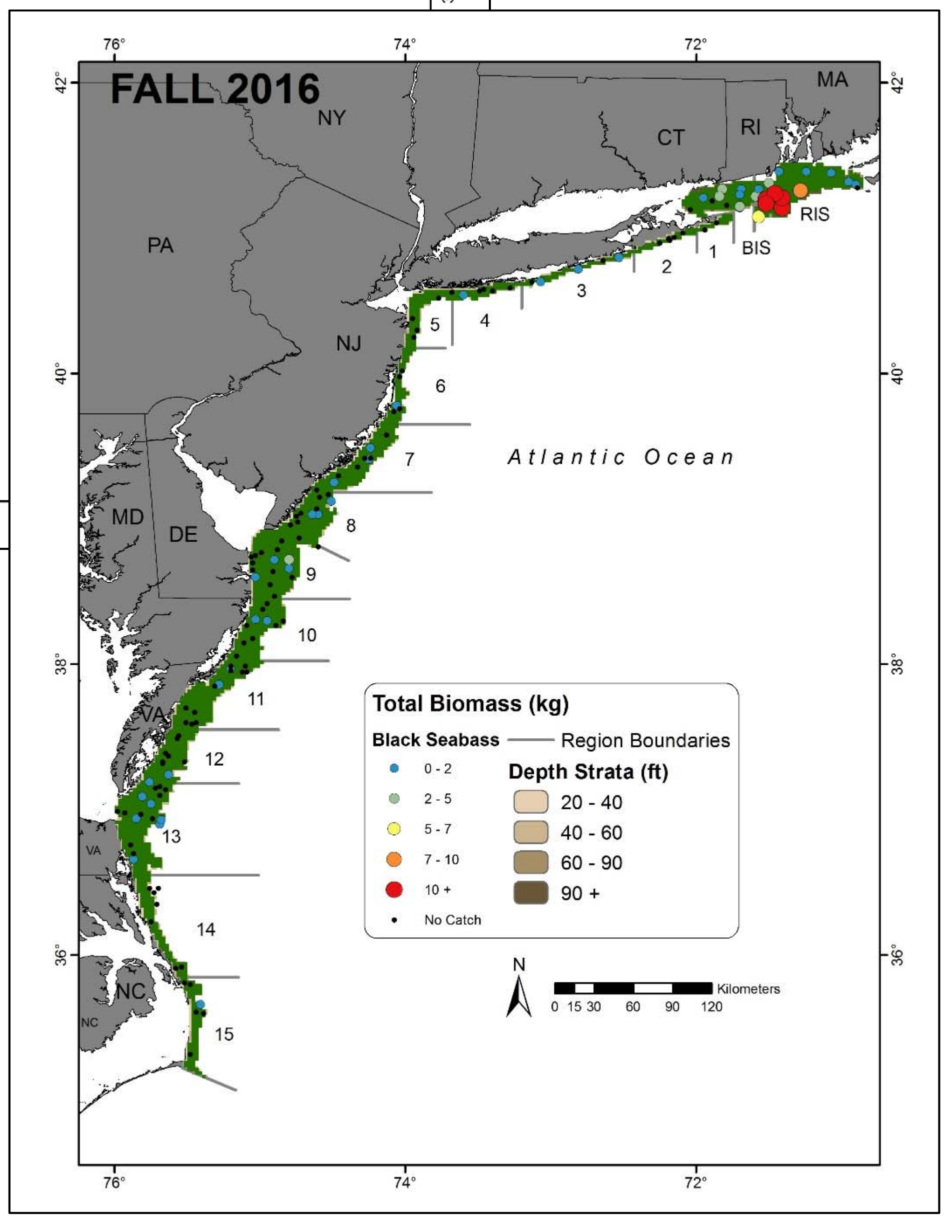


Figure 58. Black Sea Bass biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	green	green
		90+	green	green
	BIS	60-90	green	green
		90+	green	green
NY	01	40-60	green	green
	02	20-40	green	green
		40-60	green	green
	03	20-40	green	green
		40-60	green	green
	04	20-40	green	green
		40-60	green	green
	05	20-40	gray	green
		40-60	gray	green
NJ	06	20-40	gray	green
		40-60	gray	green
	07	20-40	gray	green
		40-60	gray	green
	08	20-40	gray	green
		40-60	gray	green
DE	09	20-40	gray	green
		40-60	gray	green
		60-90	gray	green
MD	10	20-40	gray	green
		40-60	gray	green
VA	11	20-40	gray	green
		40-60	gray	green
	12	20-40	gray	green
		40-60	gray	green
	13	20-40	gray	green
		40-60	gray	green
NC	14	20-40	gray	green
		40-60	gray	green
	15	20-40	gray	green
		40-60	gray	green

green = used for abundance indices
gray = not used for abundance indices

Table 24. Black Sea Bass sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	166	83.9	65.1	166	140	140	119	115
	2009	237	67.6	74.4	237	168	168	163	161
	2010	114	54.7	58.1	114	112	112	97	90
	2011	136	61.8	81.4	136	121	121	86	83
	2012	260	50.9	81.4	260	177	177	149	144
	2013	498	146.7	83.7	498	229	229	187	185
	2014	993	367.3	69.8	790	211	211	148	145
	2015	574	318.8	74.4	574	182	182	138	137
	2016	741	427.4	86.0	741	234	234	152	152
Fall	2007	401	85.3	36.0	401	219	219	211	211
	2008	174	75.2	31.3	174	115	115	114	114
	2009	470	94.5	32.0	375	148	148	138	136
	2010	121	42.8	28.0	121	90	90	86	86
	2011	196	67.3	42.0	196	169	169	152	150
	2012	1,481	237.9	48.0	588	223	223	195	190
	2013	572	218.3	37.3	572	182	182	149	142
	2014	332	135.1	33.3	332	149	149	108	108
	2015	259	134.8	24.0	259	163	163	127	126
	2016	295	143.8	33.3	295	177	177	123	122

Table 25. Black Sea Bass geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP surveys.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	44	1.13	1.69	2.39	0.77	1.18	1.69
	2009	47	1.17	1.64	2.21	0.55	0.84	1.20
	2010	43	0.83	1.30	1.90	0.49	0.78	1.13
	2011	43	1.40	1.99	2.72	0.64	1.01	1.46
	2012	43	1.67	2.36	3.23	0.60	0.88	1.21
	2013	43	3.52	5.66	8.82	1.63	2.44	3.49
	2014	43	5.99	9.01	13.32	2.96	4.31	6.12
	2015	43	2.99	4.83	7.52	2.08	3.35	5.13
	2016	43	6.43	9.61	14.14	3.94	5.79	8.33
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	44	0.04	0.09	0.14	0.01	0.02	0.03
	2009	47	0.11	0.24	0.38	0.01	0.02	0.03
	2010	43	0.01	0.03	0.06	0.00	0.00	0.01
	2011	43	0.10	0.23	0.37	0.00	0.01	0.02
	2012	43	0.27	0.46	0.69	0.02	0.03	0.04
	2013	43	0.22	0.44	0.69	0.02	0.05	0.09
	2014	43	0.06	0.13	0.20	0.01	0.02	0.02
	2015	43	0.00	0.02	0.05	0.00	0.00	0.00
	2016	43	0.03	0.14	0.25	0.00	0.00	0.01
2	2007							
	2008	44	0.29	0.48	0.70	0.11	0.19	0.28
	2009	47	0.30	0.46	0.63	0.07	0.11	0.14
	2010	43	0.27	0.44	0.64	0.09	0.14	0.20
	2011	43	0.27	0.45	0.65	0.09	0.16	0.24
	2012	43	0.49	0.72	0.98	0.14	0.20	0.27
	2013	43	1.37	2.55	4.32	0.30	0.57	0.91
	2014	43	1.56	2.56	3.94	0.46	0.87	1.40
	2015	43	0.03	0.24	0.49	0.00	0.09	0.19
	2016	43	0.89	1.54	2.40	0.30	0.53	0.80
3	2007							
	2008	44	0.40	0.67	1.00	0.20	0.34	0.51
	2009	47	0.38	0.55	0.74	0.16	0.25	0.35
	2010	43	0.34	0.55	0.78	0.16	0.25	0.36
	2011	43	0.33	0.54	0.78	0.17	0.29	0.42
	2012	43	0.42	0.62	0.85	0.20	0.30	0.41
	2013	43	0.91	1.39	1.98	0.37	0.56	0.76
	2014	43	3.07	4.94	7.69	1.36	2.23	3.44
	2015	43	0.95	1.65	2.61	0.53	0.94	1.46
	2016	43	1.53	2.32	3.37	0.86	1.34	1.93
4+	2007							
	2008	44	0.42	0.70	1.03	0.39	0.71	1.10
	2009	47	0.29	0.49	0.72	0.28	0.52	0.80
	2010	43	0.35	0.58	0.84	0.28	0.50	0.75
	2011	43	0.49	0.78	1.14	0.38	0.65	0.98
	2012	43	0.45	0.69	0.96	0.29	0.45	0.62
	2013	43	0.87	1.35	1.94	0.79	1.26	1.86
	2014	43	2.08	2.92	3.99	1.48	2.17	3.04
	2015	43	2.20	3.54	5.44	1.70	2.72	4.12
	2016	43	4.08	6.06	8.79	3.17	4.61	6.56

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	150	0.60	0.84	1.12	0.18	0.28	0.39
	2008	150	0.31	0.45	0.61	0.07	0.15	0.23
	2009	160	0.43	0.66	0.93	0.15	0.25	0.37
	2010	150	0.24	0.36	0.49	0.10	0.16	0.22
	2011	150	0.52	0.68	0.87	0.18	0.25	0.33
	2012	150	0.75	1.05	1.40	0.23	0.37	0.52
	2013	150	0.67	0.89	1.14	0.30	0.43	0.58
	2014	150	0.49	0.70	0.94	0.22	0.34	0.46
	2015	150	0.40	0.55	0.71	0.23	0.33	0.44
	2016	150	0.51	0.71	0.94	0.25	0.35	0.46
0	2007	150	0.23	0.35	0.48	0.03	0.05	0.08
	2008	150	0.13	0.21	0.29	0.01	0.02	0.03
	2009	160	0.16	0.27	0.38	0.01	0.04	0.07
	2010	150	0.07	0.13	0.20	0.01	0.02	0.03
	2011	150	0.13	0.20	0.27	0.01	0.01	0.02
	2012	150	0.16	0.28	0.41	0.00	0.05	0.11
	2013	150	0.09	0.17	0.25	0.00	0.01	0.01
	2014	150	0.09	0.14	0.20	0.00	0.01	0.01
	2015	150	0.06	0.10	0.15	0.00	0.00	0.00
	2016	150	0.00	0.03	0.05	0.00	0.00	0.00
1	2007	150	0.27	0.39	0.52	0.05	0.08	0.12
	2008	150	0.09	0.15	0.22	0.01	0.03	0.04
	2009	160	0.17	0.30	0.45	0.03	0.09	0.15
	2010	150	0.06	0.12	0.18	0.01	0.02	0.03
	2011	150	0.15	0.22	0.30	0.02	0.04	0.05
	2012	150	0.33	0.51	0.72	0.03	0.11	0.19
	2013	150	0.12	0.22	0.32	0.02	0.06	0.10
	2014	150	0.07	0.14	0.21	0.01	0.02	0.04
	2015	150	0.06	0.11	0.16	0.01	0.02	0.03
	2016	150	0.21	0.34	0.48	0.03	0.06	0.09
2	2007	150	0.16	0.26	0.36	0.05	0.10	0.15
	2008	150	0.04	0.08	0.13	0.00	0.03	0.07
	2009	160	0.10	0.20	0.32	0.03	0.08	0.13
	2010	150	0.05	0.08	0.12	0.01	0.03	0.04
	2011	150	0.10	0.16	0.23	0.02	0.04	0.07
	2012	150	0.22	0.36	0.51	0.02	0.09	0.17
	2013	150	0.19	0.33	0.48	0.06	0.14	0.22
	2014	150	0.12	0.21	0.31	0.06	0.11	0.17
	2015	150	0.05	0.09	0.13	0.02	0.04	0.06
	2016	150	0.02	0.06	0.09	0.01	0.02	0.03
3	2007	150	0.09	0.17	0.25	0.04	0.08	0.13
	2008	150	0.01	0.06	0.11	0.00	0.04	0.09
	2009	160	0.07	0.15	0.23	0.03	0.07	0.11
	2010	150	0.03	0.05	0.08	0.01	0.03	0.04
	2011	150	0.03	0.08	0.13	0.02	0.05	0.08
	2012	150	0.04	0.09	0.14	0.03	0.06	0.09
	2013	150	0.14	0.23	0.32	0.08	0.14	0.20
	2014	150	0.16	0.26	0.37	0.10	0.18	0.25
	2015	150	0.15	0.23	0.32	0.09	0.16	0.22
	2016	150	0.05	0.09	0.13	0.03	0.06	0.09
4+	2007	150	0.03	0.06	0.10	0.02	0.06	0.10
	2008	150	0.01	0.06	0.12	0.01	0.07	0.14
	2009	160	0.03	0.07	0.10	0.03	0.08	0.13
	2010	150	0.04	0.07	0.11	0.04	0.08	0.12
	2011	150	0.10	0.16	0.22	0.10	0.16	0.21
	2012	150	0.12	0.20	0.28	0.10	0.18	0.26
	2013	150	0.17	0.26	0.36	0.15	0.23	0.33
	2014	150	0.12	0.19	0.28	0.09	0.16	0.23
	2015	150	0.17	0.26	0.36	0.14	0.23	0.31
	2016	150	0.20	0.29	0.38	0.18	0.26	0.35

Figure 59. Black Sea Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and by age class (B).

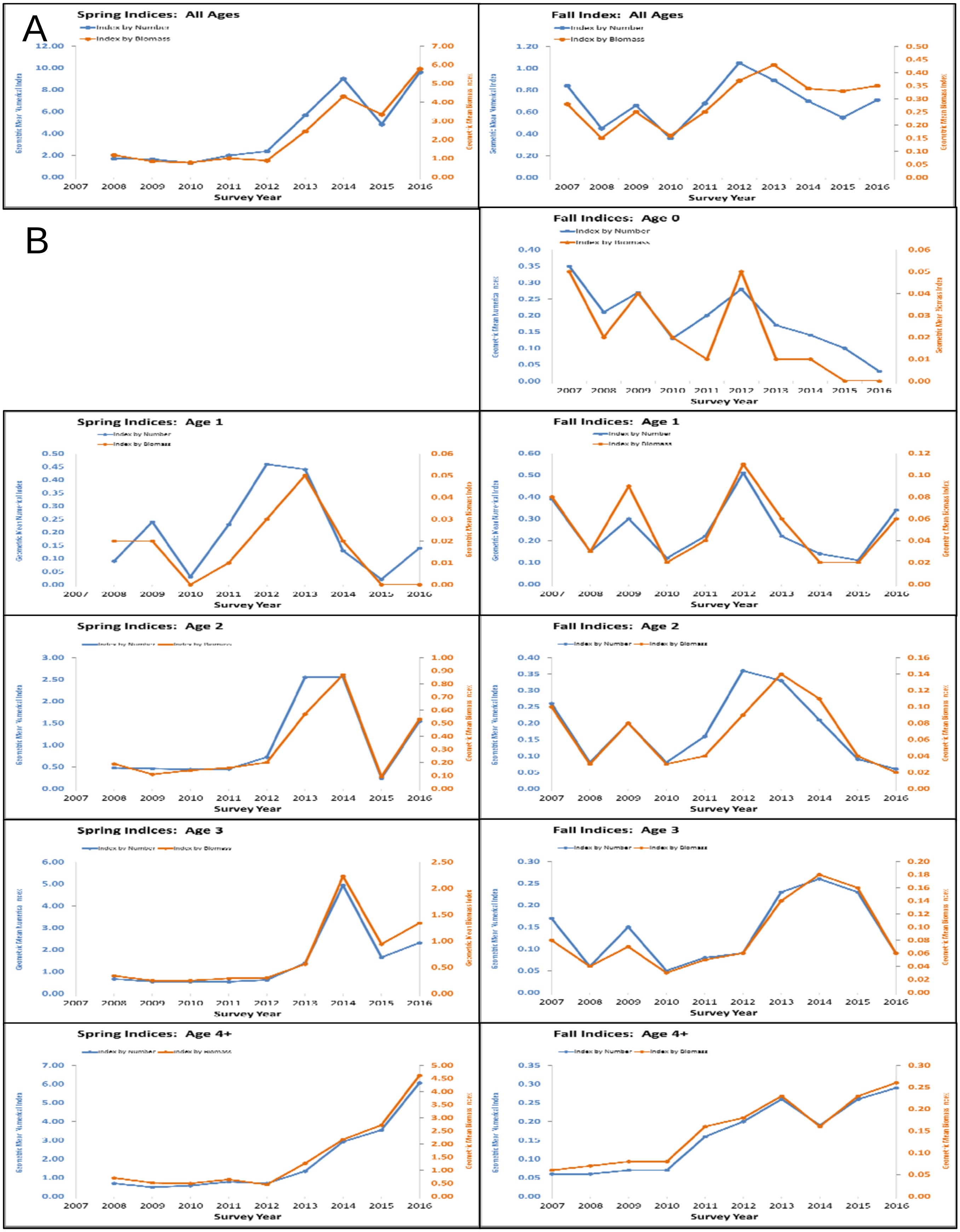


Figure 60. Black Sea Bass length-frequency distributions, by cruise.

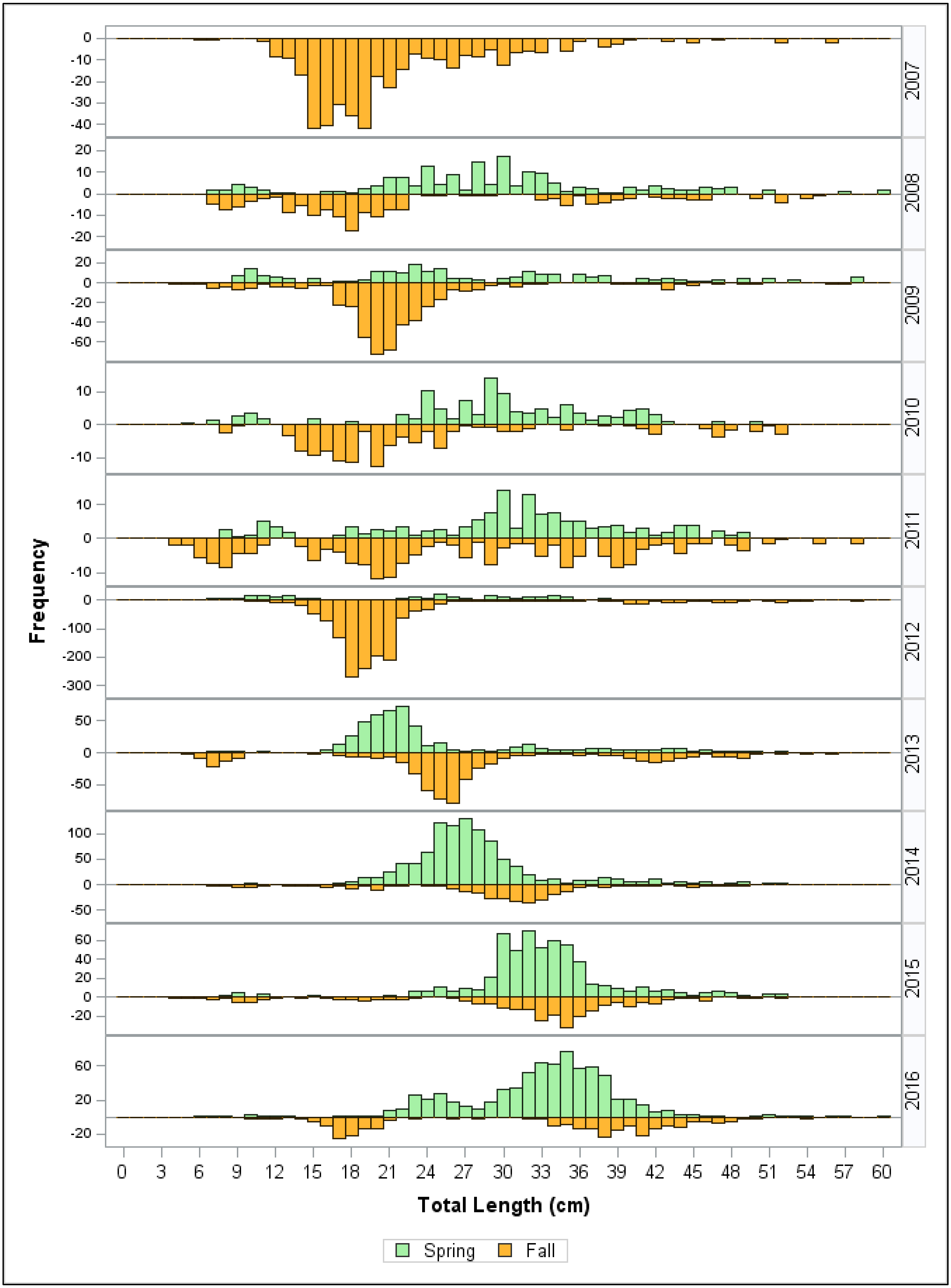


Figure 61. Black Sea Bass length-frequency distributions, by cruise and sex.

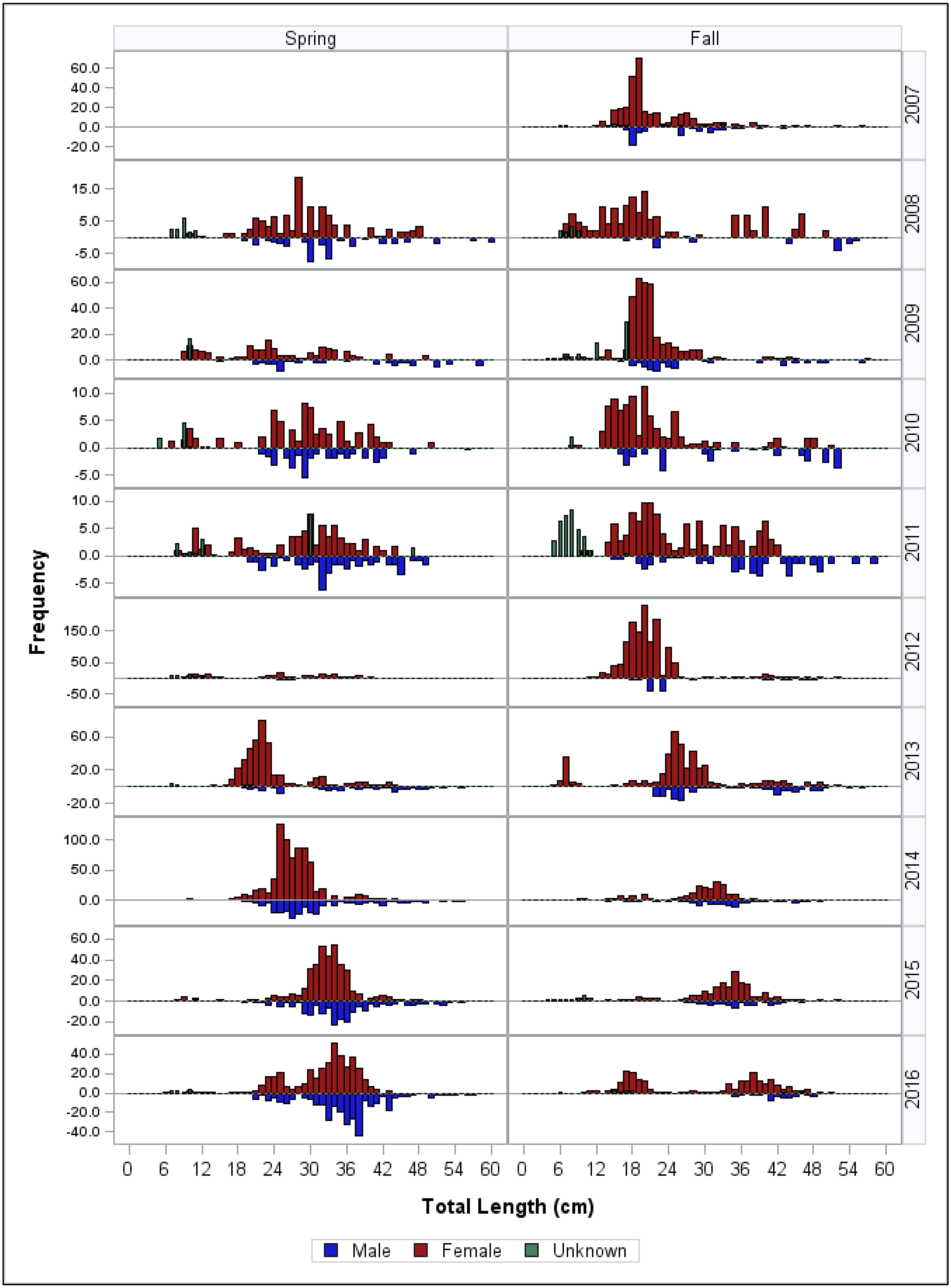


Figure 62. Black Sea Bass age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

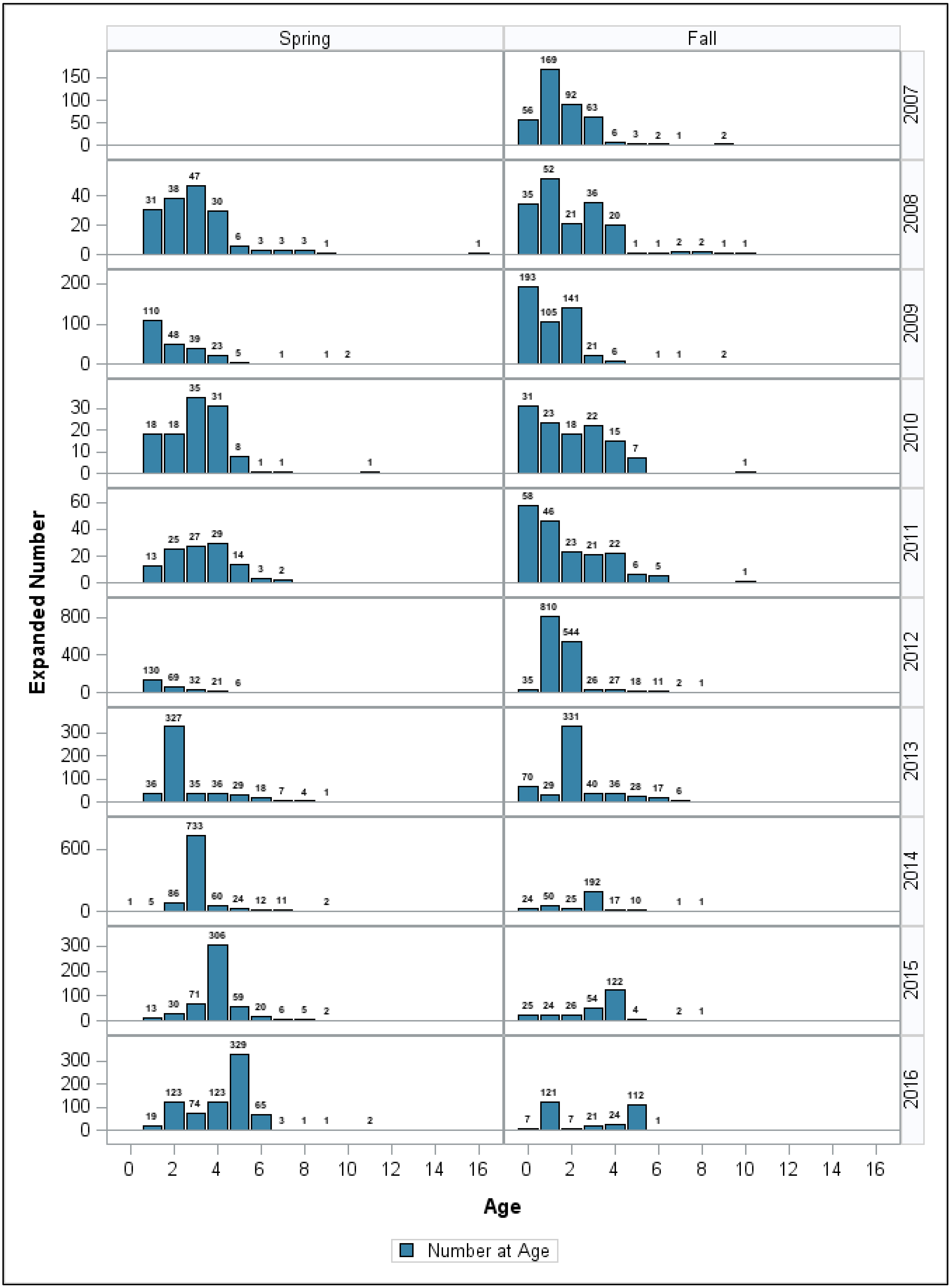


Figure 63. Black Sea Bass catch-at-age standardized to 3,000 trawl minutes, by cruise.

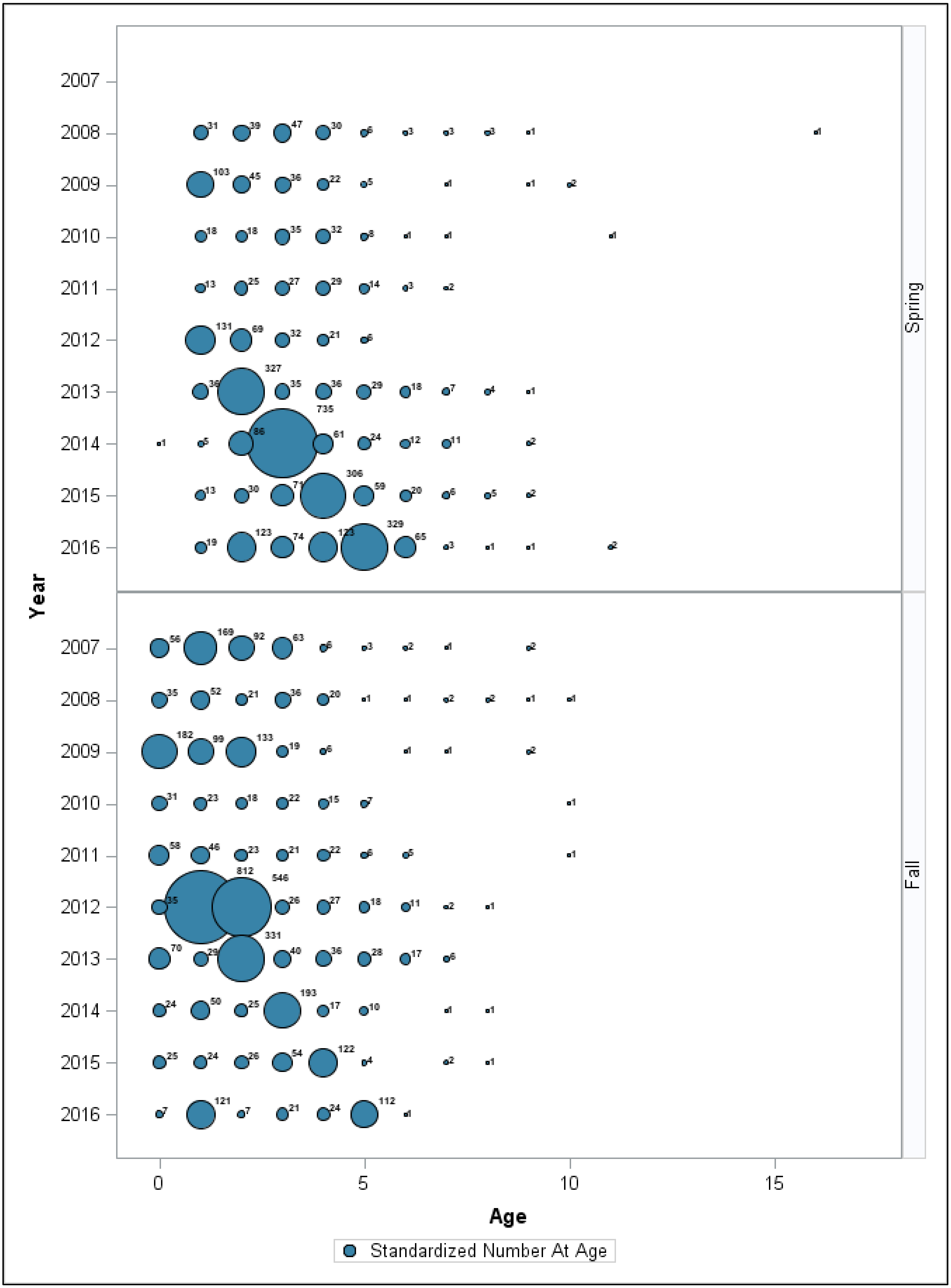


Figure 64. Black Sea Bass sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

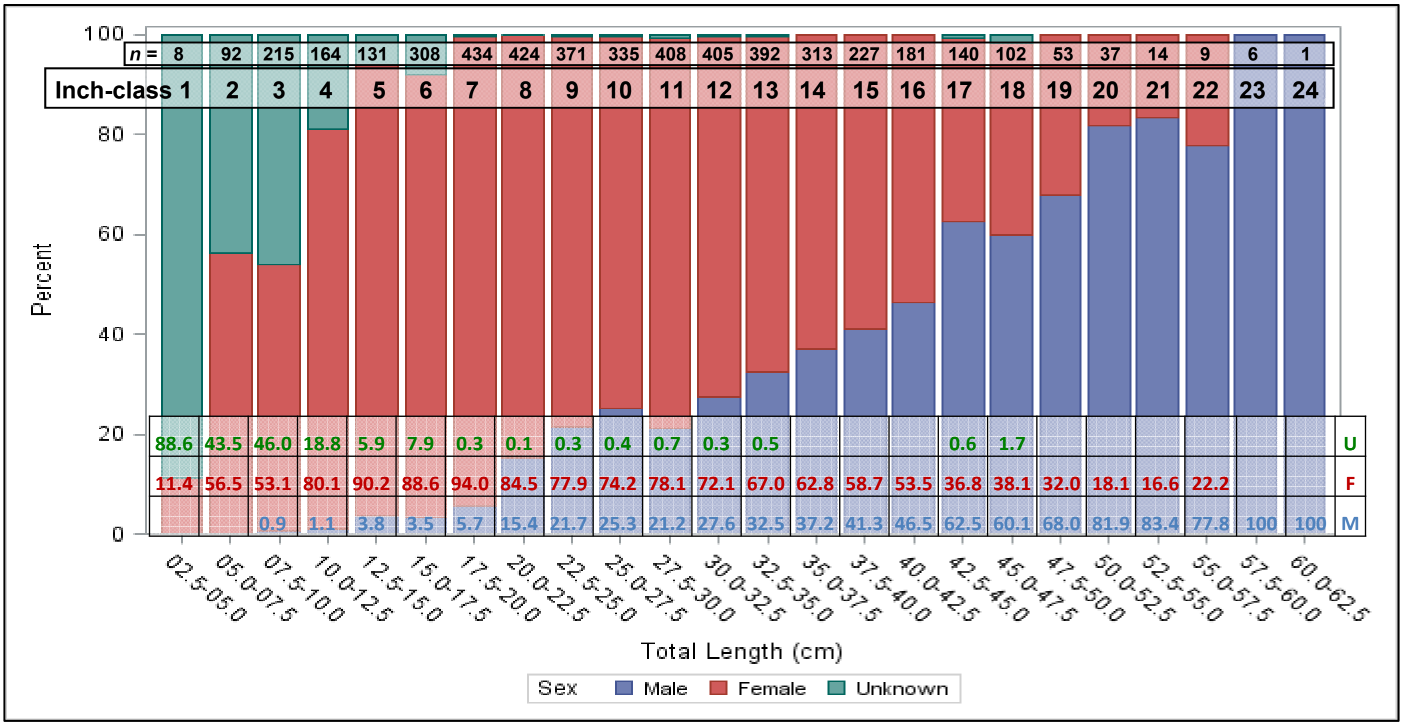


Figure 65. Black Sea Bass maturity at length, by sex for all cruises pooled, 2007-2016.

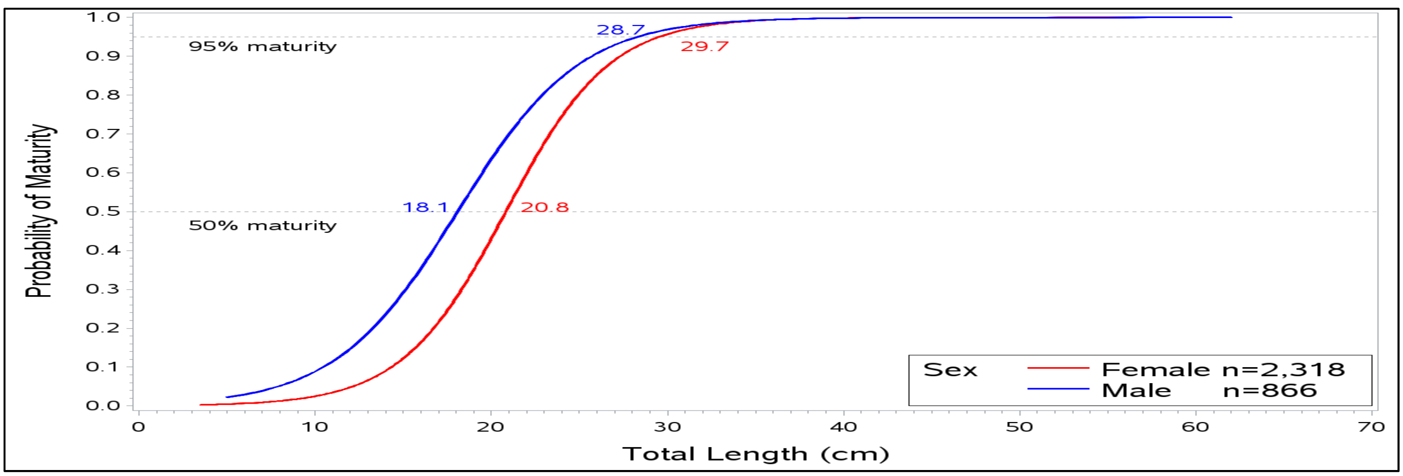


Figure 66. Black Sea Bass maturity at age, by sex for all cruises pooled, 2007-2016.

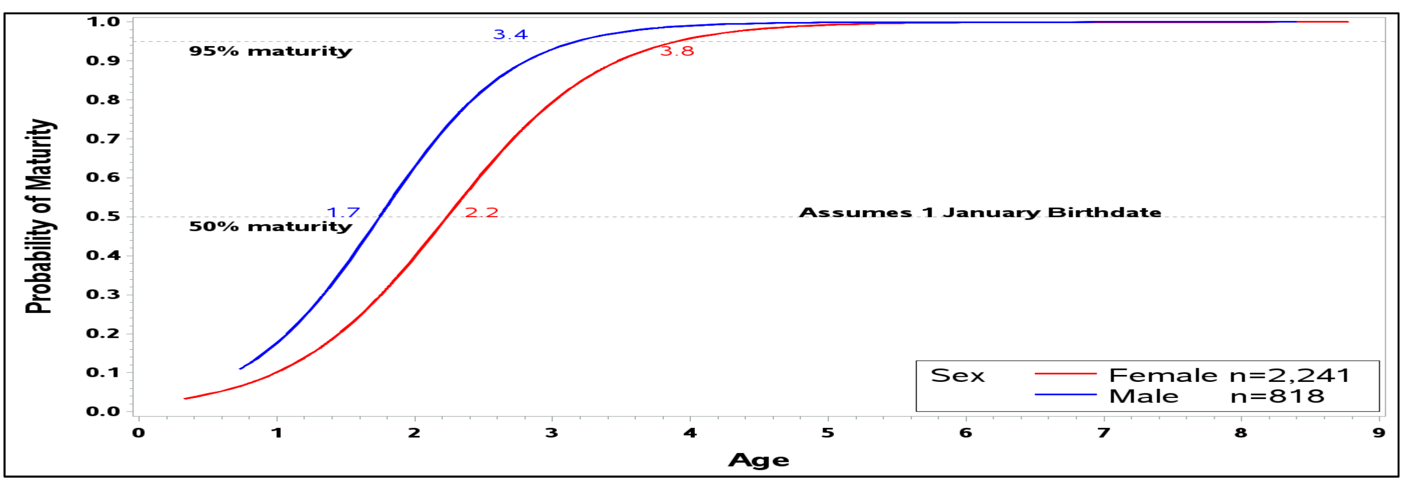
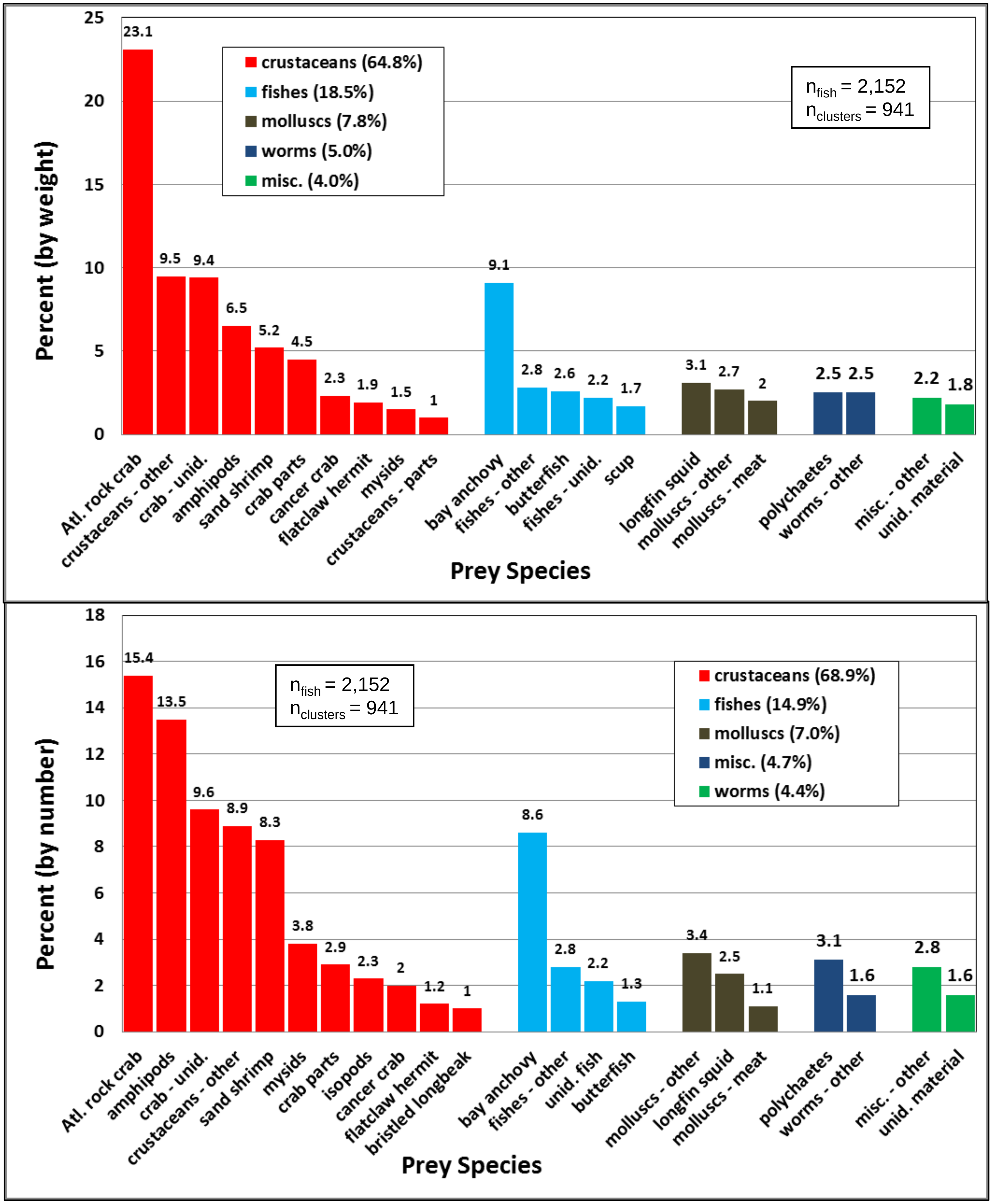


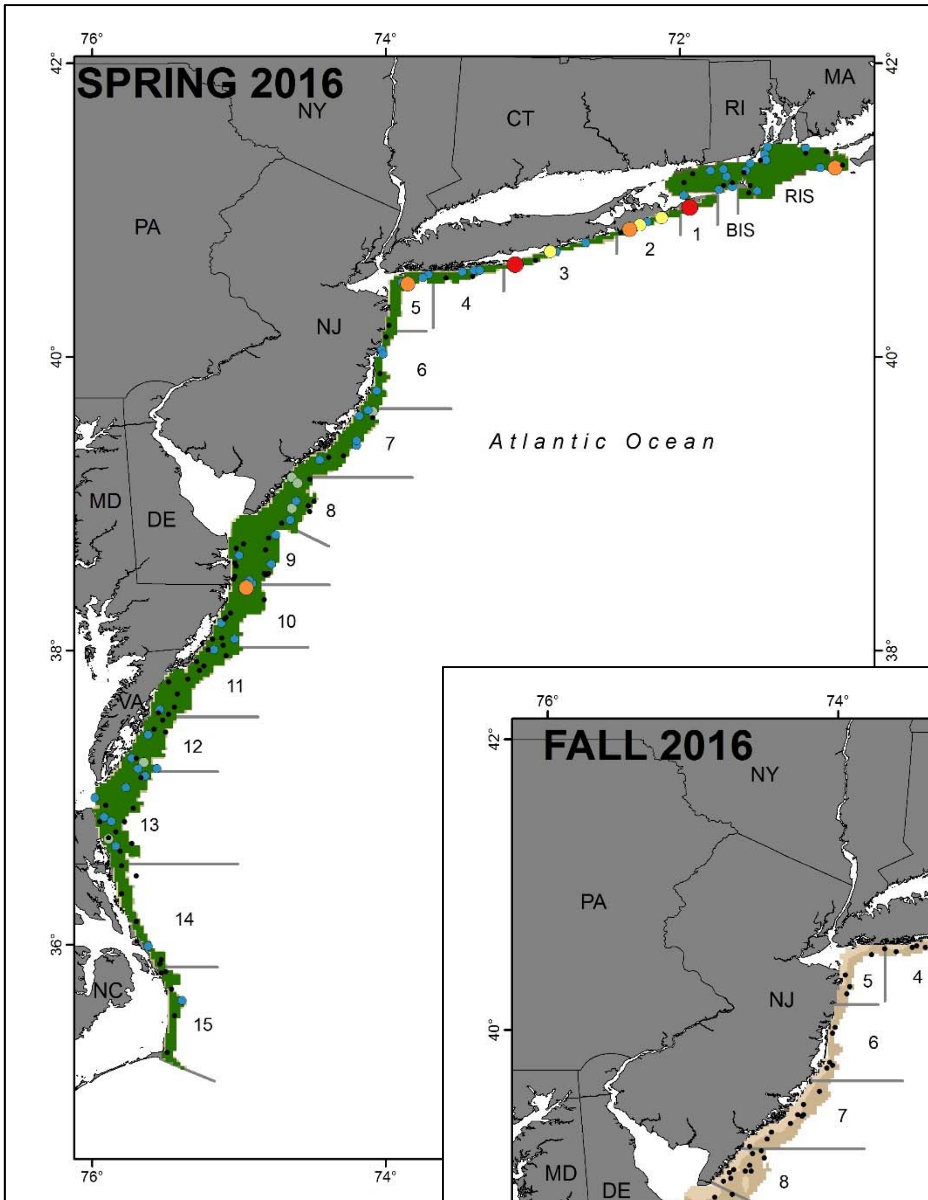
Figure 67. Black Sea Bass diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

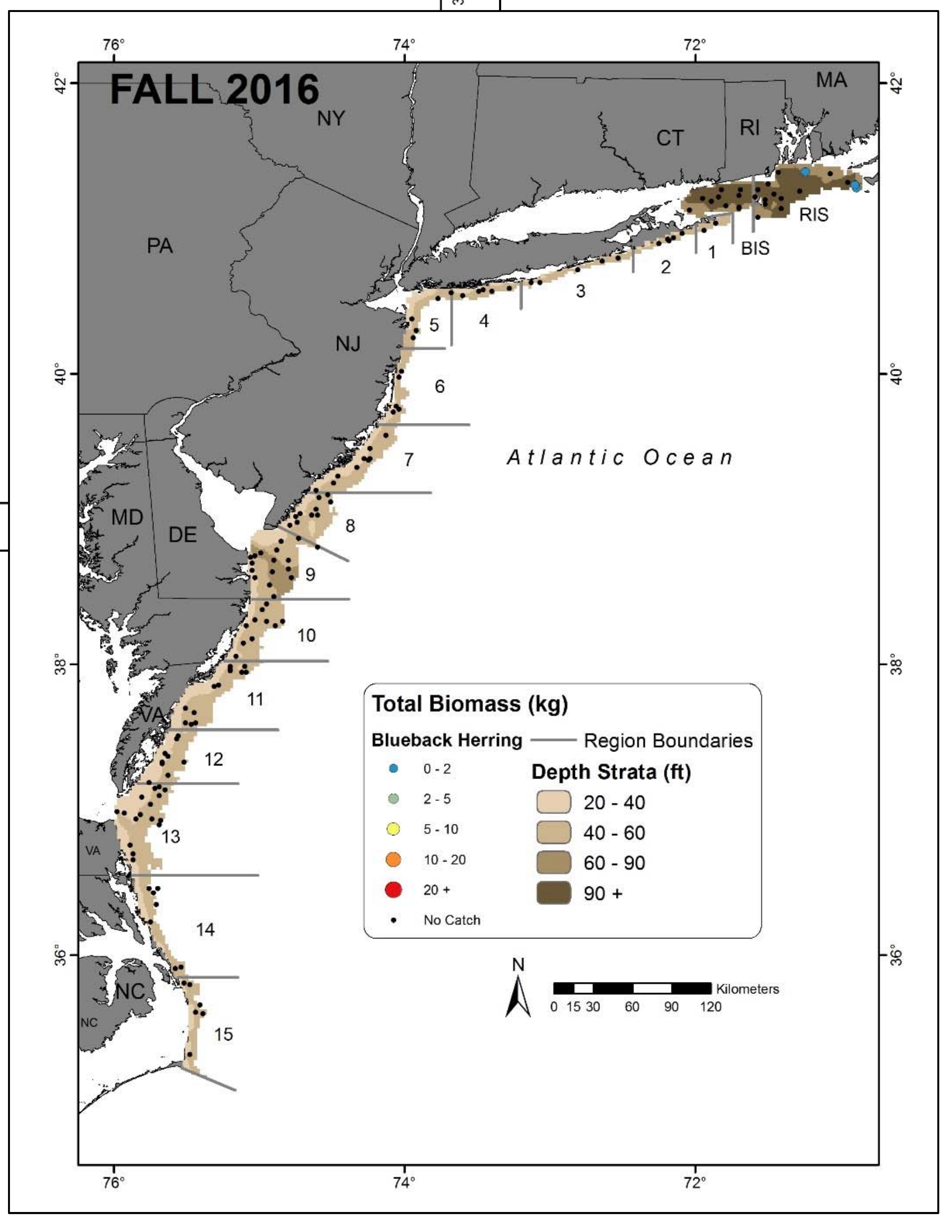


Blueback Herring

Sampling Priority: A

Figure 68. Blueback Herring biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		N/A
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		
(green)	= used for abundance indices			
(gray)	= not used for abundance indices			

Table 26. Blueback Herring sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	3,693	62.2	40.7	1,774	237	0	235	0
	2009	5,603	160.3	49.3	2,808	315	0	315	2
	2010	4,992	86.6	46.0	2,436	280	0	276	21
	2011	77,071	957.3	38.7	2,713	226	0	220	218
	2012	6,258	66.0	22.0	2,221	144	0	142	134
	2013	4,484	72.0	28.0	3,430	178	0	169	167
	2014	15,334	233.1	51.3	3,381	319	0	213	212
	2015	28,524	354.1	41.3	4,630	245	0	112	110
	2016	12,046	173.6	47.3	5,105	296	0	75	74
Fall	2007	50	1.6	0.0	50	18	0	18	0
	2008	20	0.7	0.0	20	9	0	9	0
	2009	15	0.6	0.0	15	6	0	6	6
	2010	22	0.6	0.0	22	15	0	14	12
	2011	2	0.1	0.0	2	2	0	2	2
	2012	4	0.1	0.0	4	4	0	4	3
	2013	152	8.3	0.0	152	5	0	4	4
	2014	2,368	118.6	0.0	77	12	0	9	9
	2015	4	0.1	0.0	4	4	0	0	0
	2016	28	1.0	0.0	28	7	0	1	1

Table 27. Blueback Herring geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured and for the youngest year class captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	150	1.06	1.61	2.31	0.11	0.19	0.27
	2009	160	1.45	2.18	3.12	0.21	0.33	0.45
	2010	150	1.28	1.98	2.88	0.13	0.22	0.32
	2011	150	0.75	1.18	1.73	0.09	0.16	0.24
	2012	150	0.61	1.12	1.79	0.08	0.16	0.26
	2013	150	0.70	1.12	1.64	0.11	0.18	0.26
	2014	150	2.20	3.37	4.98	0.33	0.51	0.71
	2015	150	1.33	2.24	3.50	0.21	0.37	0.55
	2016	150	1.88	2.86	4.19	0.20	0.32	0.46
1	2007							
	2008	150	0.86	1.33	1.92	0.08	0.14	0.21
	2009	160	0.85	1.33	1.93	0.09	0.17	0.24
	2010	150	1.07	1.68	2.48	0.09	0.19	0.29
	2011	150	0.55	0.94	1.41	0.07	0.14	0.22
	2012	150	0.55	1.04	1.68	0.07	0.16	0.26
	2013	150	0.57	0.93	1.37	0.09	0.15	0.21
	2014	150	0.86	1.47	2.27	0.13	0.27	0.42
	2015	150	1.03	1.82	2.92	0.17	0.33	0.52
	2016	150	1.48	2.30	3.39	0.15	0.25	0.37

Figure 69. Blueback Herring geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

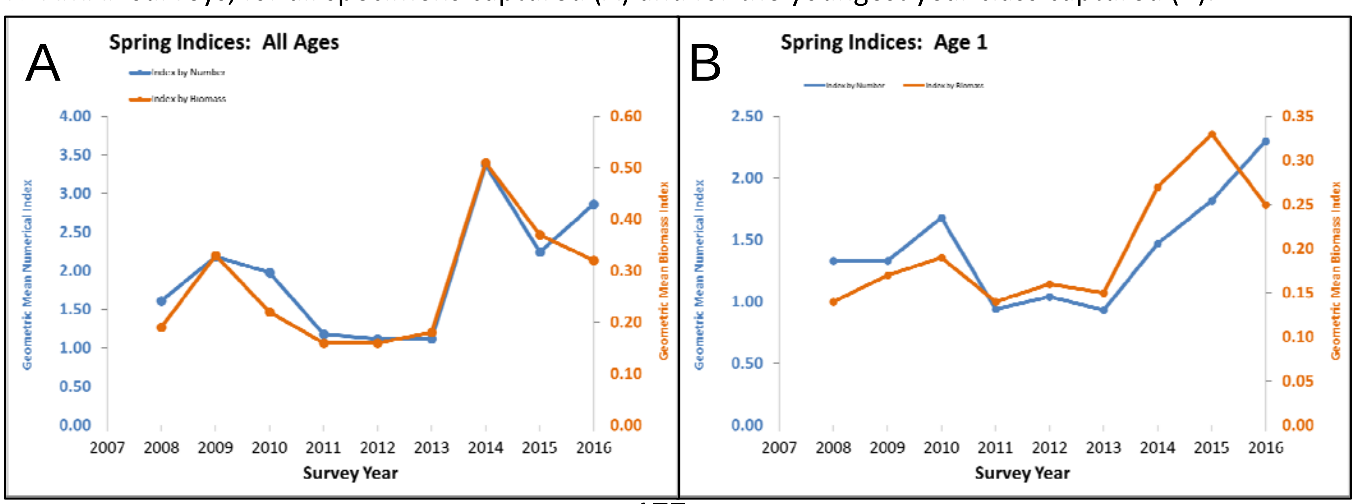


Figure 70. Blueback Herring length-frequency distributions, by cruise (Blue reference lines are placed at the size cutoff values used to separate recruits from older specimens. Cutoff values - spring 14cm - estimated by examination of these length frequency figures.).

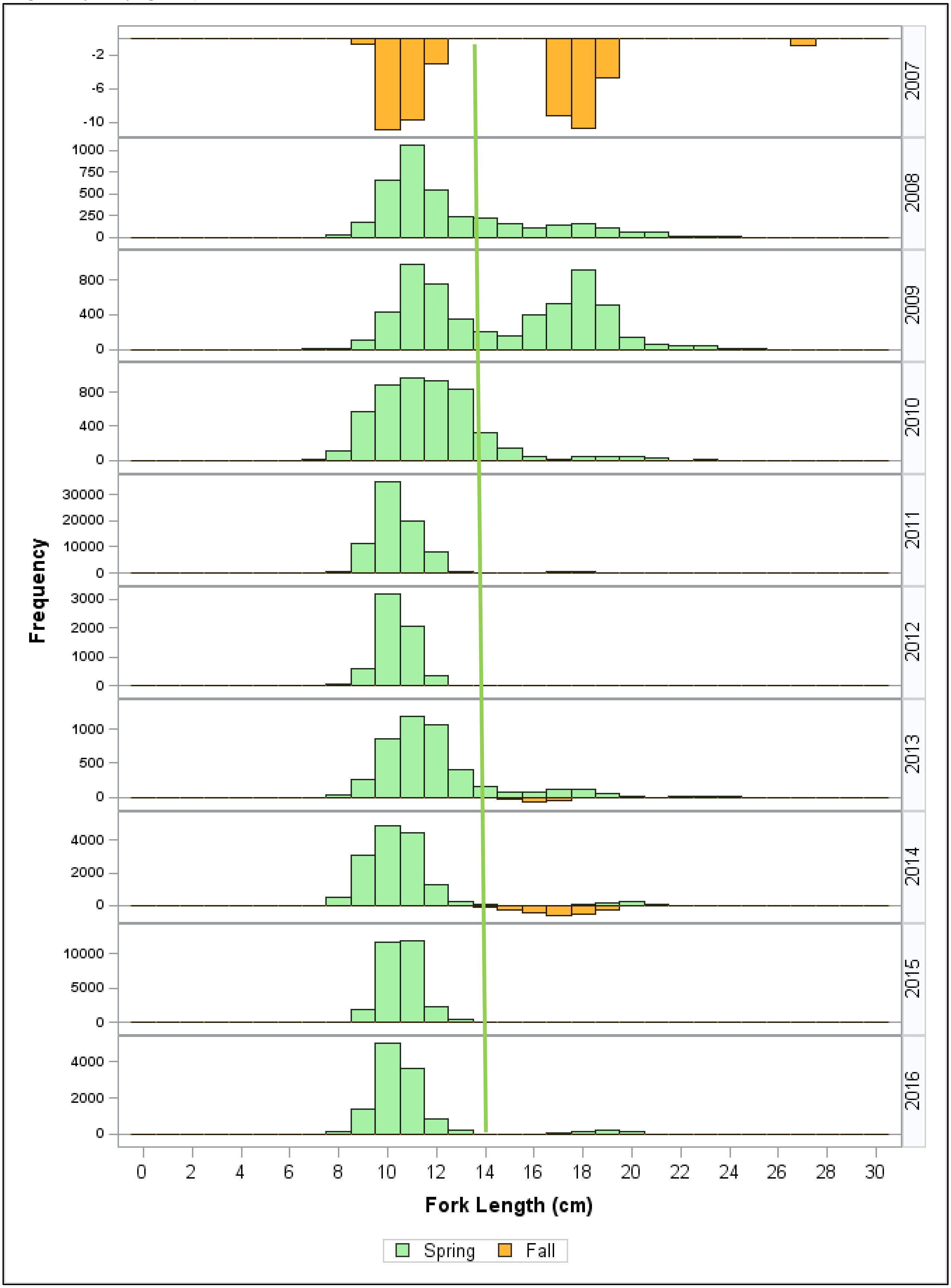


Figure 71. Blueback Herring sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

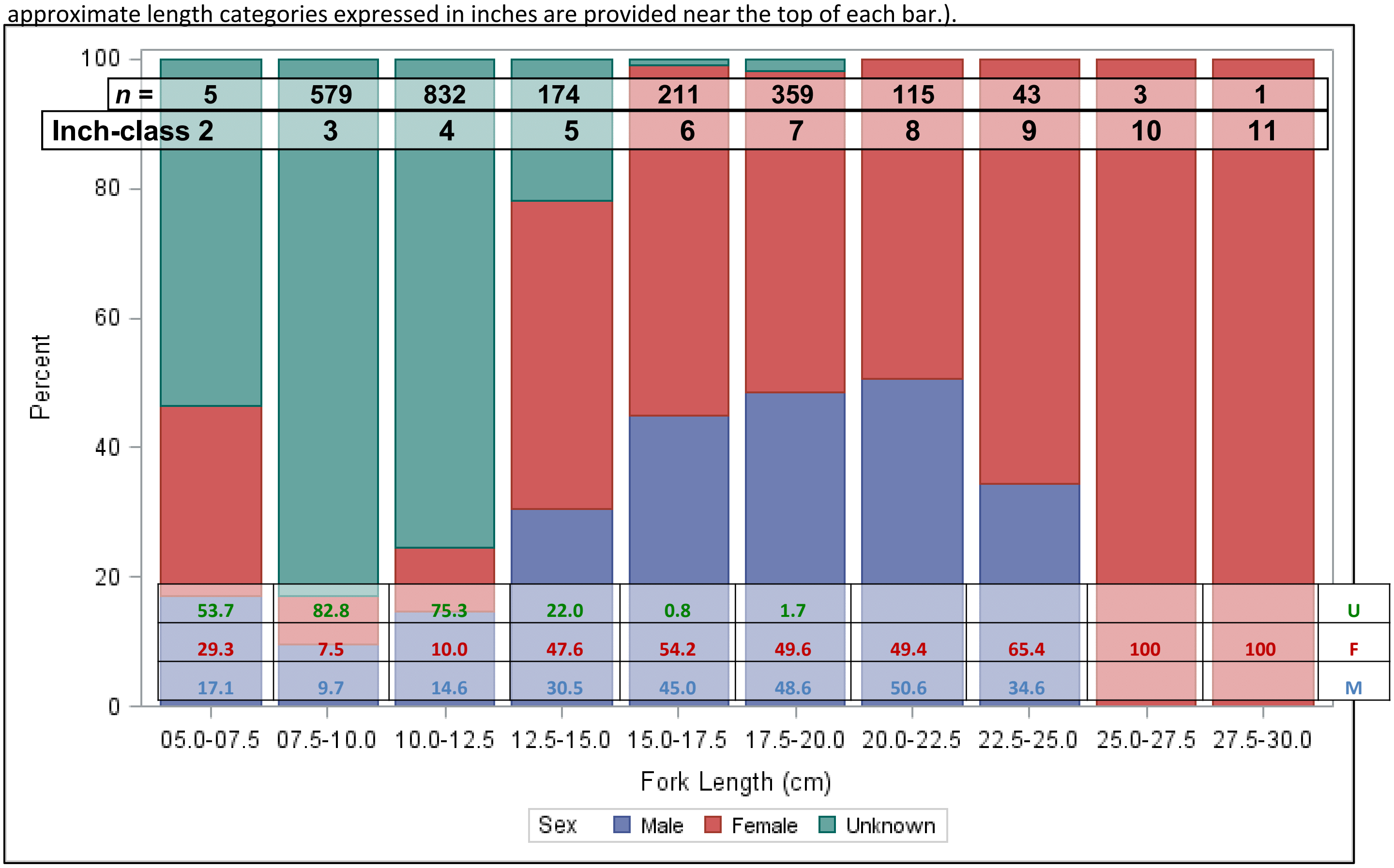


Figure 72. Blueback Herring maturity at length, by sex for all cruises pooled, 2007-2016.

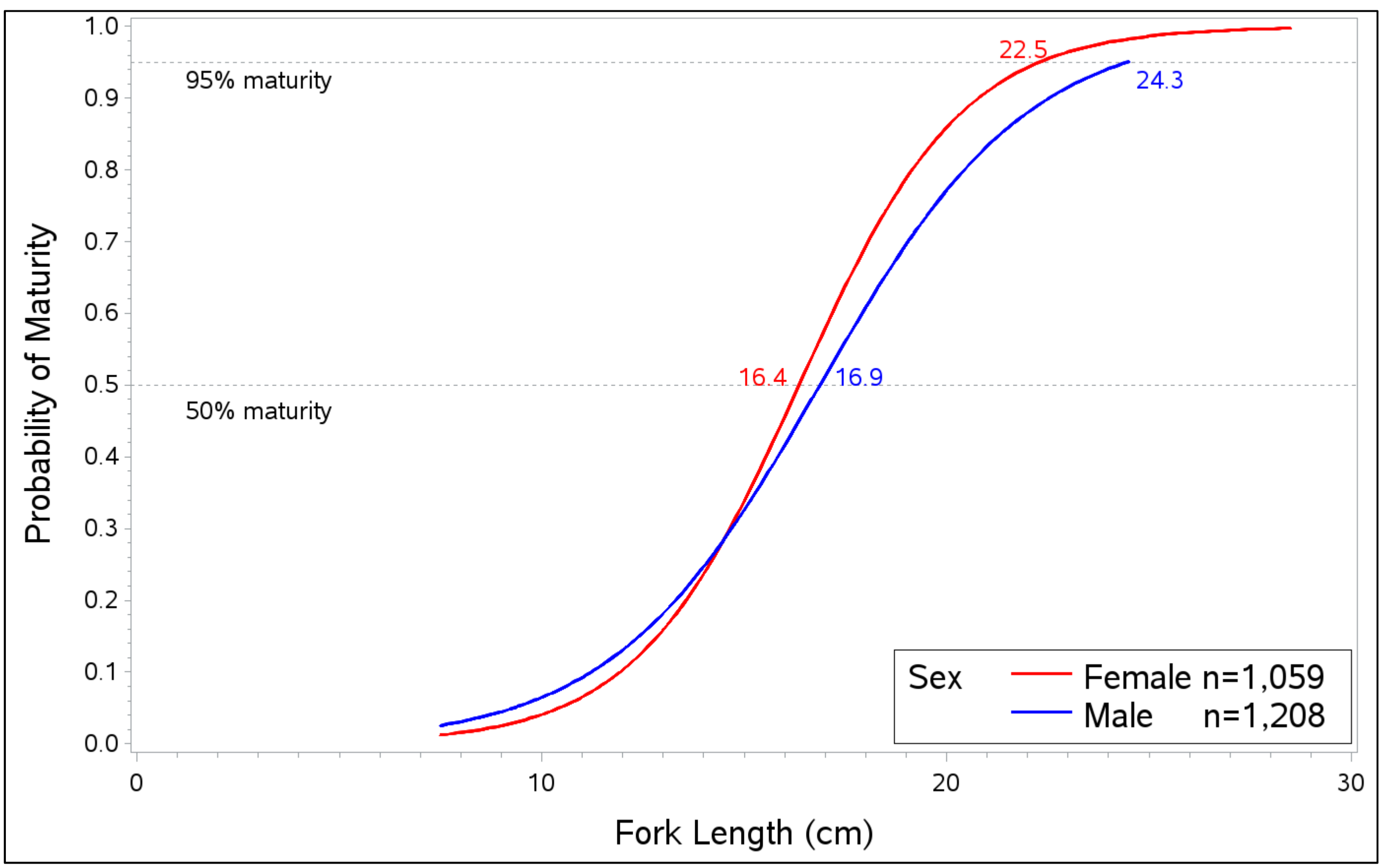
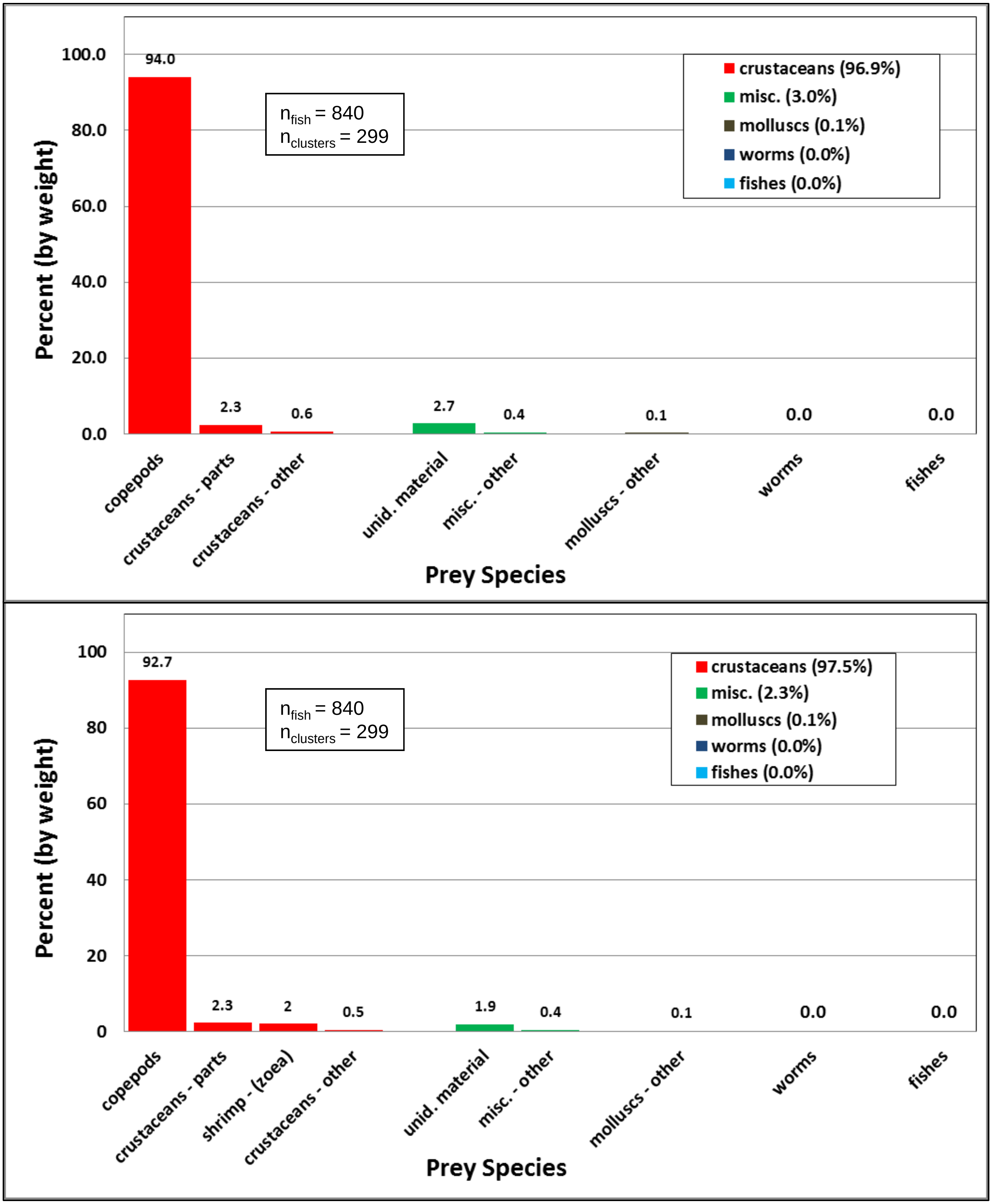
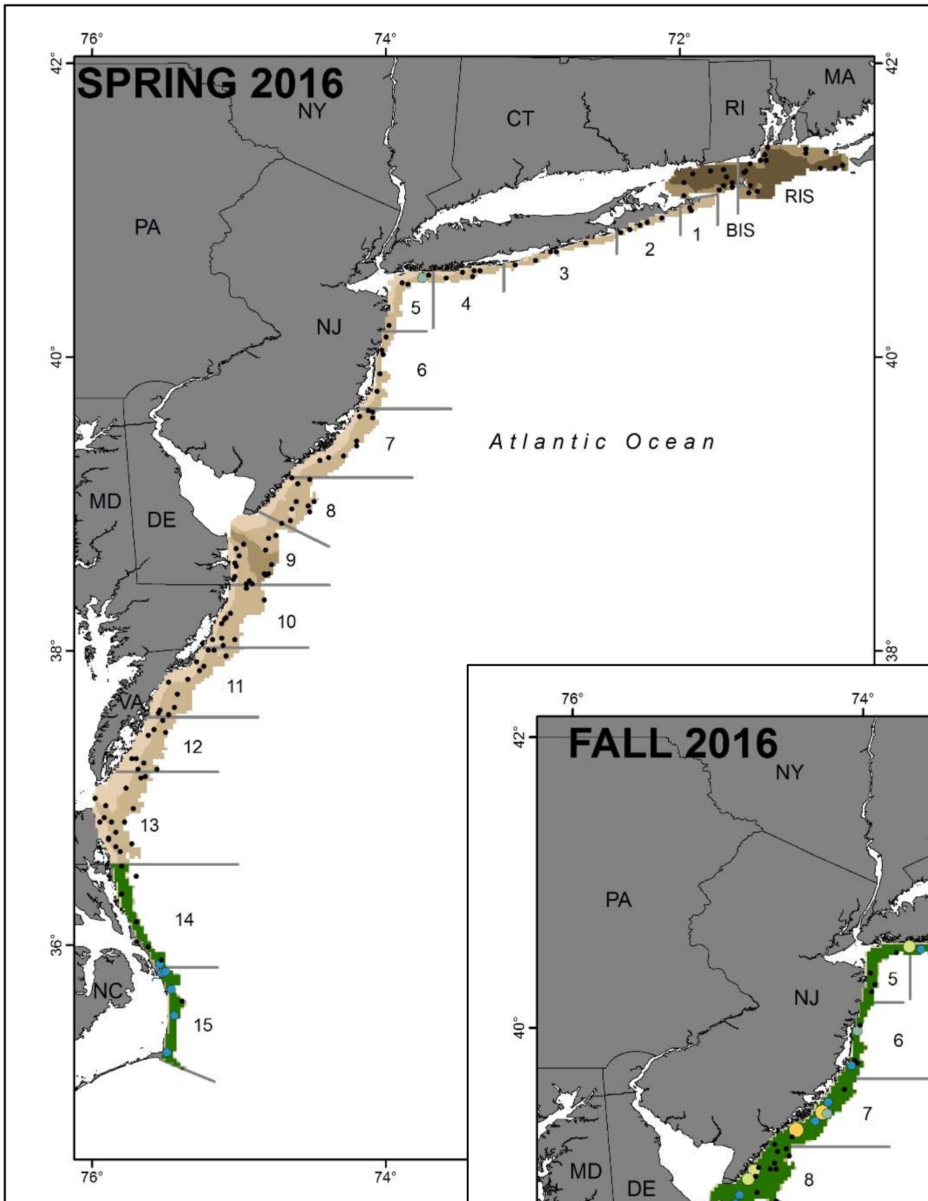


Figure 73. Blueback herring diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

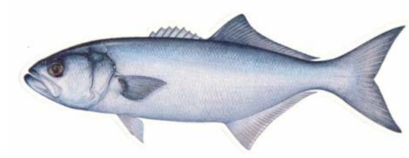


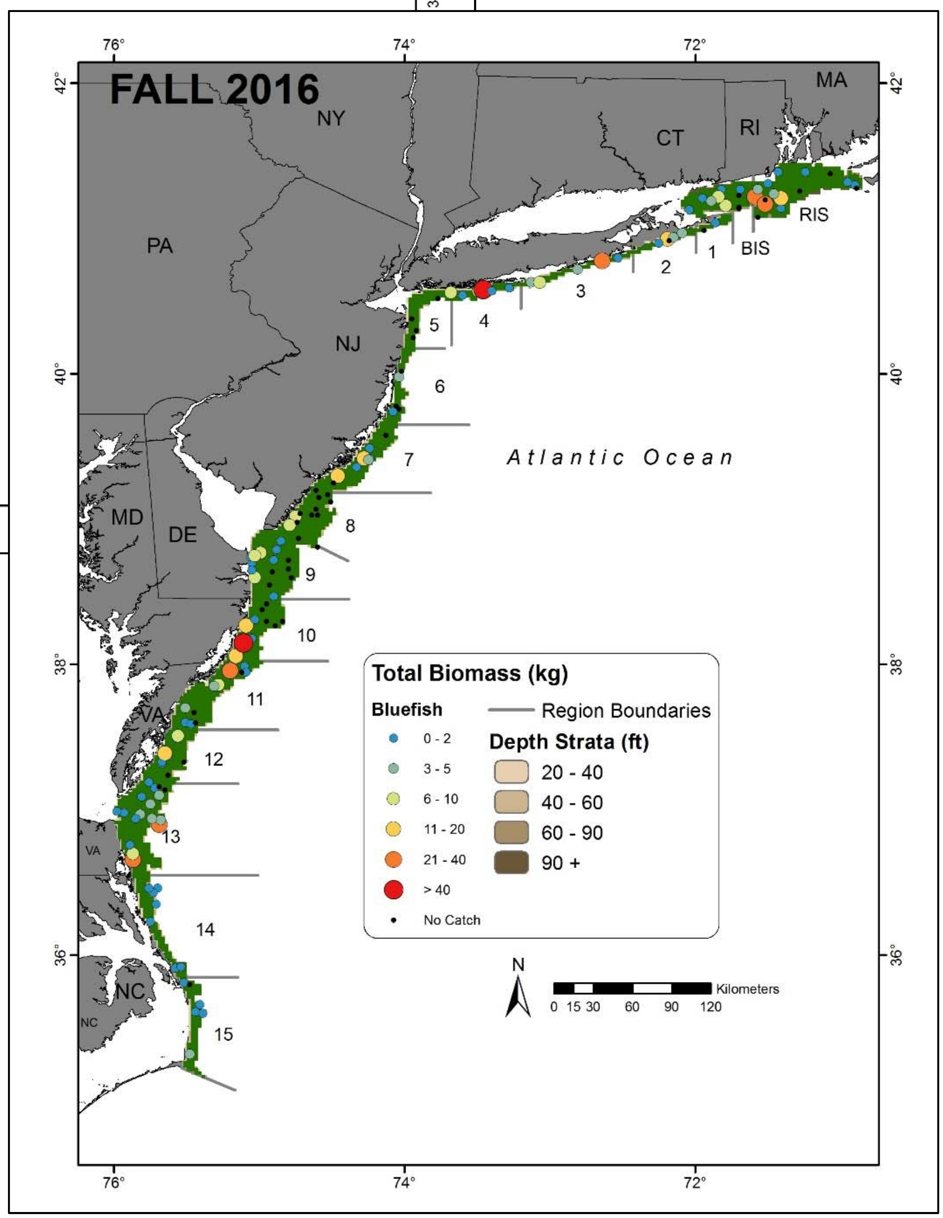


Bluefish

Sampling Priority: A

Figure 74. Bluefish biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices
= not used for abundance indices

Table 28. Bluefish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	37	10.9	33.3	37	27	26	24	24
	2009	1,580	91.2	50.0	274	35	33	14	13
	2010	312	21.4	33.3	68	18	18	15	15
	2011	18	10.5	16.7	18	11	11	3	3
	2012	74	18.7	83.3	74	40	40	15	15
	2013	12	22.6	0.0	12	12	12	7	5
	2014	23	55.9	0.0	23	21	21	19	19
	2015	15	21.6	16.7	15	15	15	9	9
	2016	64	7.5	83.3	64	23	23	4	3
Fall	2007	4,635	394.5	68.0	2,613	588	588	485	478
	2008	7,120	908.7	69.3	2,214	529	525	410	402
	2009	18,075	910.7	78.7	4,016	632	617	432	421
	2010	4,432	271.6	72.7	1,967	498	471	379	369
	2011	3,889	453.5	70.0	1,891	486	472	304	292
	2012	6,308	738.7	79.3	3,390	579	579	453	439
	2013	3,173	329.7	62.7	2,428	392	392	250	236
	2014	3,709	339.8	62.7	1,978	390	390	201	200
	2015	3,504	309.1	66.0	2,415	421	421	144	140
	2016	20,126	2,617.4	68.0	3,594	434	434	179	179

Table 29. Bluefish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age (Age-0 spring and summer cohorts shown separately).

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	13	0.00	0.66	1.93	0.00	0.07	0.15
	2009	15	0.56	1.40	2.69	0.35	0.41	0.47
	2010	13	0.00	1.38	6.73	0.00	0.29	1.00
	2011	13	0.00	0.34	1.15	0.00	0.12	0.39
	2012	13	0.29	1.31	3.14	0.03	0.34	0.75
	2013	13	0.00	0.06	0.19	0.00	0.01	0.04
	2014	13	0.00	0.00	0.00	0.00	0.00	0.00
	2015	13	0.00	0.09	0.24	0.00	0.01	0.02
	2016	13	0.50	1.81	4.25	0.04	0.22	0.43
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	13	0.00	0.66	1.93	0.00	0.07	0.15
	2009	15	0.56	1.40	2.69	0.37	0.46	0.54
	2010	13	0.00	1.35	6.46	0.00	0.66	3.30
	2011	13	0.00	0.00	0.00	0.00	0.00	0.00
	2012	13	0.00	0.45	1.25	0.00	0.08	0.20
	2013	13	0.00	0.00	0.00	0.00	0.00	0.00
	2014	13	0.00	0.00	0.00	0.00	0.00	0.00
	2015	13	0.00	0.00	0.00	0.00	0.00	0.00
	2016	13	0.00	0.00	0.00	0.00	0.00	0.00
2+	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	150	3.12	4.26	5.72	1.00	1.29	1.63
	2008	150	3.80	5.22	7.06	1.01	1.38	1.82
	2009	160	3.90	5.23	6.92	0.70	0.92	1.17
	2010	150	2.41	3.27	4.35	0.64	0.84	1.06
	2011	150	3.01	4.02	5.28	0.84	1.12	1.44
	2012	150	4.35	5.72	7.44	1.20	1.53	1.91
	2013	150	2.69	3.71	5.01	0.67	0.89	1.15
	2014	150	1.94	2.72	3.69	0.55	0.77	1.01
	2015	150	2.58	3.38	4.36	0.65	0.85	1.07
	2016	150	3.37	4.70	6.45	0.88	1.25	1.68
0	2007	150	2.36	3.31	4.53	0.57	0.81	1.08
	2008	150	3.15	4.35	5.90	0.60	0.86	1.15
	2009	160	3.52	4.76	6.34	0.52	0.74	1.00
	2010	150	1.96	2.71	3.64	0.34	0.51	0.70
	2011	150	2.45	3.27	4.28	0.58	0.82	1.09
	2012	150	3.75	4.98	6.51	0.93	1.23	1.59
	2013	150	2.53	3.50	4.75	0.54	0.73	0.94
	2014	150	1.66	2.36	3.23	0.37	0.55	0.76
	2015	150	2.44	3.20	4.13	0.52	0.68	0.87
	2016	150	2.97	4.16	5.72	0.67	0.98	1.34
1	2007	150	0.33	0.45	0.57	0.16	0.23	0.29
	2008	150	0.22	0.38	0.55	0.09	0.18	0.29
	2009	160	0.15	0.24	0.33	0.05	0.12	0.19
	2010	150	0.19	0.26	0.34	0.08	0.11	0.14
	2011	150	0.53	0.73	0.96	0.19	0.28	0.38
	2012	150	0.53	0.69	0.86	0.19	0.25	0.33
	2013	150	0.05	0.09	0.14	0.01	0.03	0.04
	2014	150	0.27	0.38	0.50	0.07	0.11	0.15
	2015	150	0.06	0.10	0.15	0.00	0.05	0.10
	2016	150	0.34	0.54	0.76	0.08	0.18	0.30
2+	2007	150	0.18	0.24	0.31	0.17	0.25	0.33
	2008	150	0.12	0.20	0.28	0.16	0.27	0.39
	2009	160	0.07	0.11	0.16	0.08	0.14	0.21
	2010	150	0.14	0.20	0.26	0.16	0.24	0.32
	2011	150	0.15	0.22	0.29	0.11	0.18	0.24
	2012	150	0.07	0.12	0.17	0.07	0.13	0.19
	2013	150	0.03	0.08	0.12	0.05	0.12	0.19
	2014	150	0.05	0.09	0.13	0.06	0.13	0.19
	2015	150	0.06	0.11	0.16	0.06	0.14	0.23
	2016	150	0.13	0.24	0.36	0.10	0.20	0.32

Age 0 Cohorts

Spring Cohort

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
0	2007	150	1.07	1.45	1.90	0.30	0.42	0.55
	2008	150	0.84	1.20	1.63	0.16	0.31	0.46
	2009	160	0.46	0.71	0.99	0.10	0.22	0.34
	2010	150	0.51	0.73	0.99	0.13	0.21	0.30
	2011	150	1.50	1.99	2.58	0.39	0.56	0.75
	2012	150	2.58	3.34	4.26	0.66	0.87	1.11
	2013	150	0.74	1.04	1.39	0.17	0.25	0.34
	2014	150	0.80	1.16	1.59	0.22	0.35	0.48
	2015	150	0.88	1.16	1.49	0.22	0.32	0.43
	2016	150	1.62	2.32	3.21	0.40	0.64	0.92

Summer Cohort

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
0	2007	150	0.83	1.24	1.74	0.17	0.30	0.44
	2008	150	1.84	2.58	3.51	0.34	0.49	0.65
	2009	160	2.13	2.83	3.69	0.28	0.38	0.49
	2010	150	1.18	1.67	2.27	0.16	0.28	0.41
	2011	150	0.50	0.74	1.02	0.11	0.20	0.29
	2012	150	0.39	0.60	0.84	0.10	0.18	0.27
	2013	150	1.16	1.63	2.20	0.23	0.33	0.43
	2014	150	0.60	0.88	1.22	0.09	0.17	0.25
	2015	150	1.01	1.38	1.83	0.19	0.29	0.39
	2016	150	0.93	1.31	1.78	0.21	0.31	0.41

Figure 75. Bluefish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A), for the youngest year class captured (B) and (using fall data only) for the spring and summer age-0 cohorts separately (C).

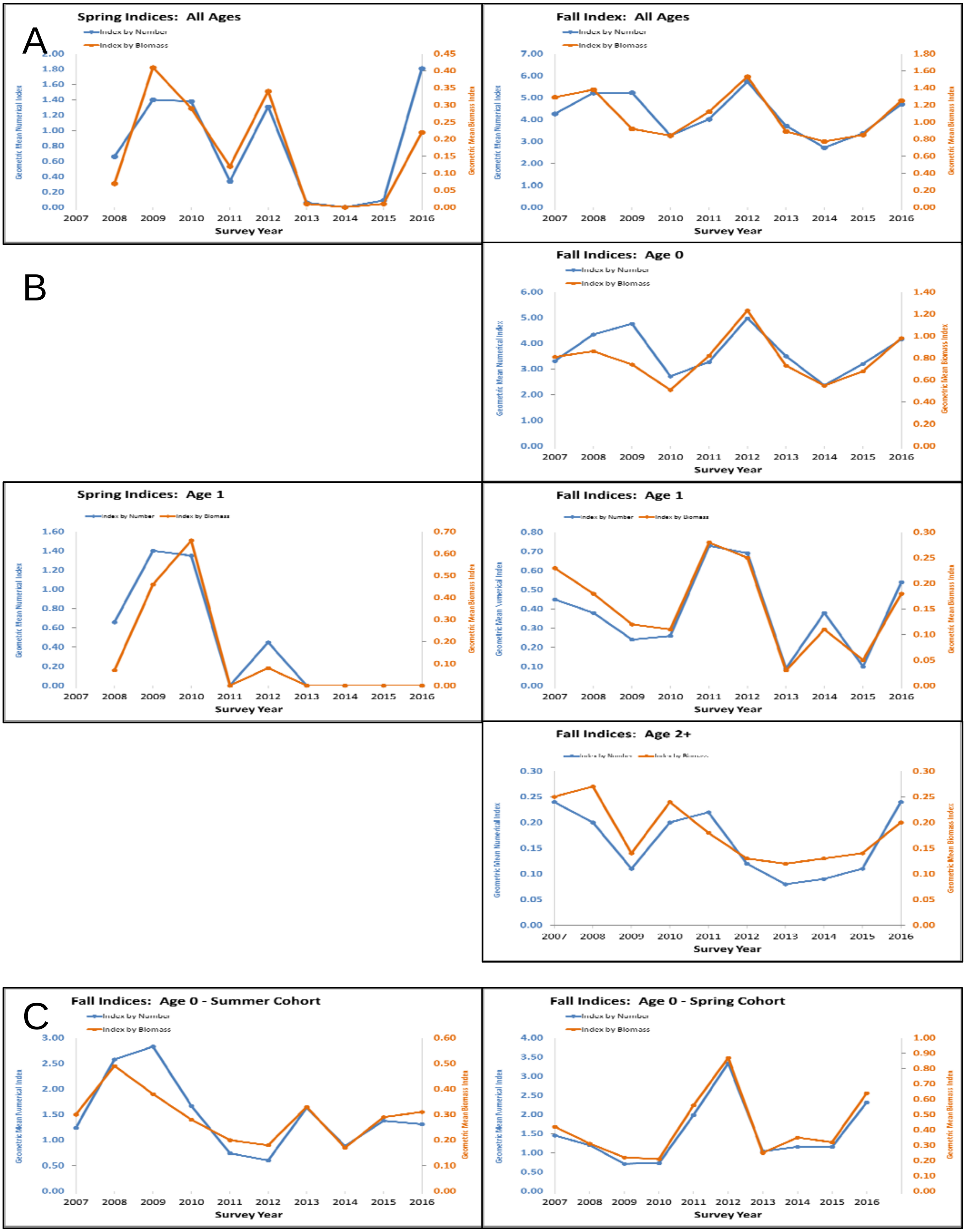


Figure 76. Bluefish length-frequency distributions, by cruise.(Blue reference line is placed at the size cutoff value – 17cm - used to separate the spring YOY cohort – to the right of the line – from the summer YOY cohort – to the left. Age-length key values were applied to the spring cohort specimens).

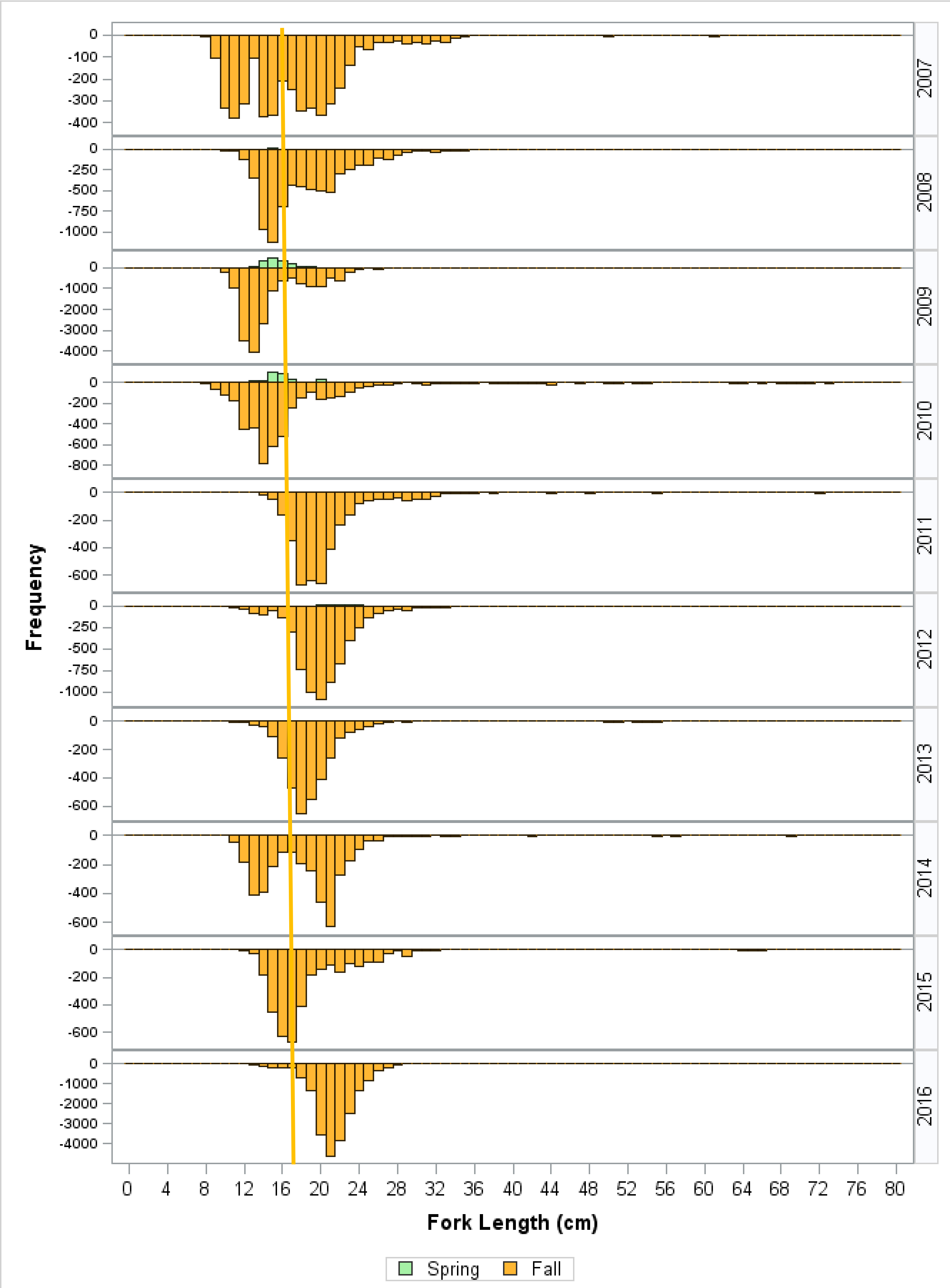


Figure 77. Bluefish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

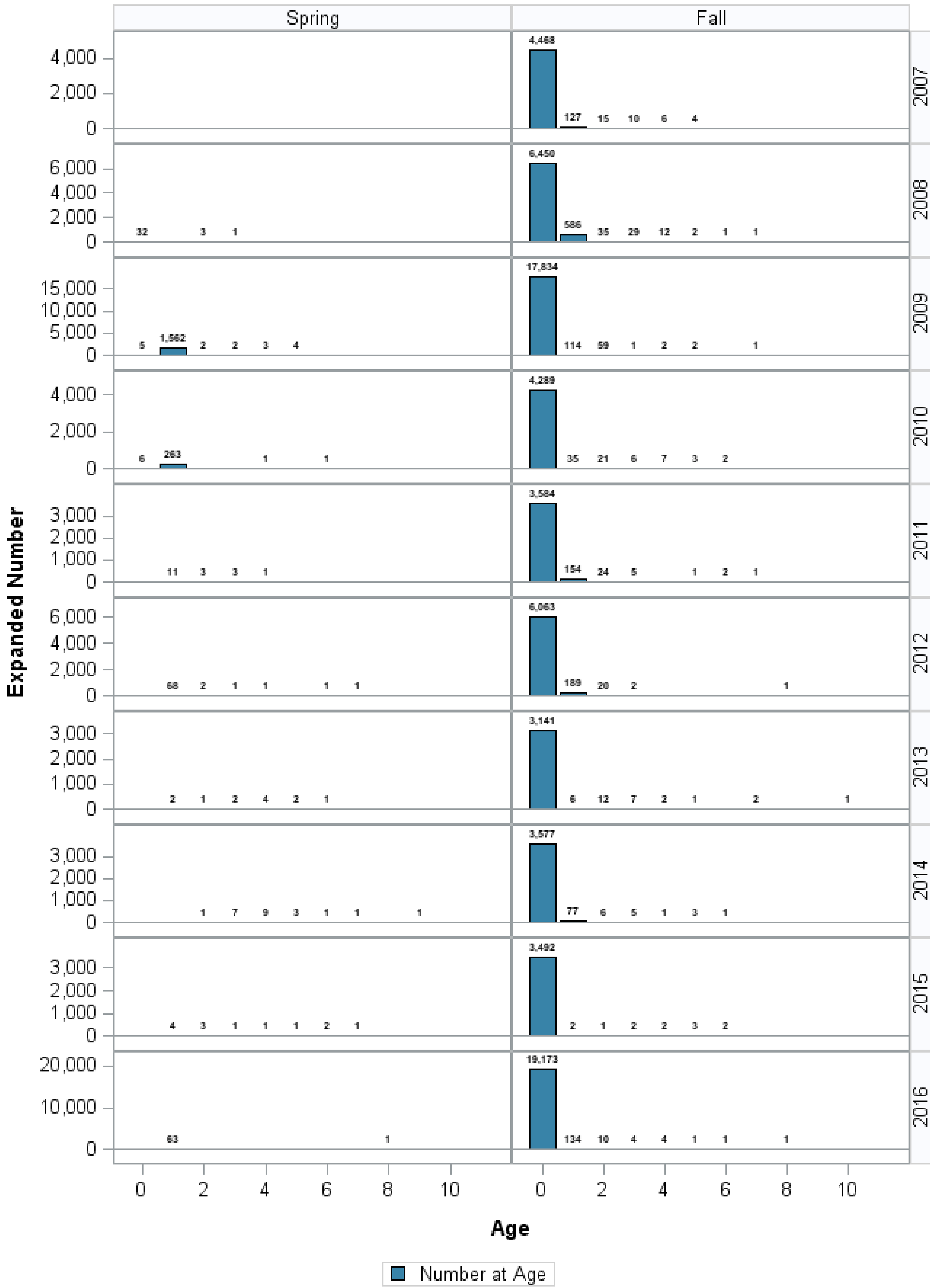


Figure 78. Bluefish catch-at-age standardized to 3,000 trawl minutes, by cruise.

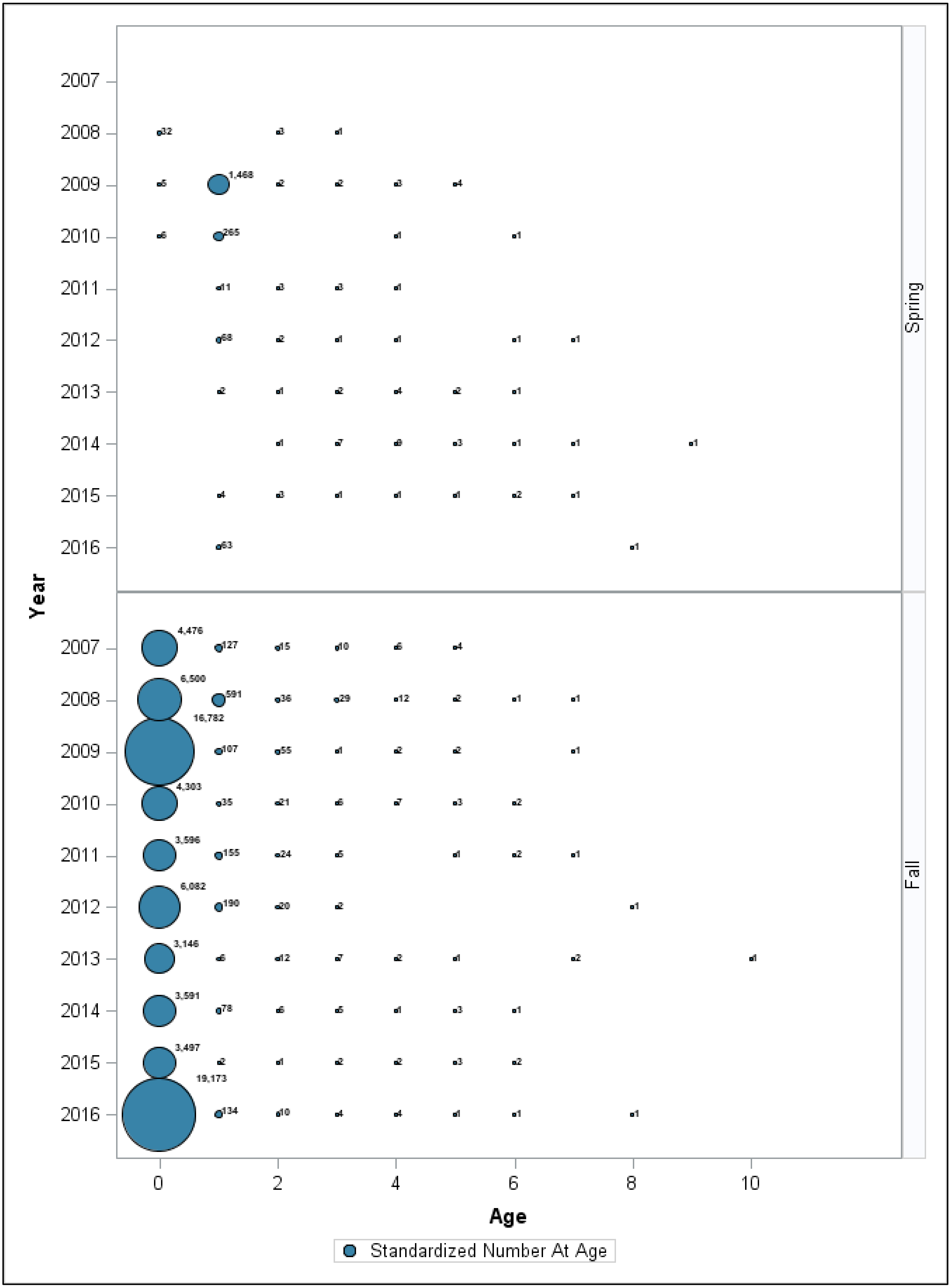


Figure 79. Bluefish sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

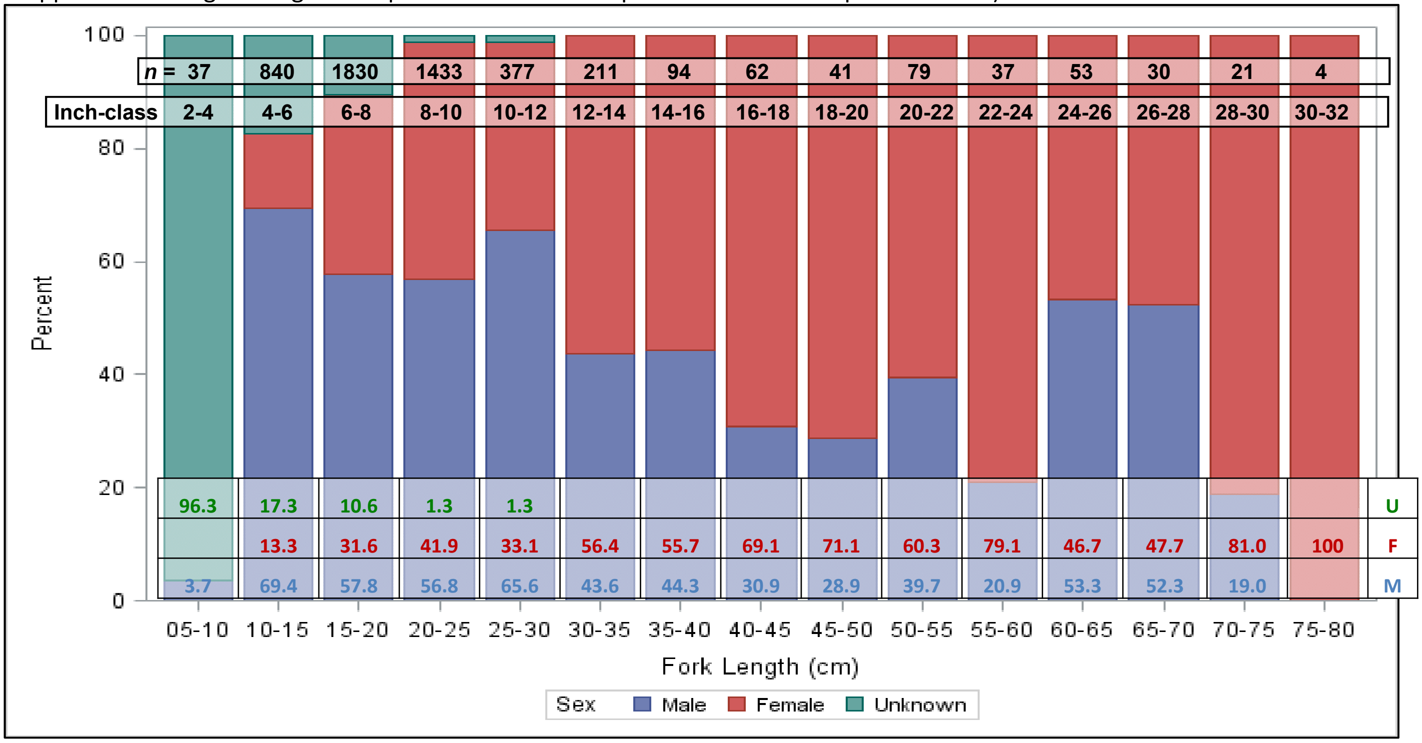


Figure 80. Bluefish maturity at length, by sex for all cruises pooled, 2007-2016.

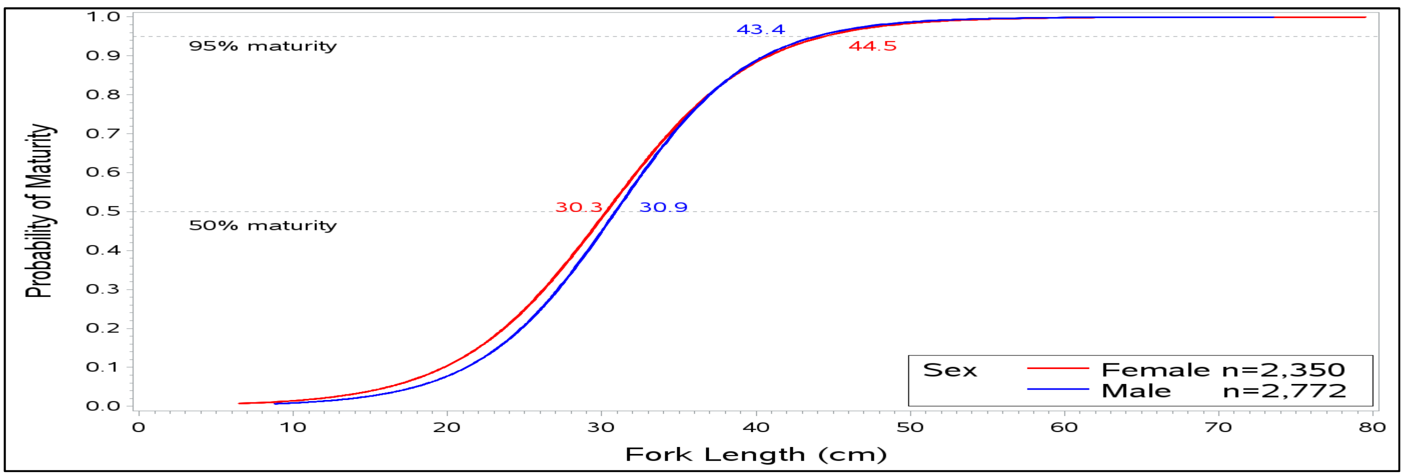


Figure 81. Bluefish maturity at age, by sex for all cruises pooled, 2007-2016.

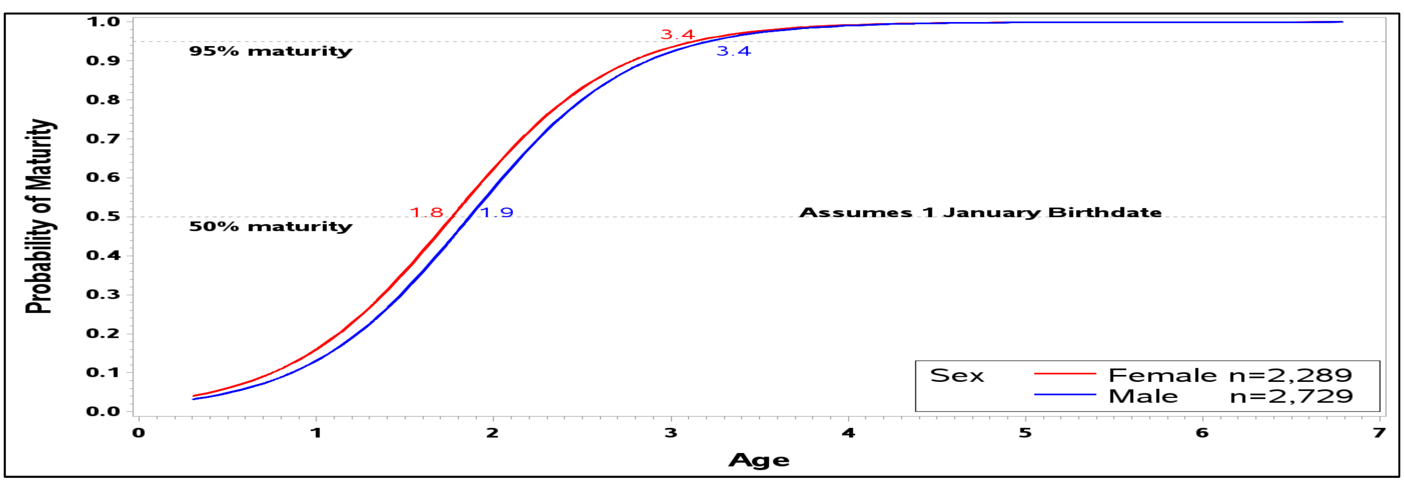
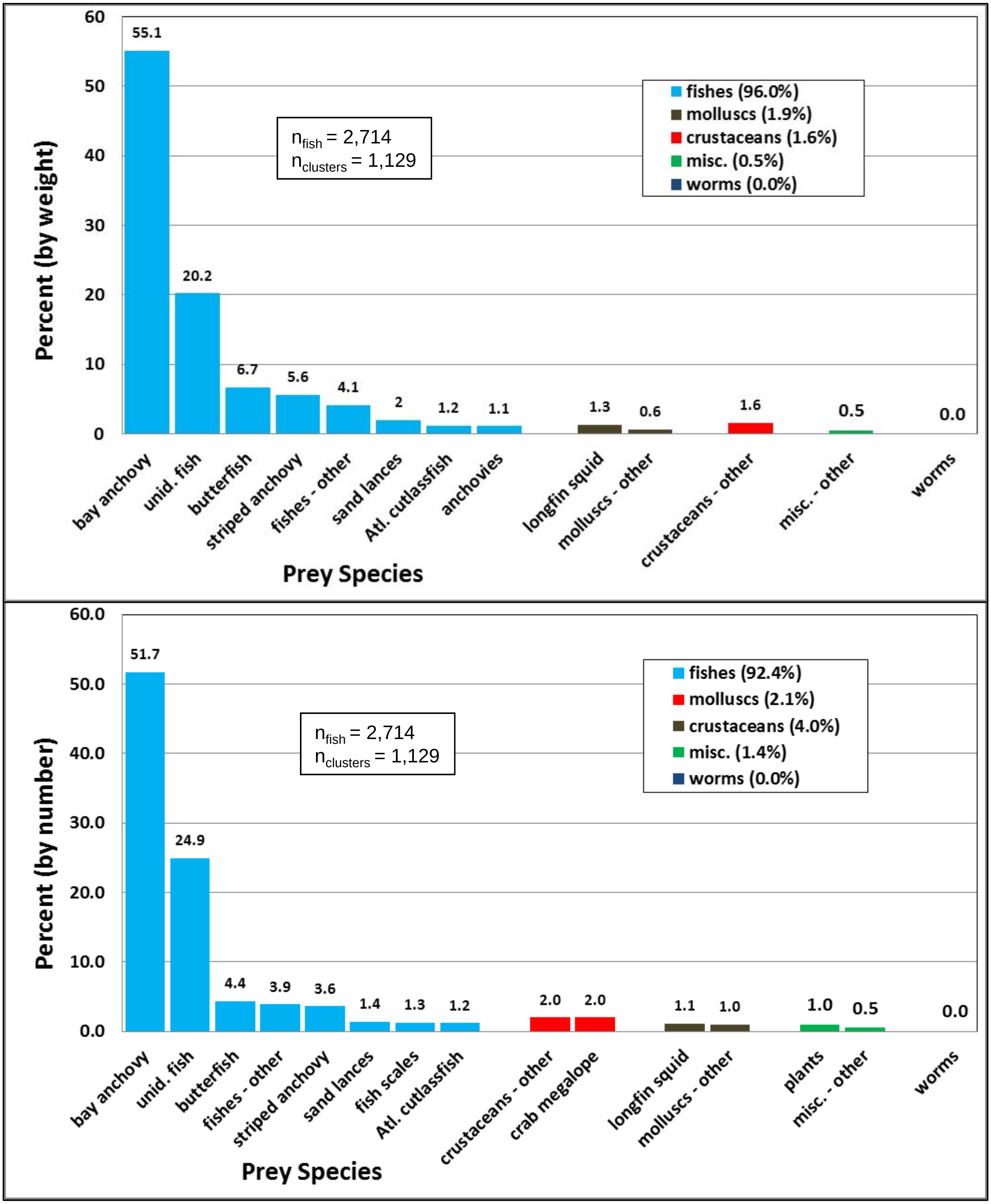


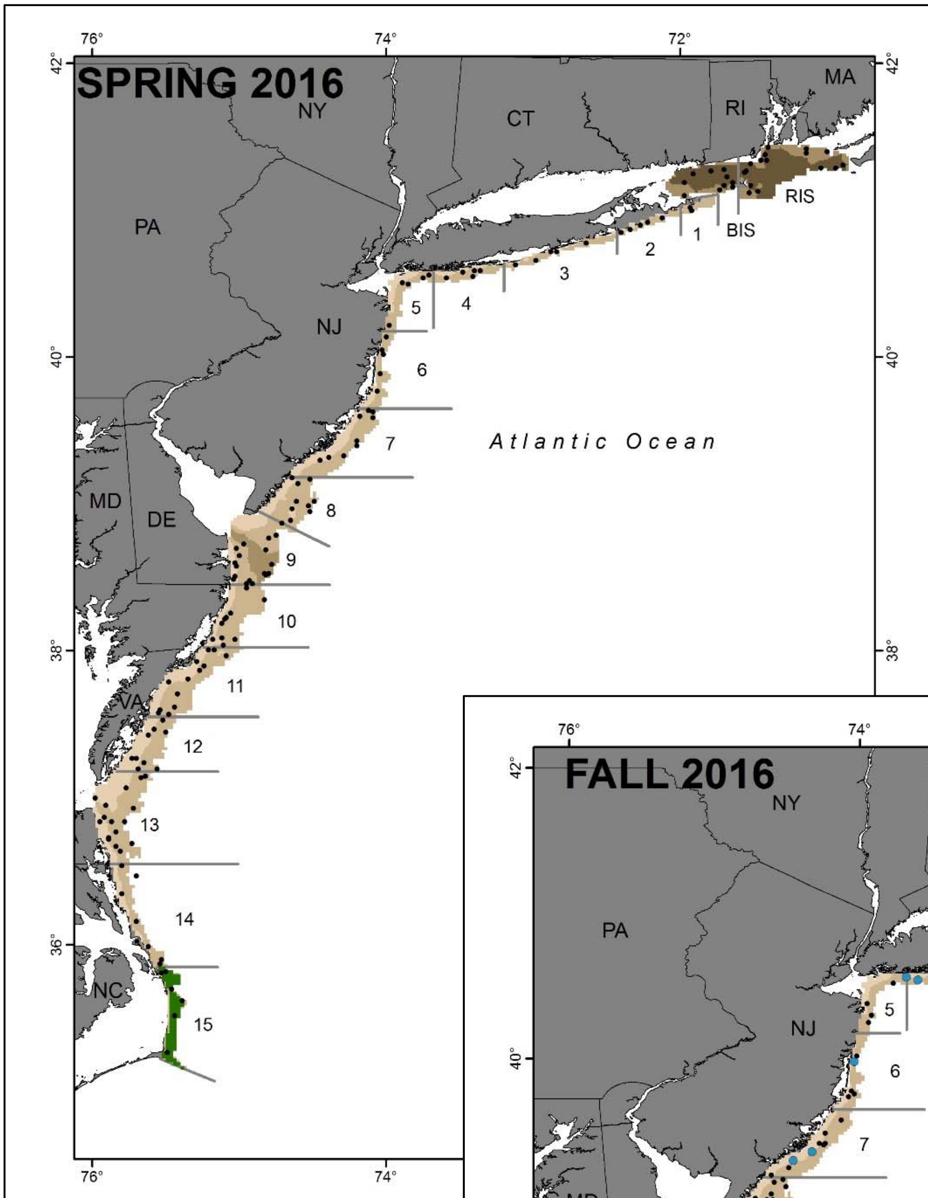
Figure 82. Bluefish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

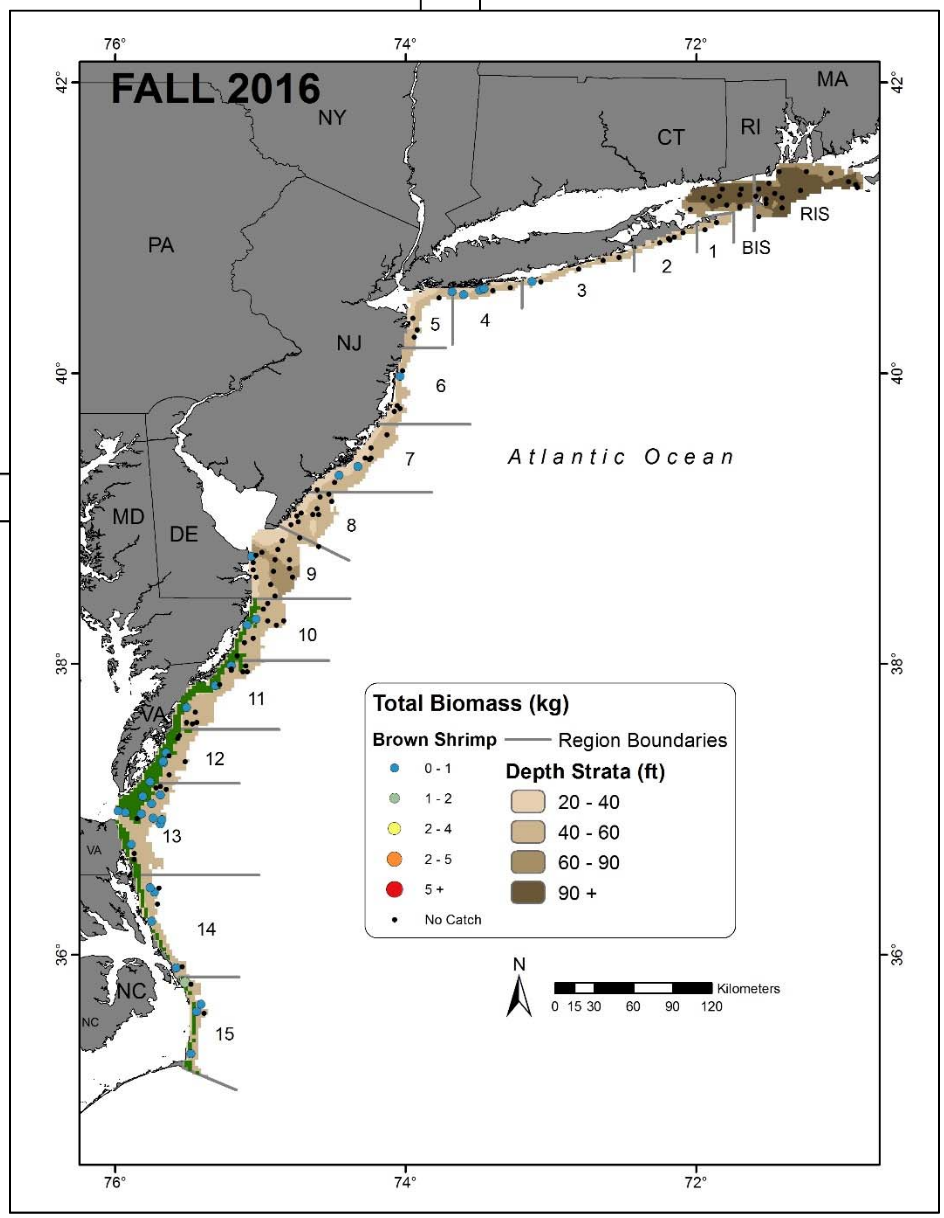


Brown Shrimp

Sampling Priority: E

Figure 83. Brown Shrimp biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	gray	gray
		90+	gray	gray
	BIS	60-90	gray	gray
		90+	gray	gray
NY	01	40-60	gray	gray
	02	20-40	gray	gray
		40-60	gray	gray
	03	20-40	gray	gray
		40-60	gray	gray
	04	20-40	gray	gray
		40-60	gray	gray
	05	20-40	gray	gray
		40-60	gray	gray
NJ	06	20-40	gray	gray
		40-60	gray	gray
	07	20-40	gray	gray
		40-60	gray	gray
	08	20-40	gray	gray
		40-60	gray	gray
DE	09	20-40	gray	gray
		40-60	gray	gray
		60-90	gray	gray
MD	10	20-40	gray	green
		40-60	gray	gray
VA	11	20-40	gray	green
		40-60	gray	gray
	12	20-40	gray	green
		40-60	gray	gray
	13	20-40	gray	green
		40-60	gray	gray
NC	14	20-40	gray	green
		40-60	gray	gray
	15	20-40	green	green
		40-60	green	gray

green = used for abundance indices

gray = not used for abundance indices

Table 30. Brown Shrimp sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	5	0.2	50.0	5	N/A	N/A	N/A	N/A
	2009	7	0.1	33.3	7	N/A	N/A	N/A	N/A
	2010	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2011	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2012	5	0.1	50.0	5	N/A	N/A	N/A	N/A
	2013	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2014	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2015	2	0.0	16.7	2	N/A	N/A	N/A	N/A
	2016	0	0.0	0.0	0	N/A	N/A	N/A	N/A
Fall	2007	898	21.6	31.1	459	N/A	N/A	N/A	N/A
	2008	509	15.3	44.3	372	N/A	N/A	N/A	N/A
	2009	45	0.9	19.7	45	N/A	N/A	N/A	N/A
	2010	79	1.3	4.9	21	N/A	N/A	N/A	N/A
	2011	406	10.2	39.3	406	N/A	N/A	N/A	N/A
	2012	286	6.4	42.6	286	N/A	N/A	N/A	N/A
	2013	8	0.2	8.2	8	N/A	N/A	N/A	N/A
	2014	288	4.1	29.5	288	N/A	N/A	N/A	N/A
	2015	353	9.0	36.1	353	N/A	N/A	N/A	N/A
	2016	269	4.4	44.3	189	N/A	N/A	N/A	N/A

Table 31. Brown Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

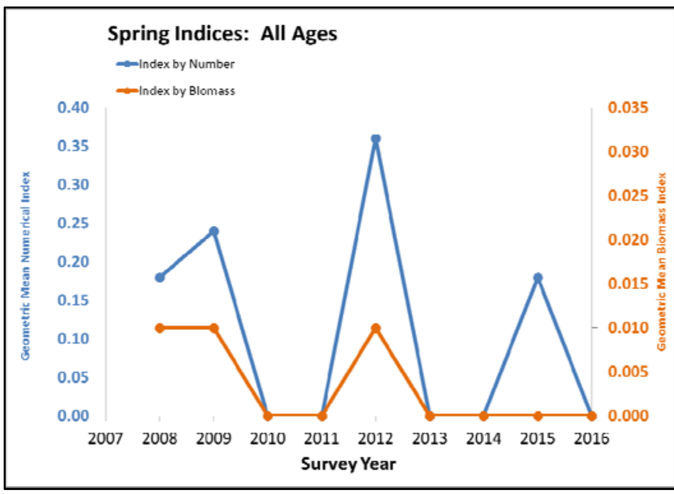
Spring Survey

Age	Year	n	Numerical Index LCI	Numerical Index Index	Numerical Index UCI	Biomass Index LCI	Biomass Index Index	Biomass Index UCI
All	2007							
	2008	5	0.00	0.18	0.63	0.00	0.01	0.03
	2009	6	0.00	0.24	0.59	0.00	0.01	0.02
	2010	5	0.00	0.00	0.00	0.00	0.00	0.00
	2011	5	0.00	0.00	0.00	0.00	0.00	0.00
	2012	5	0.11	0.36	0.67	0.00	0.01	0.02
	2013	5	0.00	0.00	0.00	0.00	0.00	0.00
	2014	5	0.00	0.00	0.00	0.00	0.00	0.00
	2015	5	0.00	0.18	0.66	0.00	0.00	0.01
	2016	5	0.00	0.00	0.00	0.00	0.00	0.00

Fall Survey

Age	Year	n	Numerical Index LCI	Numerical Index Index	Numerical Index UCI	Biomass Index LCI	Biomass Index Index	Biomass Index UCI
All	2007	23	0.88	2.76	6.52	0.05	0.23	0.44
	2008	22	0.86	2.59	5.94	0.04	0.22	0.44
	2009	25	0.04	0.45	1.03	0.00	0.02	0.03
	2010	22	0.00	0.06	0.19	0.00	0.00	0.01
	2011	22	1.51	2.83	4.87	0.11	0.17	0.23
	2012	22	1.59	3.30	6.11	0.08	0.19	0.30
	2013	22	0.00	0.14	0.35	0.00	0.01	0.02
	2014	22	0.14	0.86	2.04	0.00	0.05	0.12
	2015	22	0.87	2.50	5.55	0.04	0.12	0.21
	2016	22	0.94	2.59	5.64	0.03	0.11	0.21

Figure 84. Brown Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.



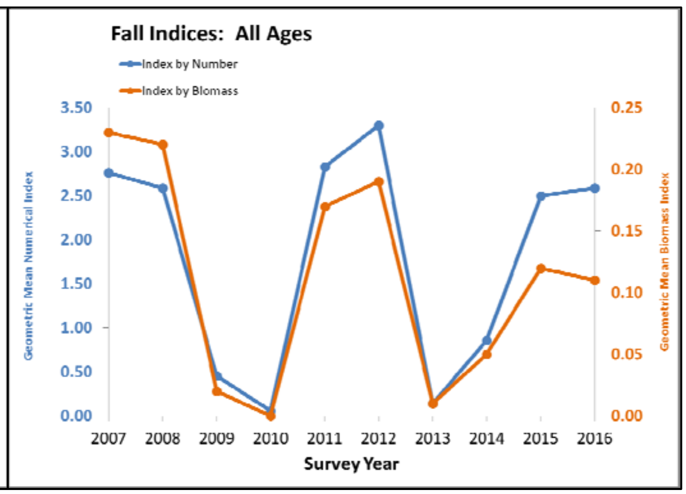
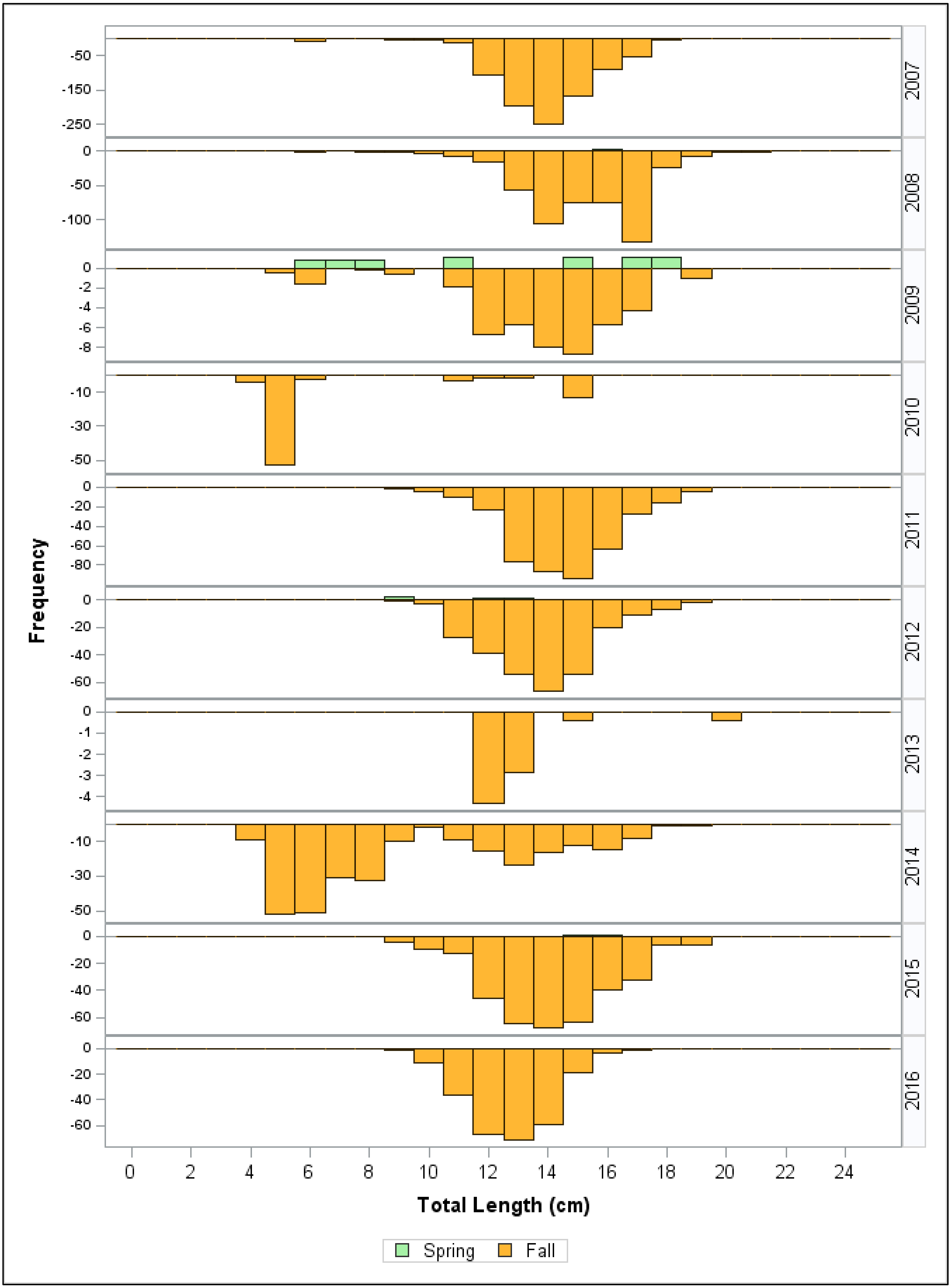


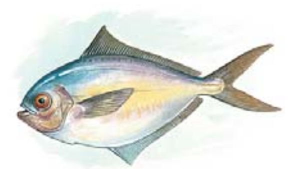
Figure 85. Brown Shrimp length-frequency distributions, by cruise.

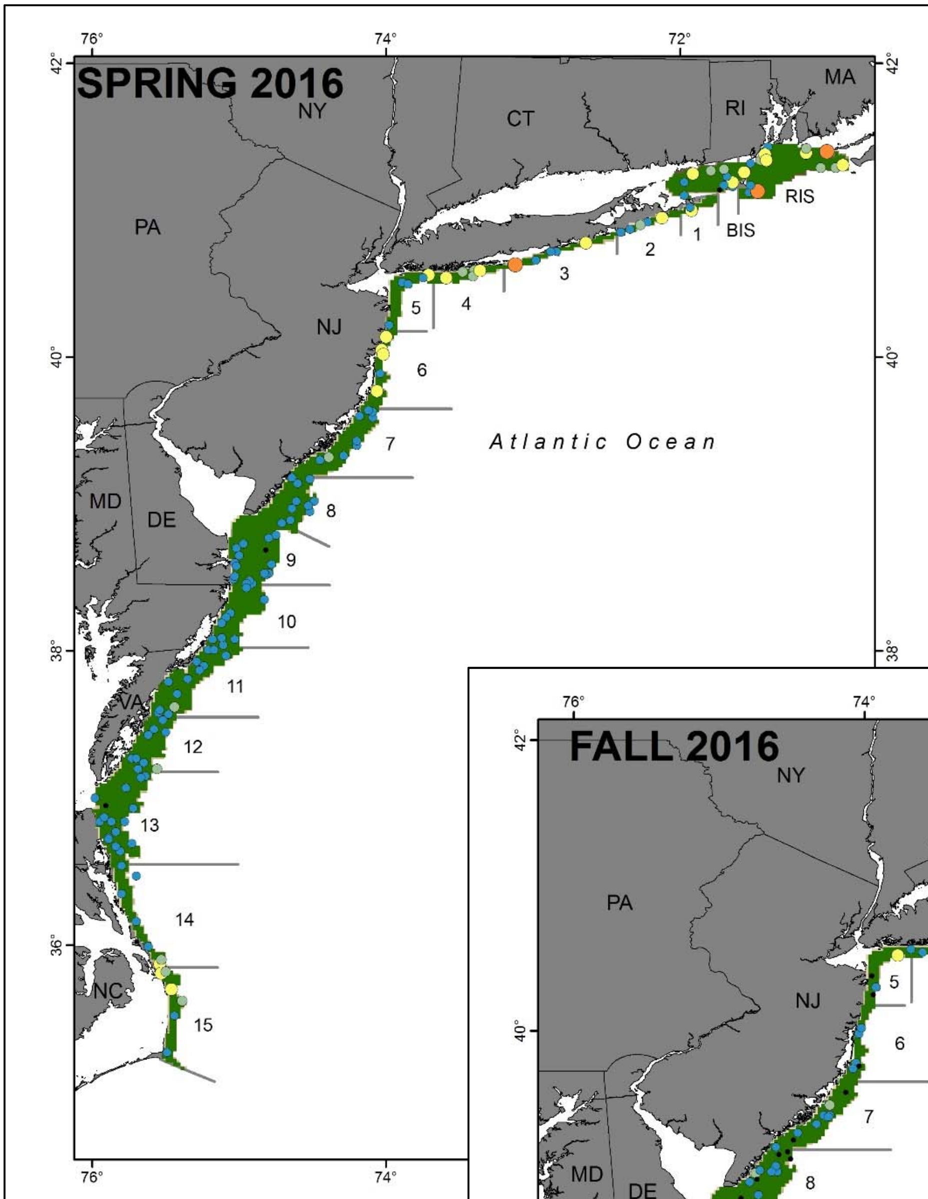


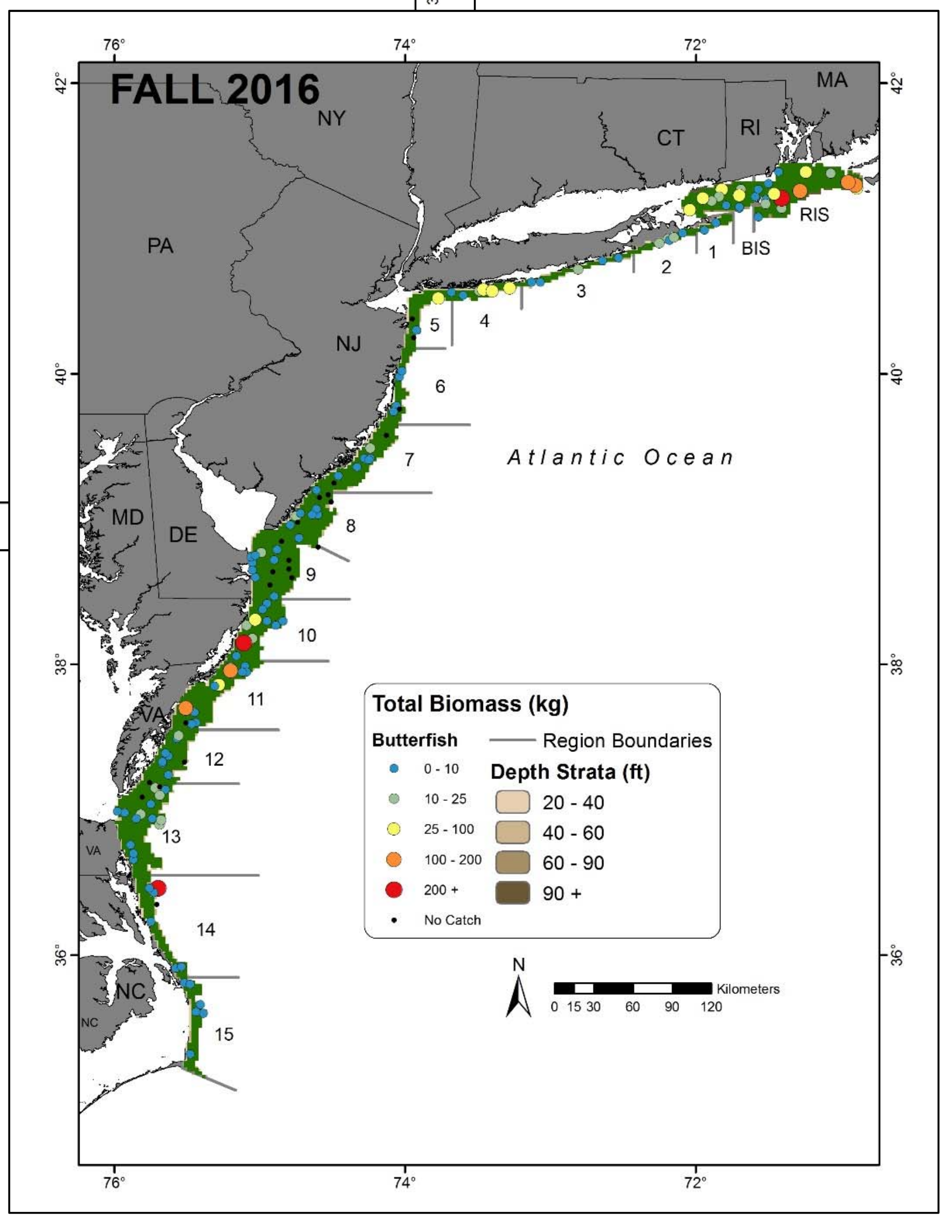
Butterfish

Sampling Priority: A

Figure 86. Butterfish biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(grey) = not used for abundance indices

Table 32. Butterfish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	47,747	689.3	90.7	8,320	751	751	5	0
	2009	35,588	816.5	98.7	16,089	1,048	1,048	0	0
	2010	64,291	2,136.2	88.7	11,212	740	740	0	0
	2011	66,089	1,448.5	93.3	17,806	766	766	0	0
	2012	70,051	2,960.2	98.7	15,328	675	675	0	0
	2013	10,476	678.6	89.3	6,033	457	457	0	0
	2014	37,877	1,137.6	88.7	9,470	554	554	0	0
	2015	18,480	860.5	82.0	5,679	465	465	0	0
	2016	47,866	1,707.8	98.0	14,721	736	725	0	0
Fall	2007	148,182	1,904.9	92.7	6,015	538	0	11	0
	2008	168,270	2,120.7	97.3	10,091	551	551	8	0
	2009	544,718	8,677.5	96.0	20,670	774	774	0	0
	2010	157,706	4,957.3	98.0	19,276	693	693	0	0
	2011	234,974	5,244.3	88.0	15,489	499	499	0	0
	2012	95,872	3,931.1	86.0	12,744	544	544	1	0
	2013	433,403	5,906.1	92.0	21,296	661	661	0	0
	2014	468,710	5,455.0	74.7	16,947	570	570	0	0
	2015	170,504	5,140.5	79.3	20,952	541	541	0	0
	2016	59,529	2,827.7	85.3	11,815	529	529	0	0

Table 33. Butterfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age class.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	150	31.8	44.1	61.1	1.76	2.28	2.90
	2009	160	50.7	63.0	78.3	1.71	2.09	2.52
	2010	150	24.5	35.7	51.8	1.62	2.27	3.09
	2011	150	76.4	103.8	140.9	2.46	3.18	4.06
	2012	150	103.3	134.9	176.0	4.74	6.19	8.00
	2013	150	9.4	11.8	14.7	0.99	1.23	1.50
	2014	150	22.1	29.3	38.8	1.32	1.73	2.21
	2015	150	5.6	8.0	11.3	0.71	1.04	1.43
	2016	150	44.9	59.3	78.3	2.87	3.66	4.60
0	2007							
	2008	150	1.7	2.5	3.6	0.05	0.14	0.23
	2009	160	4.7	5.8	7.1	0.06	0.08	0.10
	2010	150	0.8	1.1	1.4	0.01	0.03	0.05
	2011	150	12.1	16.4	22.2	0.36	0.50	0.66
	2012	150	1.1	1.5	2.0	0.02	0.03	0.04
	2013	150	0.1	0.2	0.3	0.00	0.00	0.00
	2014	150	0.1	0.2	0.2	0.00	0.01	0.02
	2015	150	0.1	0.2	0.3	0.00	0.00	0.00
	2016	150	0.0	0.0	0.1	0.00	0.00	0.00
1	2007							
	2008	150	10.0	13.6	18.4	0.74	0.97	1.23
	2009	160	30.2	38.8	49.7	1.17	1.44	1.75
	2010	150	11.6	16.5	23.1	0.82	1.17	1.58
	2011	150	17.7	23.5	31.2	1.25	1.64	2.09
	2012	150	60.4	80.4	106.9	3.96	5.19	6.74
	2013	150	7.1	8.8	10.8	0.74	0.93	1.15
	2014	150	14.7	19.4	25.5	0.79	1.05	1.34
	2015	150	5.0	7.1	10.0	0.59	0.88	1.21
	2016	150	37.9	50.6	67.4	2.39	3.07	3.89
2+	2007							
	2008	150	17.1	23.4	31.9	1.45	1.87	2.37
	2009	160	6.1	7.7	9.6	0.53	0.69	0.88
	2010	150	12.4	18.0	26.0	1.09	1.59	2.21
	2011	150	7.9	10.7	14.3	0.97	1.33	1.76
	2012	150	29.0	39.0	52.2	2.42	3.25	4.27
	2013	150	3.2	4.0	4.9	0.41	0.54	0.68
	2014	150	5.1	6.9	9.1	0.55	0.80	1.10
	2015	150	1.1	1.6	2.3	0.25	0.39	0.55
	2016	150	5.4	6.9	8.6	0.67	0.88	1.11

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	150	49.9	67.6	91.4	2.00	2.63	3.38
	2008	150	147.7	198.5	266.6	3.94	5.14	6.63
	2009	160	125.7	164.0	213.9	4.78	5.99	7.45
	2010	150	160.6	211.7	278.9	6.97	9.03	11.61
	2011	150	75.5	105.3	146.8	6.22	8.05	10.36
	2012	150	28.4	39.6	55.2	2.68	3.61	4.78
	2013	150	64.5	95.4	141.0	3.65	5.19	7.24
	2014	150	26.7	38.1	54.1	2.99	3.93	5.10
	2015	150	42.2	58.0	79.6	4.75	6.05	7.66
	2016	150	24.0	34.1	48.2	2.78	3.81	5.14
0	2007	150	29.2	38.7	51.0	1.78	2.37	3.09
	2008	150	69.0	89.5	116.1	2.67	3.38	4.23
	2009	160	35.7	46.0	59.2	2.01	2.42	2.90
	2010	150	63.9	81.7	104.4	2.60	3.23	3.98
	2011	150	38.9	52.2	70.0	3.56	4.42	5.45
	2012	150	12.8	17.0	22.5	1.42	1.89	2.44
	2013	150	44.2	64.6	94.1	2.47	3.53	4.93
	2014	150	23.2	32.3	44.9	2.67	3.49	4.48
	2015	150	12.4	15.8	20.2	1.44	1.79	2.21
	2016	150	11.5	15.2	20.0	1.05	1.41	1.84
1	2007	150	11.5	15.7	21.4	1.76	2.51	3.45
	2008	150	31.8	44.6	62.5	2.37	3.16	4.13
	2009	160	44.8	59.0	77.7	3.18	4.13	5.29
	2010	150	36.8	50.6	69.4	3.29	4.48	6.01
	2011	150	24.4	33.9	47.0	3.28	4.39	5.80
	2012	150	9.2	13.2	18.8	1.80	2.54	3.48
	2013	150	12.0	18.1	27.1	1.70	2.38	3.23
	2014	150	4.6	6.4	8.9	0.76	1.08	1.45
	2015	150	30.0	41.0	55.9	3.90	4.97	6.26
	2016	150	8.6	12.9	19.2	1.67	2.39	3.30
2+	2007	150	4.2	6.1	8.5	1.31	1.96	2.81
	2008	150	7.1	9.8	13.3	0.82	1.14	1.52
	2009	160	4.8	6.7	9.2	0.79	1.20	1.70
	2010	150	11.6	17.1	24.9	2.49	3.54	4.91
	2011	150	6.1	8.1	10.7	0.99	1.39	1.86
	2012	150	4.4	6.2	8.5	0.95	1.38	1.92
	2013	150	3.6	5.1	7.1	0.62	0.88	1.18
	2014	150	0.8	1.2	1.7	0.18	0.35	0.55
	2015	150	4.1	5.6	7.5	0.73	1.02	1.36
	2016	150	0.3	0.4	0.6	0.06	0.11	0.16

Figure 87. Butterfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and by age class (B).

Figure 88. Butterfish length-frequency distributions, by cruise.

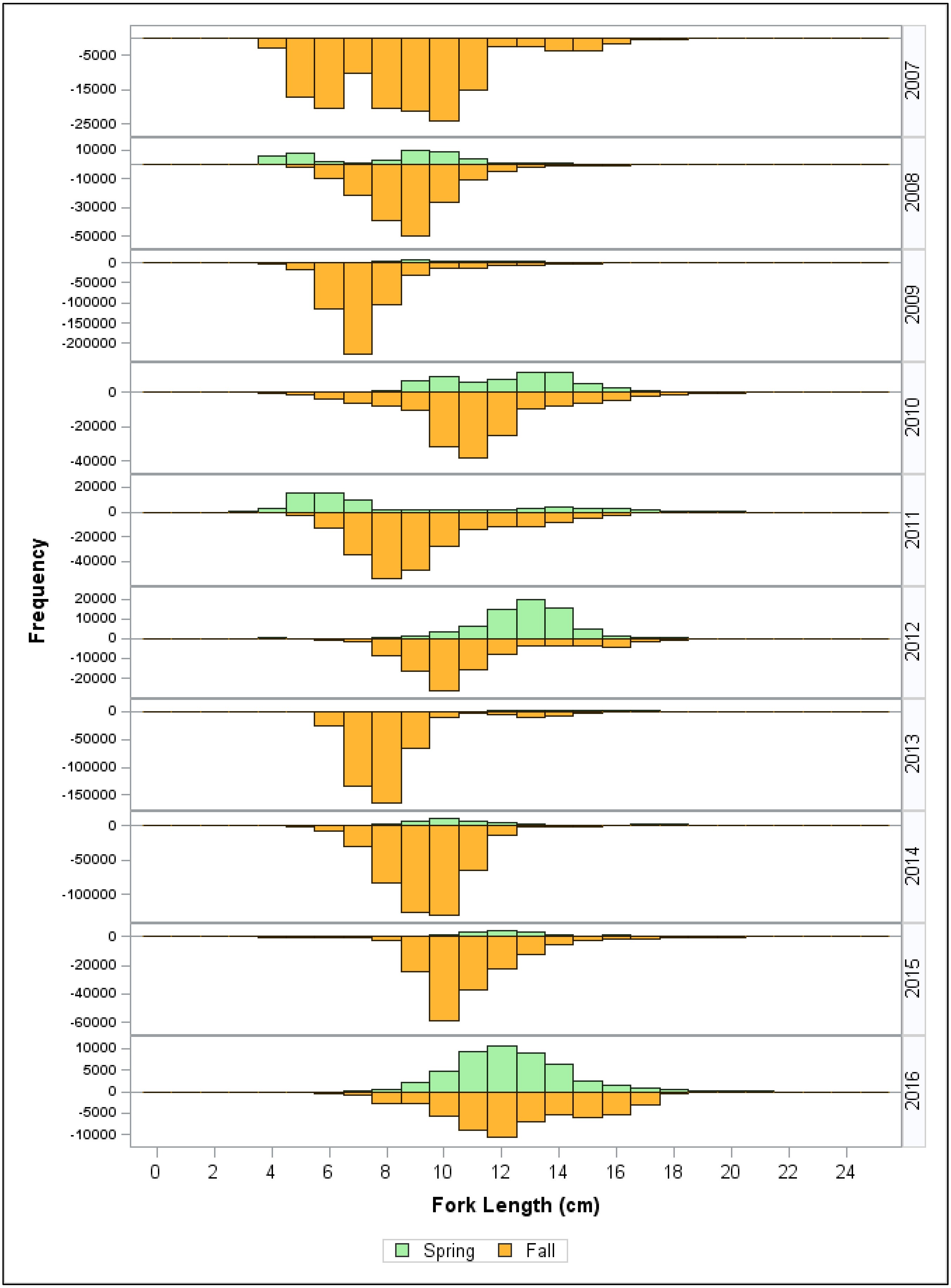


Figure 89. Butterfish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar (Values in red were generated by application of age-length keys.).

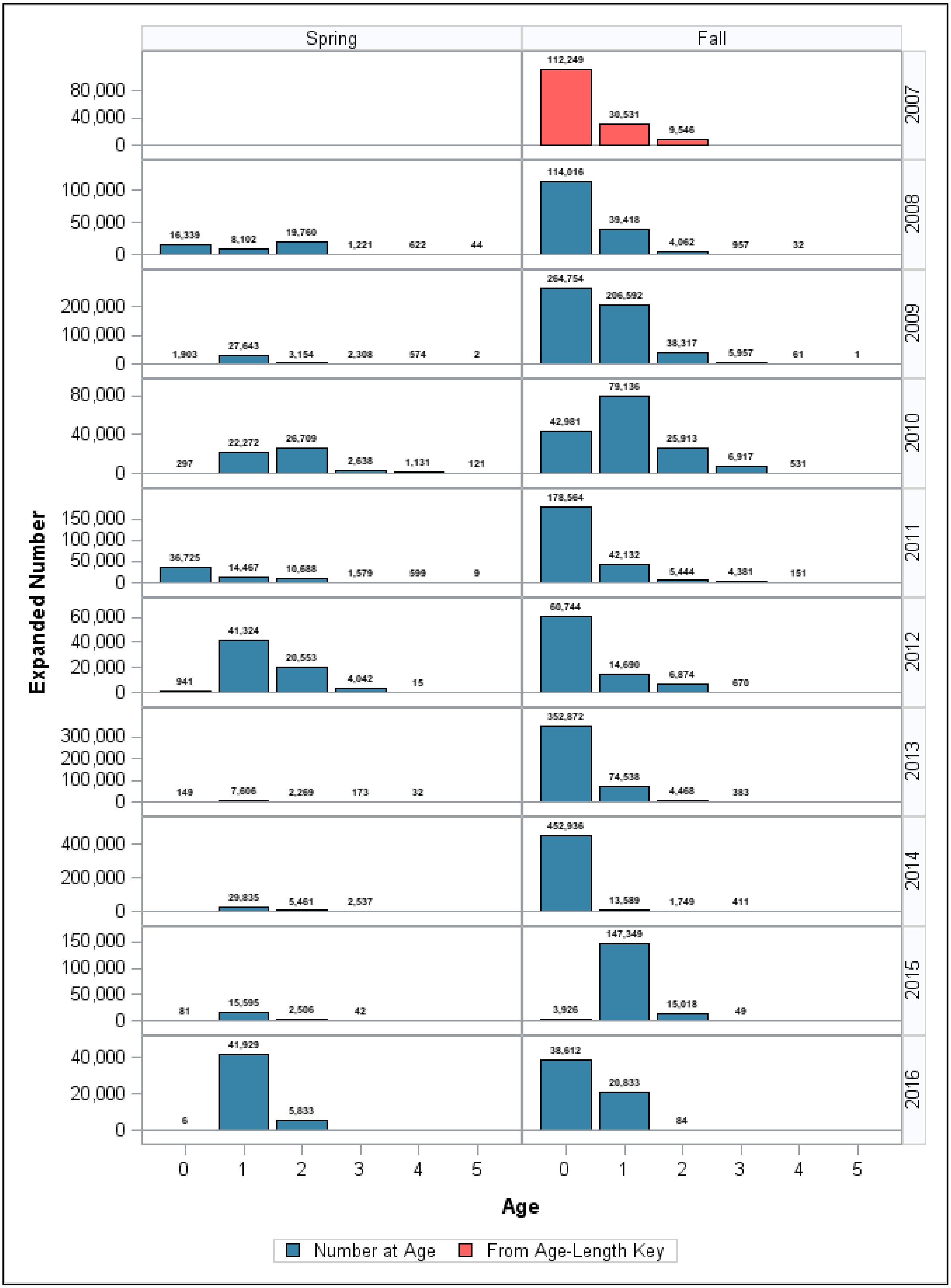


Figure 90. Butterfish catch-at-age standardized to 3,000 trawl minutes, by cruise (Values in red were generated by application of age-length keys.).

Figure 91. Butterfish sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

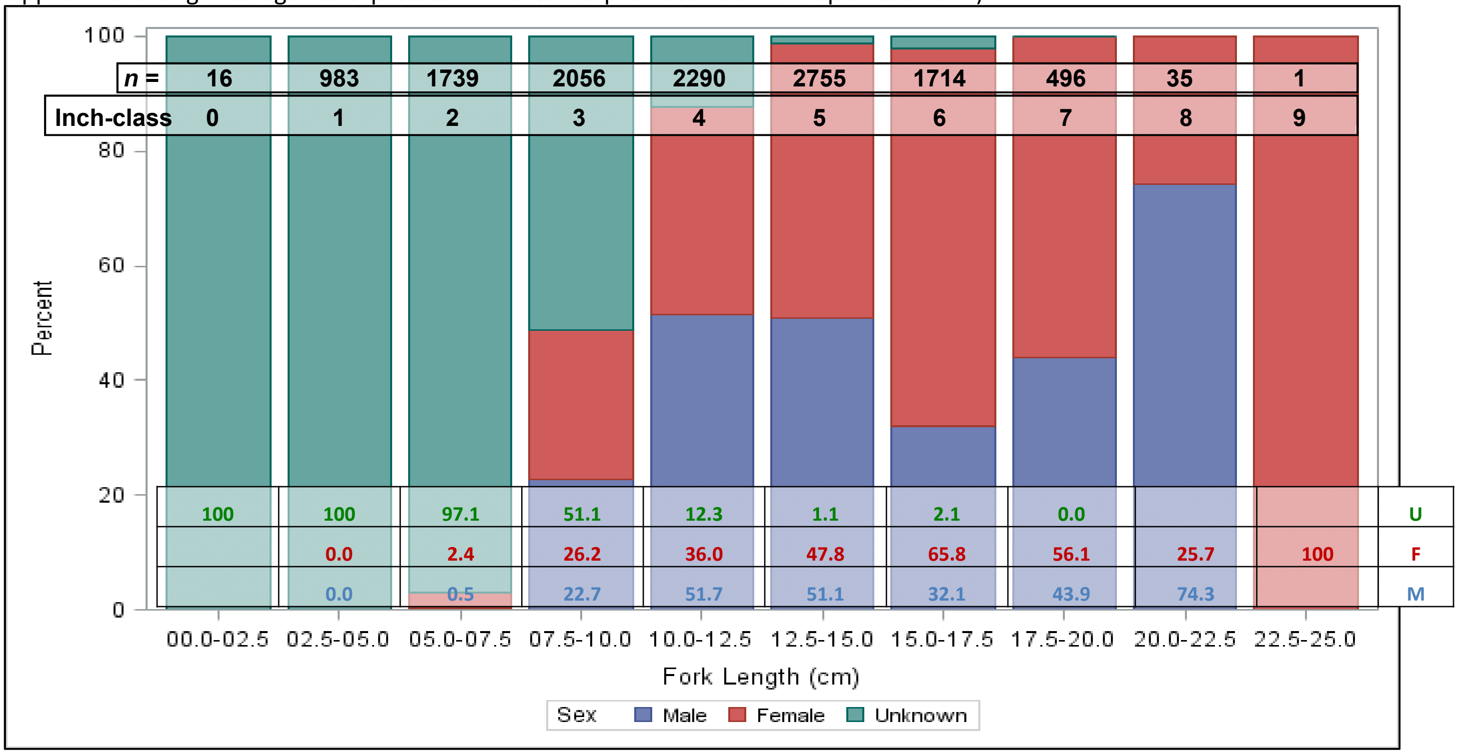


Figure 92. Butterfish maturity at length, by sex for all cruises pooled, 2007-2016.

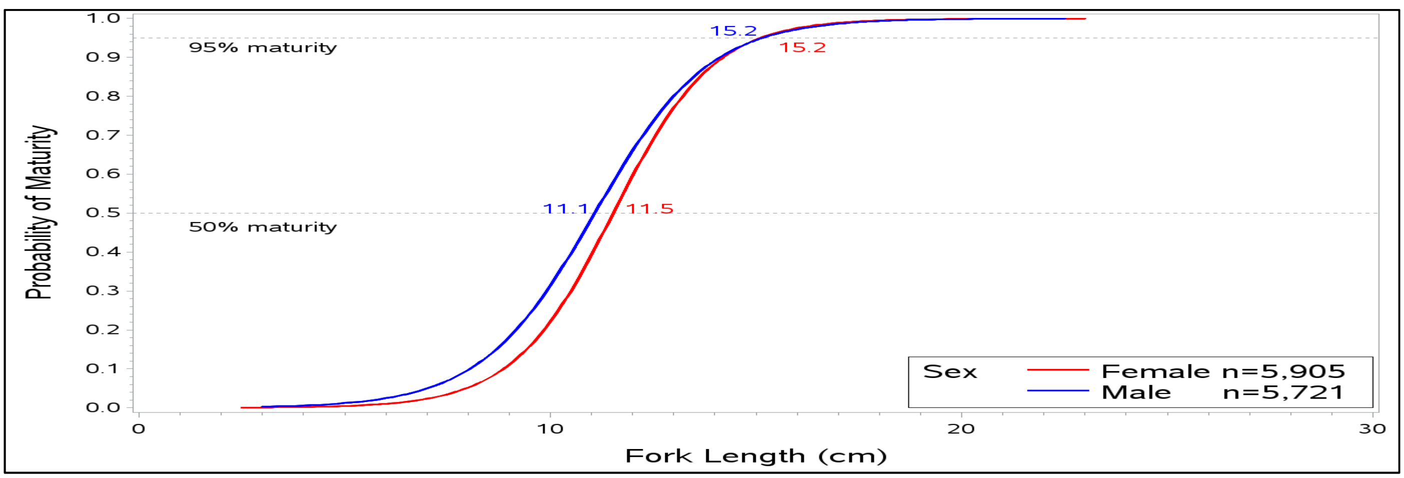
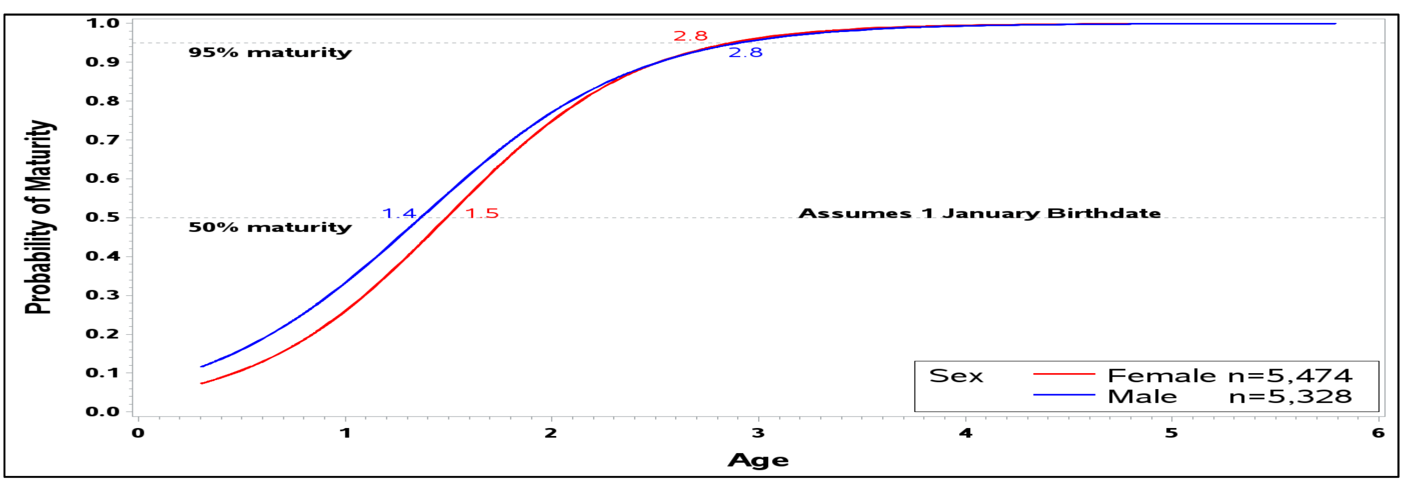


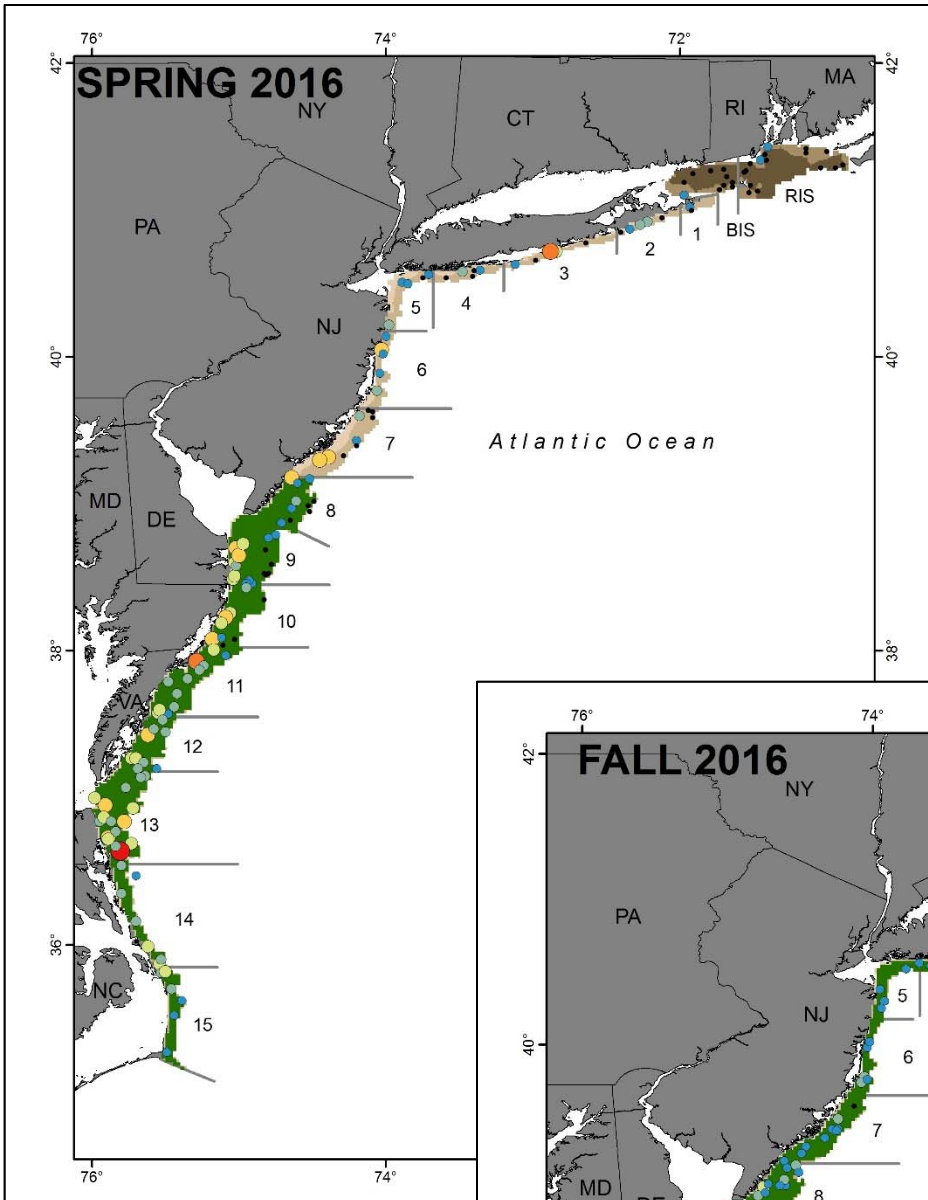
Figure 93. Butterfish maturity at age, by sex for all cruises pooled, 2007-2016.

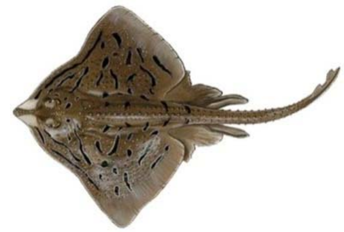


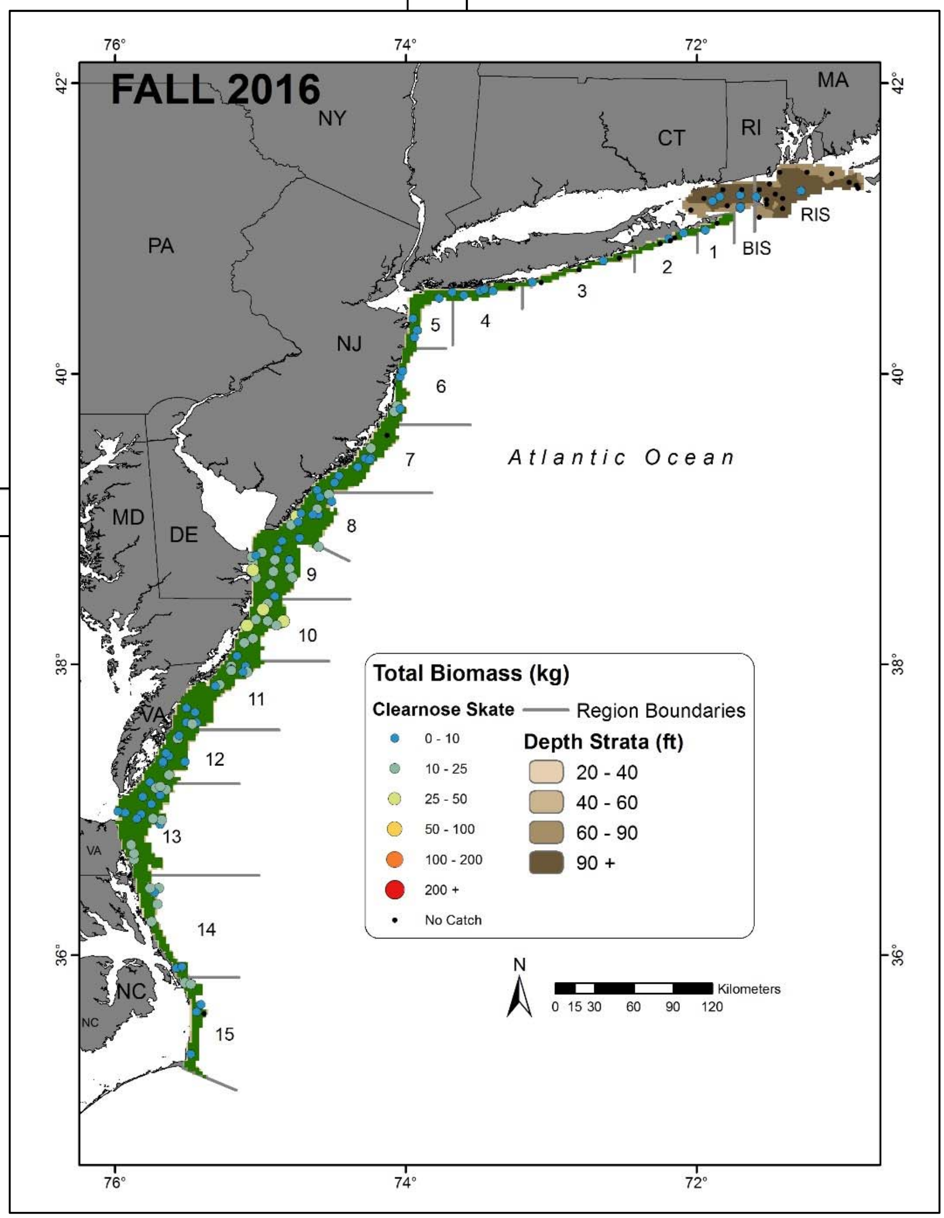
Clearnose Skate

Sampling Priority: A

Figure 94. Clearnose Skate biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[grey]	[grey]
		90+	[grey]	[grey]
	BIS	60-90	[grey]	[grey]
		90+	[grey]	[grey]
NY	01	40-60	[grey]	[green]
	02	20-40	[grey]	[green]
		40-60	[grey]	[green]
	03	20-40	[grey]	[green]
		40-60	[grey]	[green]
	04	20-40	[grey]	[green]
		40-60	[grey]	[green]
	05	20-40	[grey]	[green]
		40-60	[grey]	[green]
NJ	06	20-40	[grey]	[green]
		40-60	[grey]	[green]
	07	20-40	[grey]	[green]
		40-60	[grey]	[green]
	08	20-40	[green]	[green]
		40-60	[green]	[green]
DE	09	20-40	[green]	[green]
		40-60	[green]	[green]
		60-90	[green]	[green]
MD	10	20-40	[green]	[green]
		40-60	[green]	[green]
VA	11	20-40	[green]	[green]
		40-60	[green]	[green]
	12	20-40	[green]	[green]
		40-60	[green]	[green]
	13	20-40	[green]	[green]
		40-60	[green]	[green]
NC	14	20-40	[green]	[green]
		40-60	[green]	[green]
	15	20-40	[green]	[green]
		40-60	[green]	[green]

[green] = used for abundance indices

[grey] = not used for abundance indices

Table 34. Clearnose Skate sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	3,219	4,237.3	80.5	1,050	212	0	207	205
	2009	2,429	3,388.3	75.9	1,431	205	0	188	183
	2010	1,702	2,517.9	81.6	1,353	197	0	183	176
	2011	2,216	2,735.8	81.6	1,854	211	0	194	194
	2012	2,358	3,070.7	86.2	2,016	272	0	252	242
	2013	2,309	3,072.5	82.8	1,715	250	0	220	216
	2014	1,559	2,326.4	77.0	1,257	207	0	156	156
	2015	1,745	2,049.5	83.9	1,568	229	0	172	171
	2016	2,263	2,736.0	86.2	1,963	283	0	242	241
Fall	2007	1,505	1,854.6	93.5	1,361	346	0	330	294
	2008	885	1,196.2	89.5	806	289	0	287	287
	2009	1,107	1,355.1	91.1	1,007	335	0	308	302
	2010	875	1,056.7	91.1	875	307	0	278	274
	2011	1,179	1,361.1	91.1	1,112	320	0	295	288
	2012	1,808	2,342.3	96.0	1,808	346	0	313	307
	2013	906	1,182.1	85.5	906	291	0	266	254
	2014	1,063	1,264.8	96.0	1,063	339	0	292	291
	2015	812	993.6	84.7	779	300	0	259	254
	2016	917	1,167.7	91.9	917	332	0	288	286

Table 35. Clearnose Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	86	9.86	12.11	14.82	11.00	13.92	17.55
	2009	91	5.41	6.99	8.97	6.66	8.76	11.43
	2010	87	6.17	7.51	9.10	7.46	9.22	11.35
	2011	87	7.81	9.72	12.03	8.78	11.08	13.92
	2012	87	8.63	10.83	13.54	10.38	13.15	16.59
	2013	87	7.56	9.56	12.01	8.97	11.51	14.68
	2014	87	4.37	5.41	6.65	5.29	6.65	8.30
	2015	87	5.95	7.69	9.87	7.03	9.13	11.77
	2016	87	8.18	10.57	13.58	9.31	12.10	15.65

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	124	6.39	7.54	8.87	7.42	8.84	10.49
	2008	124	3.92	4.59	5.36	4.39	5.26	6.27
	2009	134	4.86	5.70	6.65	5.44	6.41	7.51
	2010	124	4.00	4.74	5.58	4.28	5.09	6.03
	2011	124	5.84	6.71	7.69	6.60	7.64	8.82
	2012	124	8.77	10.14	11.70	10.33	12.01	13.95
	2013	124	3.89	4.57	5.35	4.43	5.29	6.28
	2014	124	5.40	6.21	7.12	5.95	6.97	8.14
	2015	124	3.24	3.81	4.46	3.77	4.43	5.19
	2016							

Figure 95. Clearnose Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

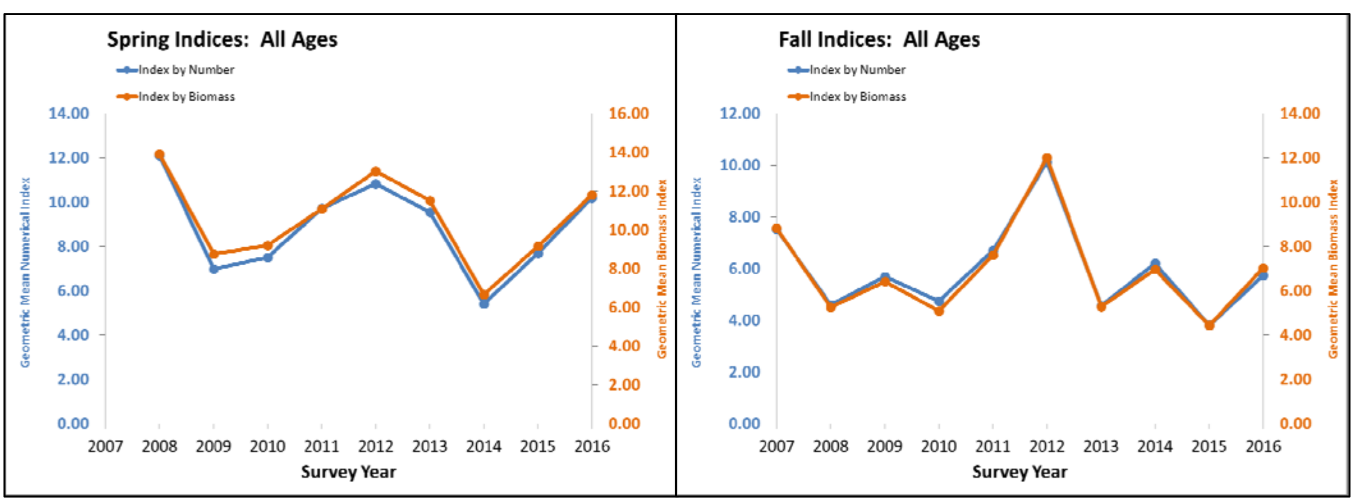


Figure 96. Clearnose Skate width-frequency distributions, by cruise.

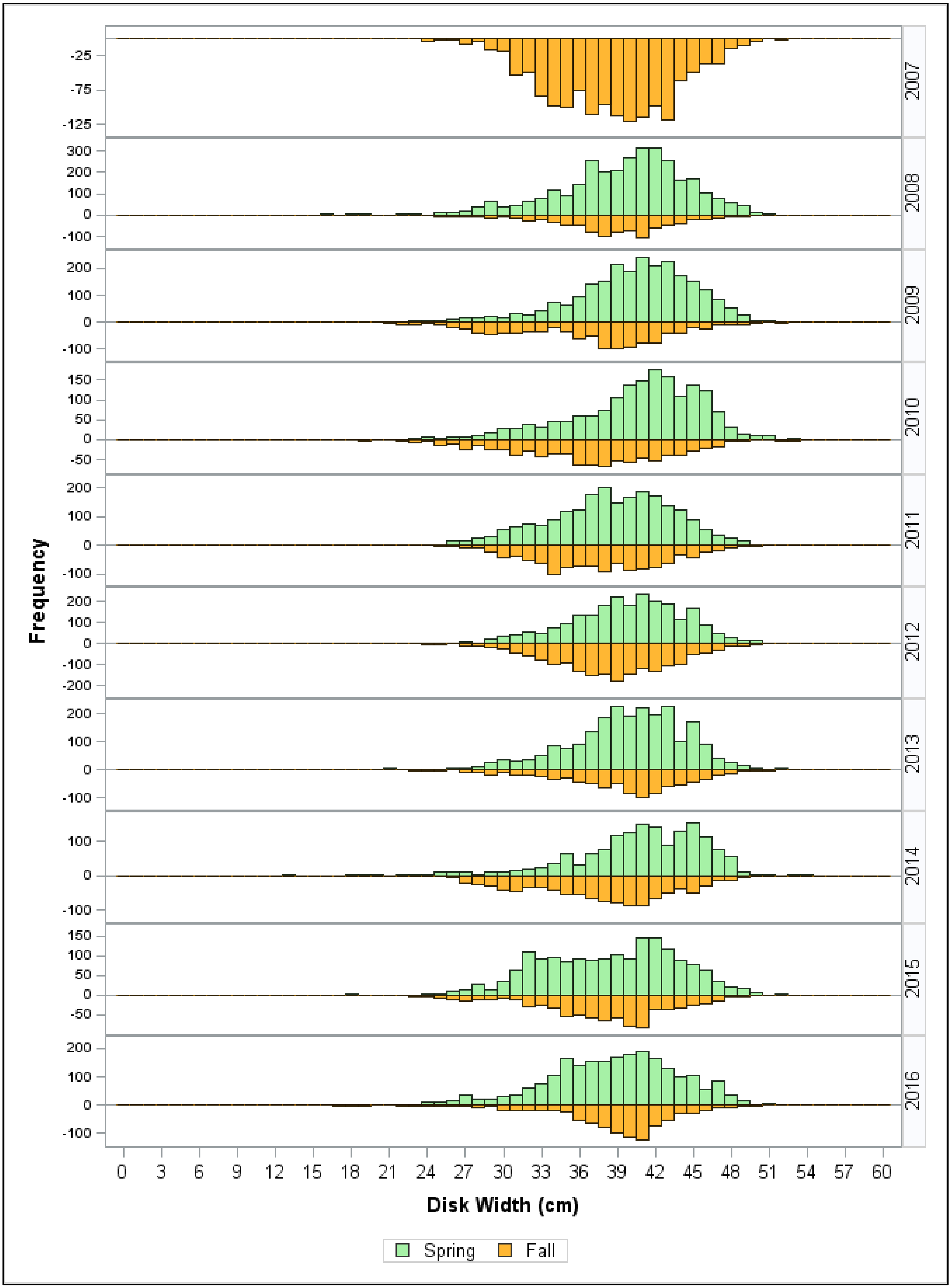


Figure 97. Clearnose Skate width-frequency distributions, by cruise and sex.

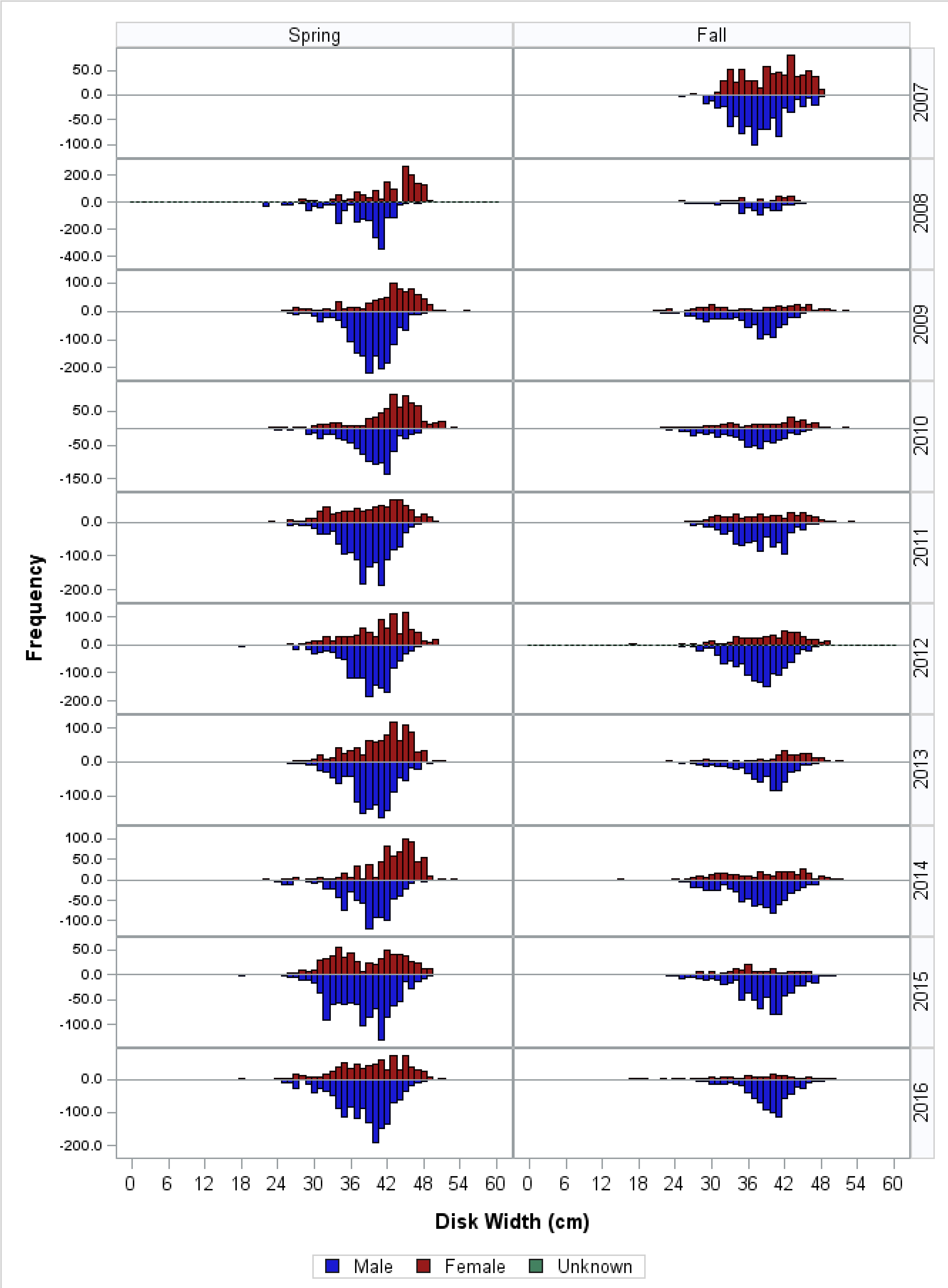


Figure 98. Clearnose Skate sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

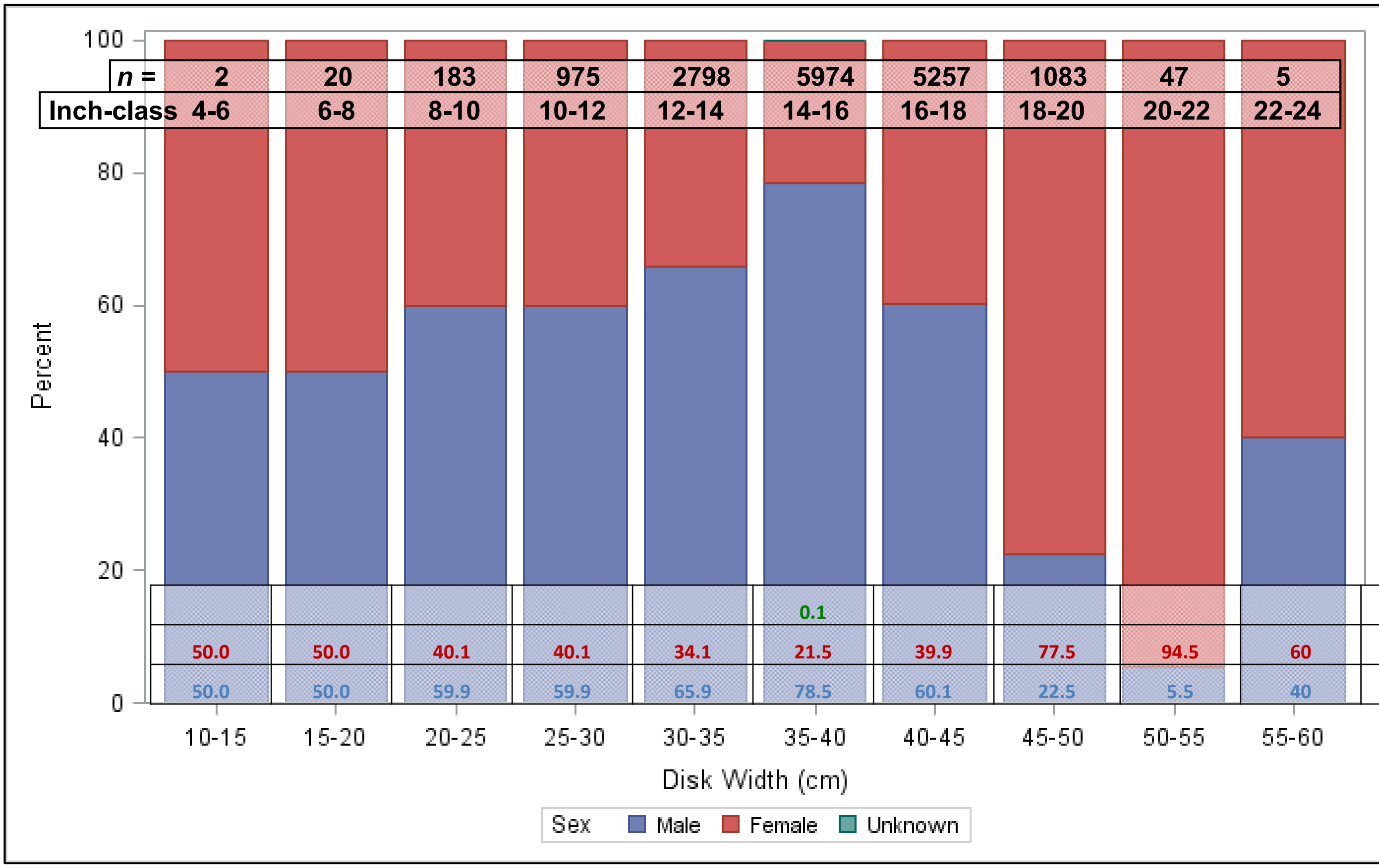


Figure 99. Clearnose Skate maturity at length, by sex for all cruises pooled, 2007-2016.

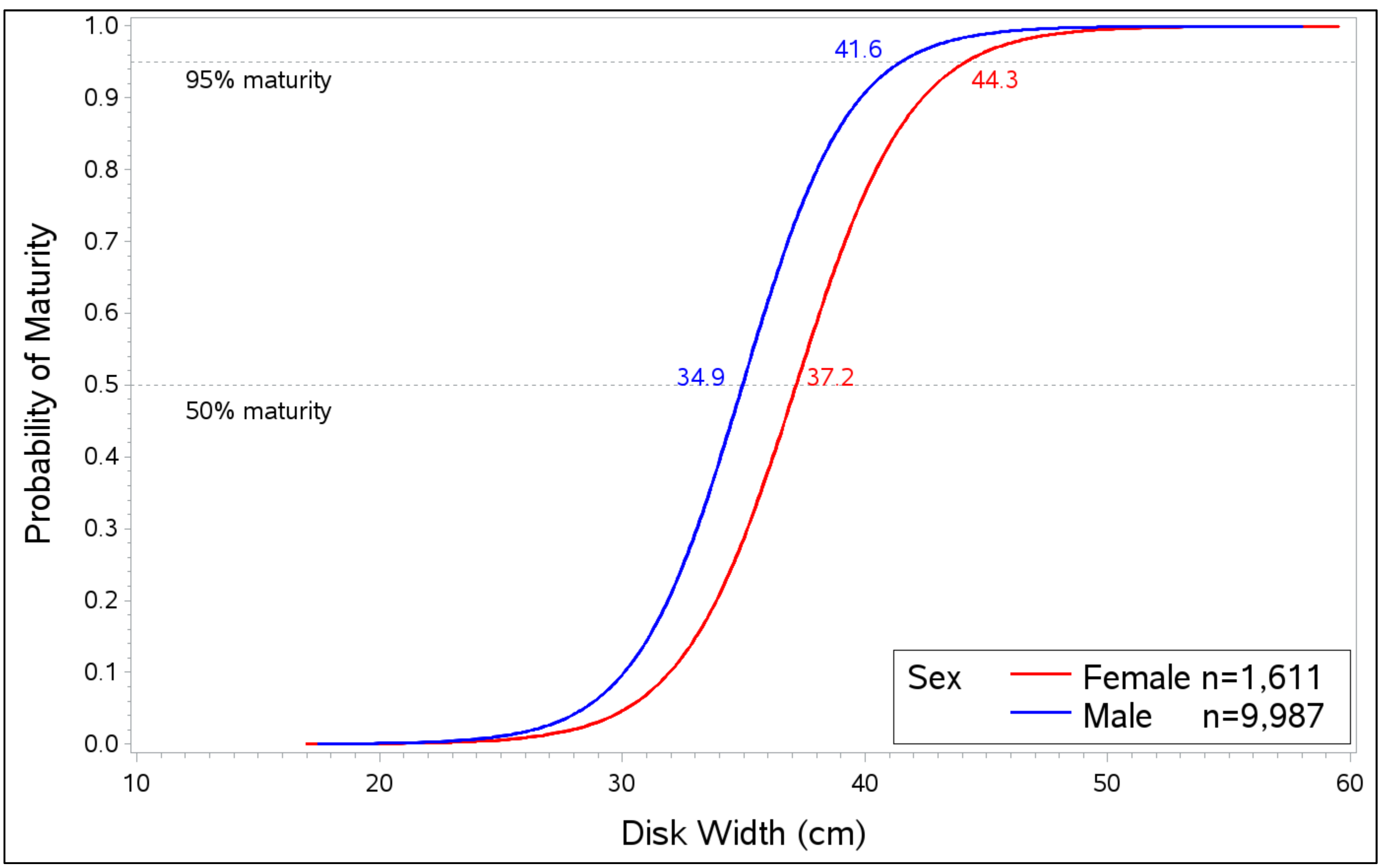
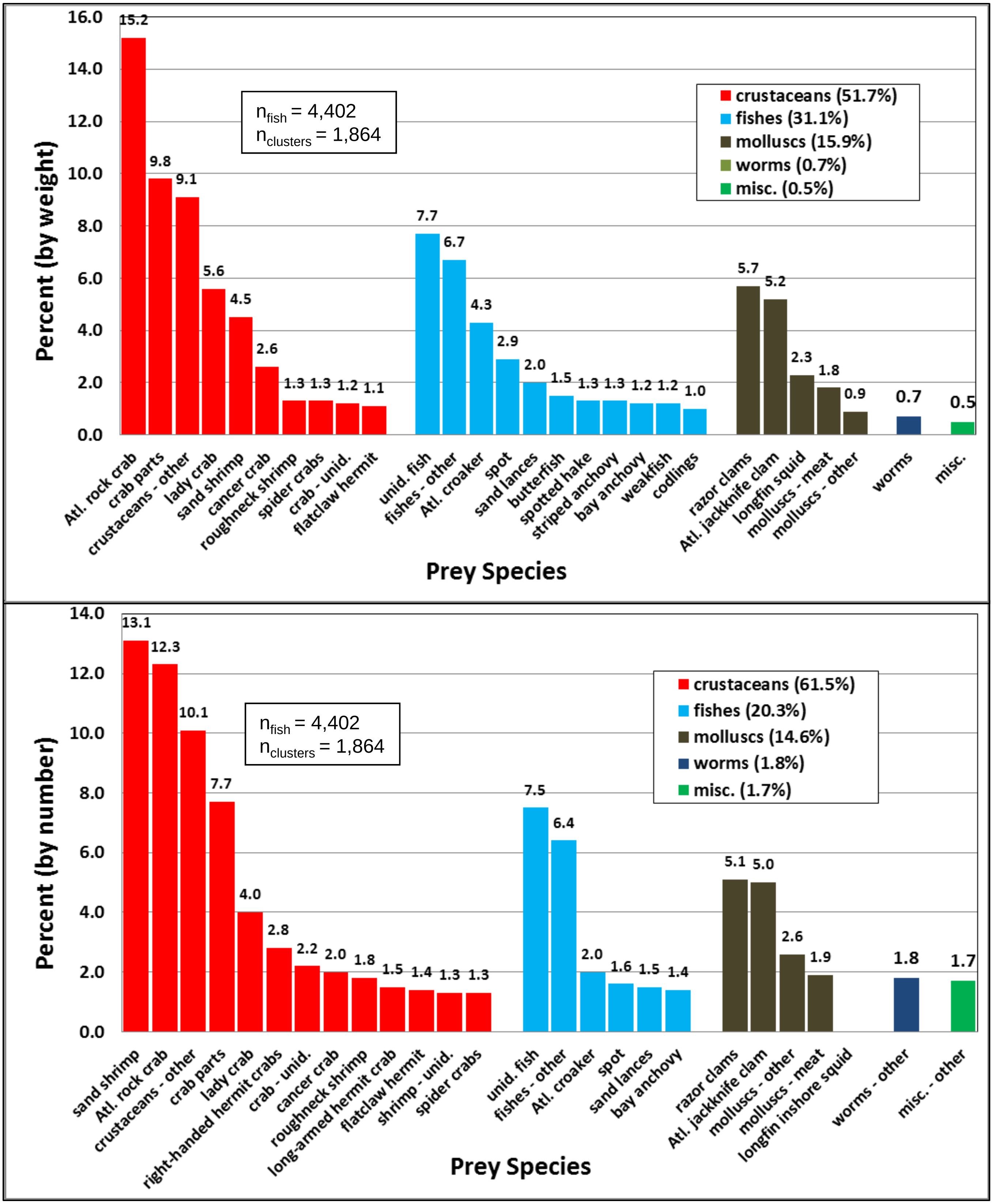


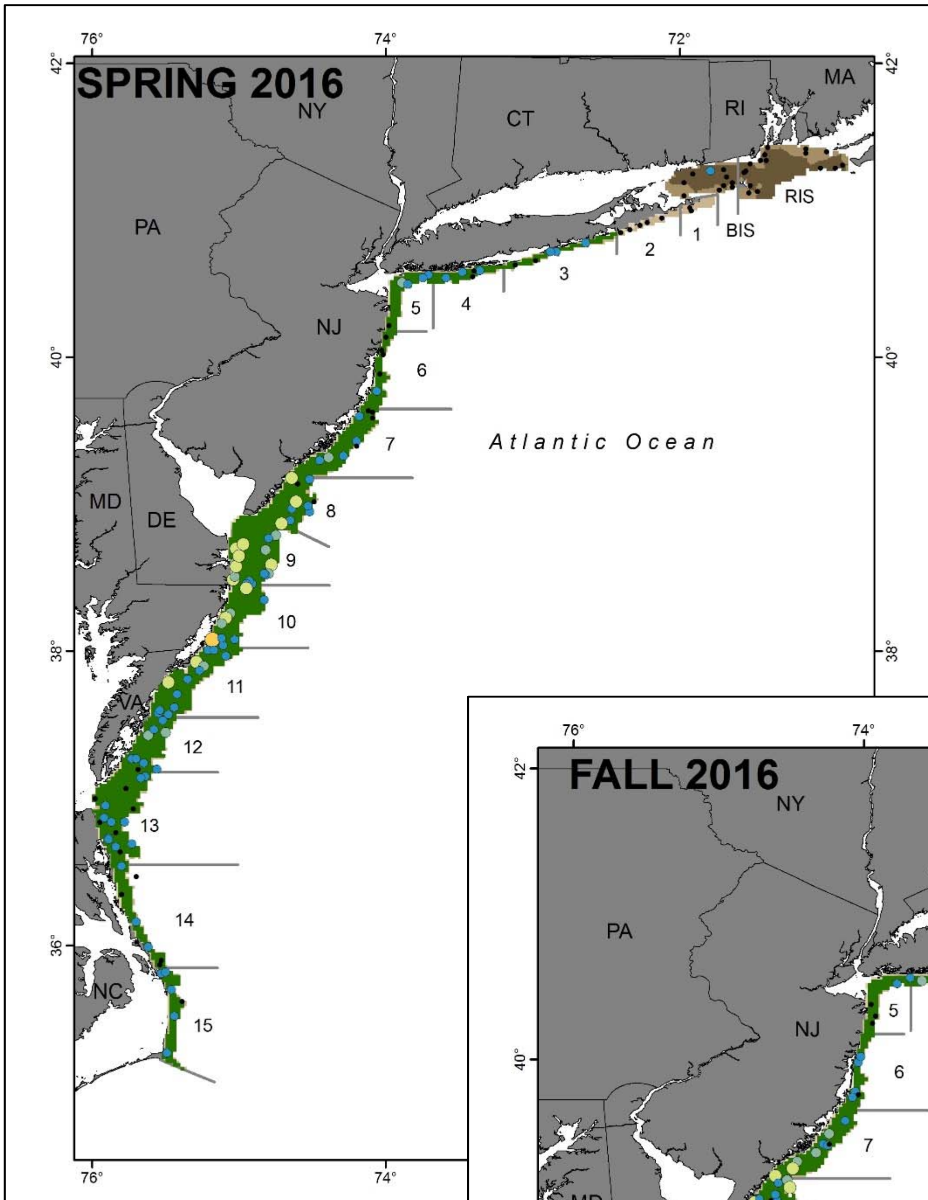
Figure 100. Clearnose Skate diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

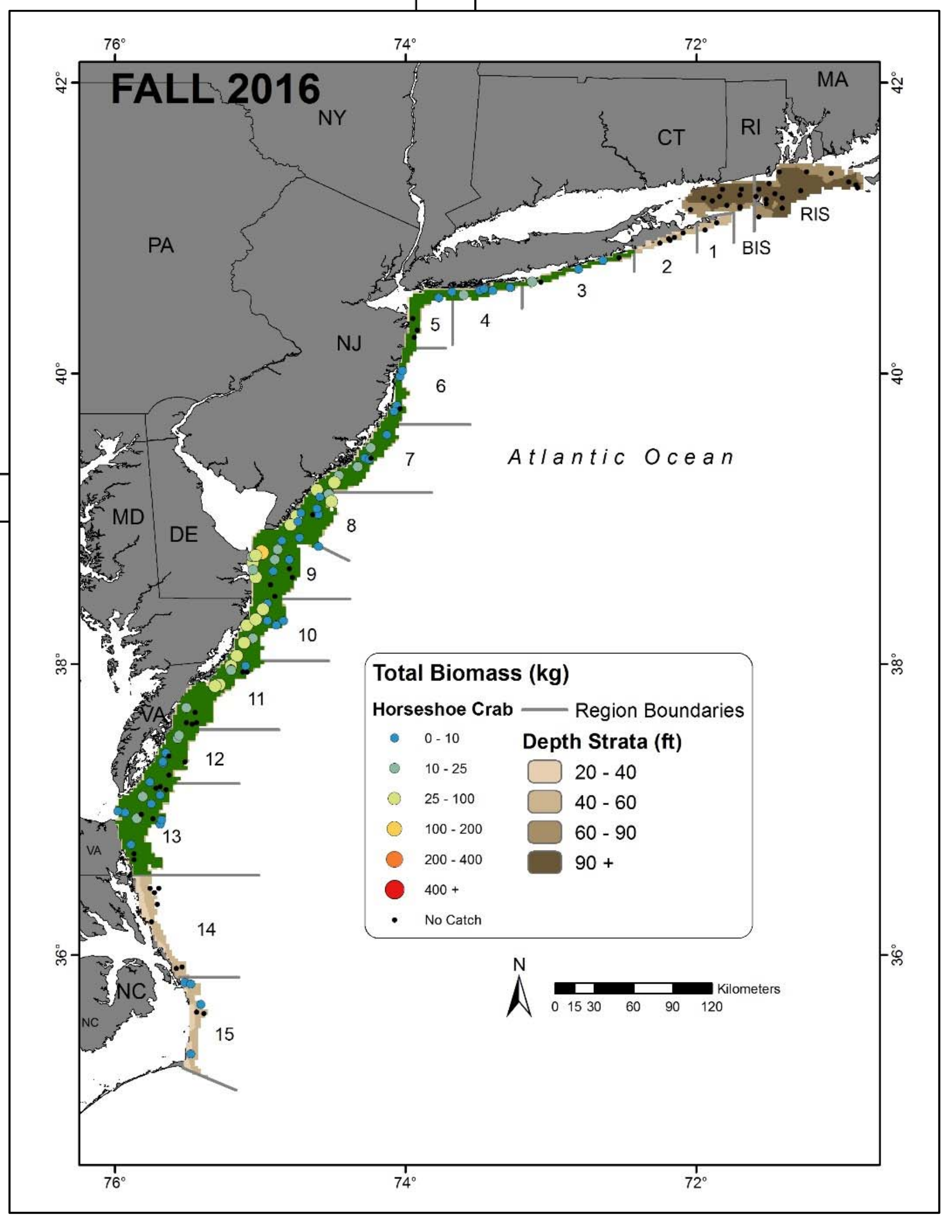


Horseshoe Crab

Sampling Priority: E

Figure 101. Horseshoe Crab biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(grey) = not used for abundance indices

Table 36. Horseshoe Crab sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,201	1,229.6	66.7	774	N/A	N/A	N/A	N/A
	2009	2,388	2,703.5	87.2	1,673	N/A	N/A	N/A	N/A
	2010	1,432	1,220.7	61.5	979	N/A	N/A	N/A	N/A
	2011	1,747	1,625.1	78.6	1,559	N/A	N/A	N/A	N/A
	2012	723	785.5	42.7	500	N/A	N/A	N/A	N/A
	2013	933	734.0	69.2	933	N/A	N/A	N/A	N/A
	2014	1,349	1,449.7	86.3	1,349	N/A	N/A	N/A	N/A
	2015	842	804.7	72.6	842	N/A	N/A	N/A	N/A
	2016	1,266	1,075.8	76.9	1,266	N/A	N/A	N/A	N/A
Fall	2007	795	1,438.8	41.3	342	N/A	N/A	N/A	N/A
	2008	1,149	1,837.2	52.9	473	N/A	N/A	N/A	N/A
	2009	1,931	2,168.0	53.8	1,092	N/A	N/A	N/A	N/A
	2010	613	862.2	57.7	498	N/A	N/A	N/A	N/A
	2011	1,144	1,613.9	56.7	1,070	N/A	N/A	N/A	N/A
	2012	1,331	1,698.8	59.6	1,271	N/A	N/A	N/A	N/A
	2013	298	489.2	43.3	298	N/A	N/A	N/A	N/A
	2014	849	1,071.2	51.0	657	N/A	N/A	N/A	N/A
	2015	1,836	2,127.9	73.1	1,654	N/A	N/A	N/A	N/A
	2016	1,200	1,598.4	73.1	1,200	N/A	N/A	N/A	N/A

Table 37. Horseshoe Crab geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by sex.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	116	2.79	3.58	4.55	2.84	3.69	4.74
	2009	125	5.64	6.87	8.33	6.63	8.10	9.85
	2010	117	2.48	3.20	4.07	2.31	2.97	3.76
	2011	117	3.94	4.80	5.80	4.12	4.99	6.01
	2012	117	0.90	1.28	1.73	1.03	1.44	1.93
	2013	117	2.57	3.25	4.06	2.19	2.80	3.53
	2014	117	5.23	6.19	7.29	5.38	6.31	7.37
	2015	117	2.46	3.03	3.71	2.59	3.21	3.93
	2016	117	2.75	3.53	4.47	2.81	3.58	4.51
Female	2007							
	2008	116	2.03	2.64	3.37	2.44	3.17	4.07
	2009	125	3.82	4.73	5.79	5.09	6.30	7.73
	2010	117	1.82	2.34	2.94	1.88	2.40	3.03
	2011	117	2.62	3.18	3.83	3.09	3.76	4.55
	2012	117	0.67	0.97	1.33	0.84	1.19	1.61
	2013	117	1.75	2.24	2.81	1.65	2.13	2.71
	2014	117	2.74	3.23	3.80	3.50	4.12	4.82
	2015	117	1.50	1.87	2.30	1.84	2.31	2.86
	2016	117	1.88	2.40	3.01	2.14	2.73	3.44
Male	2007							
	2008	116	0.67	0.89	1.13	0.67	0.89	1.14
	2009	125	1.84	2.22	2.65	1.75	2.12	2.54
	2010	117	1.06	1.42	1.85	0.75	1.01	1.30
	2011	117	1.63	2.06	2.57	1.24	1.57	1.94
	2012	117	0.40	0.59	0.81	0.33	0.50	0.68
	2013	117	0.97	1.27	1.60	0.70	0.89	1.11
	2014	117	2.39	2.89	3.46	1.79	2.16	2.58
	2015	117	1.19	1.49	1.83	0.93	1.16	1.41
	2016	117	1.17	1.58	2.06	0.85	1.15	1.49

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	104	0.82	1.23	1.74	1.09	1.68	2.43
	2008	104	1.32	2.00	2.87	1.74	2.68	3.94
	2009	110	1.87	2.79	4.00	2.11	3.17	4.60
	2010	104	1.59	2.06	2.62	2.08	2.71	3.47
	2011	104	2.01	2.77	3.74	2.64	3.69	5.02
	2012	104	1.94	2.76	3.81	2.41	3.47	4.86
	2013	104	0.69	0.98	1.31	0.91	1.30	1.78
	2014	104	1.31	1.90	2.63	1.73	2.48	3.42
	2015	104	5.04	6.60	8.55	5.61	7.30	9.41
	2016	104	3.03	4.10	5.45	3.90	5.32	7.16
Female	2007	104	0.63	0.95	1.35	0.94	1.46	2.11
	2008	104	0.91	1.40	2.01	1.36	2.13	3.15
	2009	110	1.30	1.93	2.72	1.62	2.42	3.48
	2010	104	0.93	1.23	1.58	1.46	1.94	2.50
	2011	104	1.22	1.69	2.26	1.92	2.71	3.70
	2012	104	1.19	1.72	2.37	1.77	2.60	3.67
	2013	104	0.44	0.65	0.88	0.70	1.04	1.43
	2014	104	0.88	1.26	1.73	1.37	1.95	2.69
	2015	104	2.72	3.51	4.46	3.82	4.91	6.26
	2016	104	1.78	2.39	3.15	2.83	3.88	5.21
Male	2007	104	0.41	0.62	0.86	0.42	0.64	0.90
	2008	104	0.60	0.95	1.36	0.62	0.97	1.39
	2009	110	0.89	1.38	2.00	0.86	1.34	1.95
	2010	104	0.89	1.16	1.46	0.85	1.11	1.40
	2011	104	1.14	1.62	2.21	1.16	1.65	2.25
	2012	104	1.14	1.64	2.25	1.09	1.57	2.15
	2013	104	0.36	0.53	0.72	0.34	0.50	0.69
	2014	104	0.73	1.11	1.56	0.71	1.06	1.49
	2015	104	3.01	3.93	5.07	2.62	3.35	4.24
	2016	104	1.64	2.20	2.88	1.51	2.00	2.60

Figure 102. Horseshoe Crab geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by sex.

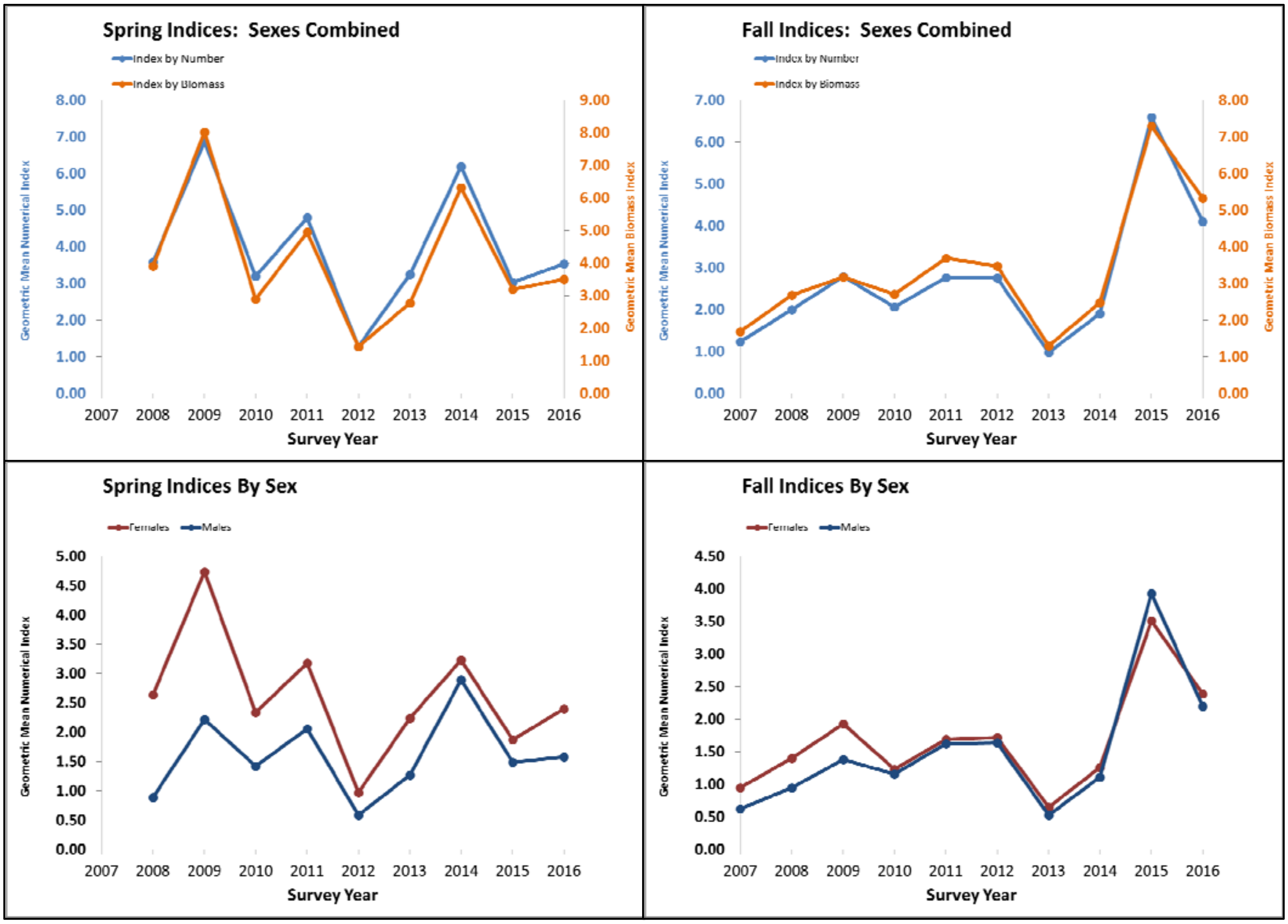


Figure 103. Horseshoe Crab width-frequency distributions, by cruise.

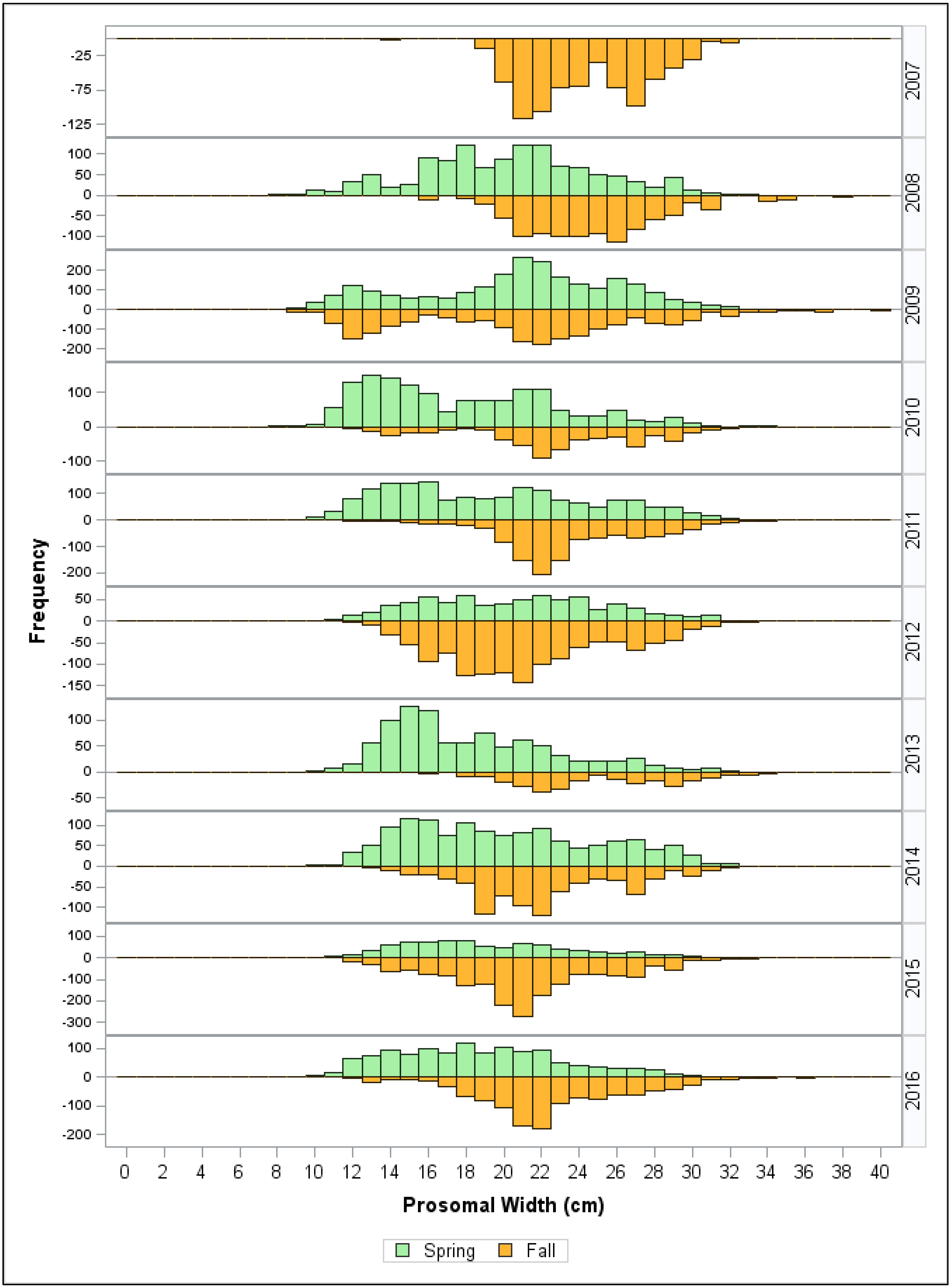


Figure 104. Horseshoe Crab width-frequency distributions, by cruise and sex.

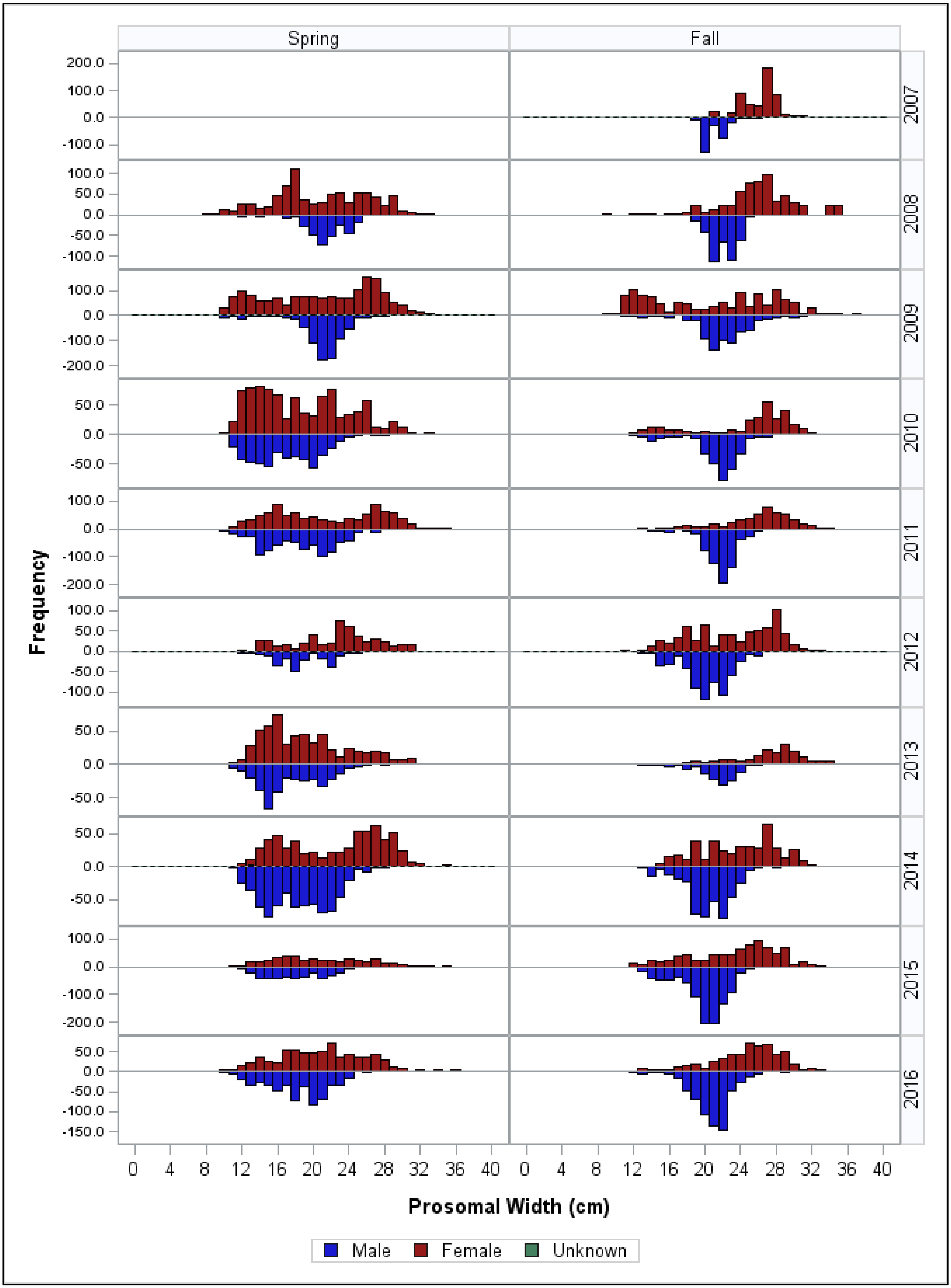


Figure 105. Horseshoe Crab sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

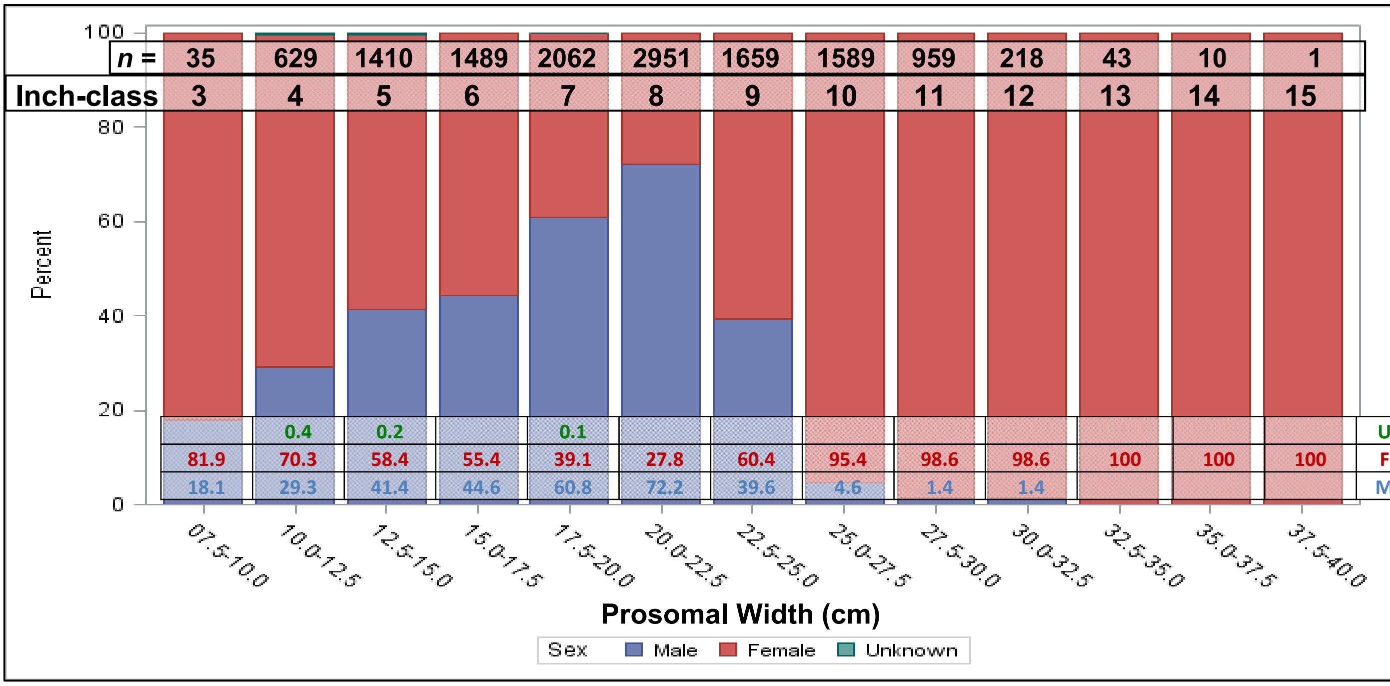


Figure 106. Horseshoe Crab maturity at length, by sex for all cruises pooled, 2007-2016.

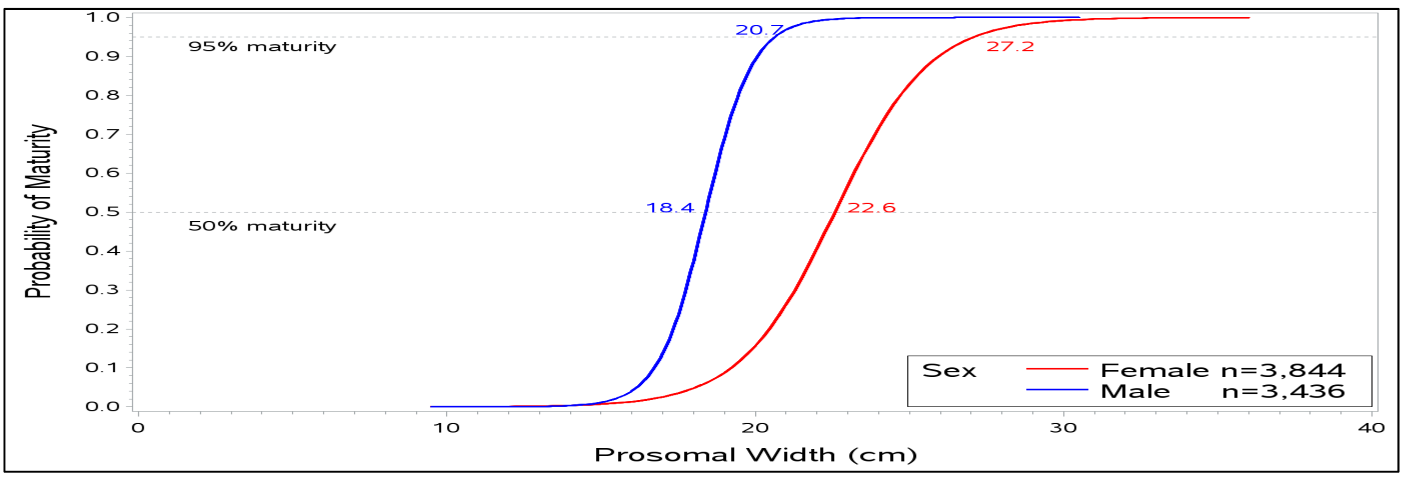
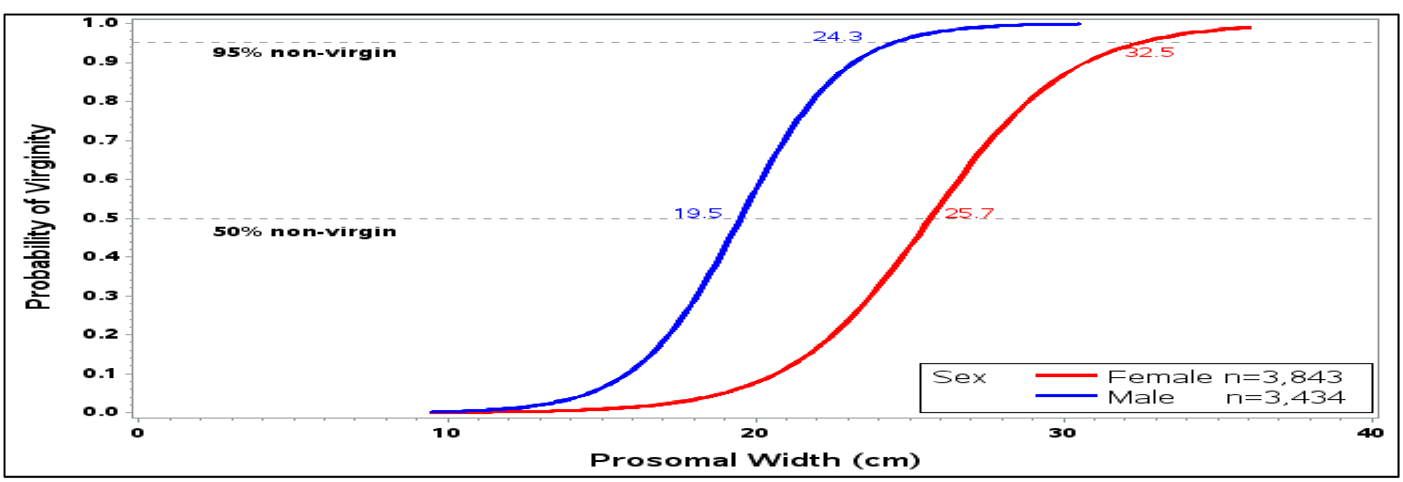


Figure 107. Horseshoe Crab virginity at length, by sex for all cruises pooled, 2007-2016.

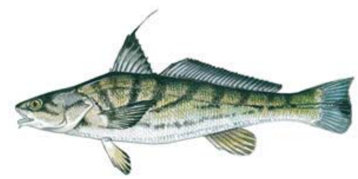


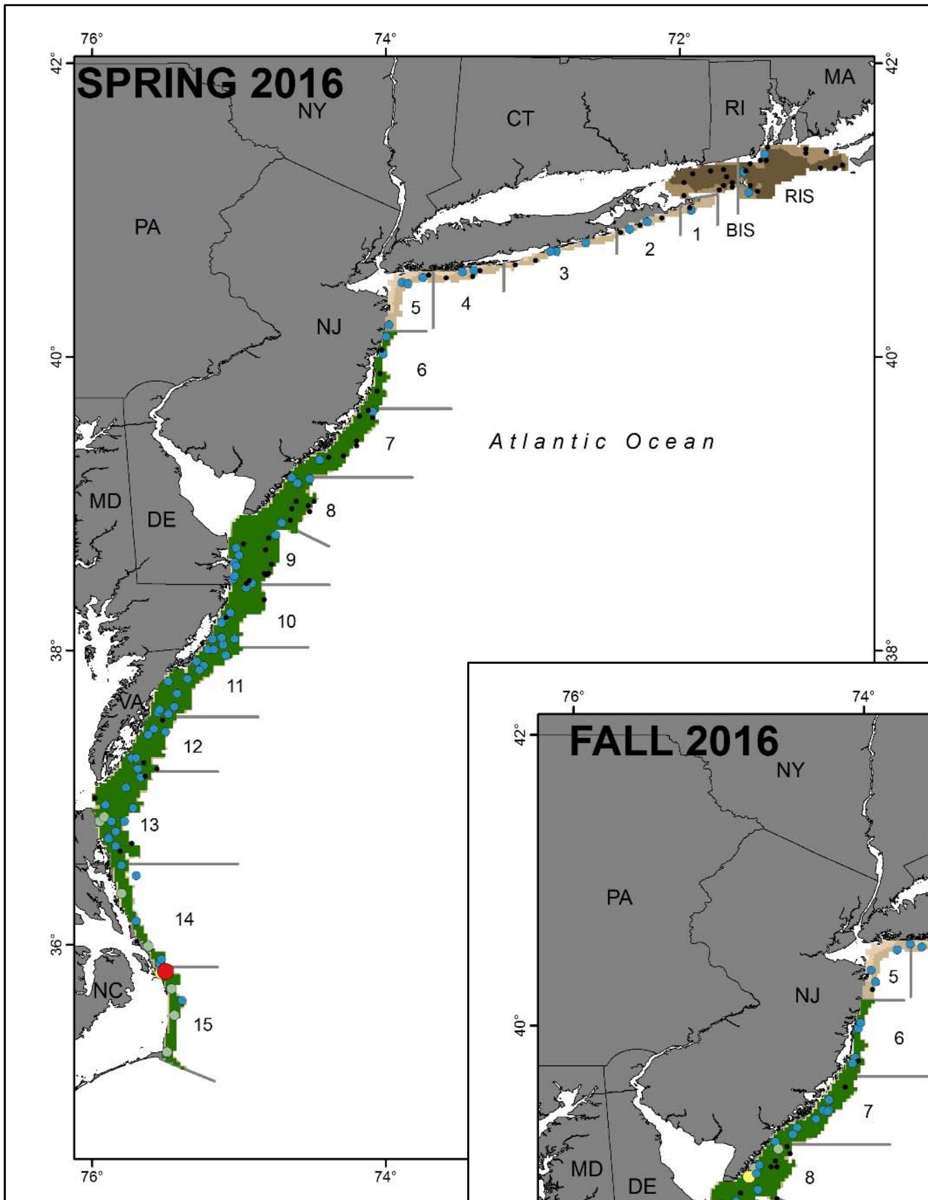
Kingfish

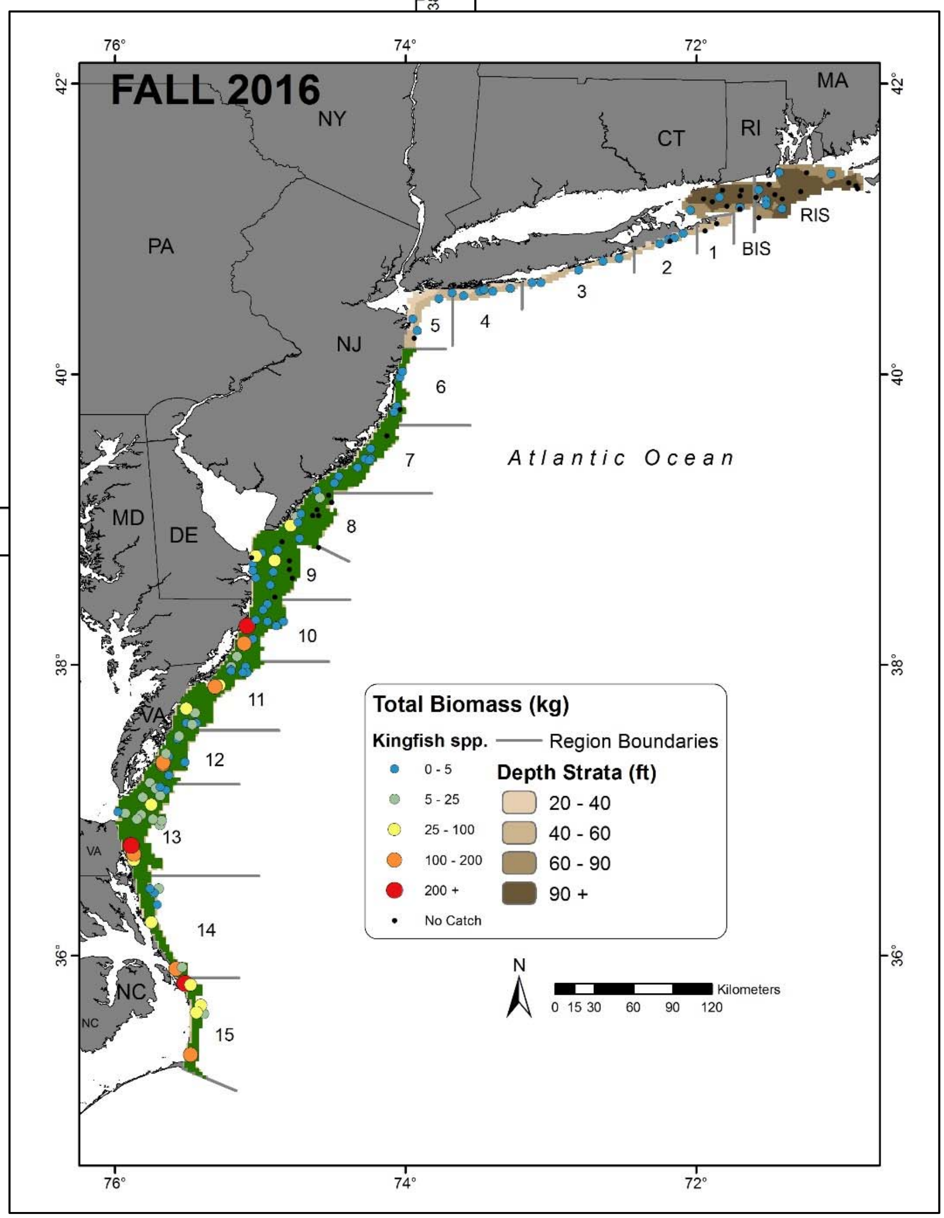
Sampling Priority: D

(Priority A in 2012&2013 for student research project)

Figure 108. Kingfish biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(grey) = not used for abundance indices

Table 38. Kingfish sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	6,638	699.8	67.6	759	0	0	0	0
	2009	1,742	207.8	42.2	483	0	0	0	0
	2010	13,179	1,230.9	26.5	479	0	0	0	0
	2011	2,098	147.2	50.0	1,216	0	0	0	0
	2012	3,435	365.2	83.3	2,101	93	0	77	0
	2013	2,309	189.1	82.4	1,927	75	0	70	0
	2014	496	67.6	38.2	192	0	0	0	0
	2015	1,152	96.2	39.2	1,022	0	0	0	0
	2016	4,069	344.7	66.7	1,524	0	0	0	0
Fall	2007	9,124	1,398.8	71.6	1,707	0	0	0	0
	2008	8,026	1,254.4	76.5	1,502	0	0	0	0
	2009	7,969	888.9	82.4	3,303	0	0	0	0
	2010	18,979	2,479.4	80.4	1,925	0	0	0	0
	2011	10,644	1,398.8	91.2	3,245	0	0	0	0
	2012	11,291	1,331.5	89.2	4,733	181	0	139	0
	2013	6,805	958.8	87.3	2,458	101	0	73	0
	2014	6,384	939.3	79.4	2,510	0	0	0	0
	2015	11,754	1,129.7	76.5	4,460	0	0	0	0
	2016	19,019	2,686.5	86.3	4,930	1	0	1	1

Table 39. Kingfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age class.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	101	2.67	3.75	5.14	0.73	1.07	1.48
	2009	107	0.67	0.94	1.26	0.21	0.30	0.40
	2010	102	0.34	0.69	1.13	0.07	0.28	0.53
	2011	102	1.31	1.89	2.62	0.35	0.52	0.71
	2012	102	4.91	6.56	8.67	1.05	1.37	1.74
	2013	102	3.97	4.97	6.17	0.81	0.99	1.20
	2014	102	0.47	0.69	0.95	0.13	0.21	0.29
	2015	102	0.73	1.02	1.36	0.22	0.31	0.41
	2016	102	2.07	2.76	3.62	0.53	0.76	1.03
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	101	0.54	0.87	1.27	0.12	0.28	0.46
	2009	107	0.18	0.31	0.47	0.05	0.09	0.13
	2010	102	0.06	0.29	0.58	0.00	0.13	0.31
	2011	102	0.28	0.51	0.79	0.06	0.14	0.23
	2012	102	1.25	1.67	2.16	0.27	0.39	0.52
	2013	102	0.92	1.19	1.49	0.17	0.23	0.30
	2014	102	0.07	0.16	0.25	0.01	0.04	0.08
	2015	102	0.18	0.28	0.38	0.04	0.07	0.10
	2016	102	0.41	0.66	0.96	0.06	0.19	0.34
2	2007							
	2008	101	1.31	1.92	2.69	0.33	0.56	0.82
	2009	107	0.39	0.54	0.71	0.11	0.15	0.20
	2010	102	0.16	0.42	0.75	0.00	0.17	0.36
	2011	102	0.68	0.95	1.25	0.16	0.25	0.34
	2012	102	2.71	3.55	4.59	0.54	0.75	0.98
	2013	102	1.85	2.30	2.81	0.33	0.43	0.52
	2014	102	0.25	0.40	0.56	0.06	0.11	0.17
	2015	102	0.43	0.59	0.76	0.10	0.14	0.19
	2016	102	1.00	1.39	1.86	0.21	0.37	0.55
3+	2007							
	2008	101	1.00	1.47	2.04	0.27	0.44	0.64
	2009	107	0.29	0.39	0.50	0.07	0.10	0.13
	2010	102	0.12	0.35	0.62	0.01	0.13	0.27
	2011	102	0.50	0.68	0.88	0.11	0.16	0.21
	2012	102	1.29	1.70	2.19	0.25	0.37	0.50
	2013	102	0.93	1.15	1.41	0.16	0.21	0.26
	2014	102	0.25	0.38	0.51	0.06	0.11	0.15
	2015	102	0.30	0.42	0.56	0.06	0.10	0.13
	2016	102	0.75	1.08	1.48	0.16	0.29	0.43

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	102	4.55	6.74	9.77	1.28	1.85	2.57
	2008	102	6.68	9.58	13.56	2.18	2.99	4.00
	2009	107	11.29	14.81	19.34	2.34	2.95	3.67
	2010	102	6.26	8.98	12.73	1.64	2.33	3.20
	2011	102	13.27	18.35	25.24	2.91	3.86	5.03
	2012	102	14.20	19.31	26.13	2.89	3.78	4.88
	2013	102	5.43	7.61	10.52	1.44	1.98	2.63
	2014	102	6.80	9.32	12.66	1.88	2.48	3.20
	2015	102	10.19	14.08	19.32	2.50	3.24	4.14
	2016	102	14.78	20.50	28.28	3.70	4.92	6.45
0	2007	102	1.90	2.80	4.00	0.50	0.77	1.10
	2008	102	2.15	3.17	4.52	0.73	1.06	1.45
	2009	107	5.68	7.68	10.28	1.19	1.55	1.98
	2010	102	3.10	4.57	6.57	0.85	1.27	1.78
	2011	102	4.88	6.84	9.46	1.17	1.60	2.11
	2012	102	6.04	8.15	10.90	1.27	1.69	2.19
	2013	102	1.63	2.33	3.22	0.48	0.68	0.92
	2014	102	2.35	3.14	4.13	0.65	0.86	1.10
	2015	102	4.97	6.97	9.65	1.35	1.80	2.34
	2016	102	4.82	6.68	9.15	1.33	1.81	2.39
1	2007	102	2.30	3.39	4.83	0.68	1.01	1.41
	2008	102	3.33	4.73	6.59	1.12	1.55	2.07
	2009	107	3.58	4.52	5.67	0.80	1.02	1.27
	2010	102	2.41	3.52	4.99	0.70	1.07	1.50
	2011	102	6.11	8.29	11.13	1.38	1.84	2.39
	2012	102	5.79	7.83	10.48	1.39	1.83	2.35
	2013	102	2.41	3.44	4.78	0.72	1.02	1.38
	2014	102	2.80	3.81	5.10	0.79	1.07	1.40
	2015	102	4.08	5.40	7.06	0.93	1.20	1.51
	2016	102	6.80	9.26	12.51	1.80	2.40	3.13
2	2007	102	1.29	1.87	2.60	0.40	0.60	0.83
	2008	102	2.00	2.74	3.67	0.65	0.88	1.15
	2009	107	1.97	2.54	3.22	0.45	0.60	0.77
	2010	102	1.31	1.86	2.54	0.39	0.57	0.78
	2011	102	2.54	3.38	4.41	0.60	0.82	1.06
	2012	102	2.32	3.10	4.05	0.59	0.79	1.01
	2013	102	1.55	2.13	2.82	0.44	0.61	0.81
	2014	102	1.89	2.55	3.36	0.52	0.71	0.92
	2015	102	1.72	2.26	2.89	0.38	0.51	0.66
	2016	102	3.52	4.78	6.39	0.97	1.33	1.75
3+	2007	102	0.78	1.15	1.60	0.24	0.39	0.54
	2008	102	1.32	1.82	2.43	0.44	0.60	0.77
	2009	107	1.26	1.63	2.07	0.28	0.38	0.49
	2010	102	0.95	1.31	1.74	0.28	0.40	0.53
	2011	102	1.32	1.75	2.26	0.32	0.44	0.58
	2012	102	1.26	1.69	2.22	0.33	0.48	0.64
	2013	102	1.02	1.37	1.78	0.28	0.40	0.52
	2014	102	1.34	1.76	2.26	0.36	0.48	0.62
	2015	102	0.94	1.27	1.64	0.22	0.30	0.40
	2016	102	2.13	2.87	3.79	0.59	0.82	1.08

Figure 109. Kingfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and by age class (B).

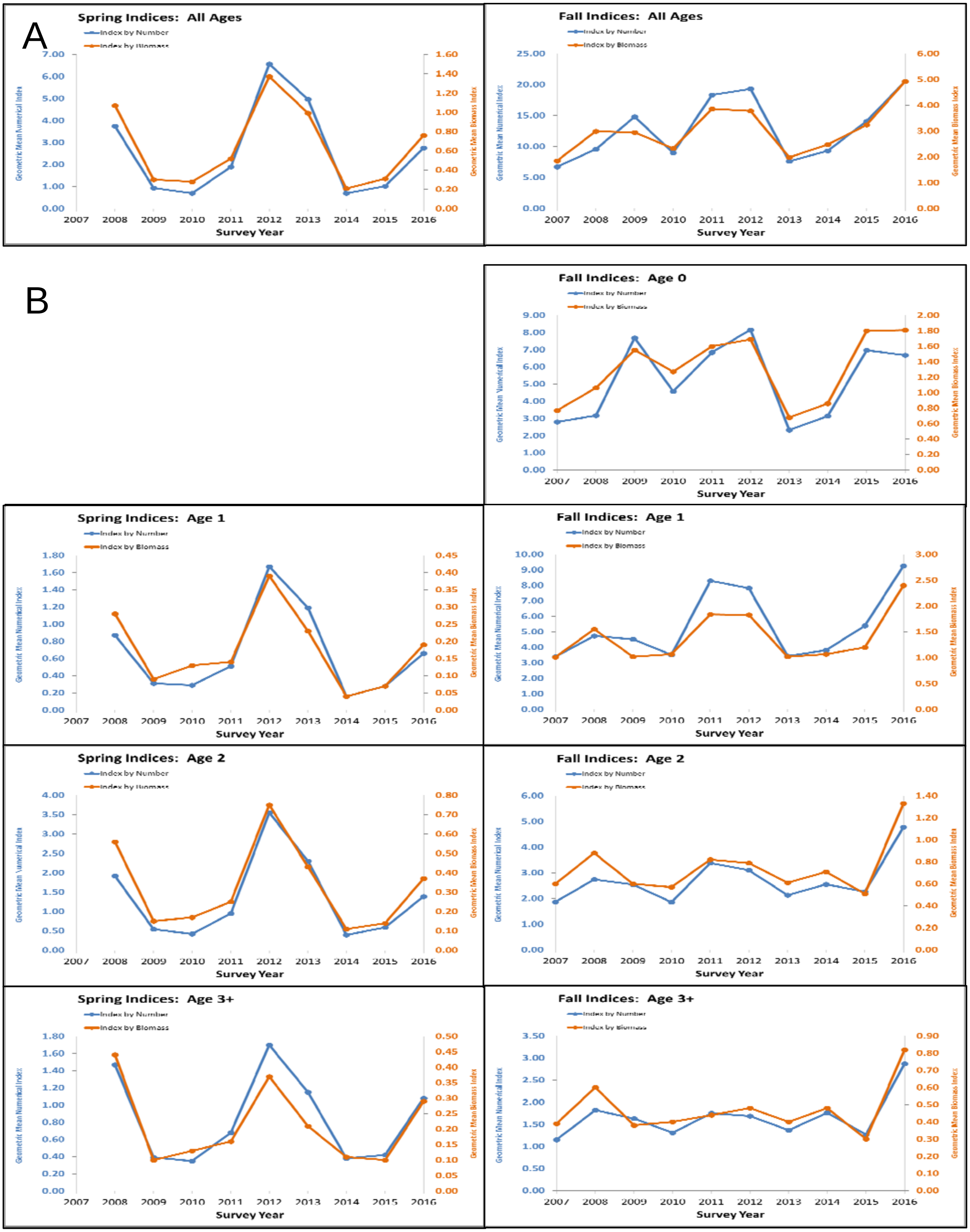


Figure 110. Kingfish length-frequency distributions, by cruise.

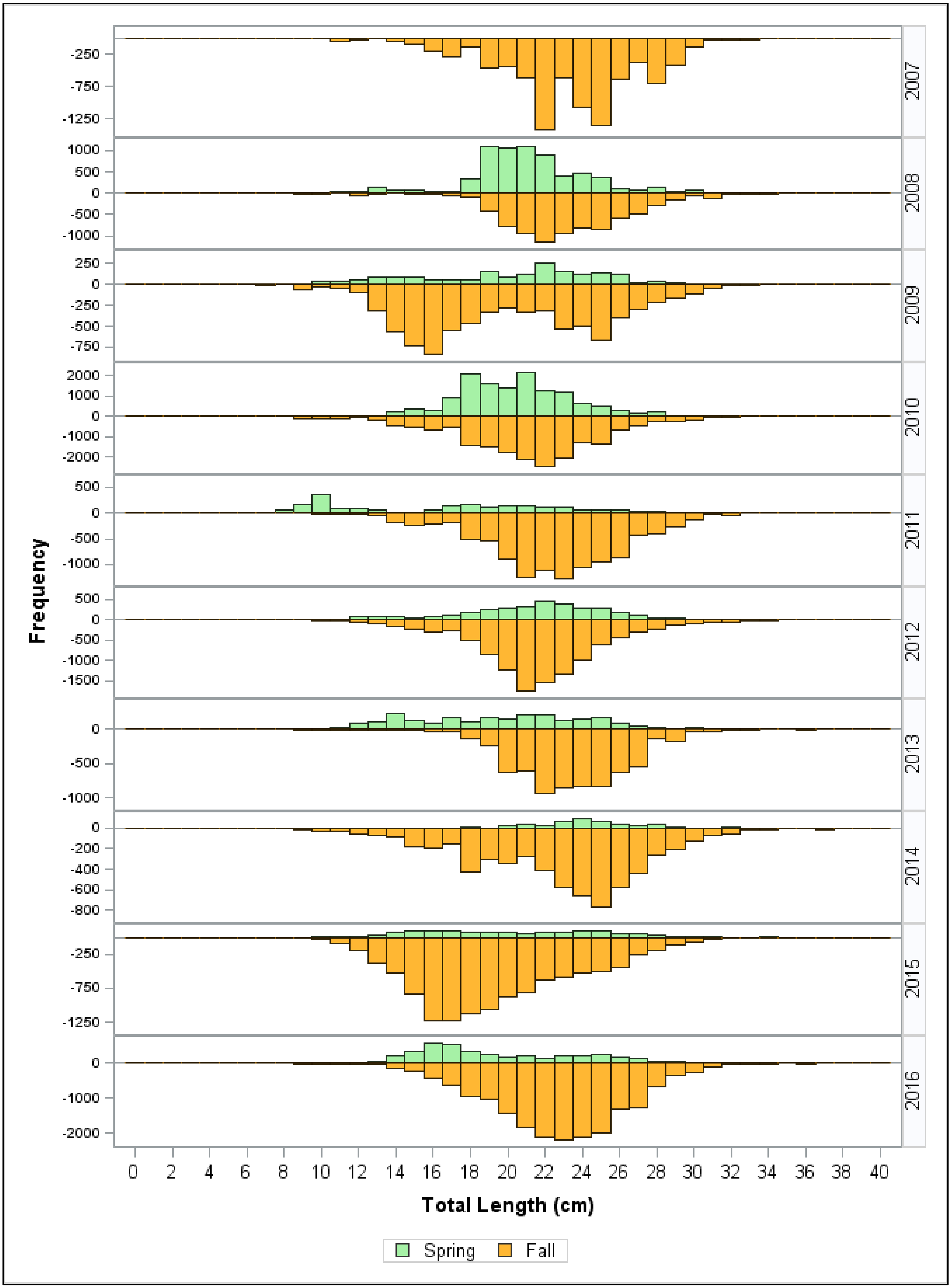


Figure 111. Kingfish sex ratio, by length group, for all cruises pooled, 2012-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

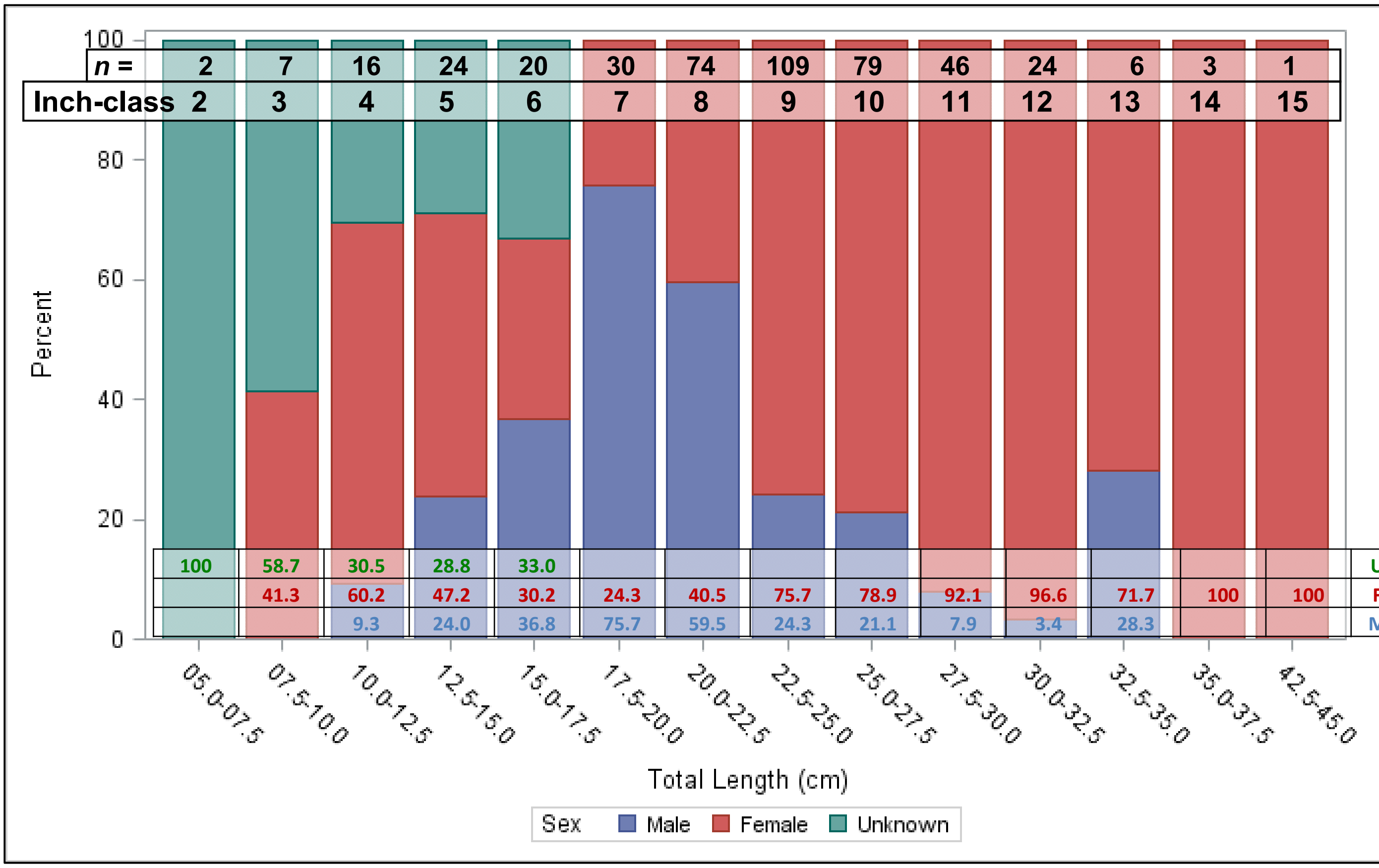
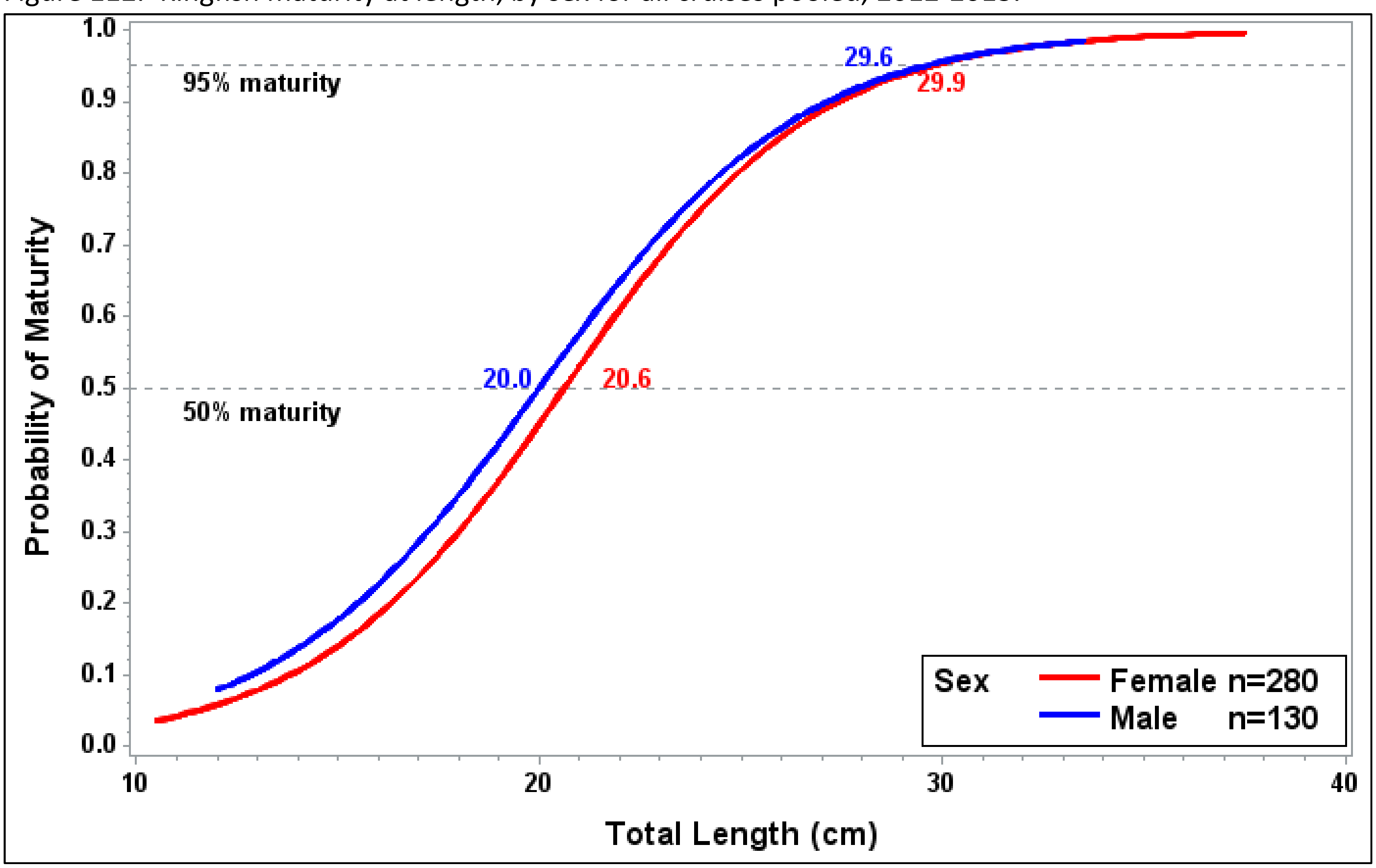


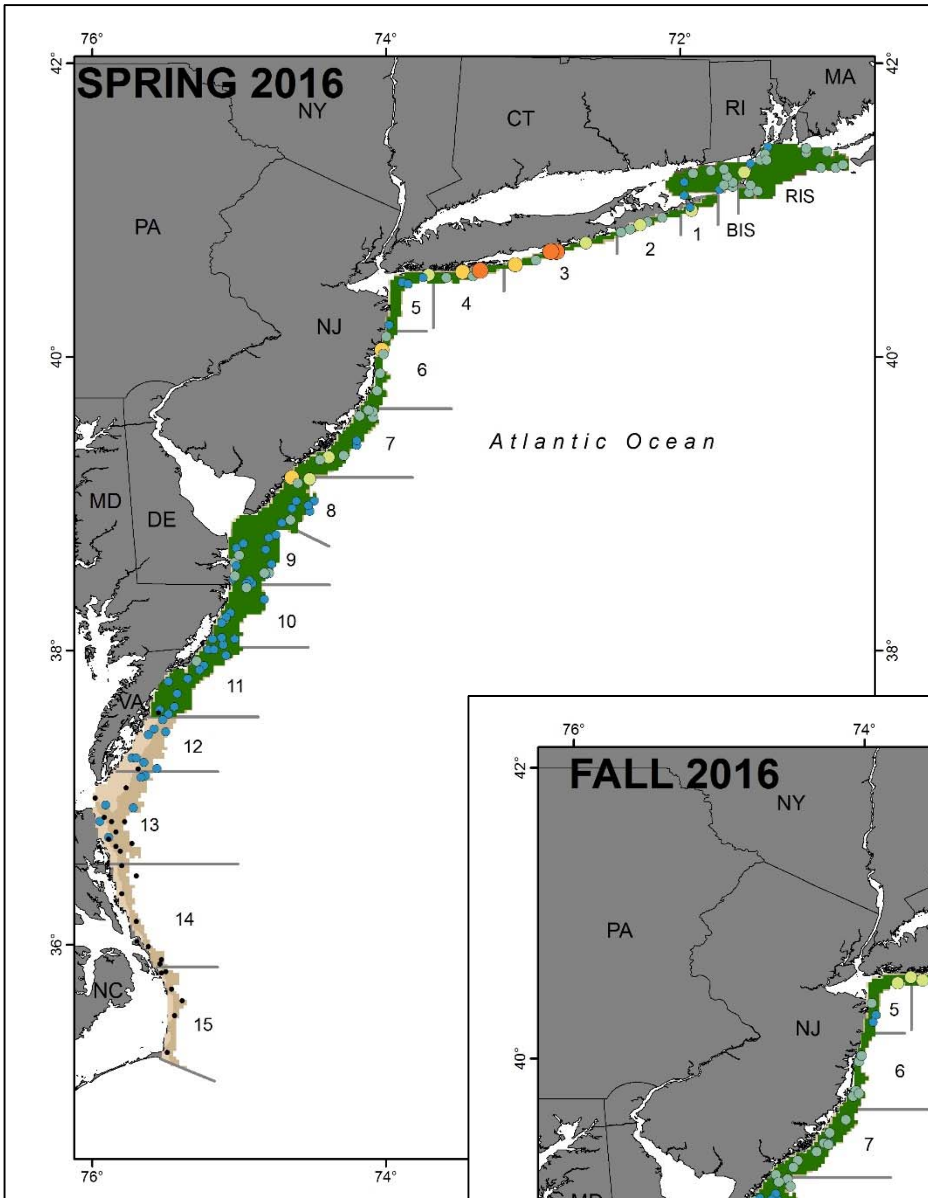
Figure 112. Kingfish maturity at length, by sex for all cruises pooled, 2012-2013.

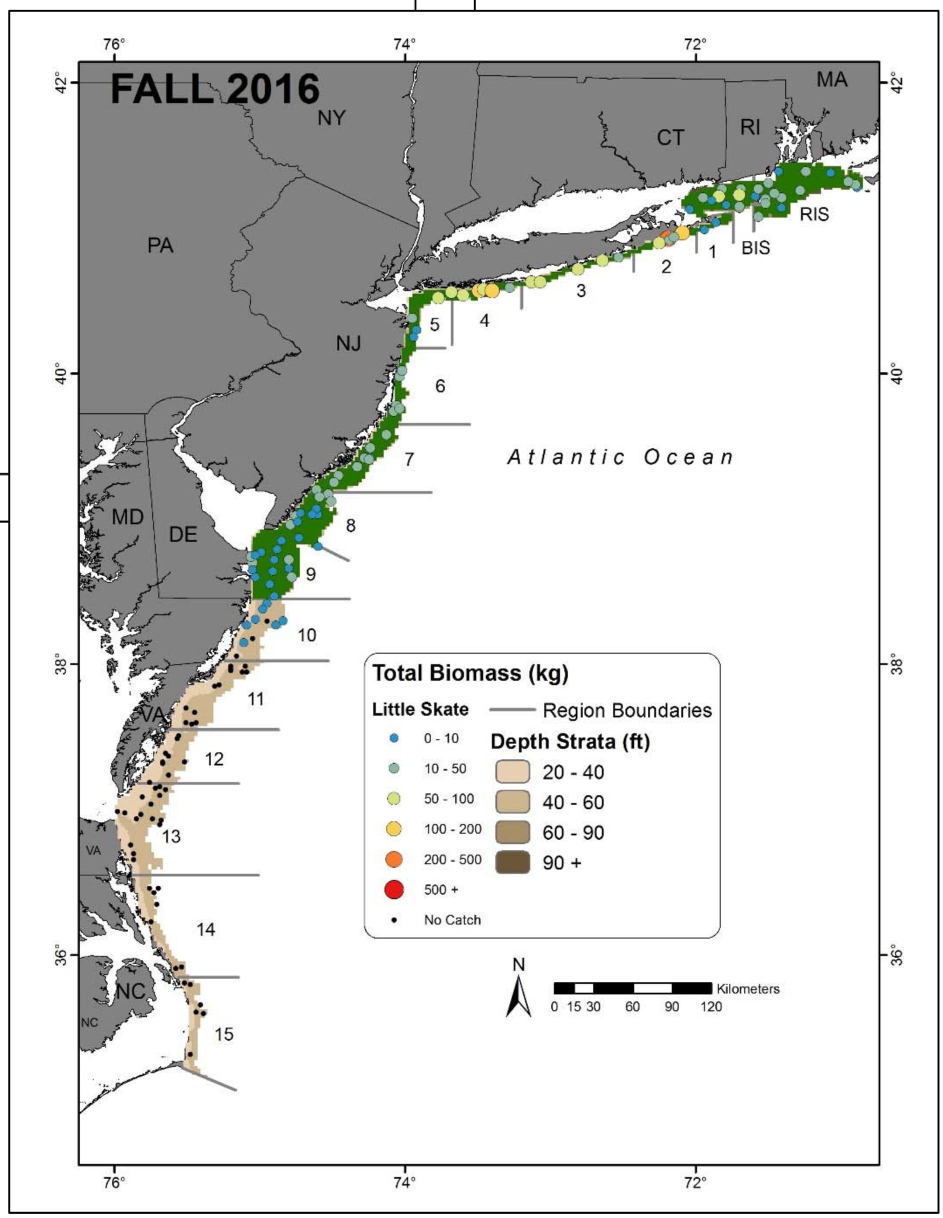


Little Skate

Sampling Priority: A

Figure 113. Little Skate biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[green]	[green]
		90+	[green]	[green]
	BIS	60-90	[green]	[green]
		90+	[green]	[green]
NY	01	40-60	[green]	[green]
	02	20-40	[green]	[green]
		40-60	[green]	[green]
	03	20-40	[green]	[green]
		40-60	[green]	[green]
	04	20-40	[green]	[green]
		40-60	[green]	[green]
	05	20-40	[green]	[green]
		40-60	[green]	[green]
NJ	06	20-40	[green]	[green]
		40-60	[green]	[green]
	07	20-40	[green]	[green]
		40-60	[green]	[green]
	08	20-40	[green]	[green]
		40-60	[green]	[green]
DE	09	20-40	[green]	[green]
		40-60	[green]	[green]
		60-90	[green]	[green]
MD	10	20-40	[green]	[grey]
		40-60	[green]	[grey]
VA	11	20-40	[green]	[grey]
		40-60	[green]	[grey]
	12	20-40	[grey]	[grey]
		40-60	[grey]	[grey]
	13	20-40	[grey]	[grey]
		40-60	[grey]	[grey]
NC	14	20-40	[grey]	[grey]
		40-60	[grey]	[grey]
	15	20-40	[grey]	[grey]
		40-60	[grey]	[grey]

[green] = used for abundance indices

[grey] = not used for abundance indices

Table 40. Little Skate sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	9,873	5,861.9	96.4	2,991	312	0	301	300
	2009	23,391	12,464.9	100.0	5,115	397	0	383	382
	2010	7,802	4,262.2	99.1	3,330	337	0	328	318
	2011	7,801	4,322.6	97.3	4,881	323	0	294	292
	2012	11,091	5,848.4	92.9	5,293	312	0	276	269
	2013	10,991	5,200.4	99.1	5,532	371	0	317	313
	2014	4,682	2,423.9	100.0	3,239	346	0	287	286
	2015	5,219	2,604.6	95.5	3,669	310	0	271	268
	2016	5,906	3,184.0	99.1	3,442	352	0	277	271
Fall	2007	5,288	3,026.2	70.8	2,659	194	0	188	181
	2008	7,014	4,104.8	97.8	2,247	263	0	259	256
	2009	8,442	4,966.0	98.9	4,371	304	0	284	277
	2010	6,453	3,739.1	96.6	3,672	263	0	238	236
	2011	6,293	3,729.9	98.9	3,553	259	0	218	216
	2012	3,642	2,054.3	75.3	2,370	184	0	145	138
	2013	4,480	2,429.4	98.9	3,606	267	0	233	219
	2014	3,210	1,787.6	93.3	2,642	236	0	155	154
	2015	4,250	2,252.3	96.6	3,565	272	0	197	191
	2016	5,213	2,688.9	100.0	4,264	274	0	183	180

Table 41. Little Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	109	33.25	39.71	47.39	20.83	24.79	29.47
	2009	120	41.19	48.38	56.80	23.48	27.60	32.41
	2010	112	24.75	29.05	34.06	14.57	17.10	20.05
	2011	112	21.66	25.44	29.85	13.11	15.33	17.90
	2012	112	21.65	25.23	29.37	12.85	14.90	17.26
	2013	112	23.33	27.42	32.19	12.96	15.14	17.67
	2014	112	16.09	19.27	23.05	8.94	10.69	12.75
	2015	112	16.04	18.86	22.14	9.21	10.79	12.61
	2016	112	16.46	19.33	22.67	9.72	11.46	13.48

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	84	9.64	12.29	15.60	6.55	8.23	10.28
	2008	89	22.56	28.18	35.13	13.48	16.76	20.78
	2009	96	32.76	37.81	43.63	17.26	20.94	25.36
	2010	89	19.75	25.39	32.56	11.77	15.02	19.10
	2011	89	19.57	23.26	27.61	11.52	13.73	16.33
	2012	89	6.04	7.60	9.52	4.08	5.07	6.25
	2013	89	22.34	27.49	33.77	12.71	15.54	18.95
	2014	89	13.06	15.63	18.68	7.90	9.36	11.06
	2015	89	21.36	25.29	29.92	12.19	14.34	16.84
	2016	89	22.19	26.13	30.74	12.38	14.55	17.07

Figure 114. Little Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

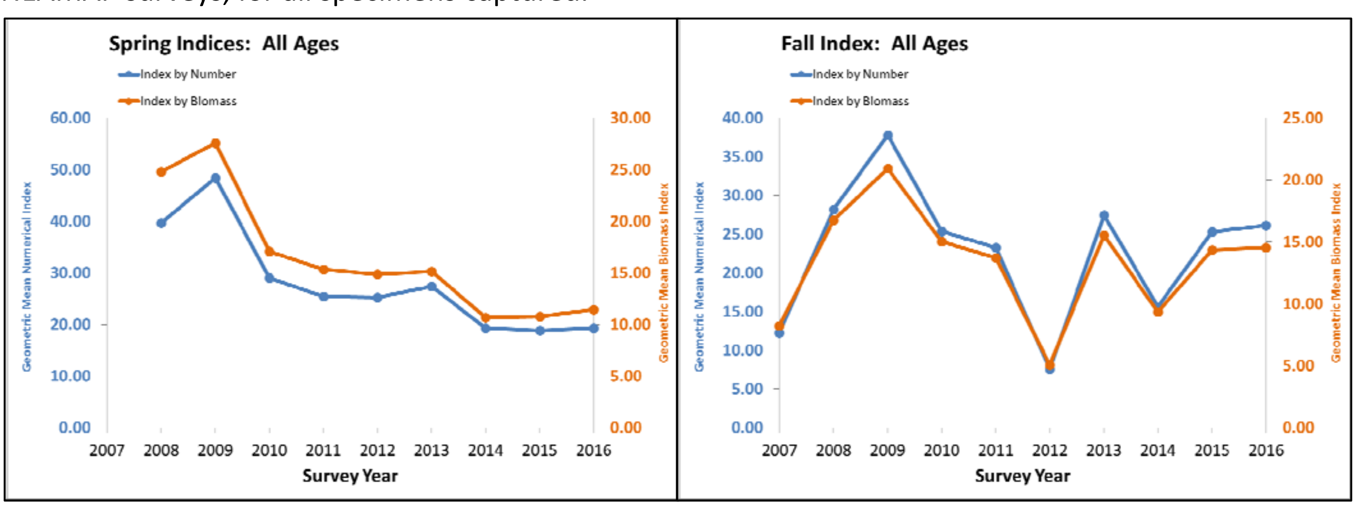


Figure 115. Little Skate width-frequency distributions, by cruise.

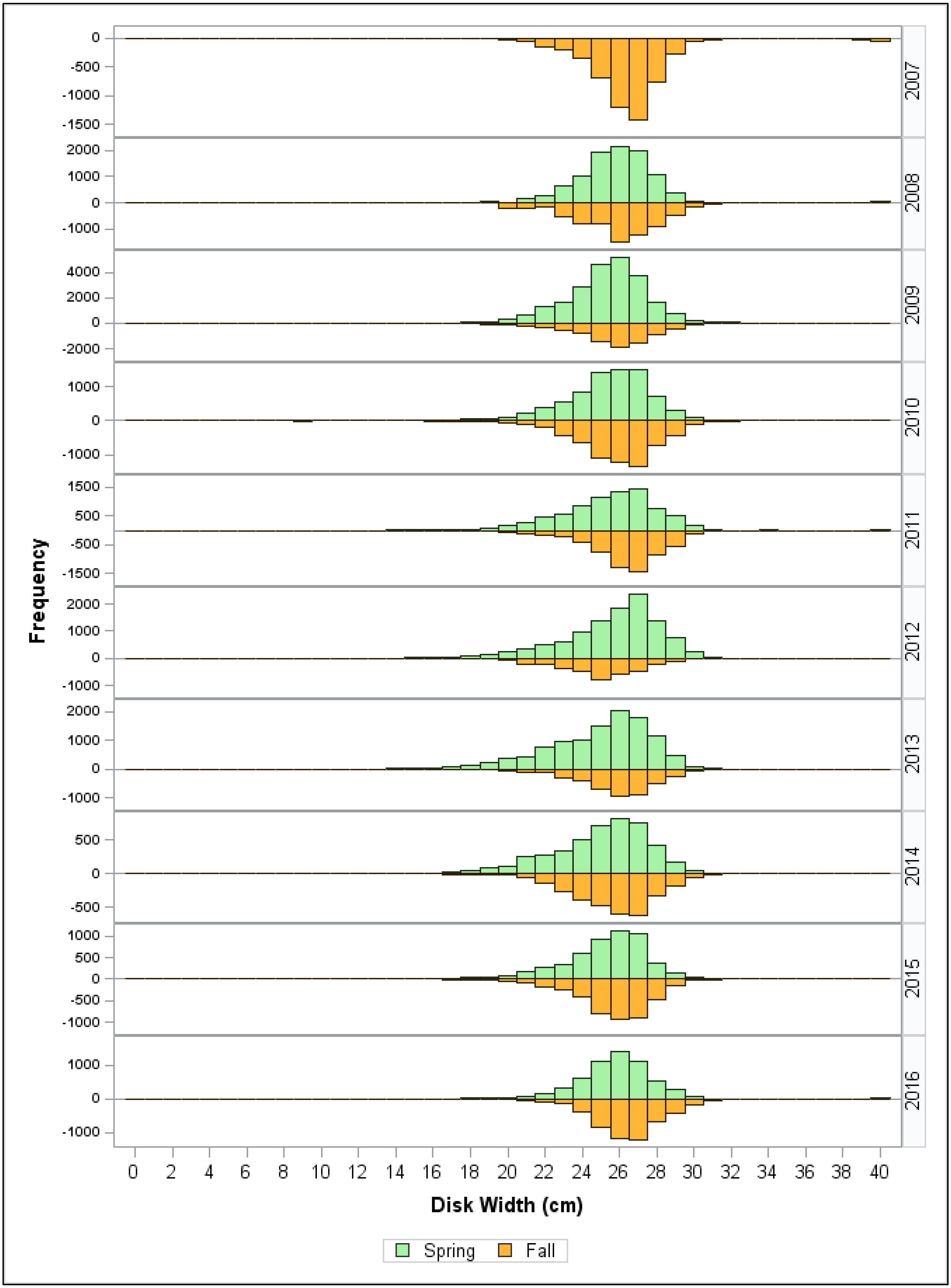


Figure 116. Little Skate width-frequency distributions, by cruise and sex.

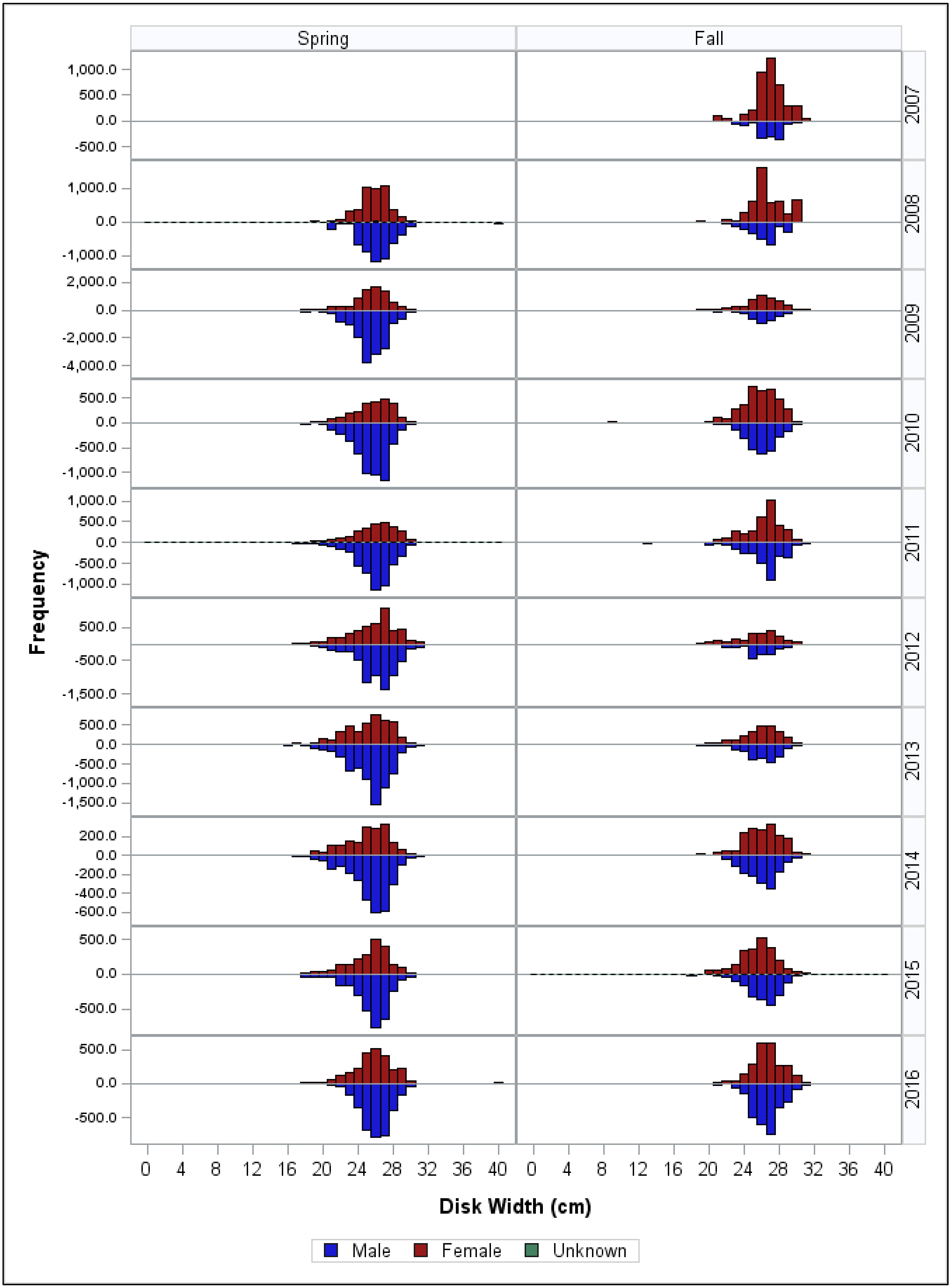


Figure 117. Little Skate sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

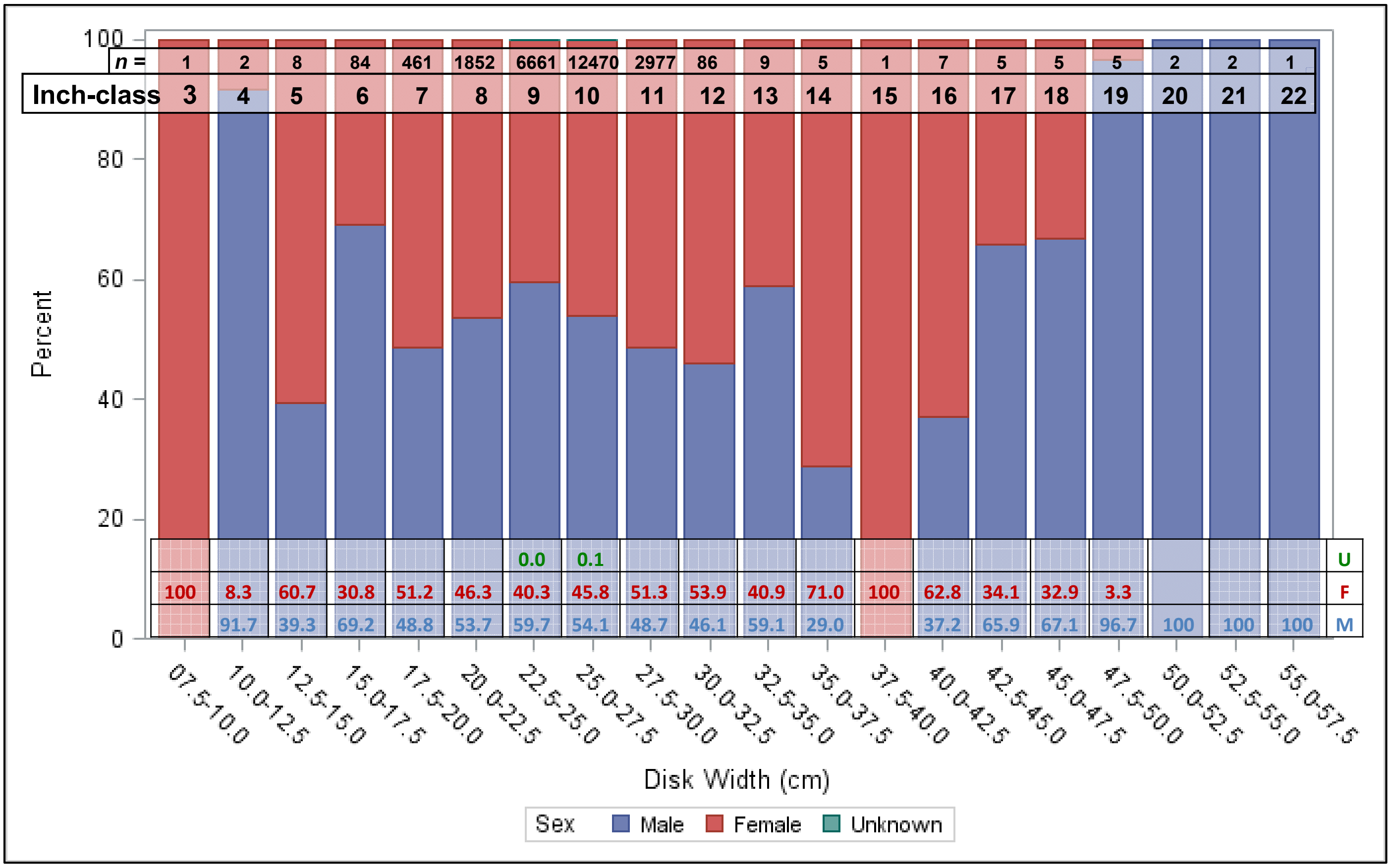


Figure 118. Little Skate maturity at length, by sex for all cruises pooled, 2007-2016.

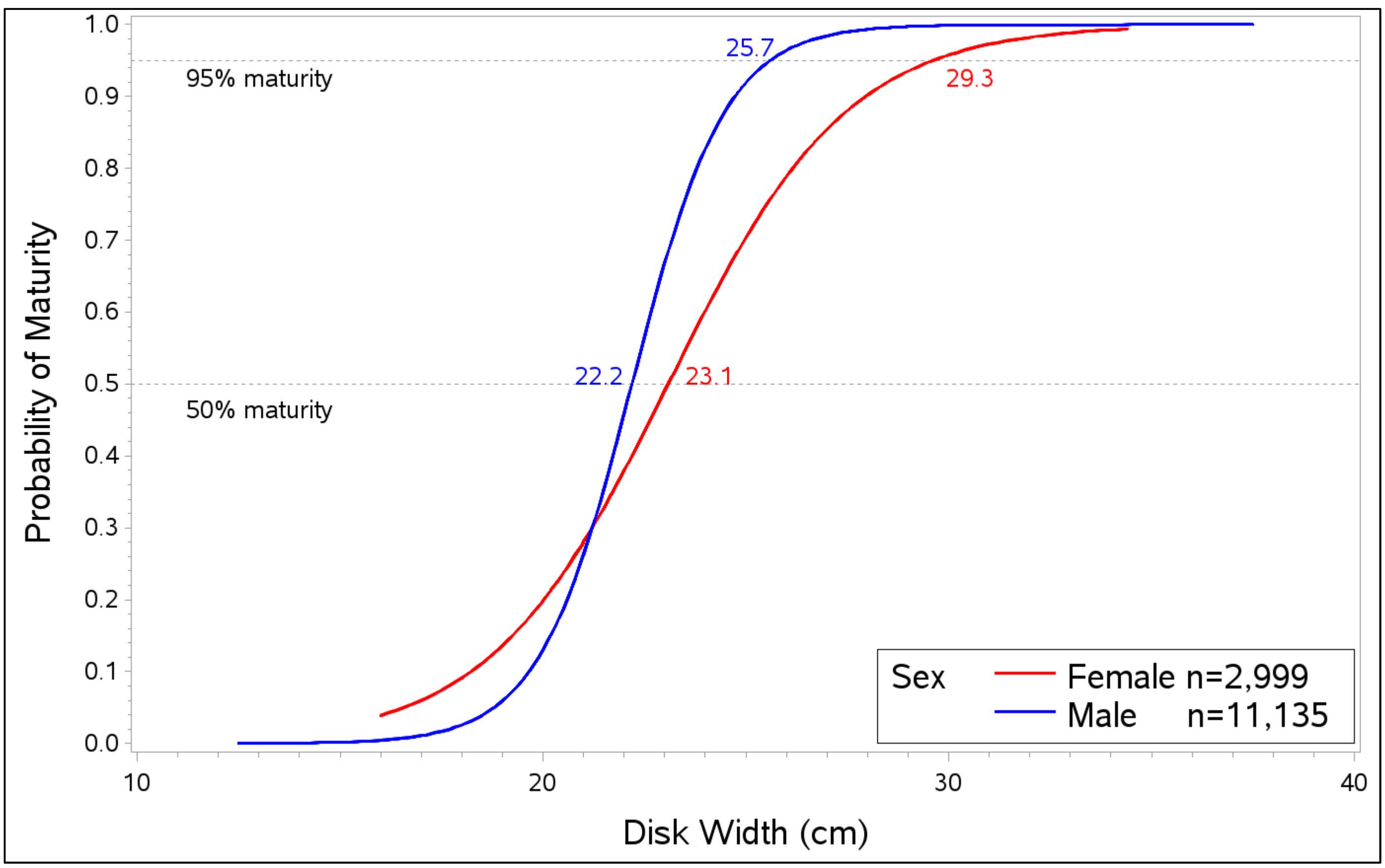
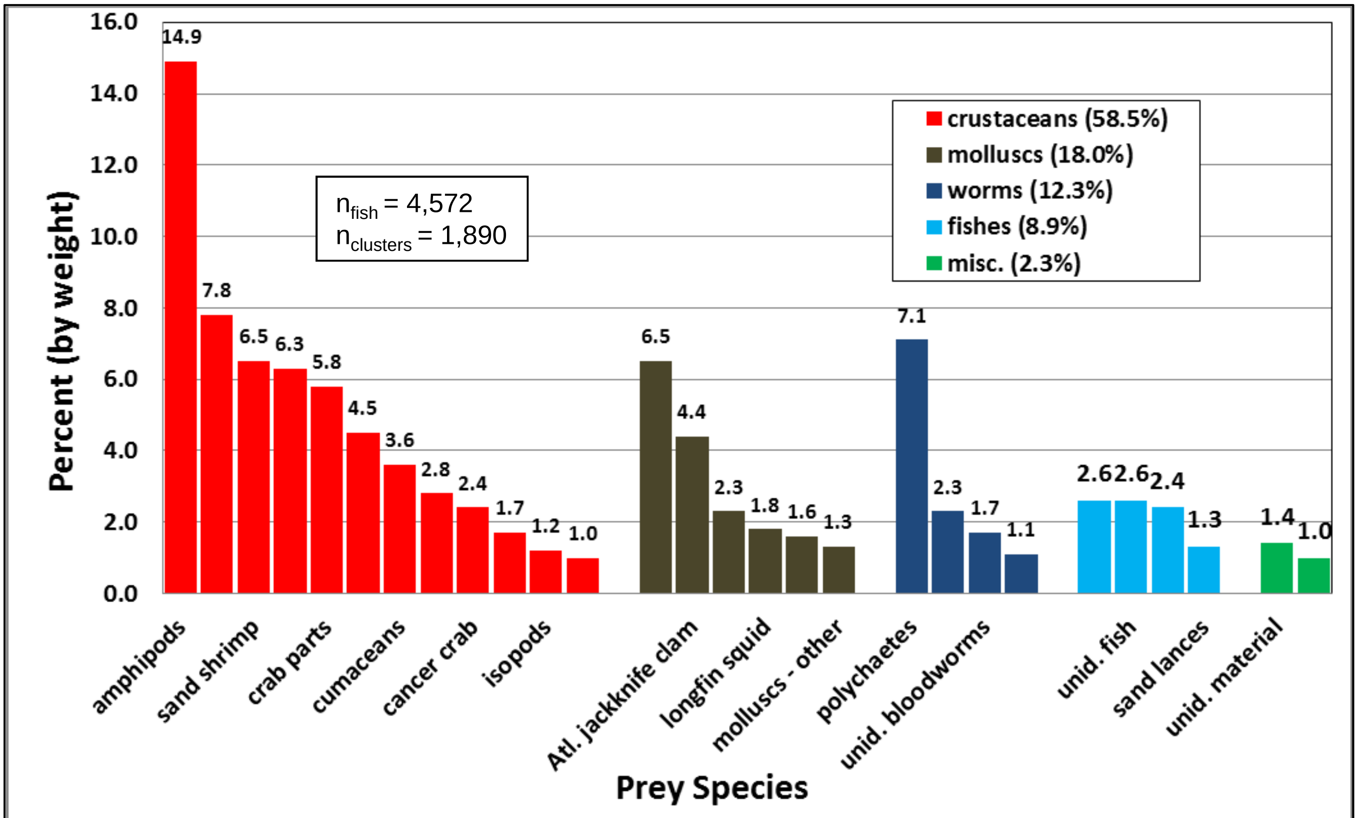
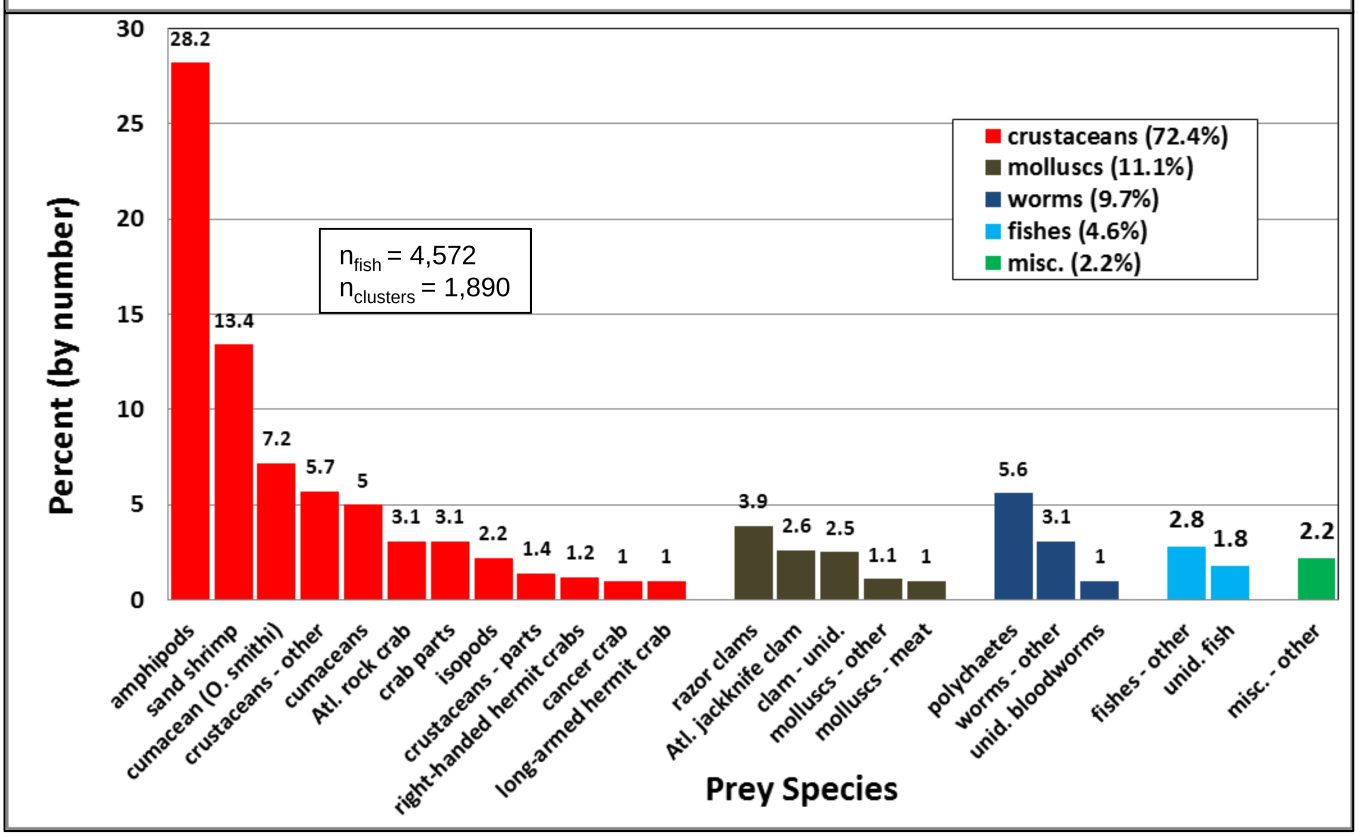


Figure 119. Little Skate diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

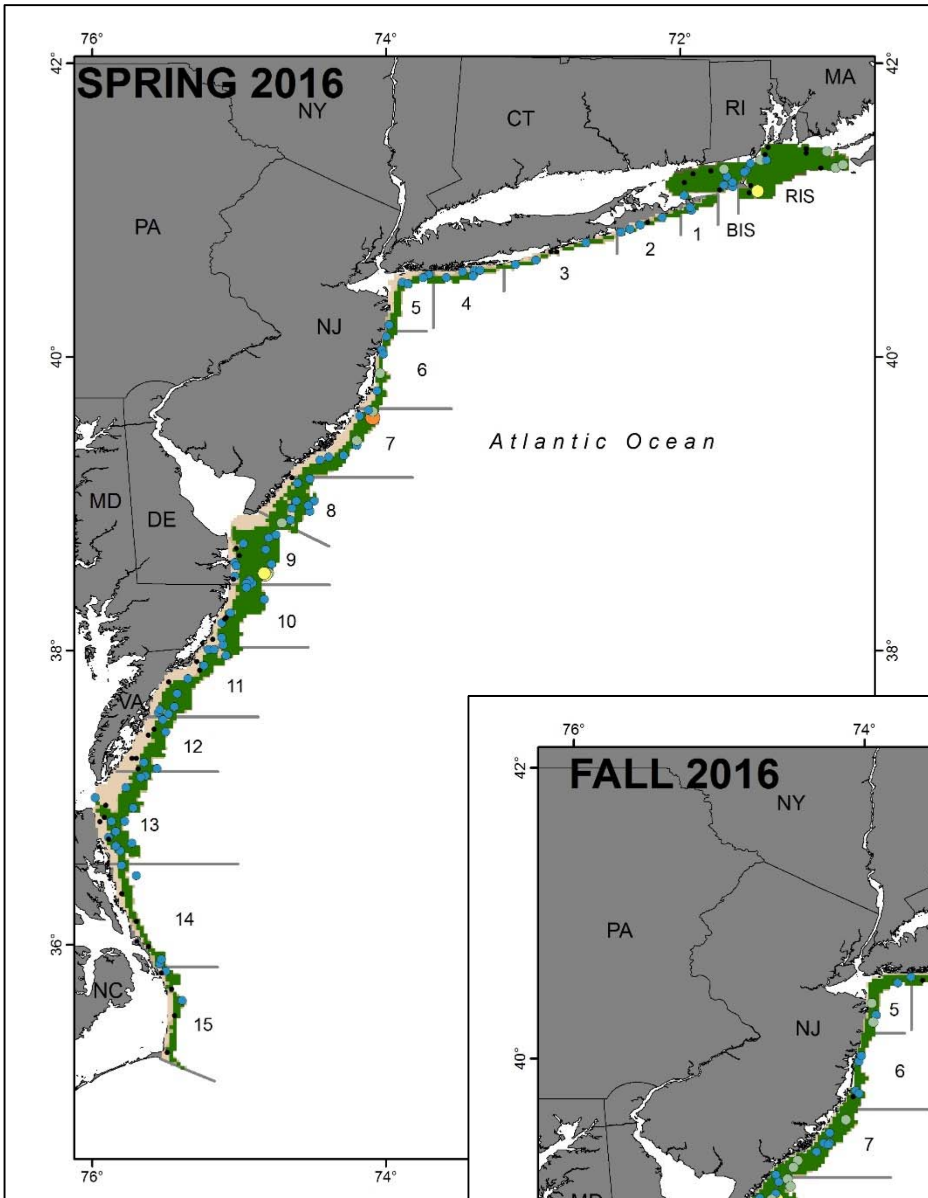


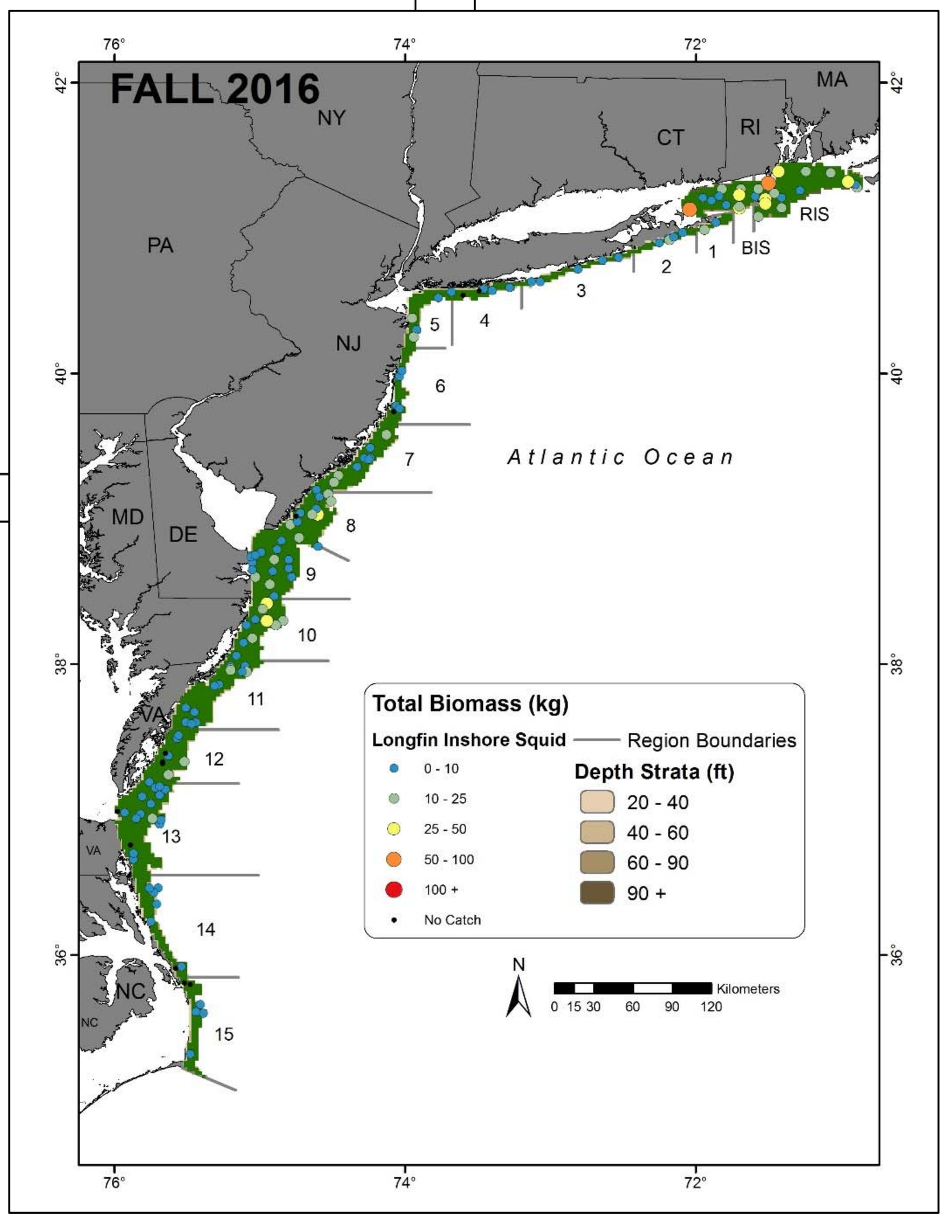


Longfin Inshore Squid

Sampling Priority: E

Figure 120. Longfin Inshore Squid biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	used	used
		90+	used	used
	BIS	60-90	used	used
		90+	used	used
NY	01	40-60	used	used
	02	20-40	not used	used
		40-60	used	used
	03	20-40	not used	used
		40-60	used	used
	04	20-40	not used	used
		40-60	used	used
	05	20-40	not used	used
		40-60	used	used
NJ	06	20-40	not used	used
		40-60	used	used
	07	20-40	not used	used
		40-60	used	used
	08	20-40	not used	used
		40-60	used	used
DE	09	20-40	not used	used
		40-60	used	used
		60-90	used	used
MD	10	20-40	not used	used
		40-60	used	used
VA	11	20-40	not used	used
		40-60	used	used
	12	20-40	not used	used
		40-60	used	used
	13	20-40	not used	used
		40-60	used	used
NC	14	20-40	not used	used
		40-60	used	used
	15	20-40	not used	used
		40-60	used	used

(green) = used for abundance indices
(grey) = not used for abundance indices

Table 42. Longfin Inshore Squid sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	19,549	776.2	90.7	5,127	N/A	N/A	N/A	N/A
	2009	12,451	501.6	90.0	5,710	N/A	N/A	N/A	N/A
	2010	7,502	316.2	66.0	2,396	N/A	N/A	N/A	N/A
	2011	9,579	416.4	87.3	6,492	N/A	N/A	N/A	N/A
	2012	46,920	1,360.5	90.7	17,073	N/A	N/A	N/A	N/A
	2013	2,078	103.0	73.3	2,078	N/A	N/A	N/A	N/A
	2014	9,129	398.5	76.0	4,910	N/A	N/A	N/A	N/A
	2015	6,682	304.4	76.0	5,540	N/A	N/A	N/A	N/A
	2016	15,429	537.8	73.3	6,797	N/A	N/A	N/A	N/A
Fall	2007	119,512	2,278.6	99.3	9,625	N/A	N/A	N/A	N/A
	2008	93,383	1,357.9	87.3	5,998	N/A	N/A	N/A	N/A
	2009	242,495	3,406.4	92.7	10,005	N/A	N/A	N/A	N/A
	2010	46,980	962.8	82.0	5,902	N/A	N/A	N/A	N/A
	2011	56,026	948.7	90.7	6,087	N/A	N/A	N/A	N/A
	2012	64,886	1,118.1	92.0	9,897	N/A	N/A	N/A	N/A
	2013	112,240	1,969.4	92.7	15,539	N/A	N/A	N/A	N/A
	2014	137,212	3,093.1	95.3	20,084	N/A	N/A	N/A	N/A
	2015	49,089	1,901.5	94.7	19,005	N/A	N/A	N/A	N/A
	2016	54,828	1,341.1	92.0	13,261	N/A	N/A	N/A	N/A

Table 43. Longfin Inshore Squid geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	107	43.56	56.78	73.93	2.71	3.35	4.11
	2009	109	26.79	33.64	42.17	1.60	1.95	2.34
	2010	108	5.27	7.04	9.30	0.49	0.67	0.86
	2011	108	19.78	27.24	37.38	1.12	1.45	1.82
	2012	108	85.63	119.40	166.34	3.79	4.77	5.96
	2013	107	4.04	5.13	6.46	0.36	0.47	0.59
	2014	107	8.46	11.64	15.89	0.97	1.25	1.57
	2015	108	9.17	13.04	18.39	0.82	1.09	1.42
	2016	108	15.28	22.46	32.79	1.54	2.04	2.65

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	150	116.51	142.57	174.41	4.16	4.94	5.84
	2008	150	38.14	48.23	60.93	2.40	2.84	3.33
	2009	160	91.63	118.05	152.01	4.95	5.84	6.85
	2010	150	29.32	37.86	48.80	2.88	3.44	4.08
	2011	150	38.08	46.20	56.00	2.67	3.05	3.47
	2012	150	49.11	60.30	73.99	2.90	3.38	3.92
	2013	150	76.50	97.25	123.55	4.76	5.68	6.75
	2014	150	208.40	259.89	324.03	9.44	11.00	12.79
	2015	150	87.89	105.36	126.26	6.48	7.51	8.69
	2016	150	78.22	98.85	124.85	4.85	5.64	6.54

Figure 121. Longfin Inshore Squid geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

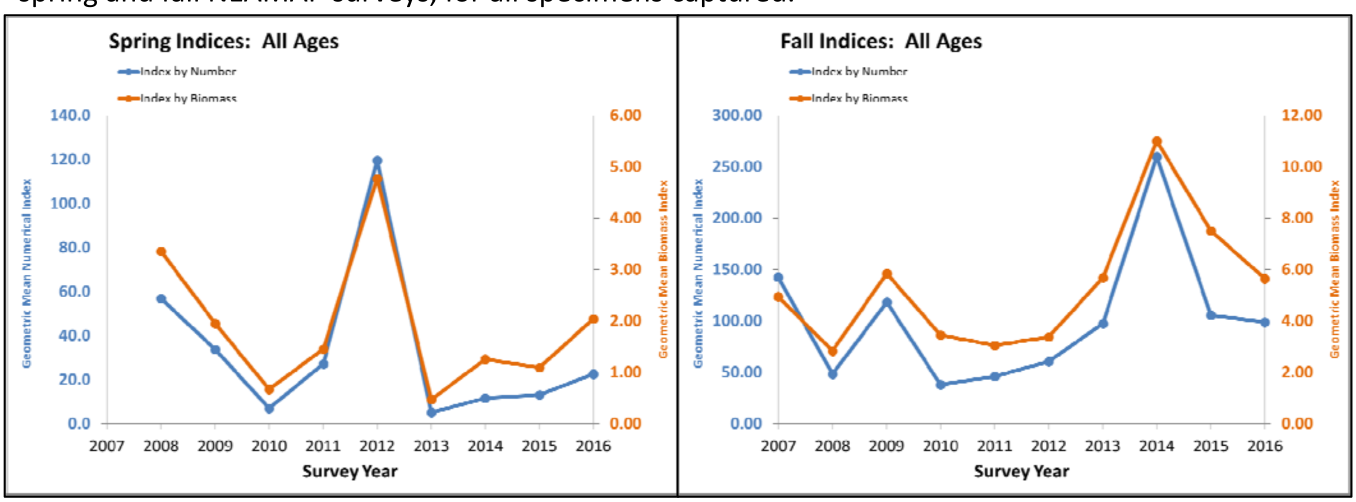


Figure 122. Longfin Inshore Squid length-frequency distributions, by cruise.

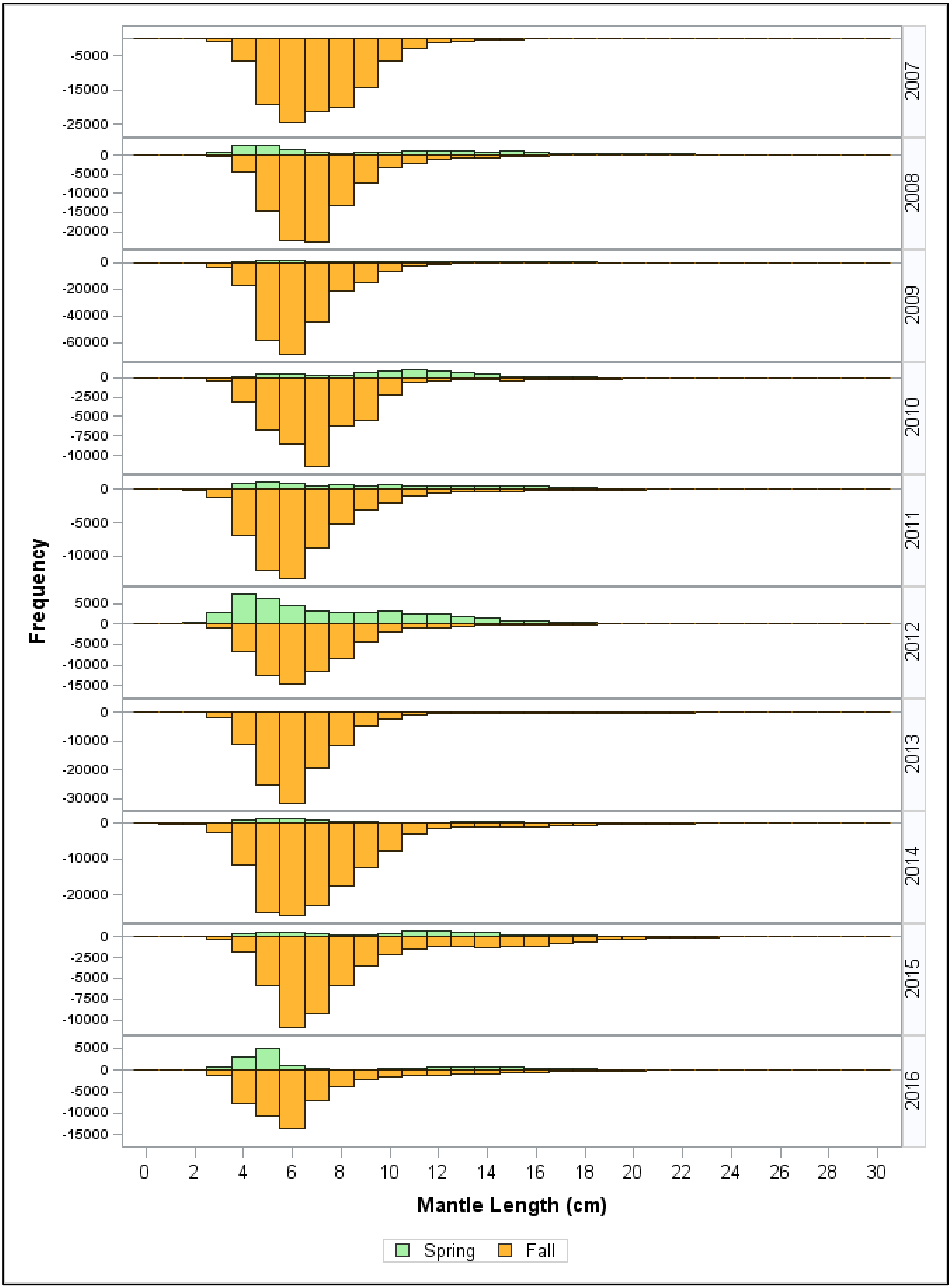


Figure 123. Longfin Inshore Squid length-frequency distributions, by cruise and sex.

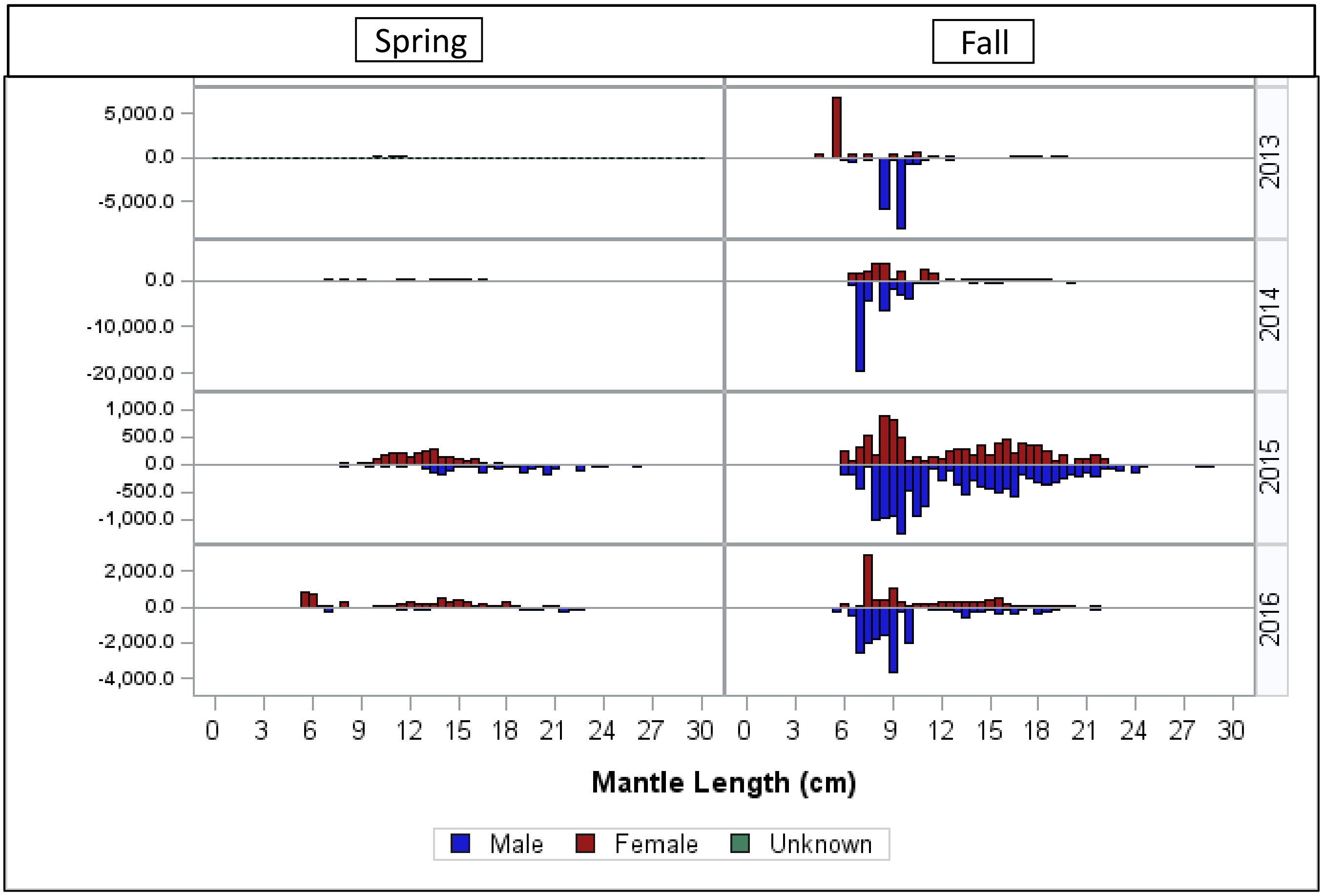


Figure 124. Longfin Inshore Squid sex ratio, by length group, for all cruises pooled, 2013-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

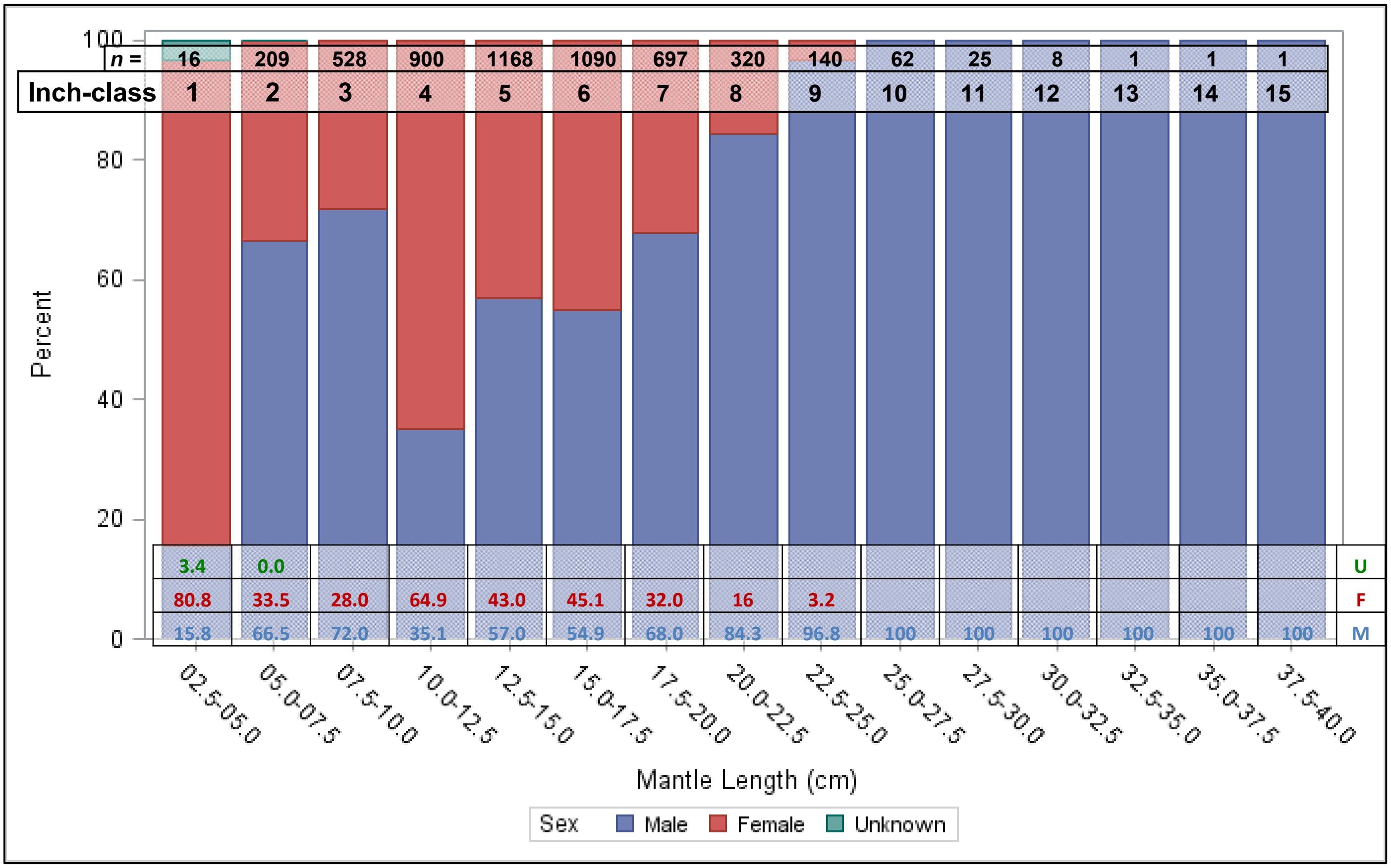
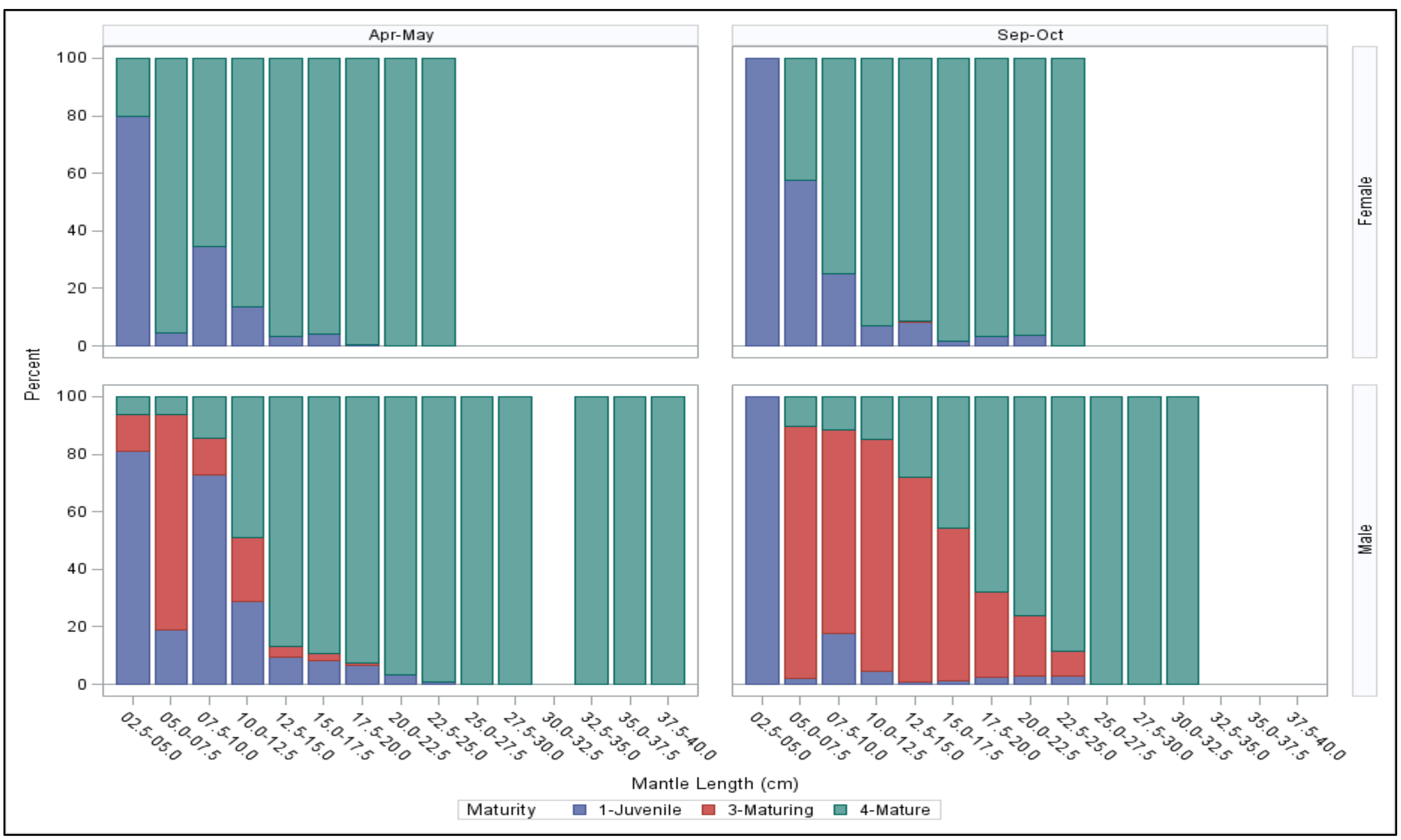


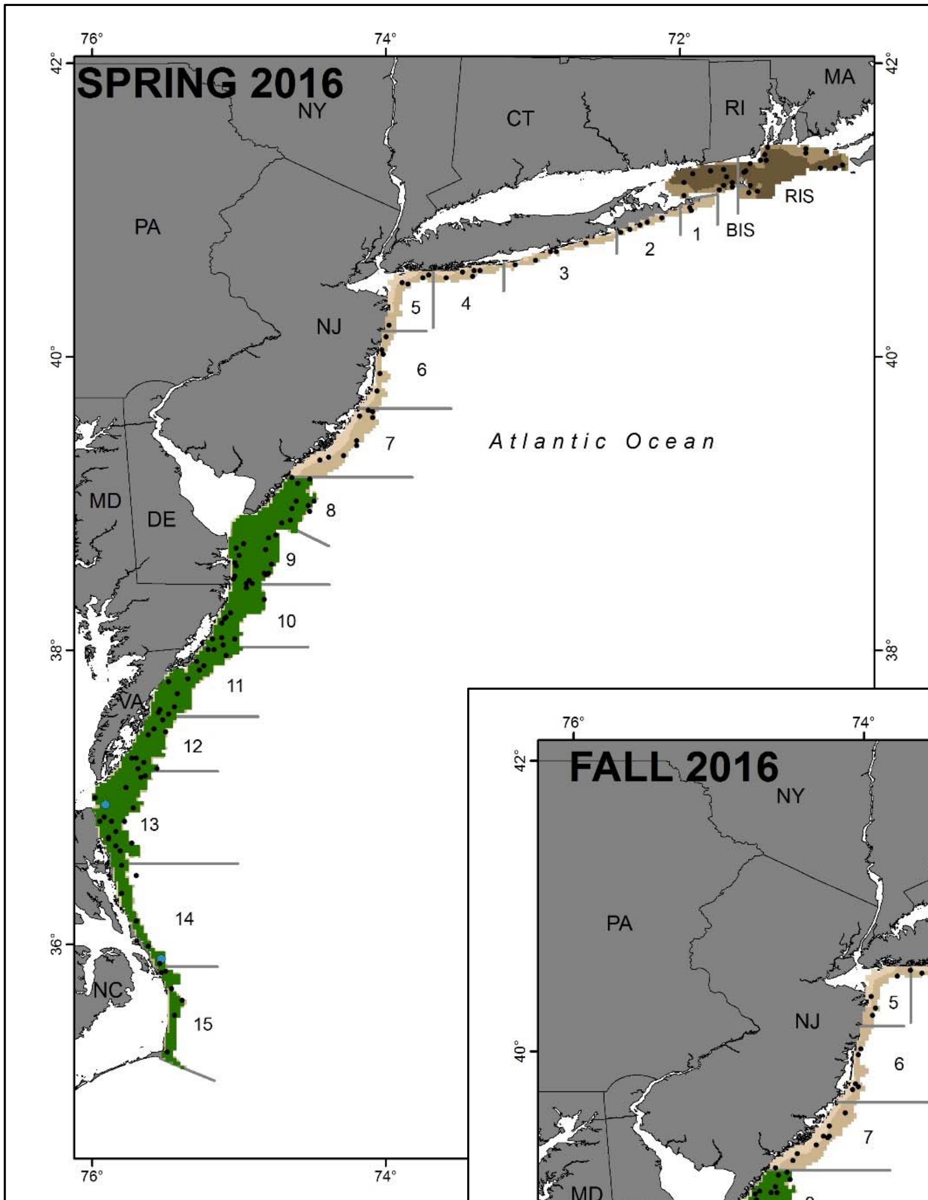
Figure 125. Longfin Inshore Squid maturity classification by season and sex, 2013-2016 pooled.

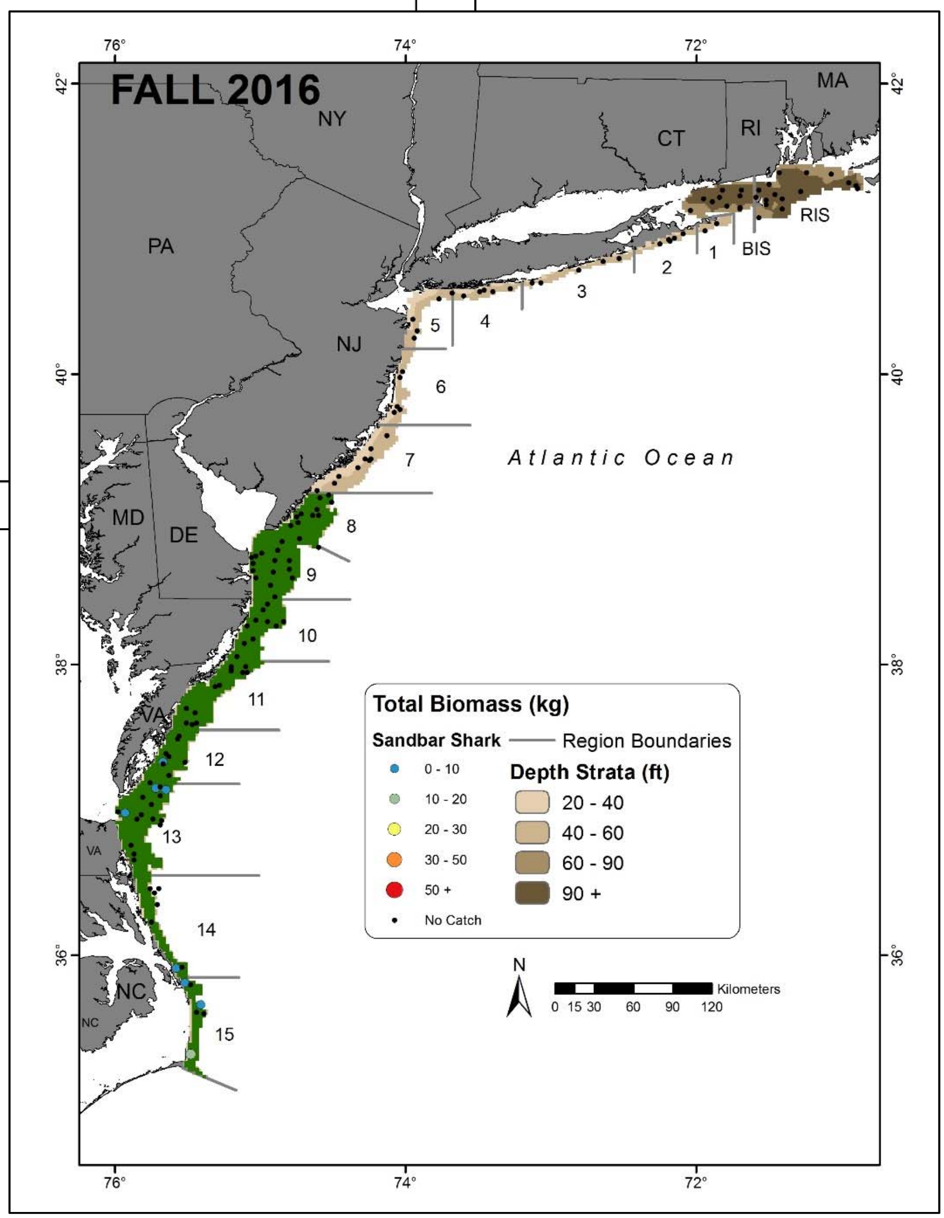


Sandbar Shark

Sampling Priority: E

Figure 126. Sandbar Shark biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

Table 44. Sandbar Shark sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	5	14.4	0.0	5	N/A	N/A	N/A	N/A
	2009	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2010	3	7.3	0.0	3	N/A	N/A	N/A	N/A
	2011	7	20.9	0.0	7	N/A	N/A	N/A	N/A
	2012	5	14.2	0.0	5	N/A	N/A	N/A	N/A
	2013	1	1.0	0.0	1	N/A	N/A	N/A	N/A
	2014	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2015	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2016	2	4.1	0.0	2	N/A	N/A	N/A	N/A
Fall	2007	15	100.1	6.9	15	9	0	9	8
	2008	12	36.0	12.6	12	N/A	N/A	N/A	N/A
	2009	5	10.8	5.7	5	N/A	N/A	N/A	N/A
	2010	81	202.2	12.6	81	N/A	N/A	N/A	N/A
	2011	43	116.6	24.1	43	N/A	N/A	N/A	N/A
	2012	58	167.6	26.4	58	N/A	N/A	N/A	N/A
	2013	28	107.7	14.9	28	N/A	N/A	N/A	N/A
	2014	64	186.1	32.2	64	N/A	N/A	N/A	N/A
	2015	40	106.5	18.4	40	N/A	N/A	N/A	N/A
	2016	13	44.6	9.2	13	N/A	N/A	N/A	N/A

Table 45. Sandbar Shark geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	**Index**	UCI	LCI	**Index**	UCI
All	2007	87	0.01	**0.08**	0.16	0.03	**0.20**	0.40
	2008	87	0.04	**0.09**	0.13	0.07	**0.18**	0.30
	2009	91	0.00	**0.04**	0.08	0.00	**0.07**	0.14
	2010	87	0.15	**0.26**	0.37	0.24	**0.39**	0.56
	2011	87	0.16	**0.26**	0.36	0.29	**0.48**	0.70
	2012	87	0.19	**0.31**	0.45	0.37	**0.61**	0.90
	2013	87	0.09	**0.18**	0.29	0.15	**0.32**	0.53
	2014	87	0.29	**0.44**	0.61	0.57	**0.87**	1.24
	2015	87	0.14	**0.25**	0.36	0.25	**0.42**	0.62
	2016	87	0.02	**0.08**	0.14	0.05	**0.15**	0.25

Figure 127. Sandbar Shark geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

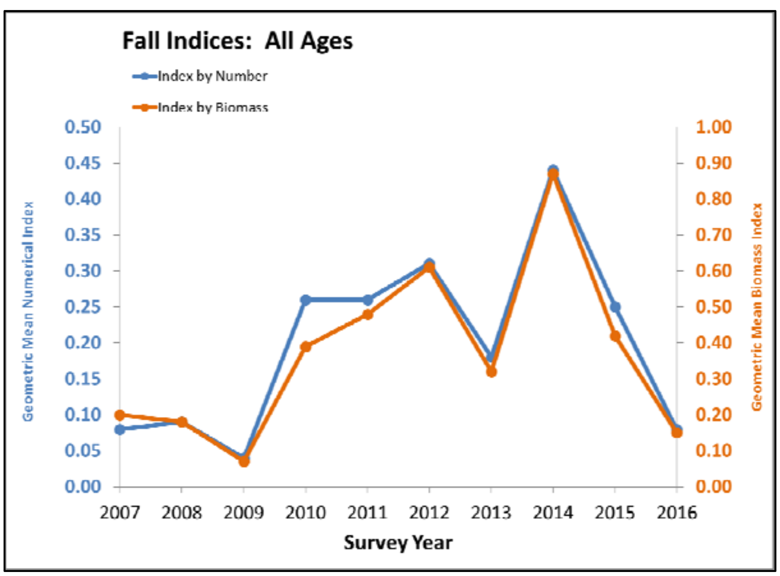


Figure 128. Sandbar Shark length-frequency distributions, by cruise.

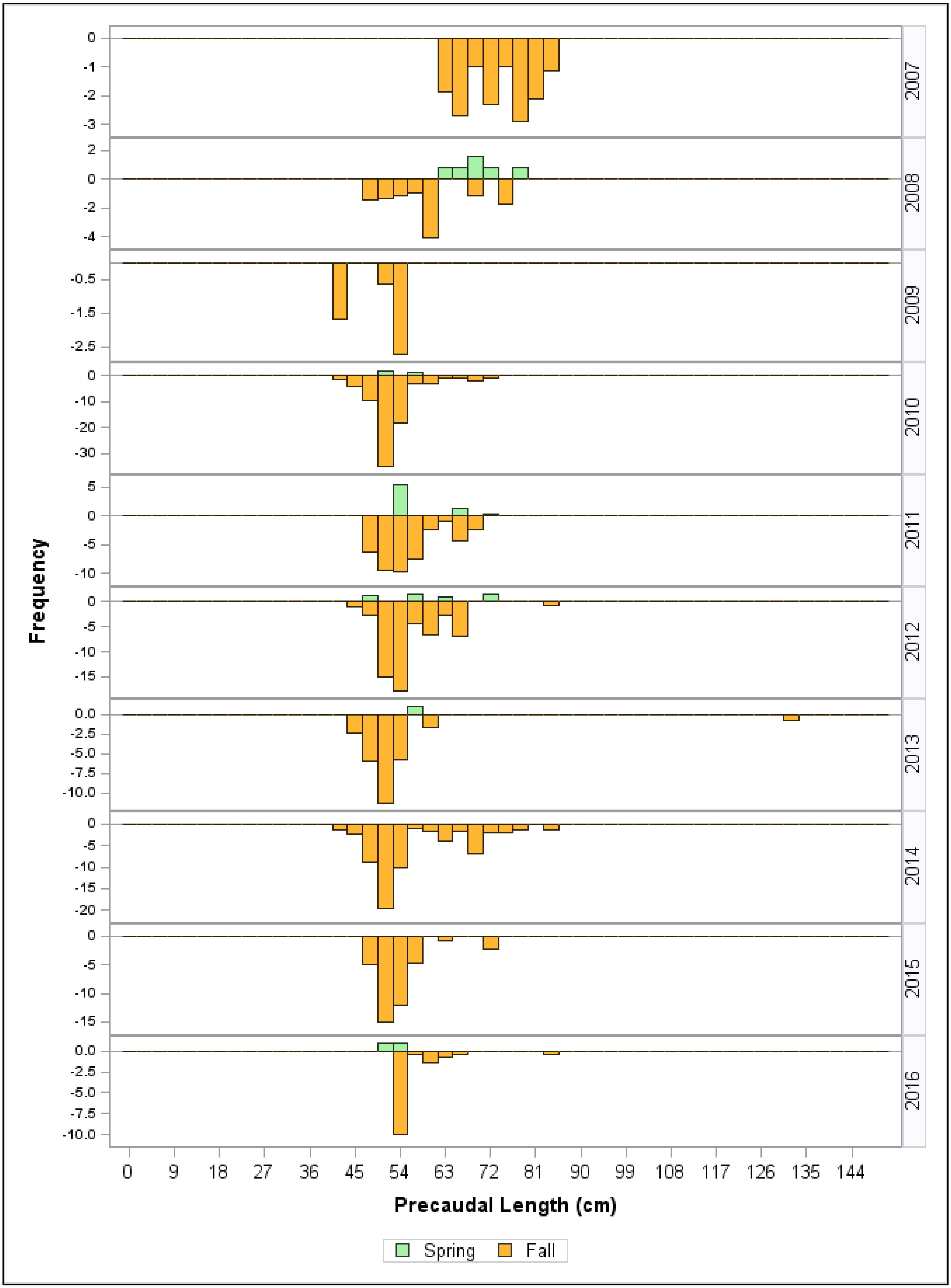


Figure 129. Sandbar Shark length-frequency distributions, by cruise and sex.

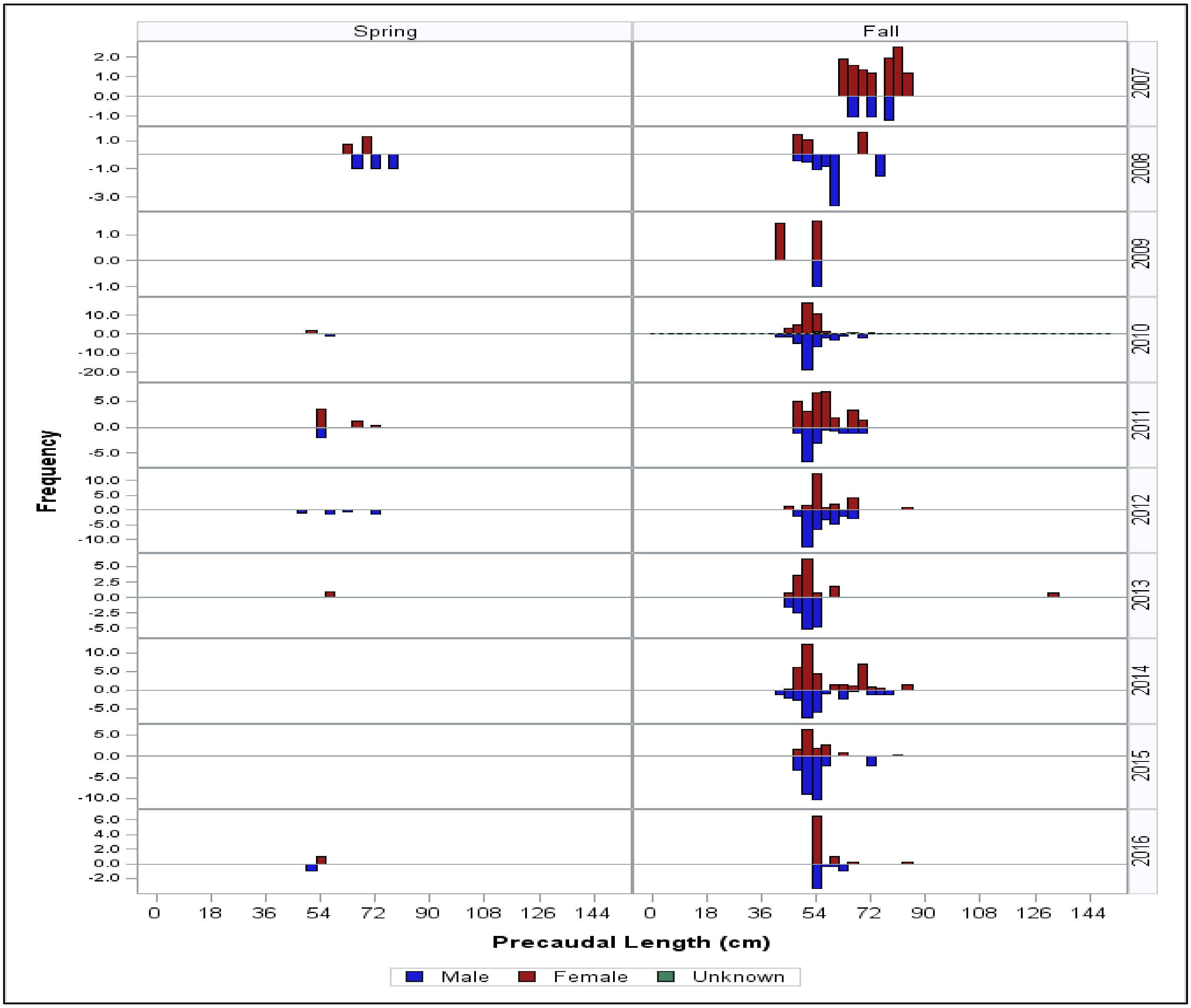
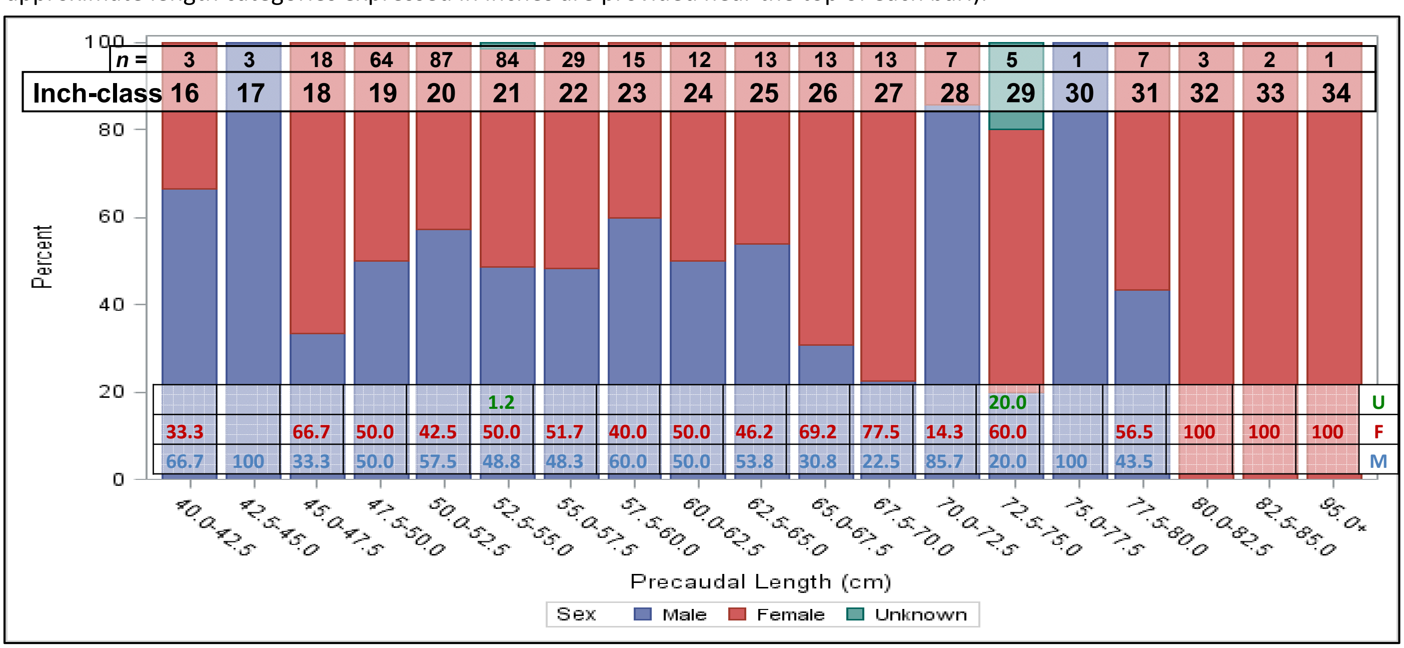


Figure 130. Sandbar Shark sex ratio, by length group, for all cruises pooled, 2007-2016.

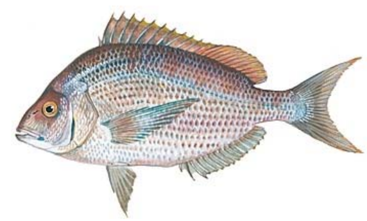
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

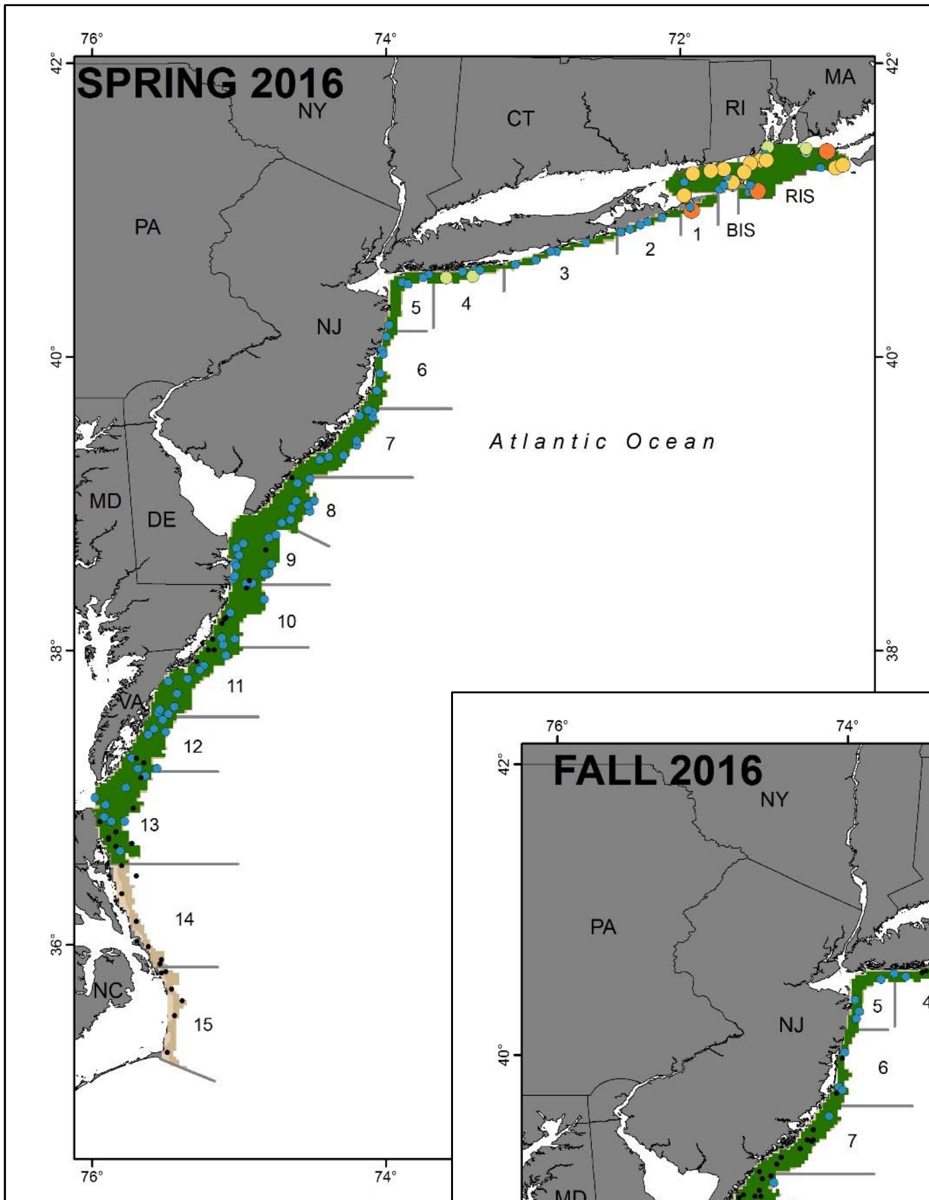


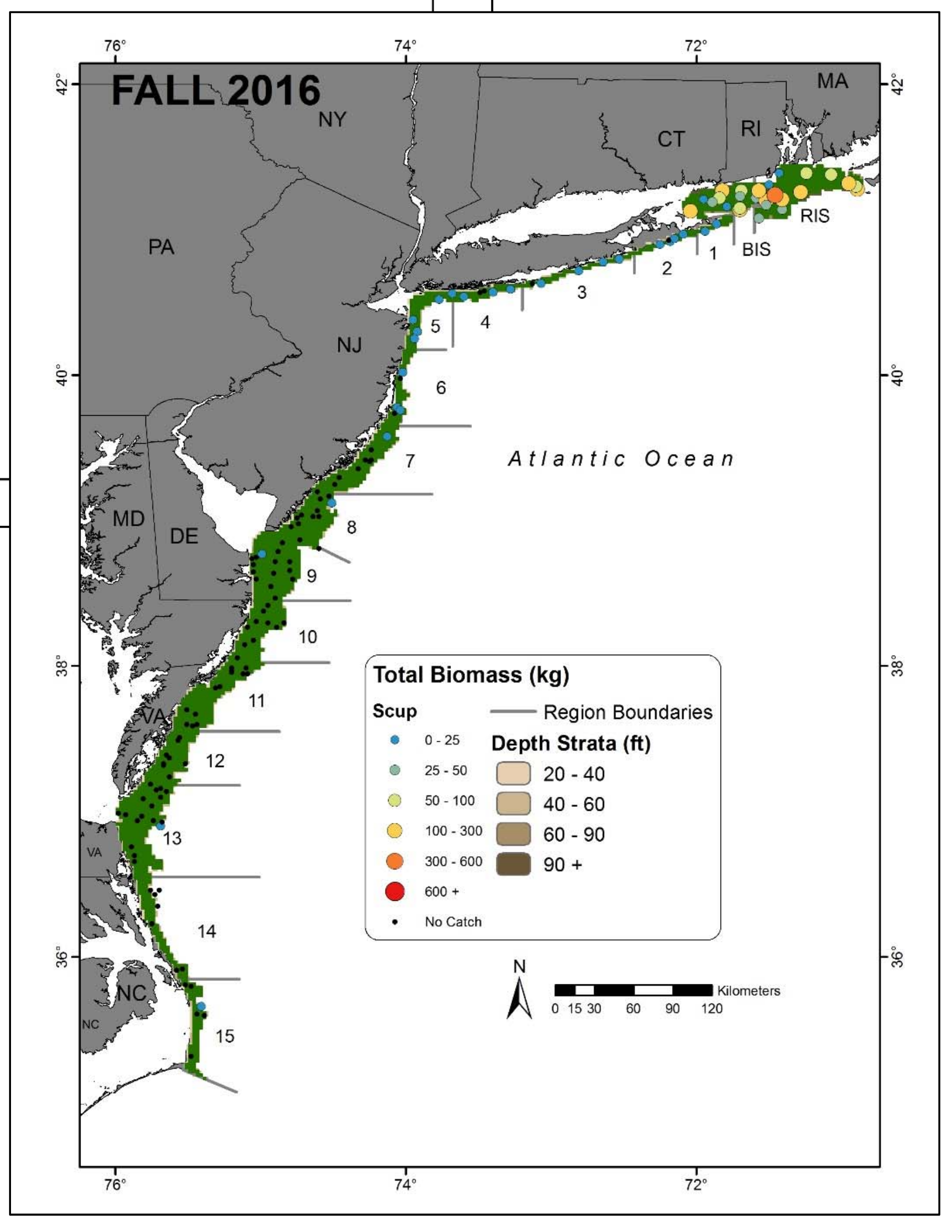
Scup

Sampling Priority: A

Figure 131. Scup biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	(green)	(green)
		90+	(green)	(green)
	BIS	60-90	(green)	(green)
		90+	(green)	(green)
NY	01	40-60	(green)	(green)
	02	20-40	(green)	(green)
		40-60	(green)	(green)
	03	20-40	(green)	(green)
		40-60	(green)	(green)
	04	20-40	(green)	(green)
		40-60	(green)	(green)
	05	20-40	(green)	(green)
		40-60	(green)	(green)
NJ	06	20-40	(green)	(green)
		40-60	(green)	(green)
	07	20-40	(green)	(green)
		40-60	(green)	(green)
	08	20-40	(green)	(green)
		40-60	(green)	(green)
DE	09	20-40	(green)	(green)
		40-60	(green)	(green)
		60-90	(green)	(green)
MD	10	20-40	(green)	(green)
		40-60	(green)	(green)
VA	11	20-40	(green)	(green)
		40-60	(green)	(green)
	12	20-40	(green)	(green)
		40-60	(green)	(green)
	13	20-40	(green)	(green)
		40-60	(green)	(green)
NC	14	20-40	(grey)	(green)
		40-60	(grey)	(green)
	15	20-40	(grey)	(green)
		40-60	(grey)	(green)

(green) = used for abundance indices
(grey) = not used for abundance indices

Table 46. Scup sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	51,629	1,256.1	93.4	7,167	869	869	754	744
	2009	16,884	2,827.3	72.3	7,043	743	740	714	702
	2010	4,209	928.5	54.7	2,287	465	465	404	321
	2011	3,007	755.9	66.4	1,812	451	451	369	353
	2012	70,112	1,477.1	79.6	11,289	658	658	556	524
	2013	9,755	1,555.7	73.0	4,083	553	551	343	337
	2014	6,610	660.7	57.7	2,881	459	459	256	251
	2015	39,921	987.3	86.1	7,428	680	680	264	258
	2016	212,353	4,071.0	84.7	15,772	826	826	272	267
Fall	2007	276,237	3,928.8	90.0	13,721	811	811	803	795
	2008	77,858	2,503.2	72.0	6,946	671	671	669	666
	2009	158,567	2,577.8	69.3	12,792	897	897	892	729
	2010	131,471	3,959.2	73.3	14,006	727	727	717	699
	2011	64,928	1,906.3	65.3	7,944	624	624	598	567
	2012	88,163	1,814.7	61.3	10,950	696	696	646	634
	2013	43,604	857.1	47.3	5,622	372	372	309	302
	2014	204,343	2,433.1	49.3	11,937	520	520	291	290
	2015	143,333	2,538.1	63.3	21,358	729	729	360	336
	2016	72,610	2,473.7	34.7	10,568	530	530	237	236

Table 47. Scup geometric mean indices of abundance, for all specimens captured by number and biomass and by age-class for spring and fall NEAMAP surveys.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	137	24.51	32.83	43.86	1.93	2.46	3.09
	2009	145	5.87	8.17	11.23	0.99	1.42	1.96
	2010	137	1.74	2.26	2.88	0.57	0.79	1.04
	2011	137	1.79	2.38	3.10	0.38	0.59	0.83
	2012	137	14.38	20.62	29.40	1.26	1.70	2.22
	2013	137	4.16	5.31	6.72	1.02	1.36	1.76
	2014	137	2.63	3.49	4.55	0.61	0.84	1.11
	2015	137	8.78	12.69	18.17	1.13	1.64	2.29
	2016	137	28.10	37.39	49.63	3.75	4.82	6.14
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	137	14.12	18.80	24.92	1.02	1.39	1.82
	2009	145	2.48	3.27	4.24	0.25	0.34	0.44
	2010	137	0.42	0.62	0.84	0.03	0.05	0.08
	2011	137	0.73	0.91	1.11	0.05	0.08	0.11
	2012	137	12.47	17.89	25.49	0.94	1.33	1.80
	2013	137	1.66	2.23	2.94	0.13	0.30	0.49
	2014	137	1.74	2.39	3.18	0.19	0.29	0.41
	2015	137	6.20	9.14	13.29	0.57	0.87	1.22
	2016	137	24.82	32.97	43.70	1.98	2.57	3.27
2+	2007							
	2008	137	6.40	8.15	10.31	1.06	1.37	1.74
	2009	145	3.94	5.47	7.46	0.84	1.26	1.76
	2010	137	1.16	1.51	1.92	0.56	0.80	1.07
	2011	137	1.01	1.40	1.88	0.35	0.56	0.80
	2012	137	2.54	3.44	4.56	0.42	0.59	0.78
	2013	137	1.85	2.35	2.92	0.78	1.06	1.38
	2014	137	1.15	1.53	1.97	0.40	0.58	0.78
	2015	137	1.77	2.44	3.26	0.38	0.55	0.74
	2016	137	5.90	7.53	9.53	1.15	1.48	1.87

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	150	79.12	116.66	171.79	5.39	7.23	9.60
	2008	150	17.10	24.49	34.89	2.51	3.29	4.24
	2009	160	28.77	40.84	57.81	3.29	4.18	5.26
	2010	150	21.63	31.03	44.34	2.50	3.42	4.58
	2011	150	9.45	13.65	19.55	1.74	2.34	3.06
	2012	150	12.07	16.59	22.67	1.84	2.37	3.01
	2013	150	3.46	4.52	5.83	0.68	0.90	1.14
	2014	150	10.49	13.75	17.95	1.79	2.23	2.73
	2015	150	13.31	18.09	24.47	2.02	2.52	3.12
	2016	150	4.16	4.90	5.74	1.25	1.44	1.65
0	2007	150	40.33	59.25	86.83	4.21	5.92	8.20
	2008	150	8.45	11.85	16.46	1.87	2.52	3.32
	2009	160	17.33	24.05	33.22	2.67	3.48	4.47
	2010	150	14.51	21.16	30.66	1.78	2.57	3.57
	2011	150	4.78	6.90	9.79	0.93	1.30	1.75
	2012	150	7.37	9.99	13.44	1.01	1.38	1.82
	2013	150	2.88	3.74	4.78	0.59	0.83	1.11
	2014	150	9.54	12.39	16.01	1.76	2.22	2.75
	2015	150	11.29	15.39	20.85	1.60	2.04	2.55
	2016	150	2.89	3.49	4.17	0.63	0.78	0.94
1	2007	150	18.99	26.62	37.15	3.62	4.96	6.69
	2008	150	8.53	11.94	16.58	1.91	2.54	3.30
	2009	160	15.85	21.80	29.85	2.79	3.65	4.70
	2010	150	6.08	8.39	11.47	0.95	1.42	2.02
	2011	150	5.50	7.79	10.89	1.28	1.74	2.30
	2012	150	3.50	4.82	6.54	0.83	1.22	1.70
	2013	150	0.98	1.32	1.72	0.22	0.34	0.48
	2014	150	1.98	2.57	3.28	0.46	0.61	0.77
	2015	150	2.08	2.68	3.39	0.57	0.76	0.98
	2016	150	2.30	2.78	3.33	0.83	1.03	1.25
2+	2007	150	2.72	3.58	4.64	0.75	1.03	1.36
	2008	150	1.68	2.30	3.05	0.51	0.72	0.96
	2009	160	3.16	4.18	5.45	0.64	0.91	1.21
	2010	150	2.20	3.09	4.24	0.52	0.85	1.24
	2011	150	1.43	1.94	2.55	0.49	0.69	0.92
	2012	150	0.49	0.71	0.97	0.16	0.31	0.48
	2013	150	0.25	0.40	0.58	0.09	0.18	0.29
	2014	150	0.33	0.53	0.76	0.12	0.24	0.38
	2015	150	1.04	1.35	1.71	0.34	0.49	0.65
	2016	150	0.82	1.06	1.33	0.38	0.55	0.73

Figure 132. Scup geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.

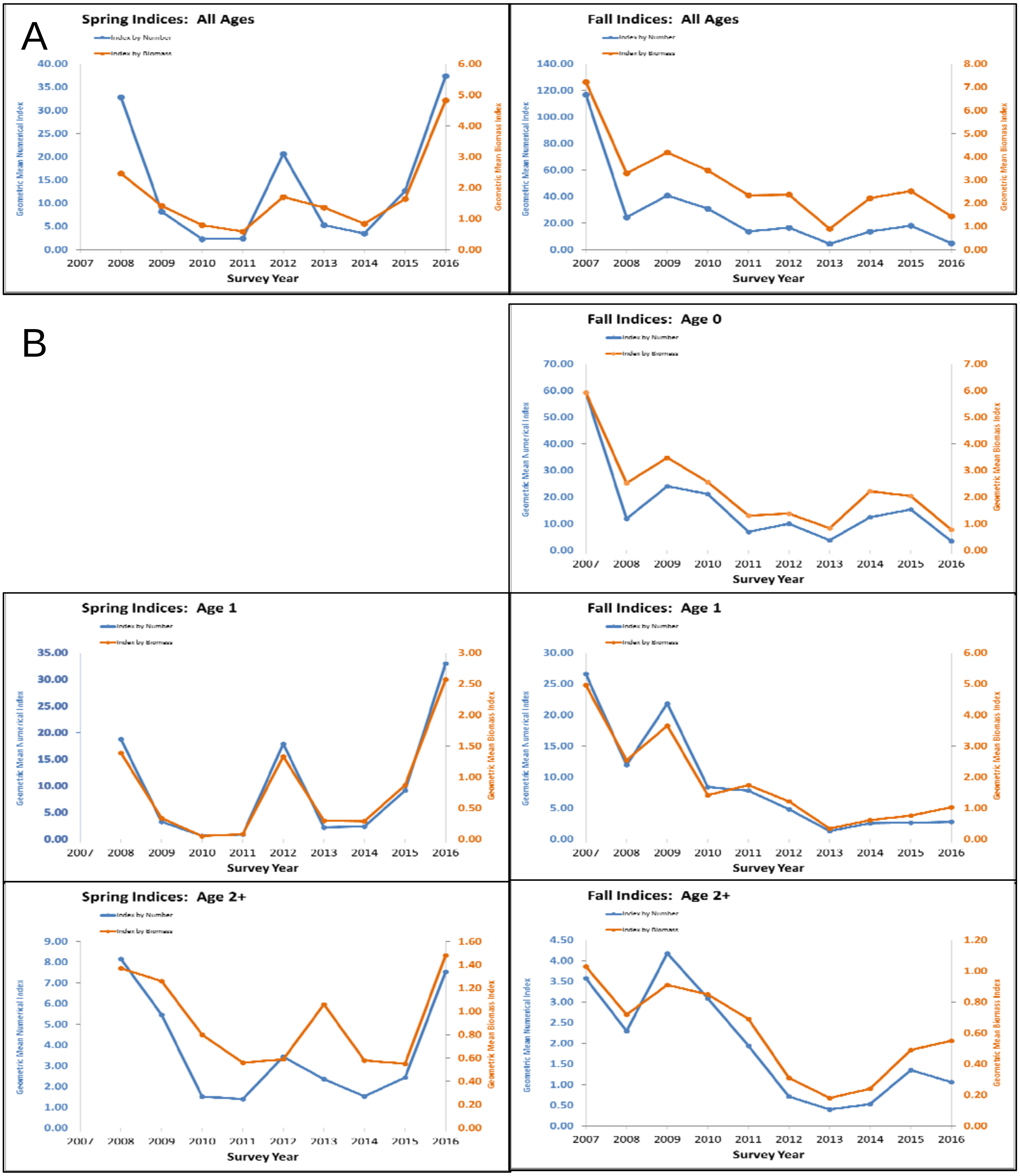


Figure 133. Scup length-frequency distributions, by cruise.

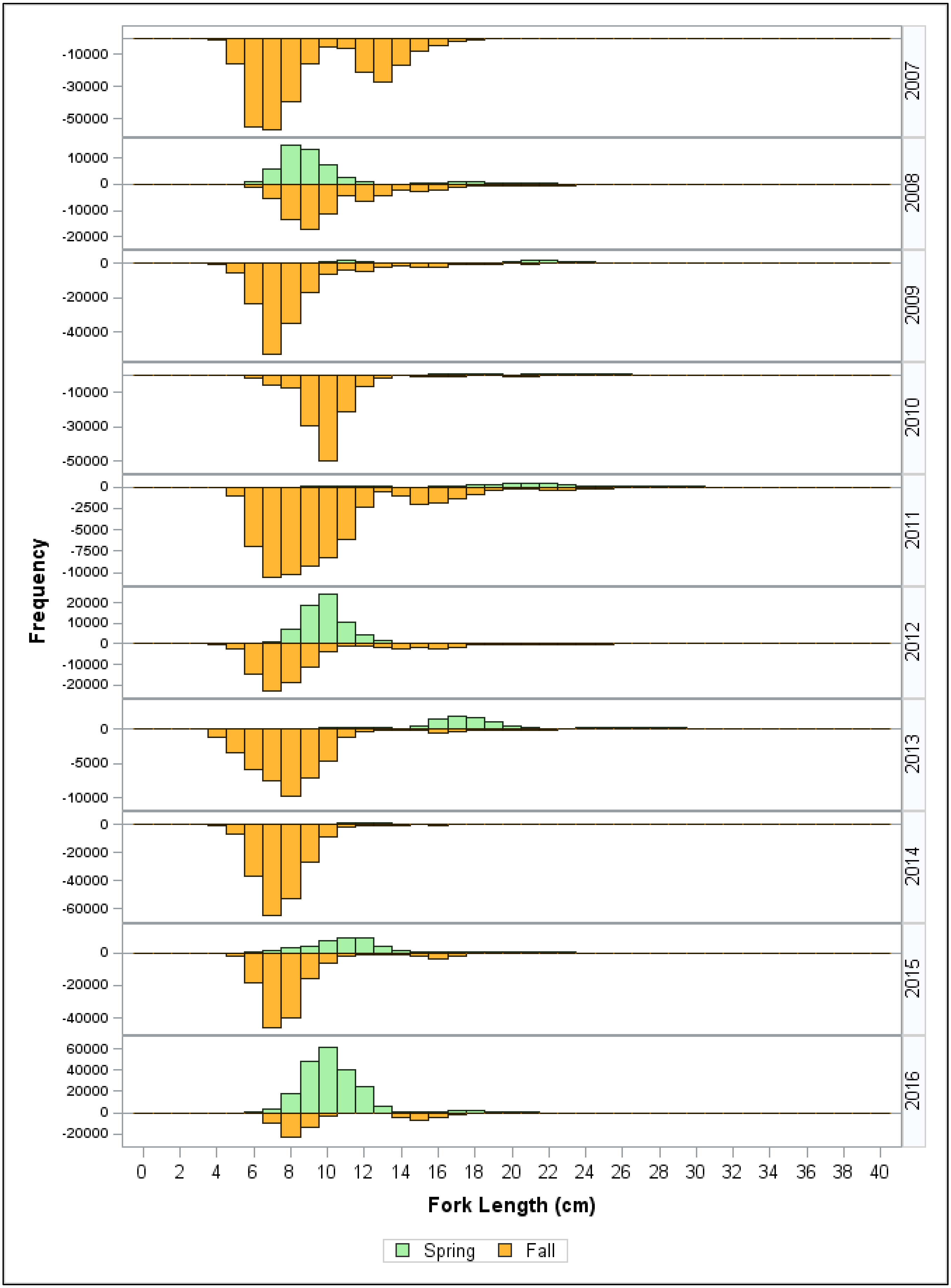


Figure 134. Scup age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

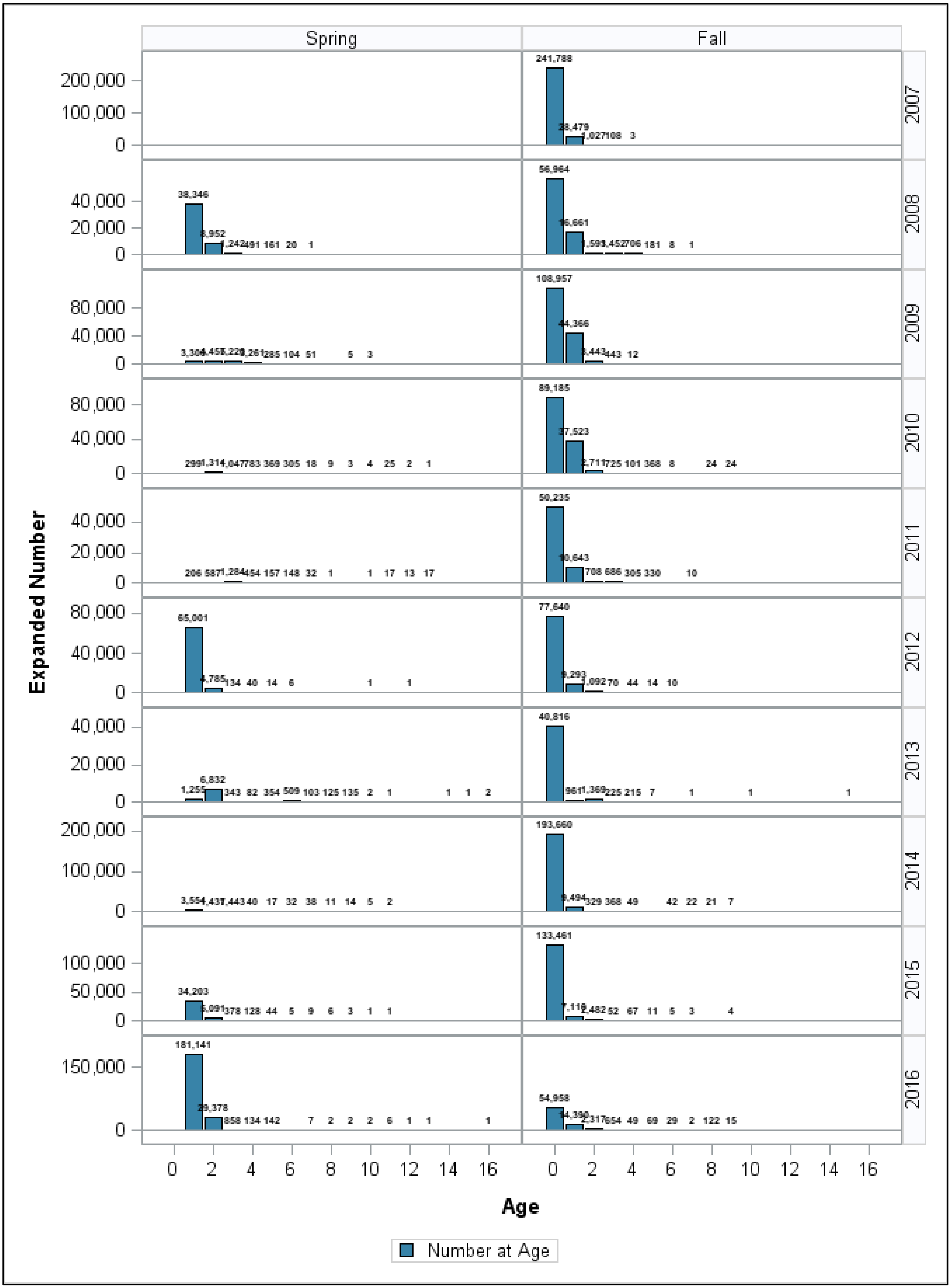


Figure 135. Scup catch-at-age standardized to 3,000 trawl minutes, by cruise.

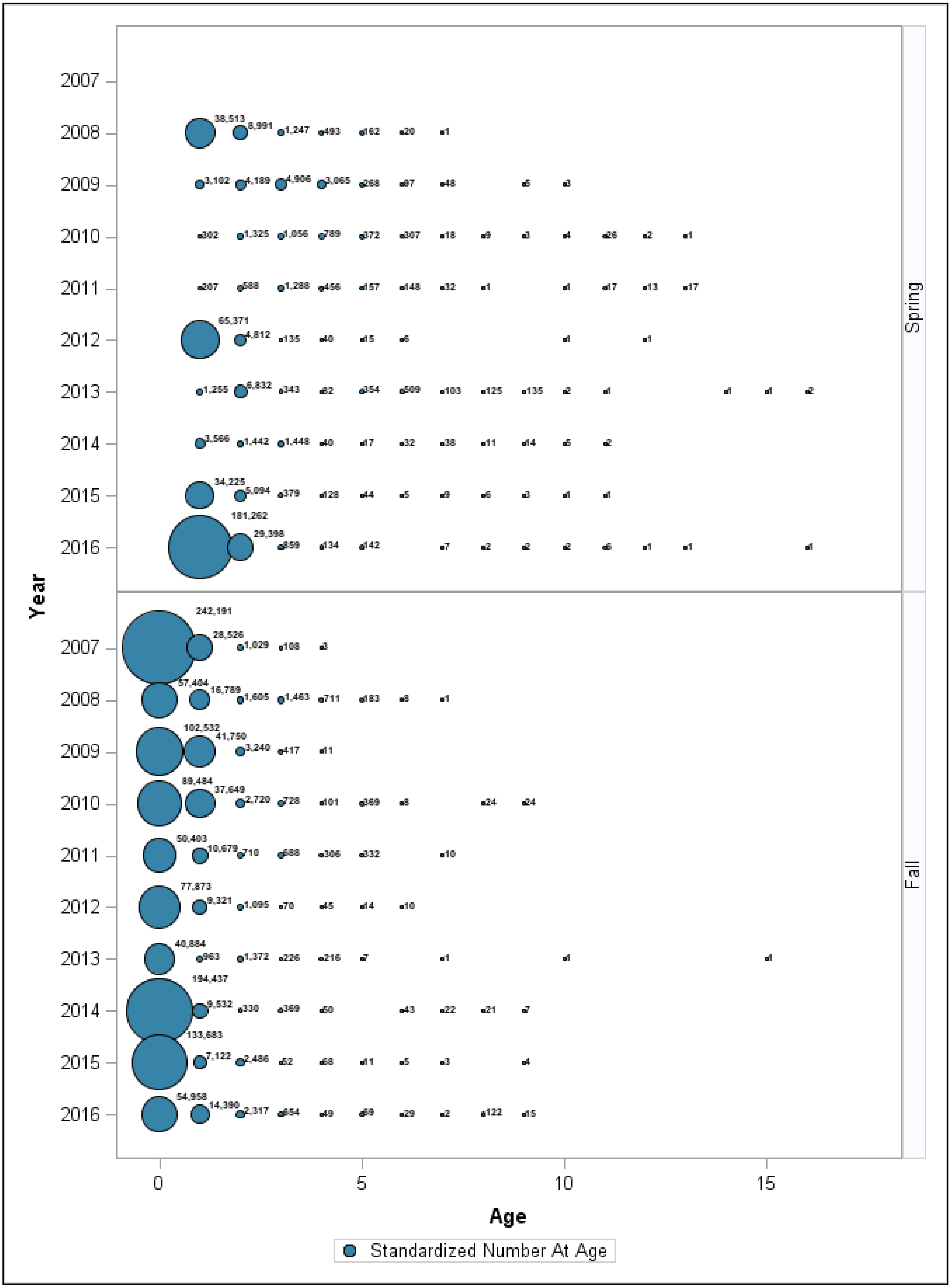


Figure 136. Scup sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

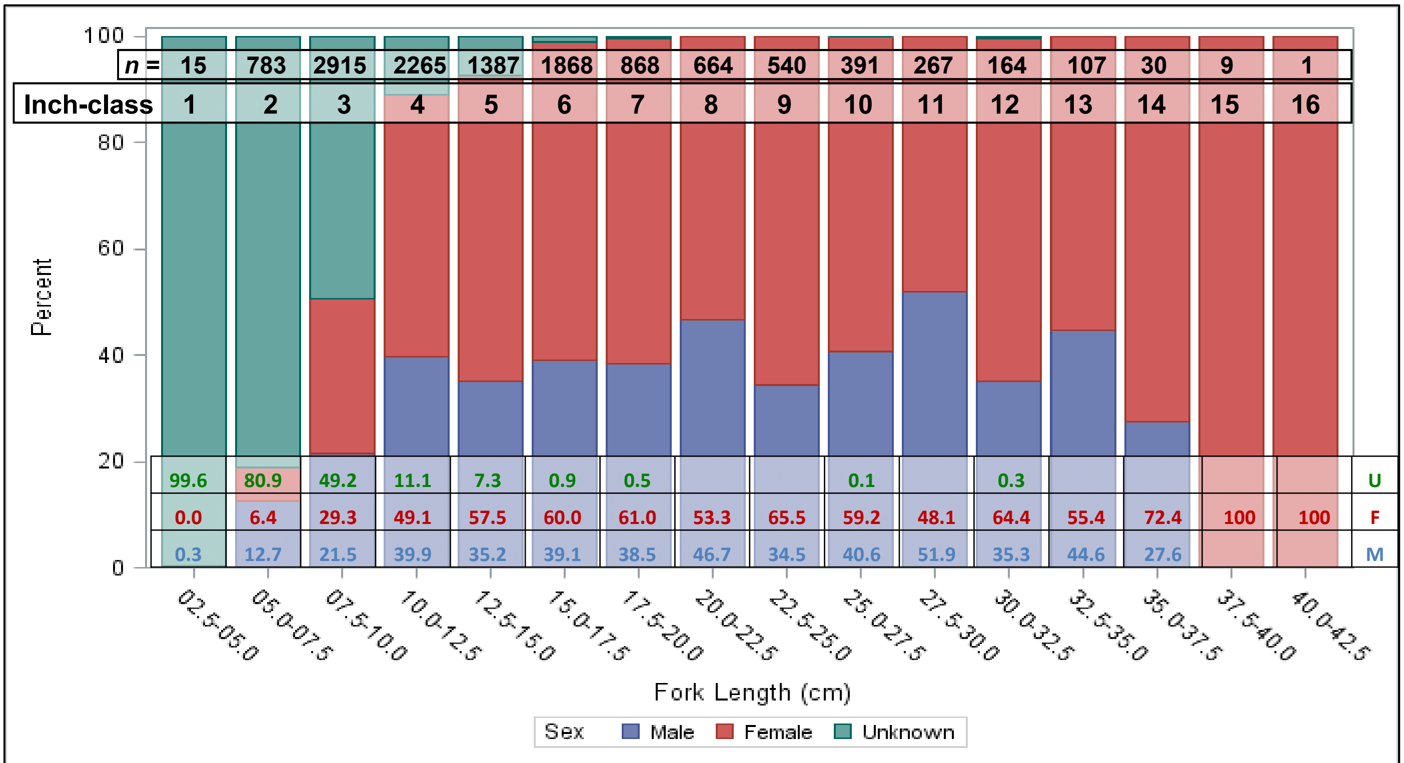


Figure 137. Scup maturity at length, by sex for all cruises pooled, 2007-2016.

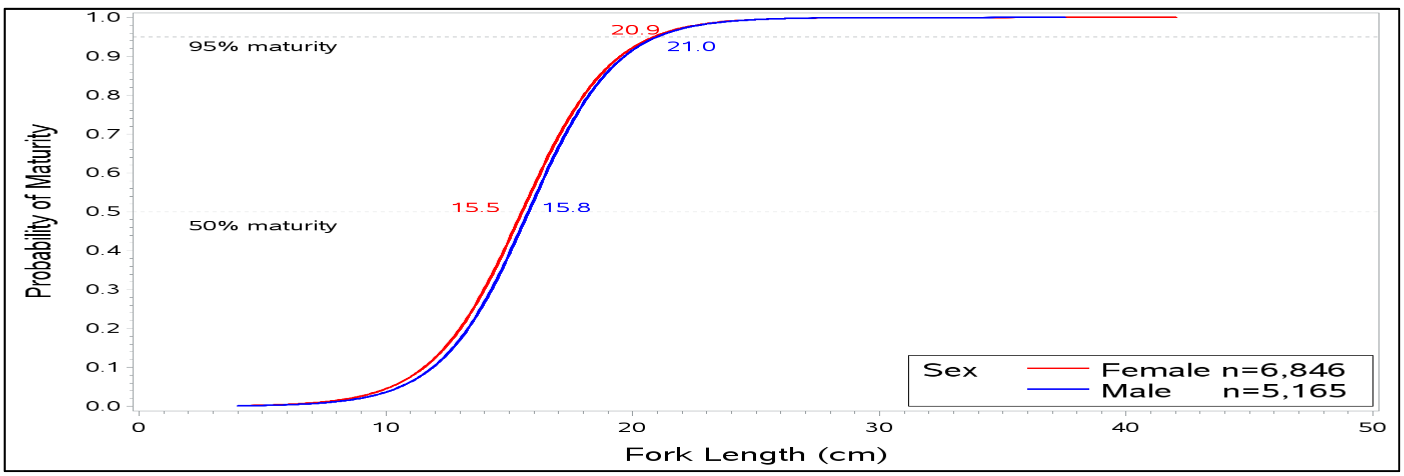


Figure 138. Scup maturity at age, by sex for all cruises pooled, 2007-2016.

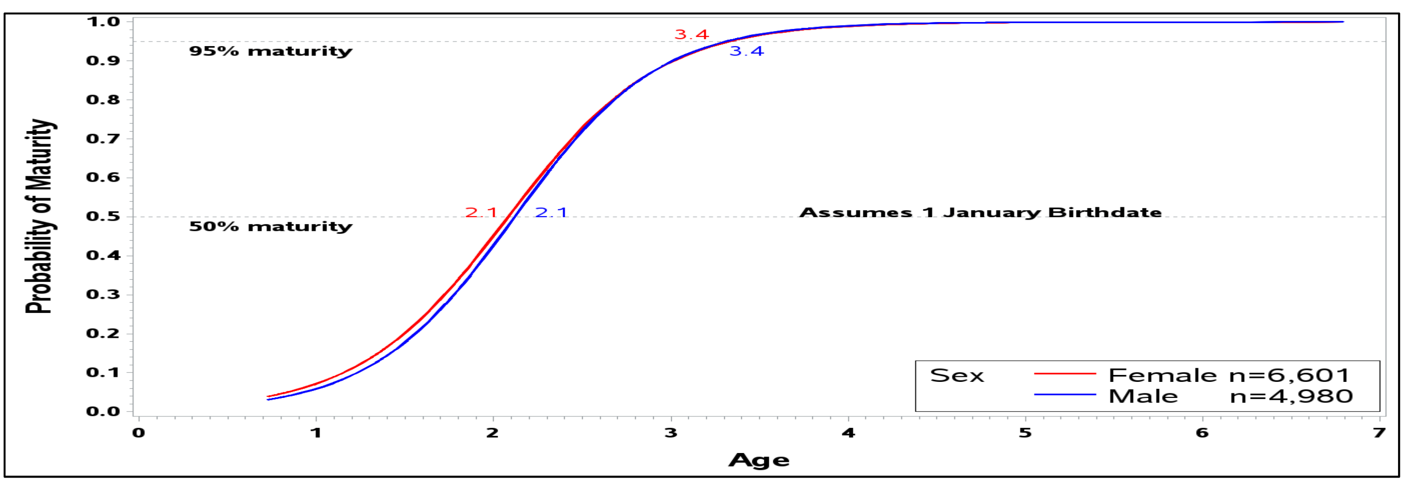
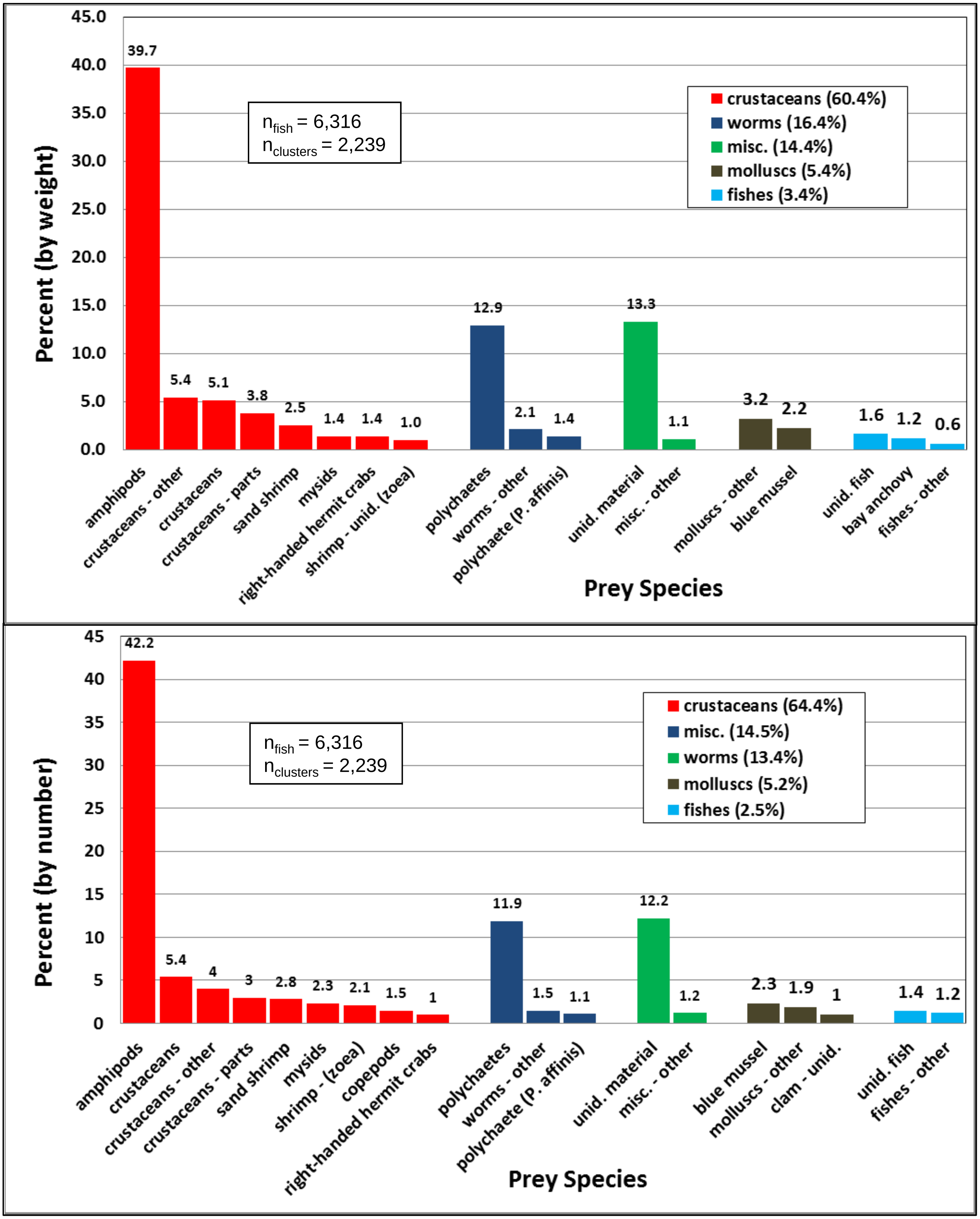


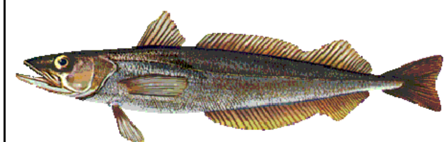
Figure 139. Scup diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

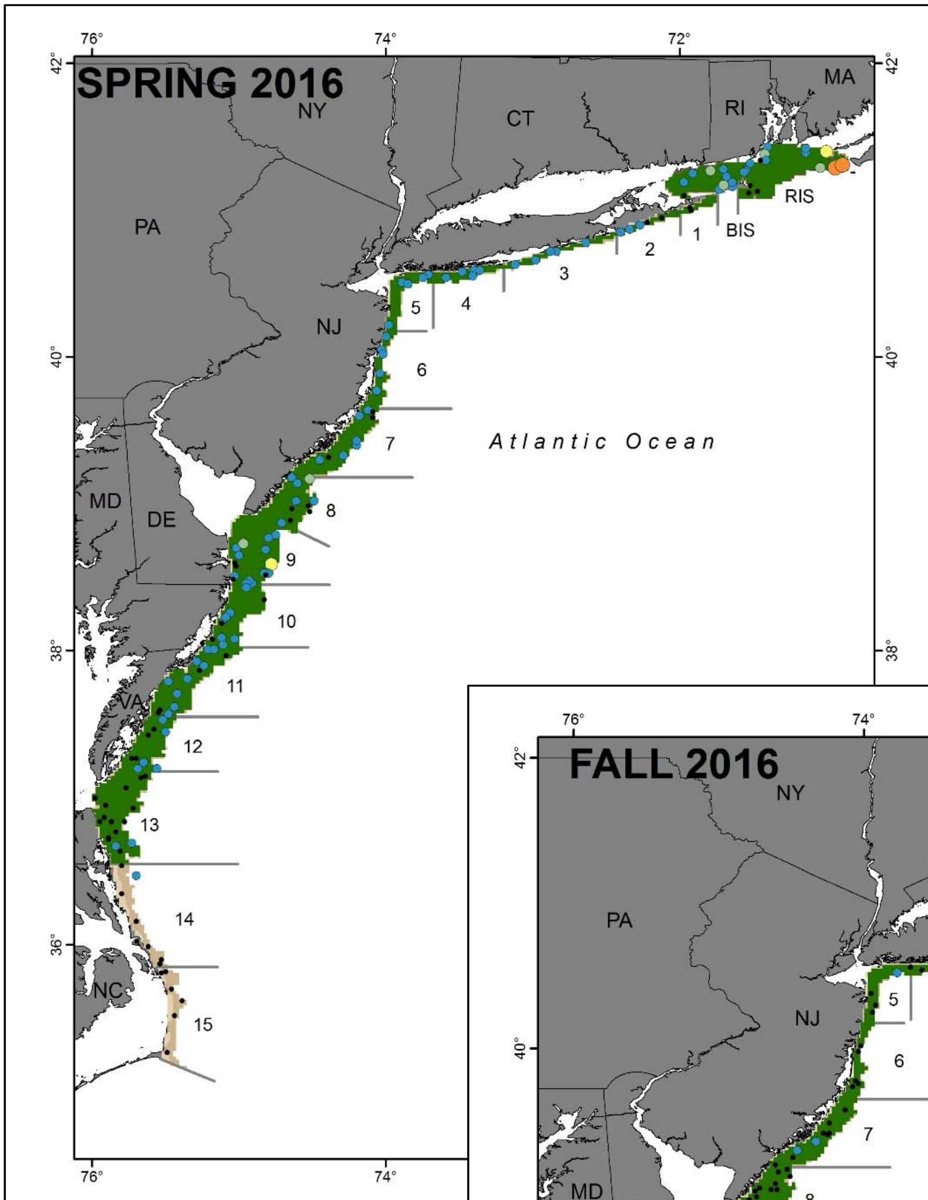


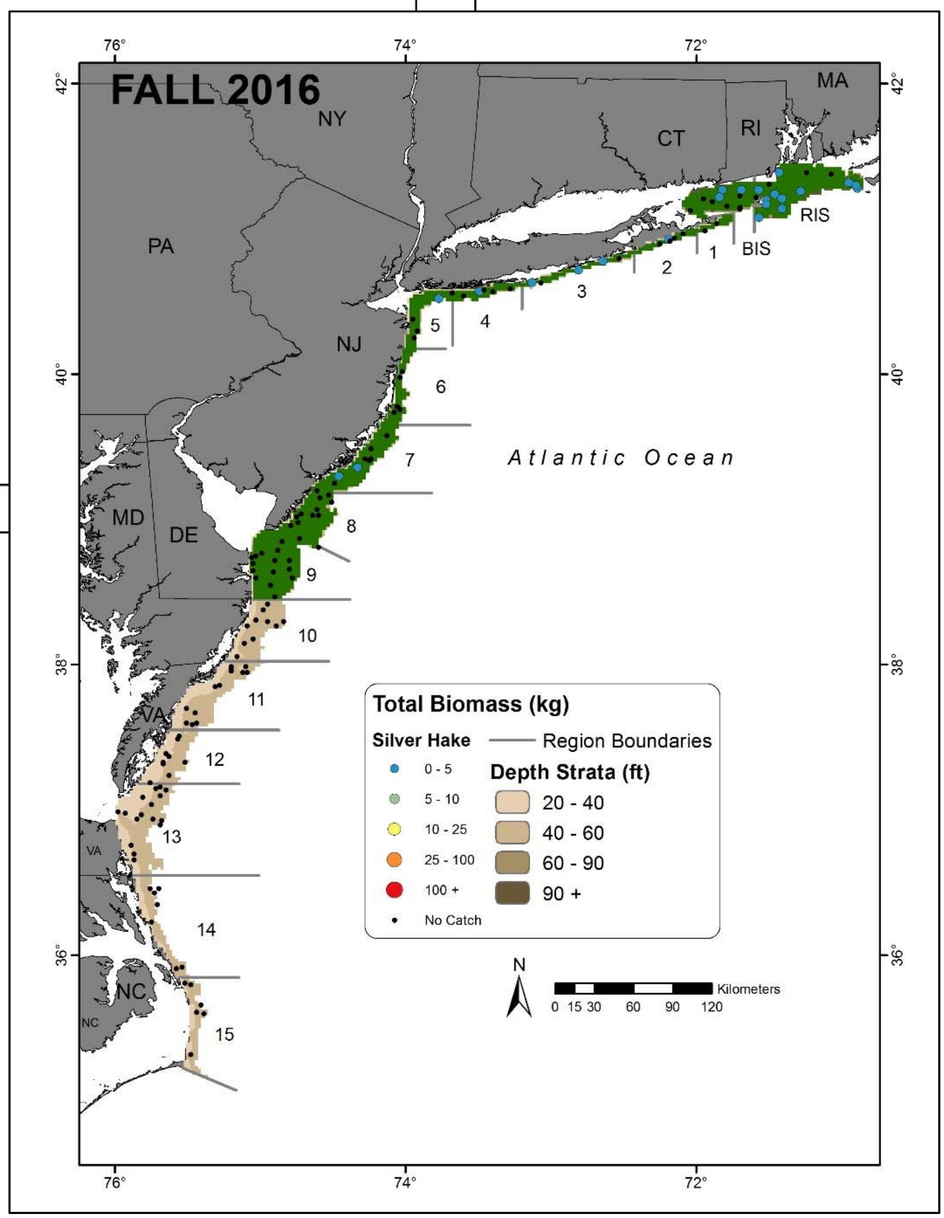
Silver Hake (Whiting)

Sampling Priority: A

Figure 140. Silver Hake biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[green]	[green]
		90+	[green]	[green]
	BIS	60-90	[green]	[green]
		90+	[green]	[green]
NY	01	40-60	[green]	[green]
	02	20-40	[green]	[green]
		40-60	[green]	[green]
	03	20-40	[green]	[green]
		40-60	[green]	[green]
	04	20-40	[green]	[green]
		40-60	[green]	[green]
	05	20-40	[green]	[green]
		40-60	[green]	[green]
NJ	06	20-40	[green]	[green]
		40-60	[green]	[green]
	07	20-40	[green]	[green]
		40-60	[green]	[green]
	08	20-40	[green]	[green]
		40-60	[green]	[green]
DE	09	20-40	[green]	[green]
		40-60	[green]	[green]
		60-90	[green]	[green]
MD	10	20-40	[green]	[grey]
		40-60	[green]	[grey]
VA	11	20-40	[green]	[grey]
		40-60	[green]	[grey]
	12	20-40	[green]	[grey]
		40-60	[green]	[grey]
	13	20-40	[green]	[grey]
		40-60	[green]	[grey]
NC	14	20-40	[grey]	[grey]
		40-60	[grey]	[grey]
	15	20-40	[grey]	[grey]
		40-60	[grey]	[grey]

[green] = used for abundance indices
[grey] = not used for abundance indices

Table 48. Silver Hake sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	28,765	549.8	64.2	3,063	409	0	398	392
	2009	5,153	105.7	70.8	1,789	406	0	402	398
	2010	10,483	155.3	59.9	2,378	380	0	376	314
	2011	8,675	174.6	79.6	5,631	572	0	533	525
	2012	35,837	1,502.2	86.1	11,377	668	0	598	561
	2013	4,843	178.9	70.8	3,751	526	0	492	485
	2014	5,536	111.0	55.5	2,211	377	0	281	278
	2015	1,015	33.9	31.4	331	149	0	113	109
	2016	6,401	164.4	67.2	2,845	439	0	262	262
Fall	2007	346	24.8	28.1	346	59	0	59	59
	2008	3,125	183.9	41.6	515	96	0	88	87
	2009	1,470	17.3	37.1	499	125	0	122	116
	2010	440	18.2	34.8	409	124	0	122	119
	2011	1,057	35.8	32.6	503	135	0	130	107
	2012	328	18.4	20.2	263	96	0	67	63
	2013	568	5.6	37.1	568	140	0	75	64
	2014	529	26.5	24.7	529	73	0	41	41
	2015	294	14.8	36.0	284	156	0	55	55
	2016	132	12.3	25.8	132	67	0	33	32

Table 49. Silver Hake geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and for the youngest year class captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	137	5.68	7.60	10.05	0.74	1.00	1.31
	2009	145	2.69	3.70	4.98	0.21	0.33	0.46
	2010	137	3.48	4.73	6.32	0.28	0.39	0.51
	2011	137	9.68	13.07	17.54	0.64	0.82	1.02
	2012	137	21.43	27.76	35.87	1.88	2.37	2.95
	2013	137	4.86	6.42	8.40	0.41	0.59	0.78
	2014	137	2.61	3.48	4.55	0.40	0.60	0.83
	2015	137	0.48	0.75	1.06	0.02	0.09	0.16
	2016	137	3.13	4.44	6.17	0.40	0.63	0.89
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	137	5.63	7.52	9.95	0.72	1.01	1.37
	2009	145	2.24	3.13	4.26	0.09	0.24	0.41
	2010	137	3.45	4.69	6.28	0.24	0.36	0.49
	2011	137	7.51	10.31	14.03	0.38	0.50	0.62
	2012	137	13.11	16.88	21.65	0.97	1.22	1.51
	2013	137	4.39	5.81	7.61	0.26	0.37	0.48
	2014	137	2.27	3.15	4.26	0.16	0.26	0.37
	2015	137	0.44	0.68	0.96	0.00	0.05	0.10
	2016	137	2.84	4.07	5.71	0.25	0.39	0.56
2+	2007							
	2008	137	0.25	0.42	0.61	0.09	0.22	0.36
	2009	145	0.33	0.48	0.65	0.10	0.16	0.22
	2010	137	0.04	0.12	0.21	0.01	0.05	0.09
	2011	137	0.44	0.62	0.82	0.12	0.20	0.27
	2012	137	1.60	2.08	2.65	0.66	0.90	1.18
	2013	137	0.41	0.62	0.87	0.10	0.18	0.28
	2014	137	0.30	0.43	0.58	0.12	0.18	0.25
	2015	137	0.04	0.14	0.25	0.00	0.06	0.13
	2016	137	0.36	0.55	0.78	0.11	0.19	0.28

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	84	0.33	0.65	1.05	0.02	0.10	0.19
	2008	89	0.42	0.85	1.43	0.01	0.18	0.36
	2009	96	0.51	0.93	1.46	0.00	0.09	0.18
	2010	89	0.64	1.02	1.48	0.07	0.15	0.23
	2011	89	0.88	1.31	1.84	0.14	0.24	0.36
	2012	89	0.36	0.65	1.01	0.04	0.12	0.20
	2013	89	0.69	1.02	1.41	0.03	0.05	0.07
	2014	89	0.33	0.61	0.95	0.04	0.13	0.24
	2015	89	0.62	0.94	1.33	0.06	0.13	0.19
	2016	89	0.38	0.54	0.71	0.07	0.11	0.14
0	2007	84	0.13	0.29	0.49	0.00	0.01	0.02
	2008	89	0.23	0.47	0.76	0.00	0.06	0.12
	2009	96	0.43	0.82	1.32	0.00	0.12	0.33
	2010	89	0.28	0.45	0.64	0.01	0.01	0.02
	2011	89	0.41	0.68	1.00	0.01	0.08	0.15
	2012	89	0.13	0.31	0.51	0.00	0.01	0.03
	2013	89	0.61	0.91	1.26	0.02	0.03	0.05
	2014	89	0.23	0.47	0.75	0.01	0.08	0.15
	2015	89	0.28	0.48	0.73	0.01	0.02	0.03
	2016	89	0.00	0.04	0.08	0.00	0.00	0.01
1	2007	84	0.12	0.34	0.60	0.02	0.11	0.20
	2008	89	0.11	0.42	0.83	0.00	0.15	0.34
	2009	96	0.02	0.15	0.29	0.00	0.04	0.09
	2010	89	0.22	0.46	0.76	0.06	0.13	0.21
	2011	89	0.36	0.63	0.94	0.11	0.19	0.29
	2012	89	0.22	0.46	0.75	0.03	0.12	0.21
	2013	89	0.03	0.11	0.21	0.00	0.02	0.03
	2014	89	0.17	0.39	0.65	0.02	0.11	0.21
	2015	89	0.27	0.49	0.75	0.05	0.11	0.18
	2016	89	0.37	0.52	0.68	0.07	0.11	0.15

Figure 141. Silver Hake geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

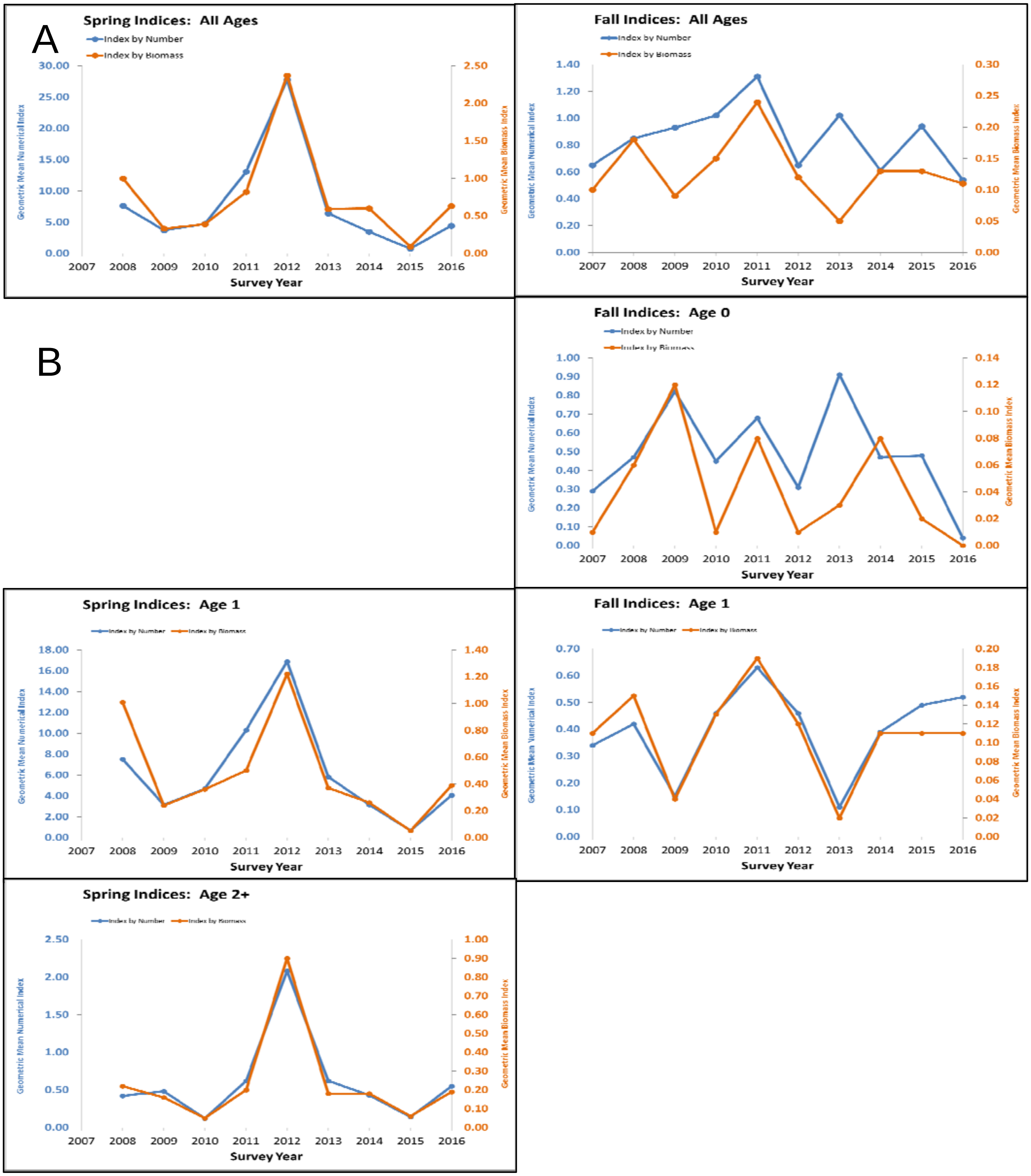


Figure 142. Silver Hake length-frequency distributions, by cruise (Reference lines are placed at the size cutoff values used to separate recruits from older specimens. Cutoff values - spring 20cm, fall 17cm - estimated by examination of these length frequency figures.).

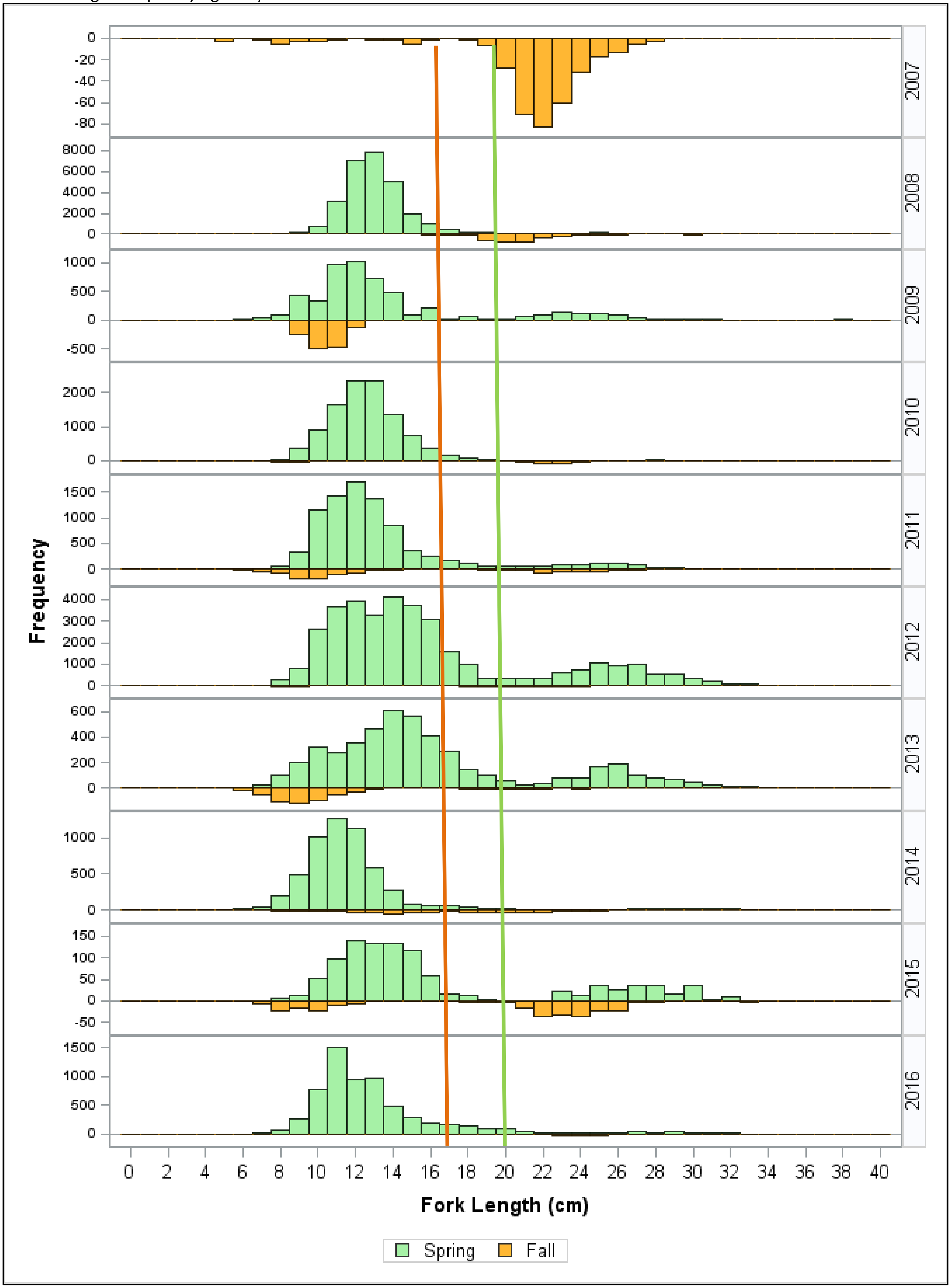


Figure 143. Silver Hake sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

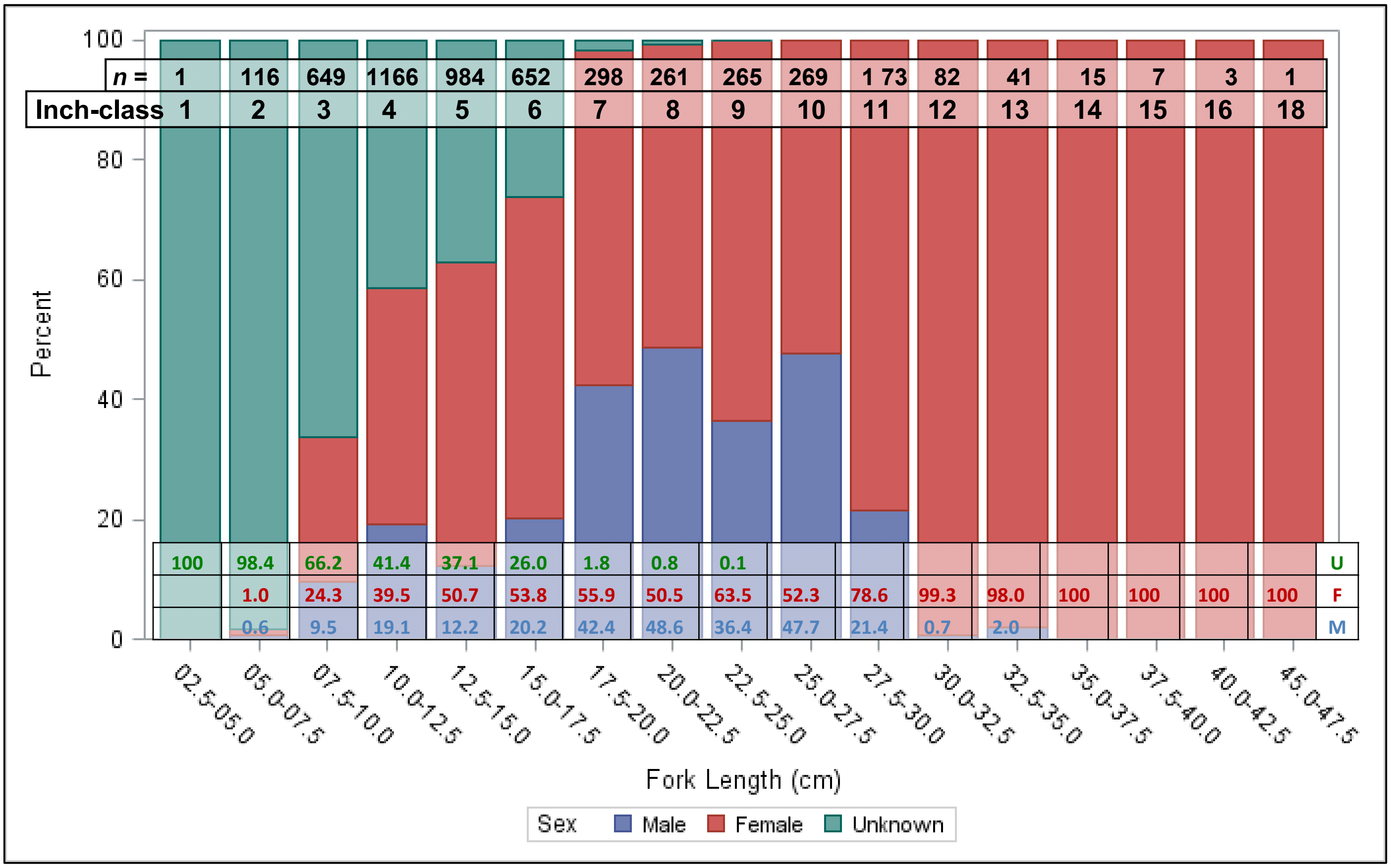


Figure 144. Silver Hake maturity at length, by sex for all cruises pooled, 2007-2016.

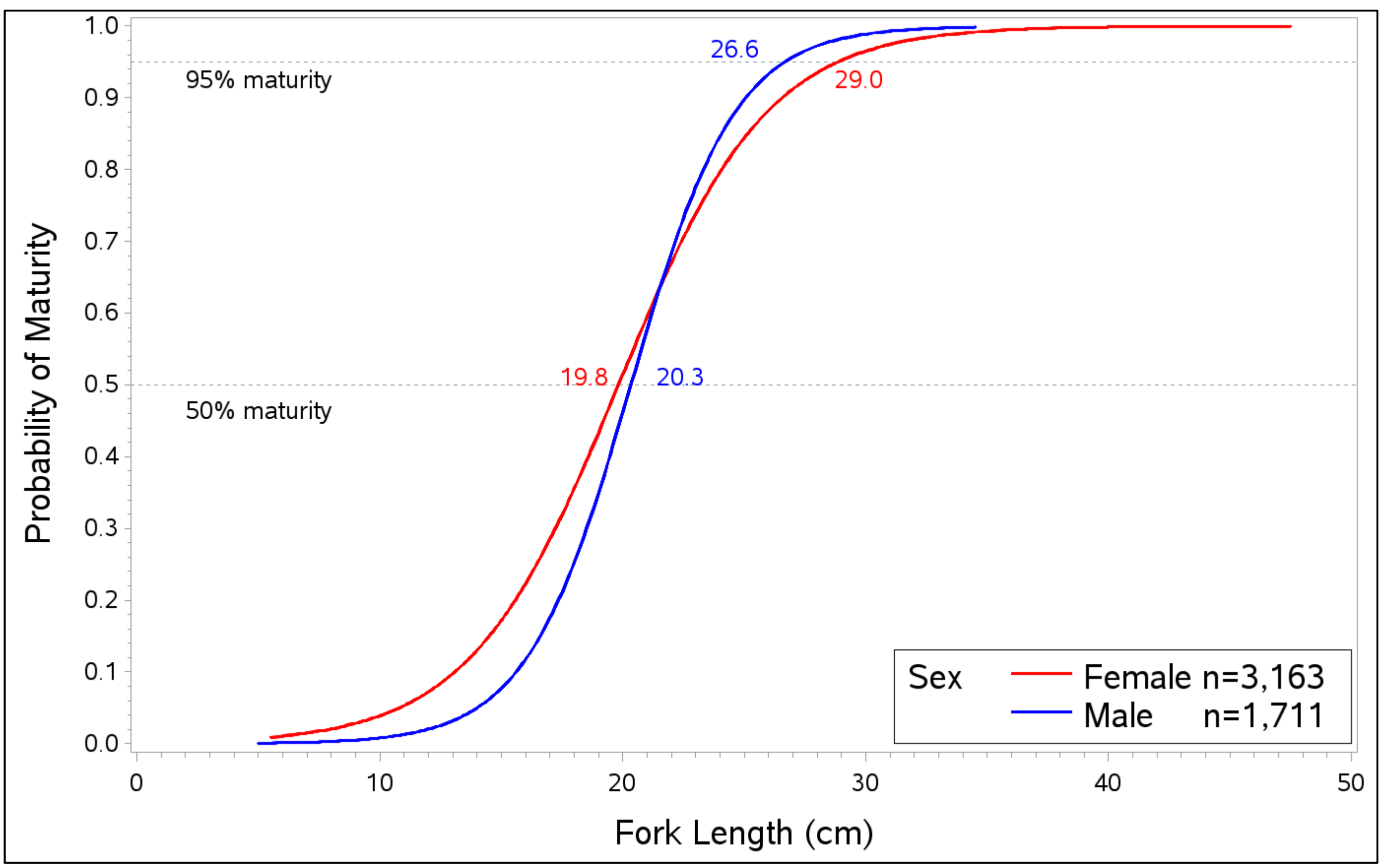
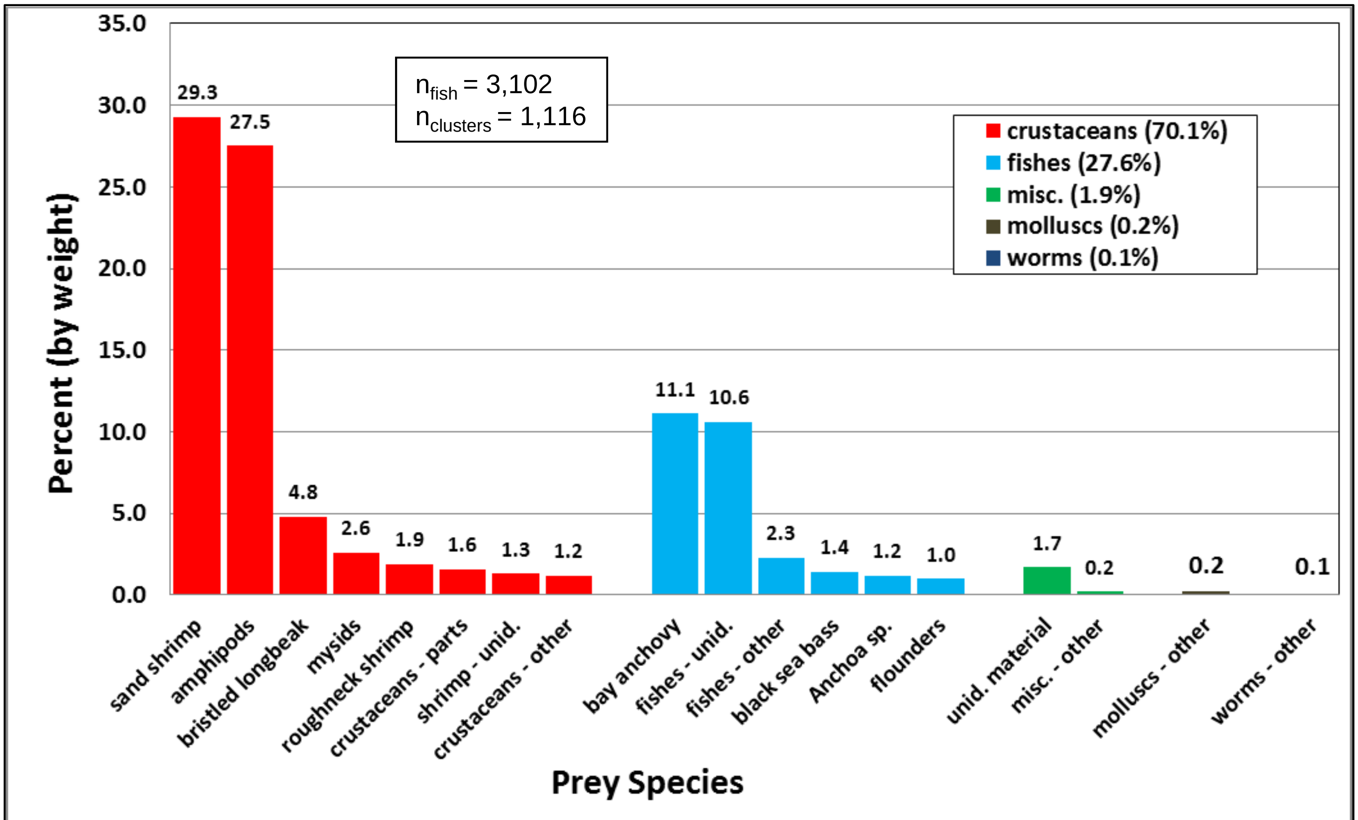
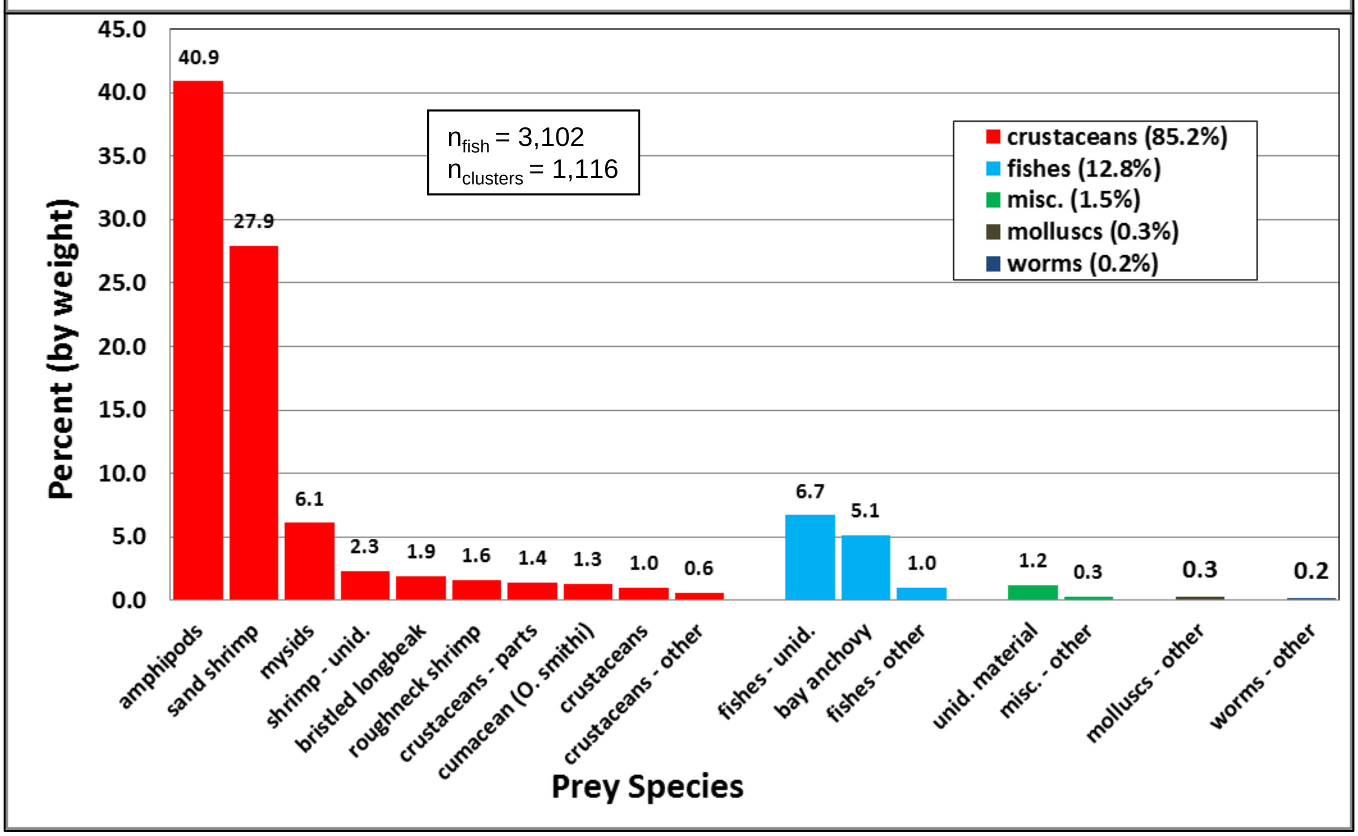


Figure 145. Silver Hake diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

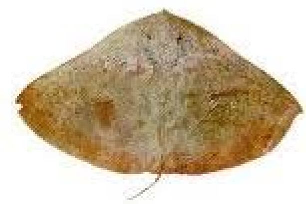


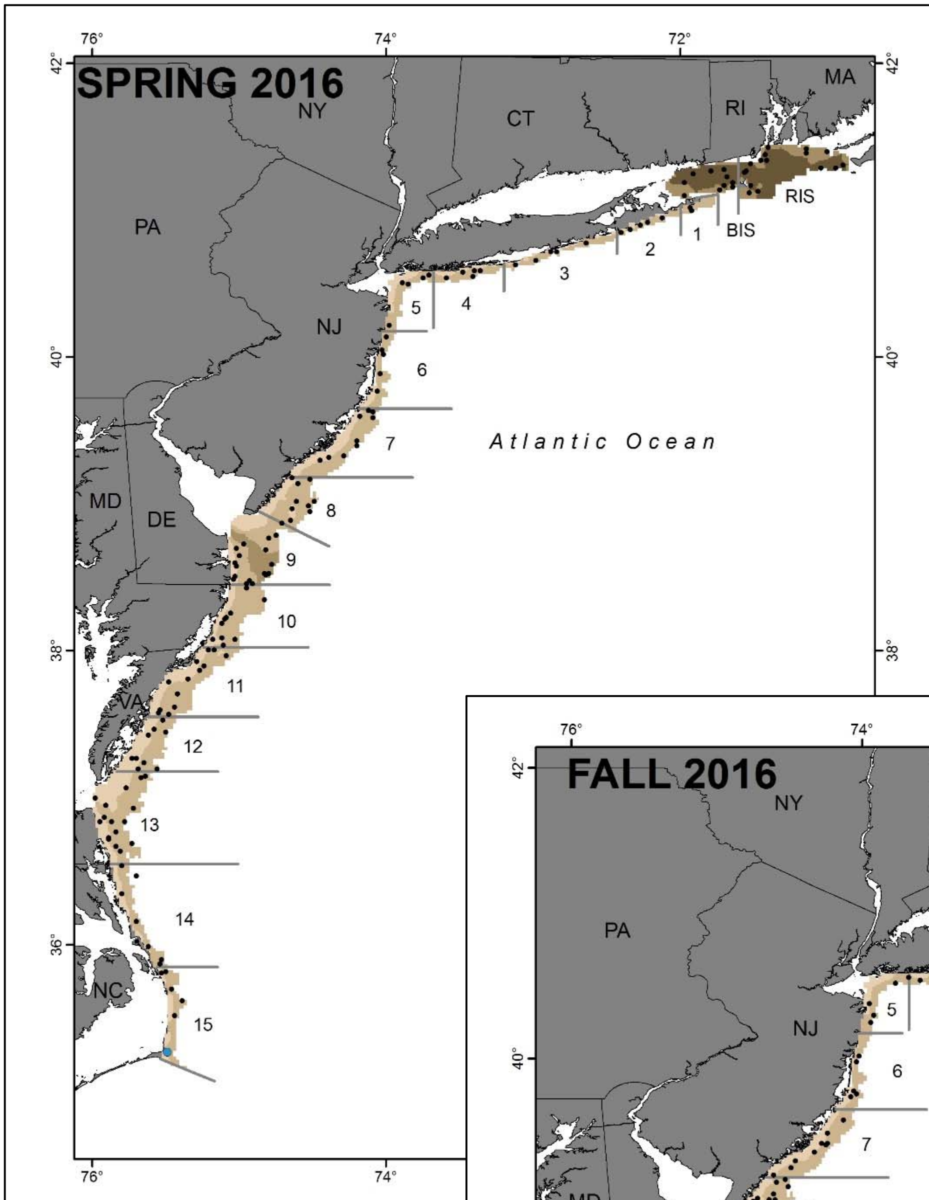


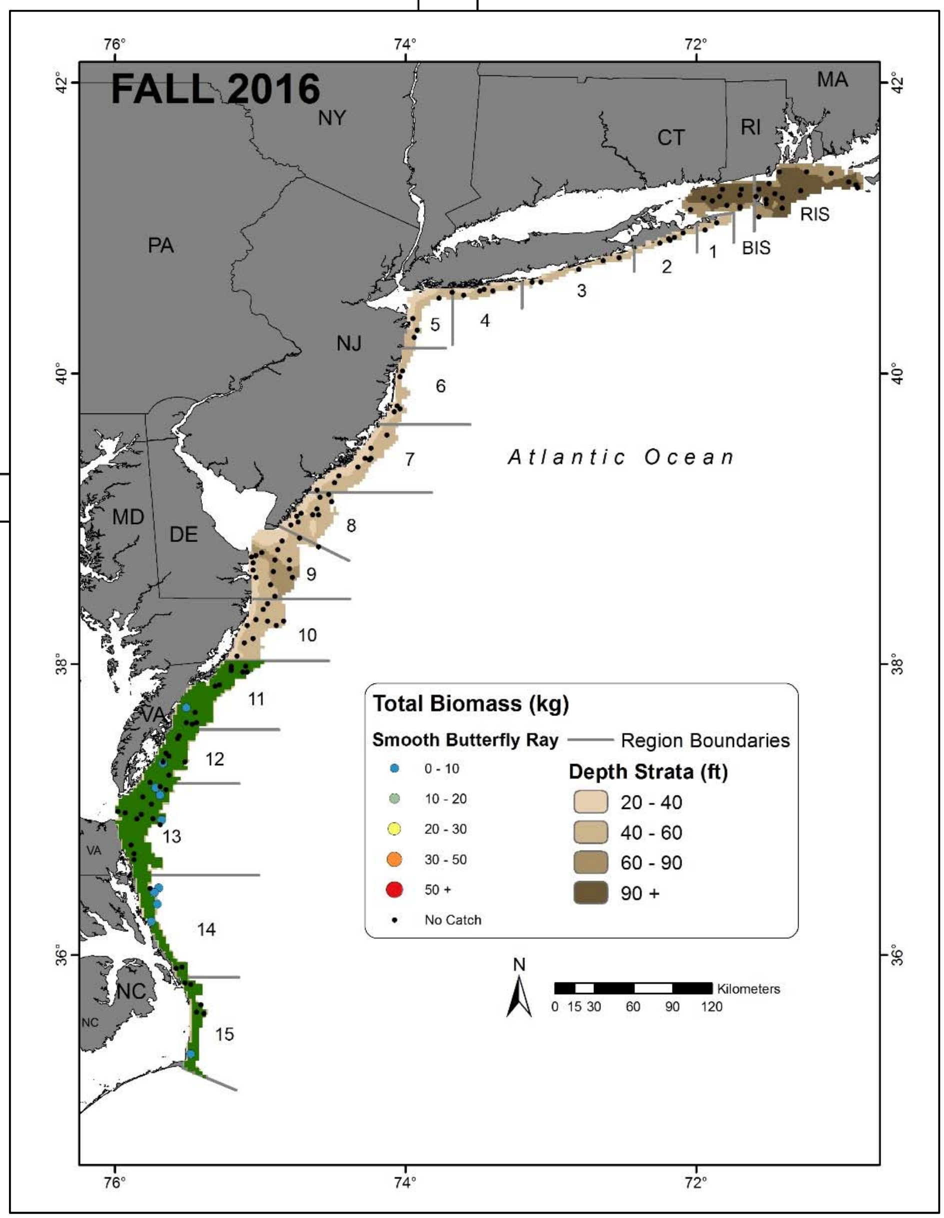
Smooth Butterfly Ray

Sampling Priority: E

Figure 146. Smooth Butterfly Ray biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

Table 50. Smooth Butterfly Ray sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2009	2	4.5	0.0	2	N/A	N/A	N/A	N/A
	2010	3	4.7	0.0	3	N/A	N/A	N/A	N/A
	2011	1	6.9	0.0	1	N/A	N/A	N/A	N/A
	2012	16	31.8	0.0	16	14	0	0	0
	2013	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2014	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2015	1	0.6	0.0	1	0	0	0	0
	2016	1	0.8	0.0	1	0	0	0	0
Fall	2007	292	557.1	56.9	292	0	0	0	0
	2008	227	346.6	62.7	195	0	0	0	0
	2009	61	132.2	29.4	61	0	0	0	0
	2010	182	581.4	43.1	171	0	0	0	0
	2011	77	154.9	52.9	77	0	0	0	0
	2012	143	264.8	76.5	143	51	0	2	0
	2013	57	108.2	47.1	57	6	0	0	0
	2014	94	198.5	64.7	94	0	0	0	0
	2015	25	36.8	25.5	25	0	0	0	0
	2016	13	23.0	19.6	13	0	0	0	0

Table 51. Smooth Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	**Index**	UCI	LCI	**Index**	UCI
All	2007	56	0.85	1.43	2.18	1.46	2.55	4.14
	2008	51	1.45	2.22	3.23	1.80	2.87	4.37
	2009	53	0.28	0.49	0.74	0.27	0.54	0.89
	2010	51	0.90	1.31	1.81	1.22	2.02	3.12
	2011	51	0.55	0.84	1.19	0.75	1.31	2.03
	2012	51	1.06	1.60	2.28	1.43	2.28	3.42
	2013	51	0.47	0.71	0.99	0.61	0.98	1.44
	2014	51	0.71	1.06	1.47	1.10	1.85	2.86
	2015	51	0.18	0.33	0.49	0.17	0.39	0.65
	2016	51	0.07	0.16	0.27	0.08	0.21	0.36

Figure 147. Smooth Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

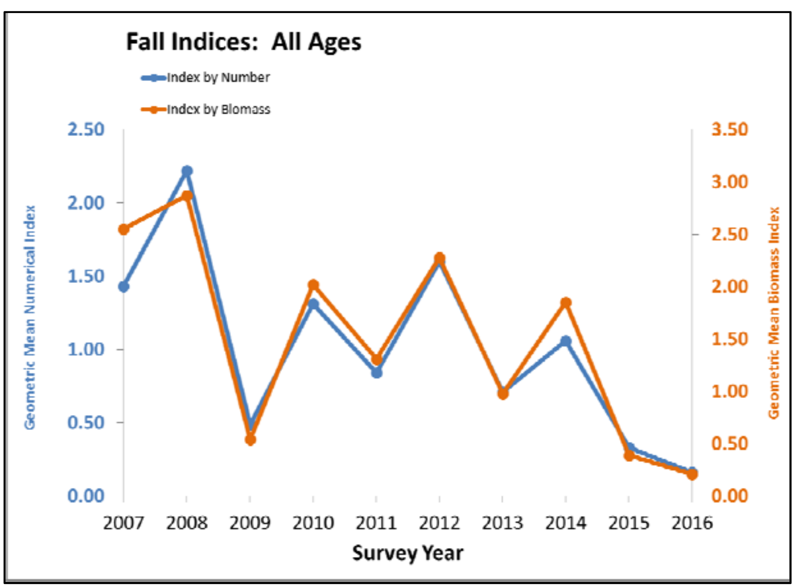


Figure 148. Smooth Butterfly Ray length-frequency distributions, by cruise.

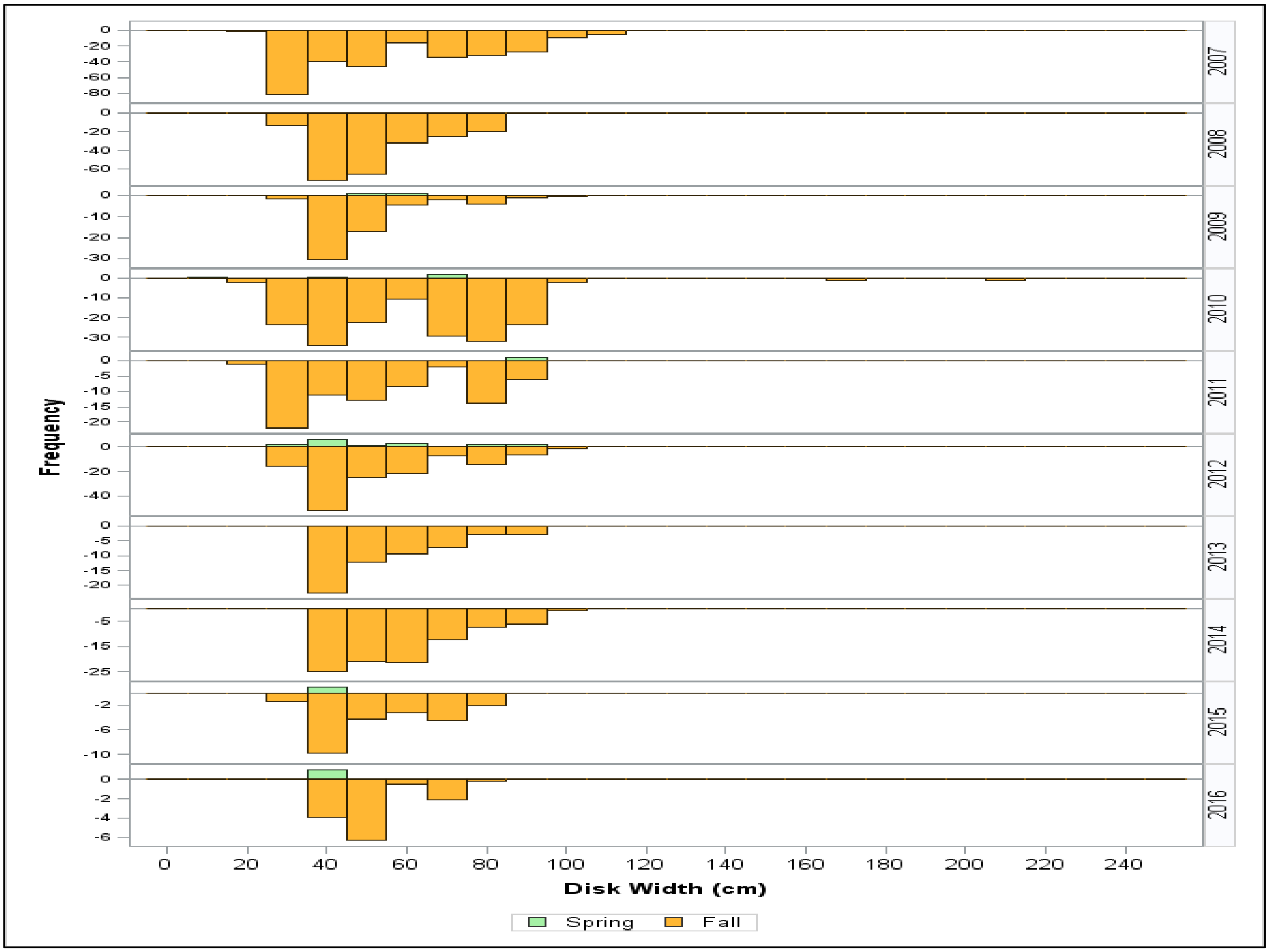
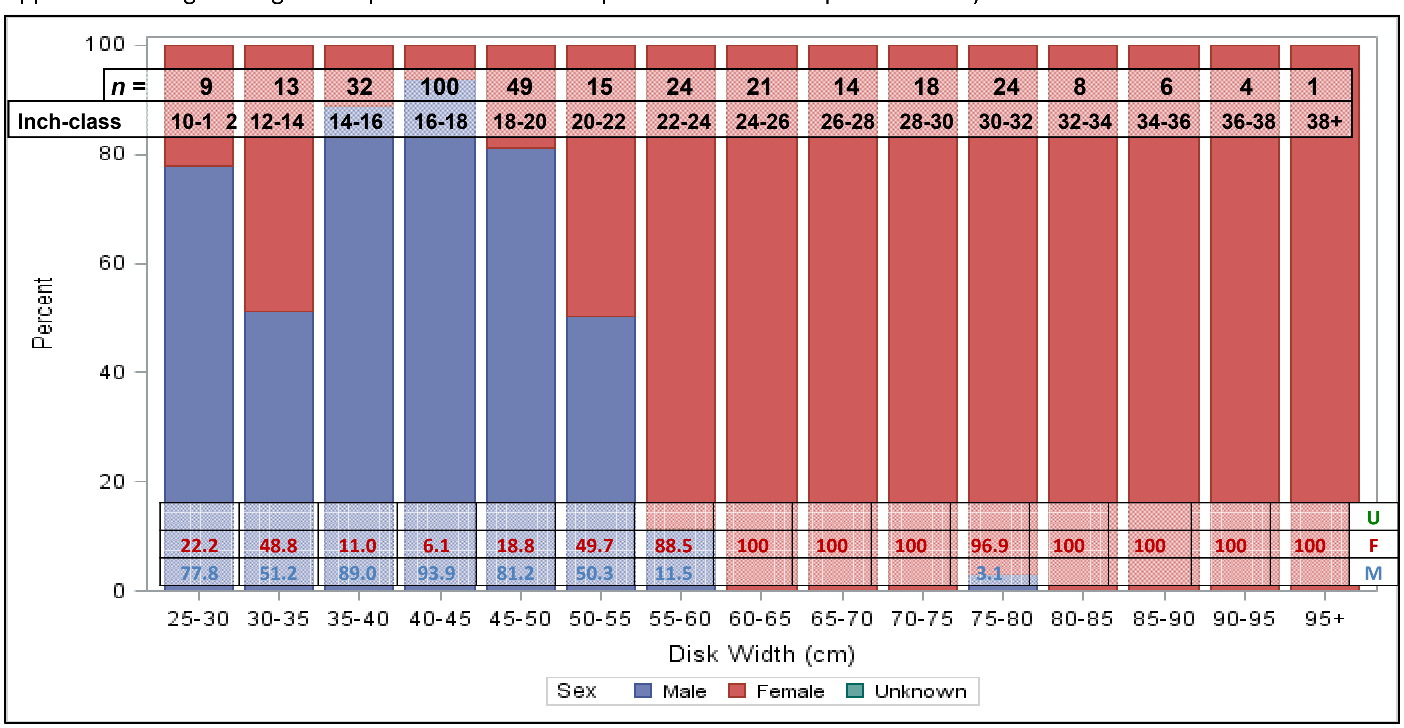


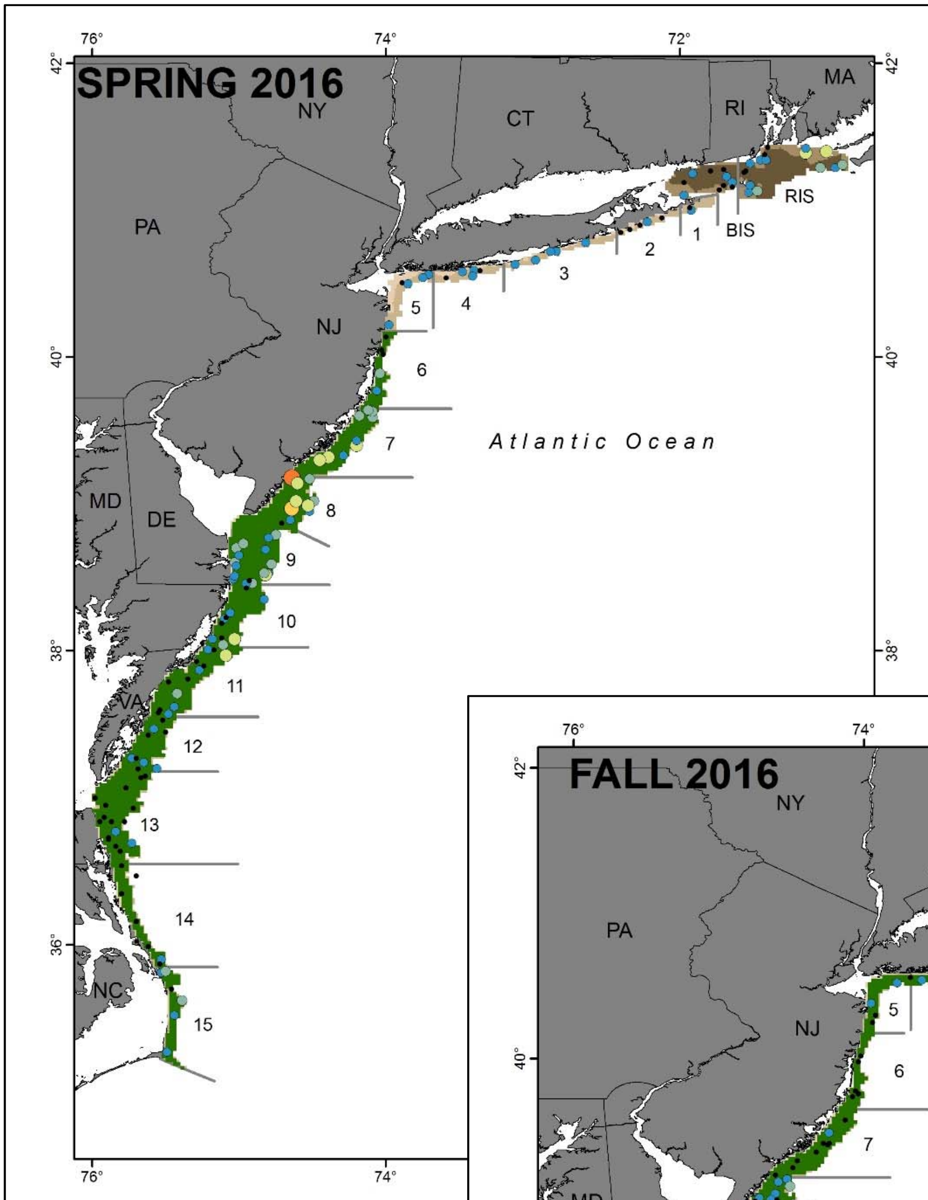
Figure 149. Smooth Butterfly Ray sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

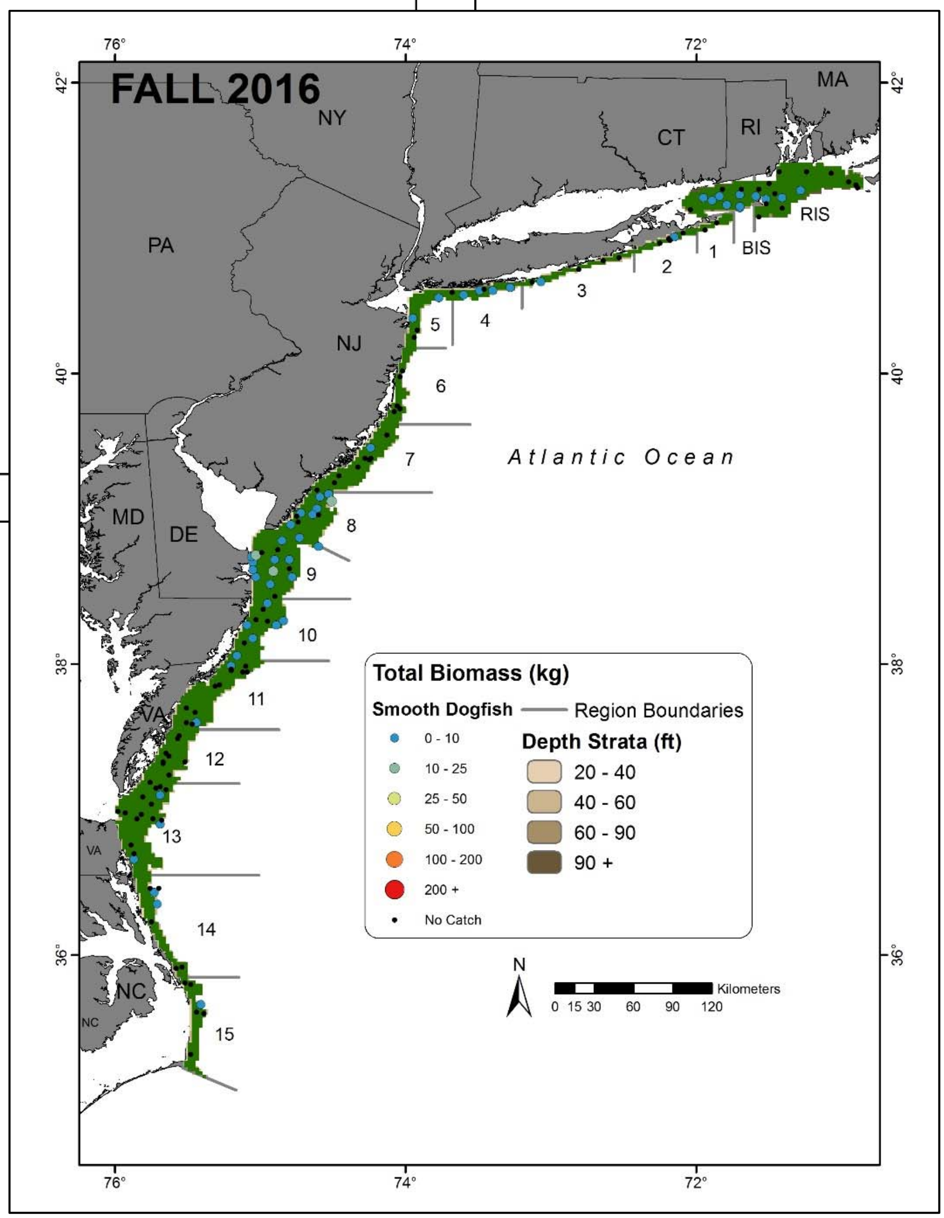


Smooth Dogfish

Sampling Priority: A

Figure 150. Smooth Dogfish biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	grey	green
		90+	grey	green
	BIS	60-90	grey	green
		90+	grey	green
NY	01	40-60	grey	green
	02	20-40	grey	green
		40-60	grey	green
	03	20-40	grey	green
		40-60	grey	green
	04	20-40	grey	green
		40-60	grey	green
	05	20-40	grey	green
		40-60	grey	green
NJ	06	20-40	green	green
		40-60	green	green
	07	20-40	green	green
		40-60	green	green
	08	20-40	green	green
		40-60	green	green
DE	09	20-40	green	green
		40-60	green	green
		60-90	green	green
MD	10	20-40	green	green
		40-60	green	green
VA	11	20-40	green	green
		40-60	green	green
	12	20-40	green	green
		40-60	green	green
	13	20-40	green	green
		40-60	green	green
NC	14	20-40	green	green
		40-60	green	green
	15	20-40	green	green
		40-60	green	green

green = used for abundance indices
grey = not used for abundance indices

Table 52. Smooth Dogfish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	927	2,490.9	96.1	688	297	0	288	286
	2009	947	2,746.4	82.4	725	236	0	221	216
	2010	402	1,232.6	76.5	399	188	0	181	174
	2011	521	1,741.5	61.8	458	186	0	173	171
	2012	189	627.3	50.0	189	138	0	132	123
	2013	411	1,236.1	65.7	411	176	0	167	163
	2014	321	961.3	59.8	321	140	0	137	137
	2015	292	948.8	61.8	292	178	0	174	173
	2016	365	1,104.7	58.8	357	187	0	176	176
Fall	2007	1,684	1,557.7	54.7	759	196	0	194	192
	2008	414	364.8	48.7	386	162	0	161	161
	2009	1,178	847.5	76.0	1,178	333	0	330	323
	2010	758	690.5	60.7	602	223	0	215	215
	2011	606	612.1	58.0	606	205	0	203	203
	2012	783	946.2	43.3	783	161	0	158	151
	2013	549	770.3	53.3	459	174	0	170	166
	2014	490	560.2	50.0	432	165	0	157	157
	2015	545	544.1	56.7	545	186	0	179	179
	2016	224	182.6	36.0	224	109	0	105	103

Table 53. Smooth Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and for the youngest year class captured (fall only).

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	101	4.85	5.95	7.26	11.40	14.24	17.72
	2009	107	3.11	3.97	4.99	6.92	9.20	12.12
	2010	102	1.85	2.36	2.96	4.52	5.94	7.72
	2011	102	1.54	1.89	2.30	3.52	4.45	5.57
	2012	102	0.63	0.82	1.03	1.13	1.56	2.07
	2013	102	1.28	1.63	2.03	2.68	3.58	4.70
	2014	102	1.07	1.38	1.73	2.09	2.78	3.61
	2015	102	0.97	1.25	1.58	2.11	2.85	3.76
	2016	102	1.16	1.46	1.81	2.37	3.16	4.14

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	150	1.45	1.92	2.48	1.34	1.79	2.33
	2008	150	0.80	1.08	1.40	0.71	0.98	1.31
	2009	160	2.84	3.42	4.08	2.20	2.73	3.36
	2010	150	1.48	1.84	2.26	1.19	1.54	1.93
	2011	150	1.32	1.60	1.90	1.17	1.47	1.82
	2012	150	0.98	1.27	1.59	1.19	1.55	1.97
	2013	150	0.80	1.06	1.35	0.92	1.27	1.69
	2014	150	0.80	1.05	1.34	0.94	1.29	1.70
	2015	150	1.12	1.43	1.77	1.22	1.58	1.99
	2016	150	0.46	0.62	0.80	0.41	0.58	0.77
0	2007	150	0.84	1.15	1.51	0.57	0.82	1.09
	2008	150	0.45	0.64	0.87	0.23	0.34	0.46
	2009	160	2.15	2.58	3.08	1.25	1.49	1.77
	2010	150	1.09	1.35	1.65	0.64	0.82	1.01
	2011	150	0.88	1.08	1.31	0.54	0.67	0.81
	2012	150	0.48	0.69	0.92	0.31	0.46	0.63
	2013	150	0.36	0.52	0.71	0.21	0.31	0.43
	2014	150	0.38	0.50	0.64	0.24	0.33	0.42
	2015	150	0.63	0.85	1.10	0.43	0.59	0.77
	2016	150	0.32	0.44	0.59	0.22	0.31	0.41

Figure 151. Smooth Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

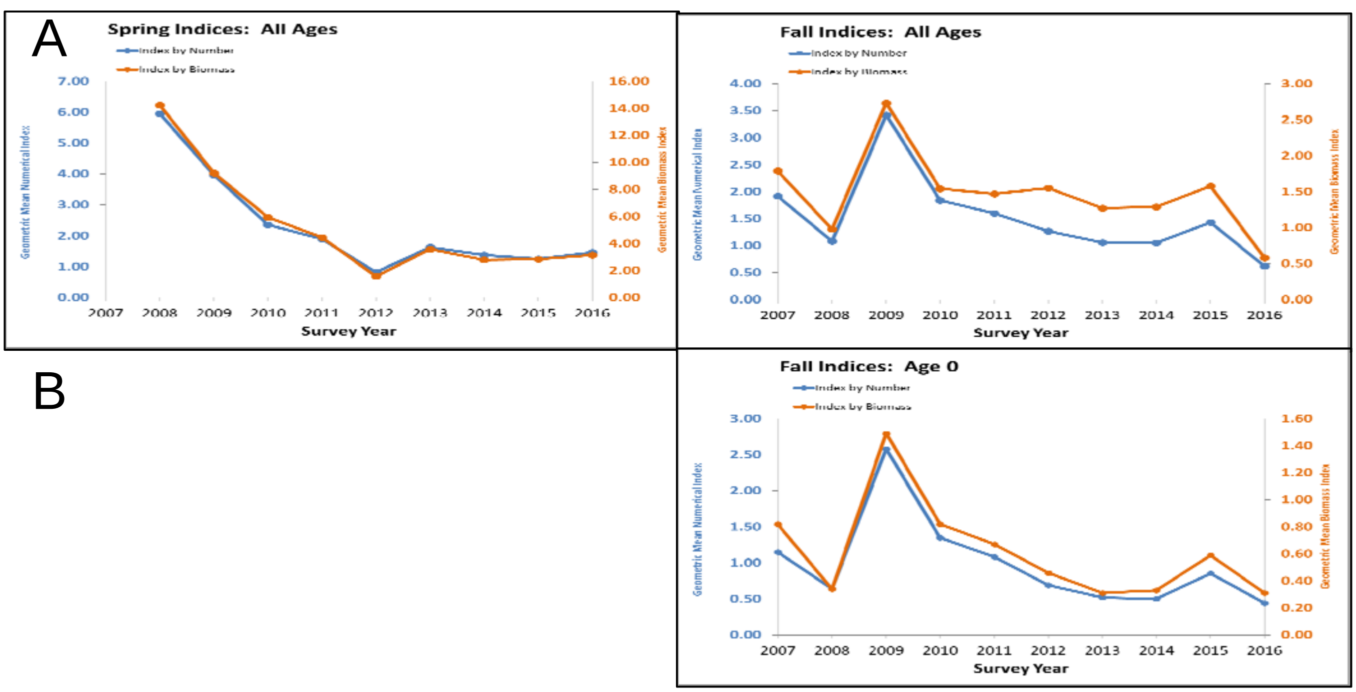


Figure 152. Smooth Dogfish length-frequency distributions, by cruise (Blue reference line is placed at the size cutoff value used to separate recruits from older specimens. Cutoff value - fall 47cm - estimated by examination of these length frequency figures and from Conrath et al., (2002)).

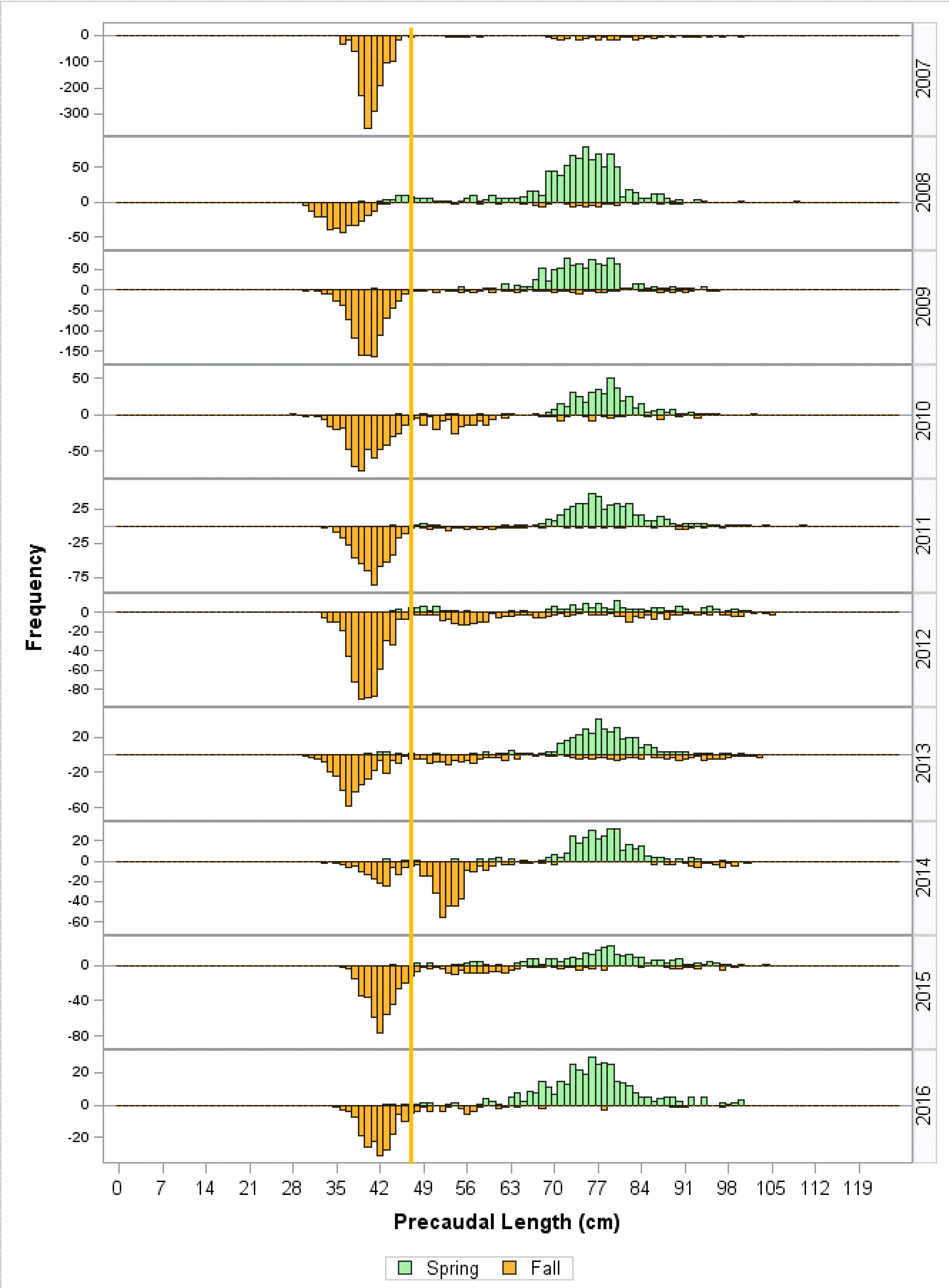


Figure 153. Smooth Dogfish length-frequency distributions, by cruise and sex.

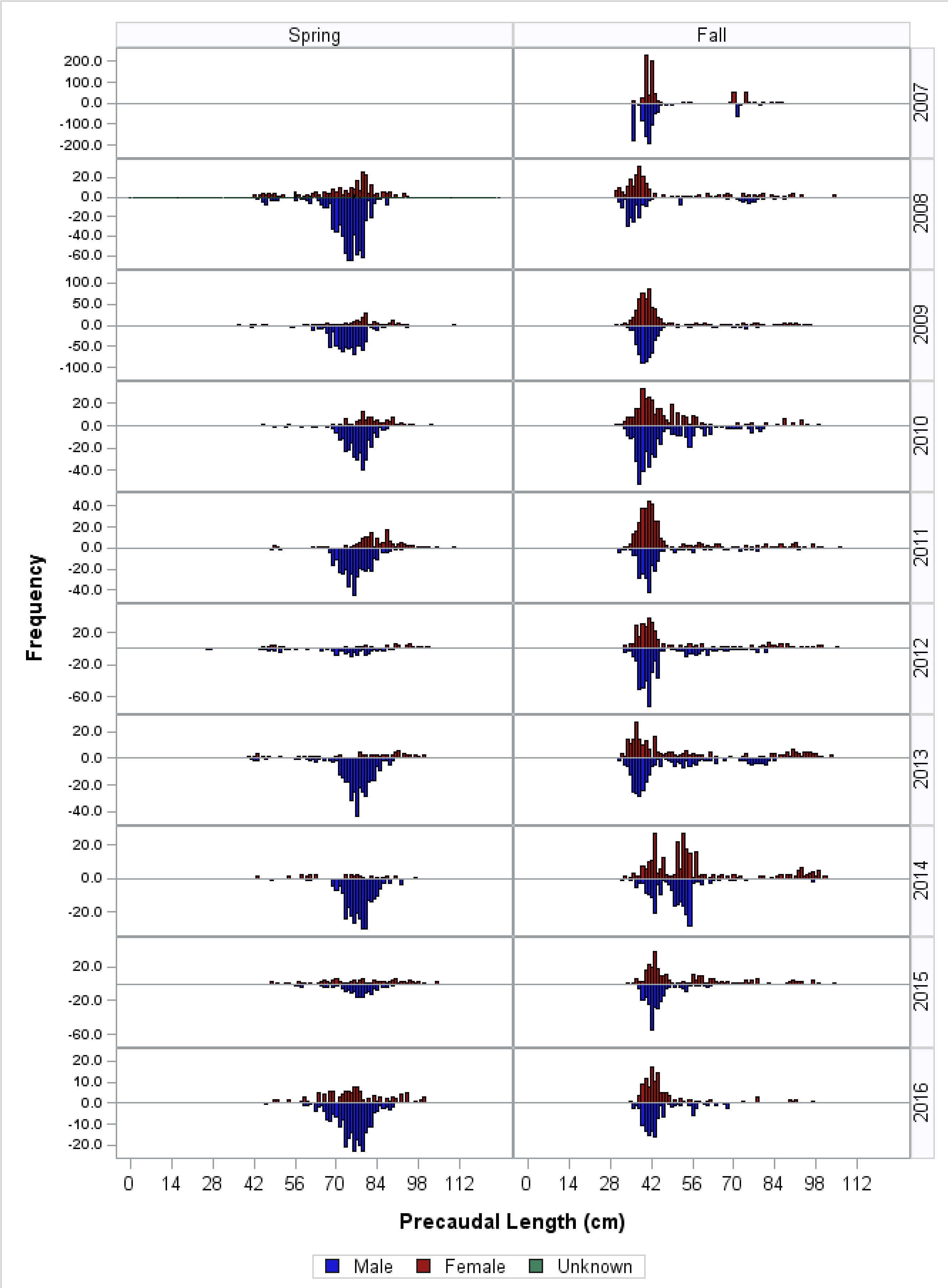


Figure 154. Smooth Dogfish sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

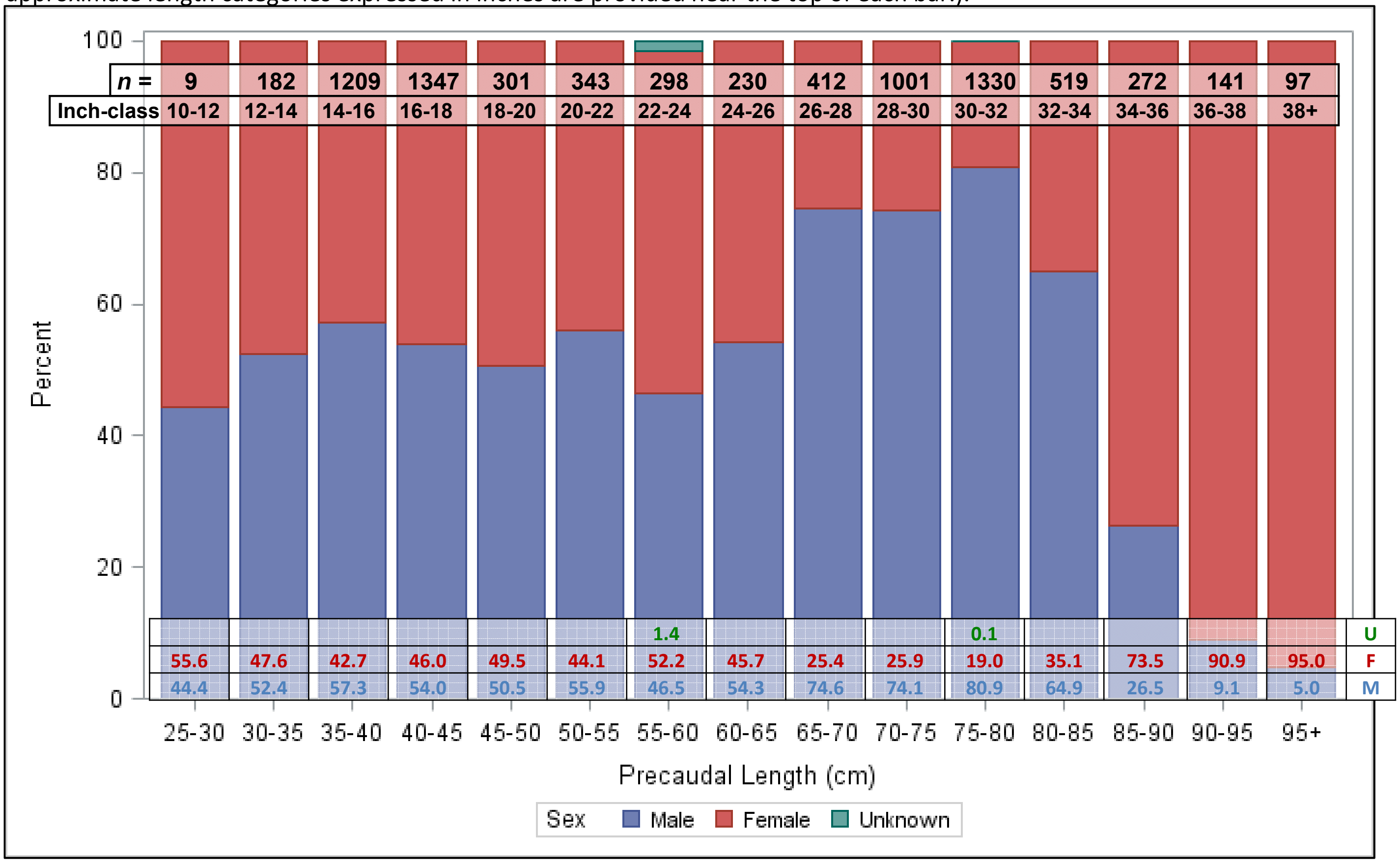


Figure 155. Smooth Dogfish maturity at length, by sex for all cruises pooled, 2007-2016.

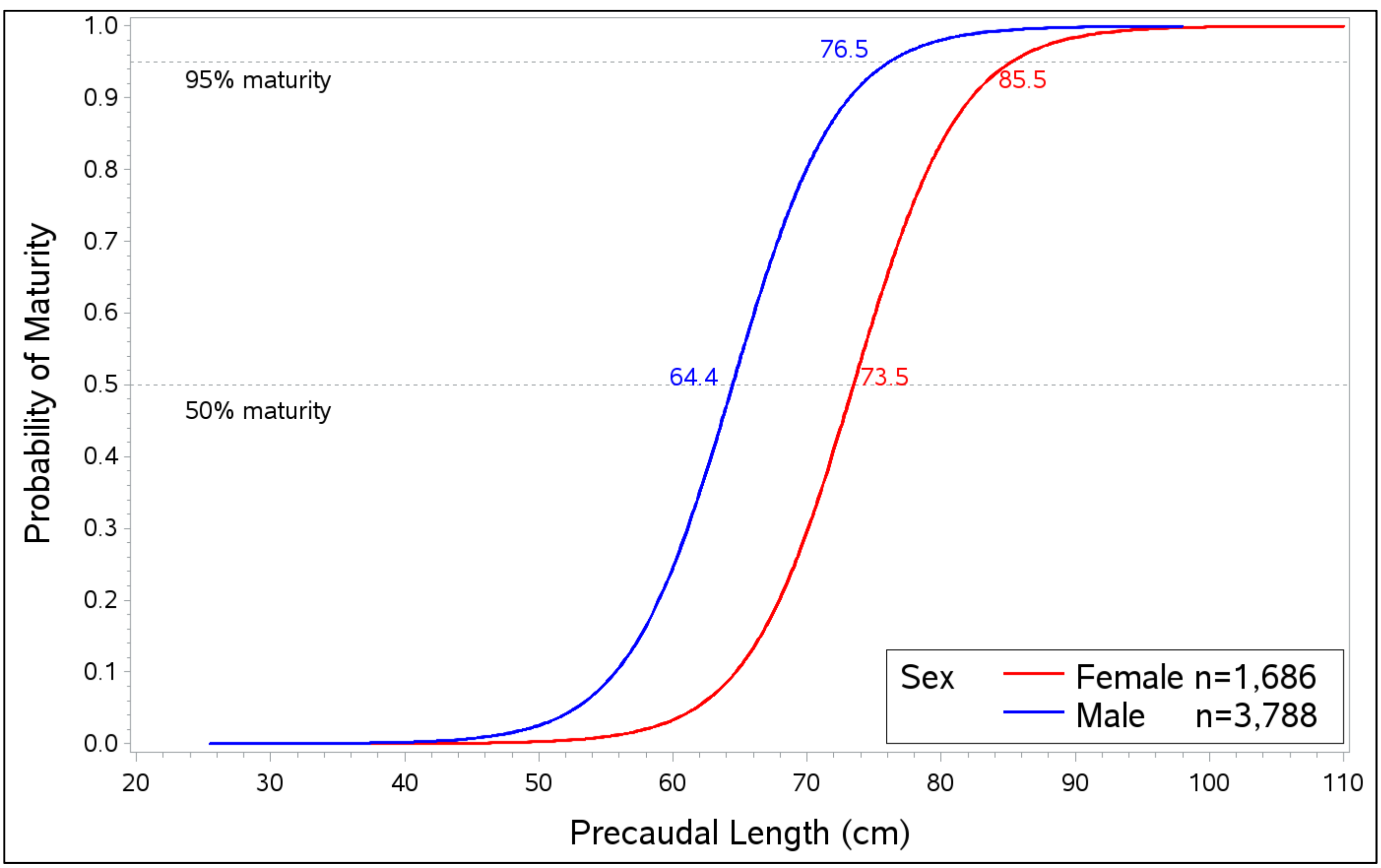


Figure 156. Smooth Dogfish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

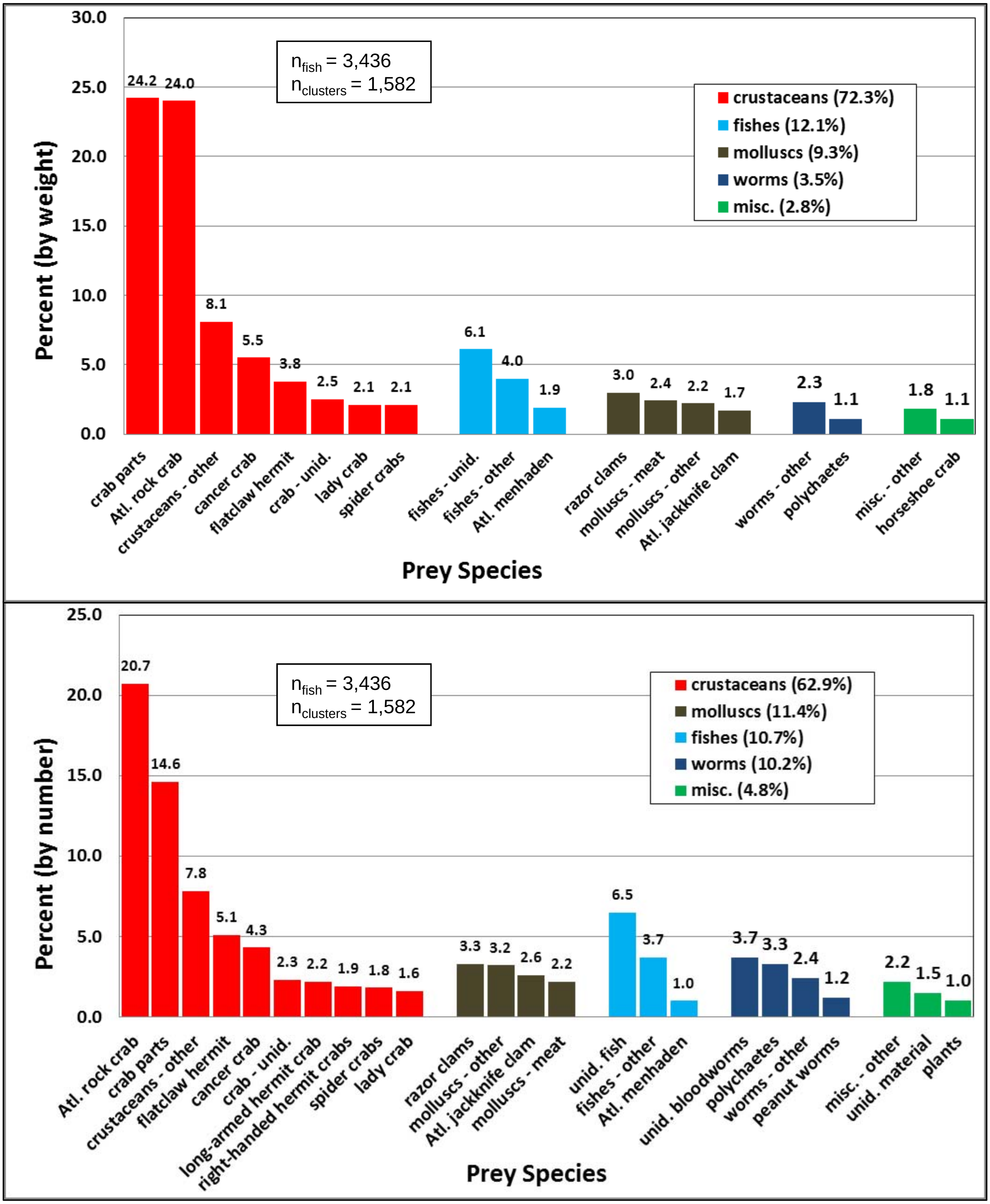
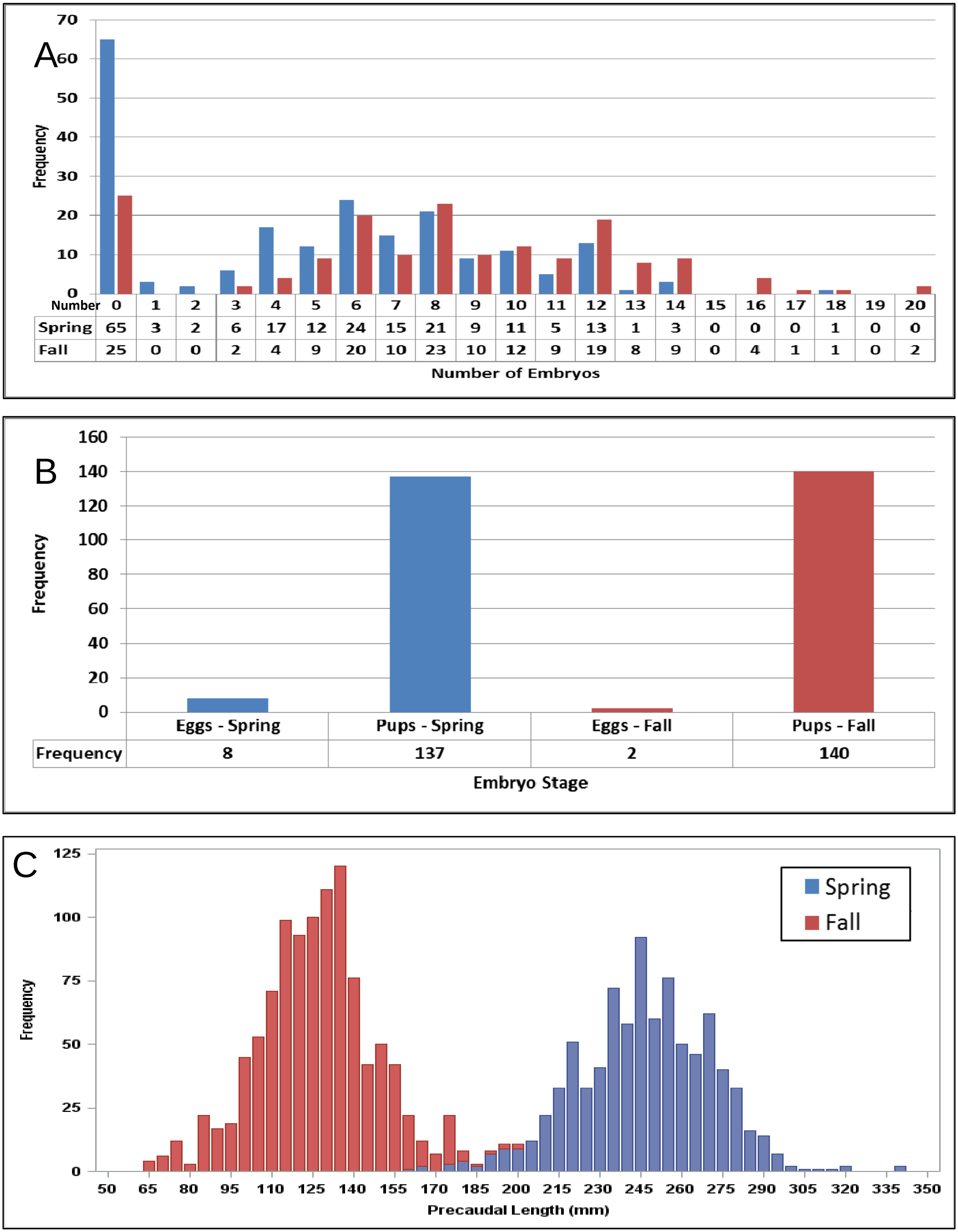


Figure 157. Smooth Dogfish reproductive data by season; A – frequency histogram of number of embryos found in females, B – frequency histogram of embryo stages, C – length-frequency histogram of embryos.



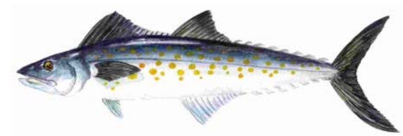
Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Spring	65	3	2	6	17	12	24	15	21	9	11	5	13	1	3	0	0	0	1	0	0
Fall	25	0	0	2	4	9	20	10	23	10	12	9	19	8	9	0	4	1	1	0	2

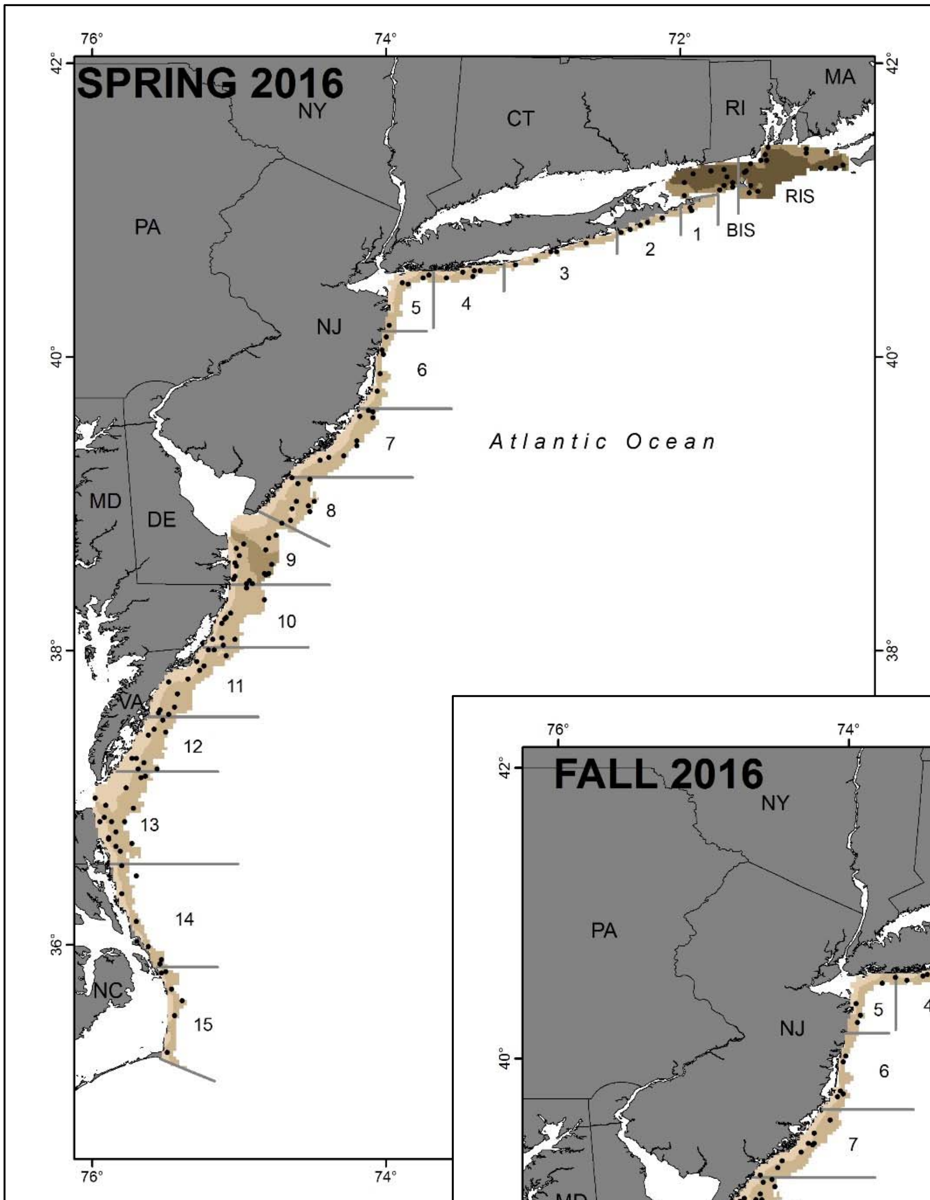
	Eggs - Spring	Pups - Spring	Eggs - Fall	Pups - Fall
Frequency	8	137	2	140

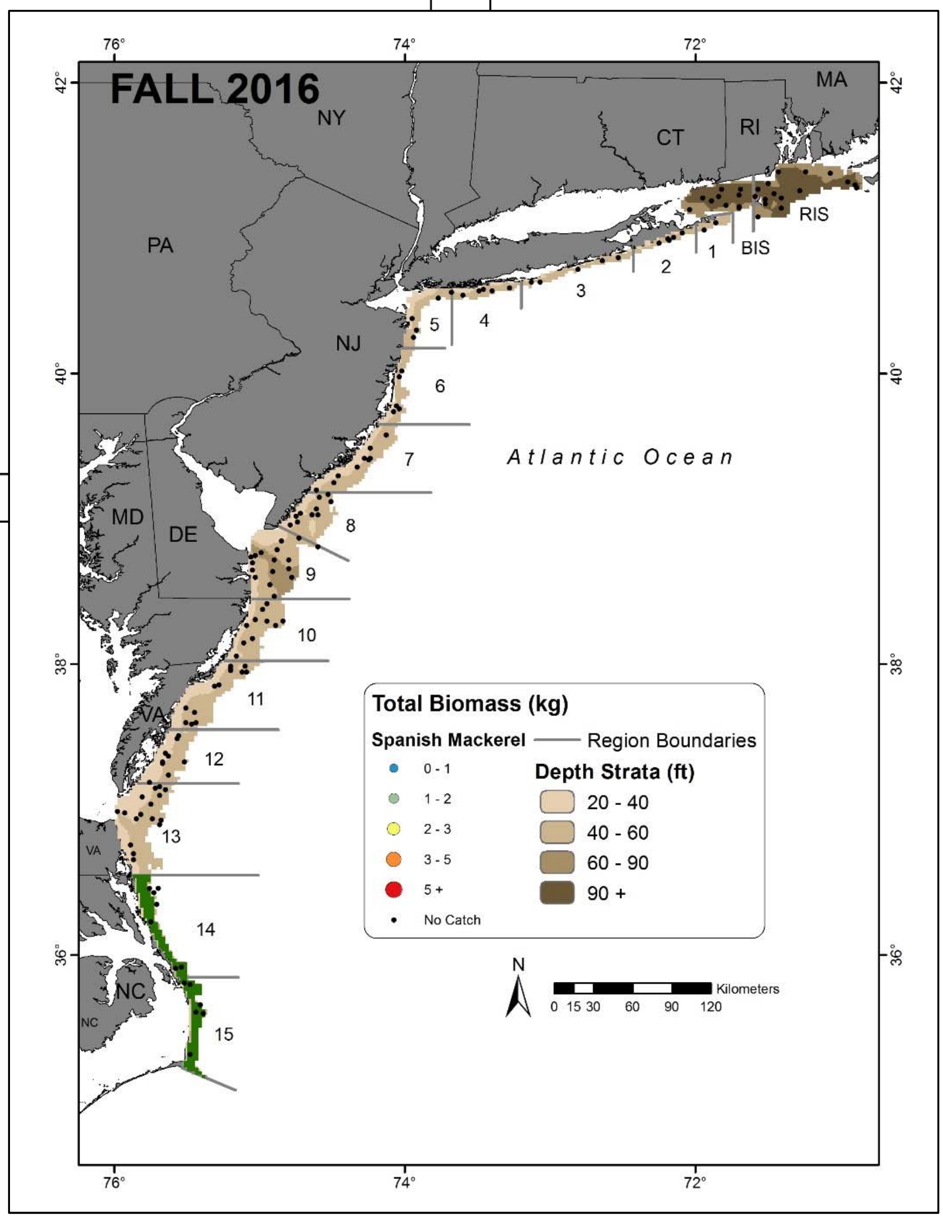
Spanish Mackerel

Sampling Priority: A

Figure 158. Spanish Mackerel biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

Table 54. Spanish Mackerel sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0	0.0	0	0	0	0	0
	2009	0	0.0	0.0	0	0	0	0	0
	2010	0	0.0	0.0	0	0	0	0	0
	2011	0	0.0	0.0	0	0	0	0	0
	2012	0	0.0	0.0	0	0	0	0	0
	2013	0	0.0	0.0	0	0	0	0	0
	2014	0	0.0	0.0	0	0	0	0	0
	2015	0	0.0	0.0	0	0	0	0	0
	2016	0	0.0	0.0	0	0	0	0	0
Fall	2007	161	42.5	46.2	161	0	0	0	0
	2008	14	2.0	7.7	14	0	0	0	0
	2009	31	3.9	7.7	31	12	0	10	10
	2010	141	9.6	38.5	141	17	0	17	17
	2011	9	0.6	7.7	9	6	0	5	0
	2012	17	3.1	15.4	17	1	0	1	1
	2013	1	0.1	0.0	1	1	0	1	0
	2014	0	0.0	0.0	0	0	0	0	0
	2015	0	0.0	0.0	0	0	0	0	0
	2016	0	0.0	0.0	0	0	0	0	0

Table 55. Spanish Mackerel geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	13	0.45	1.39	2.93	0.00	0.00	0.00
	2008	13	0.00	0.29	1.14	0.00	0.00	0.00
	2009	15	0.00	0.33	1.02	0.00	0.11	0.28
	2010	13	0.07	1.43	4.51	0.00	0.32	0.95
	2011	13	0.00	0.21	0.78	0.00	0.04	0.12
	2012	13	0.00	0.23	0.68	0.00	0.00	0.00
	2013	13	0.00	0.00	0.00	0.00	0.00	0.00
	2014	13	0.00	0.00	0.00	0.00	0.00	0.00
	2015	13	0.00	0.00	0.00	0.00	0.00	0.00
	2016	13	0.00	0.00	0.00	0.00	0.00	0.00

Figure 159. Spanish Mackerel geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

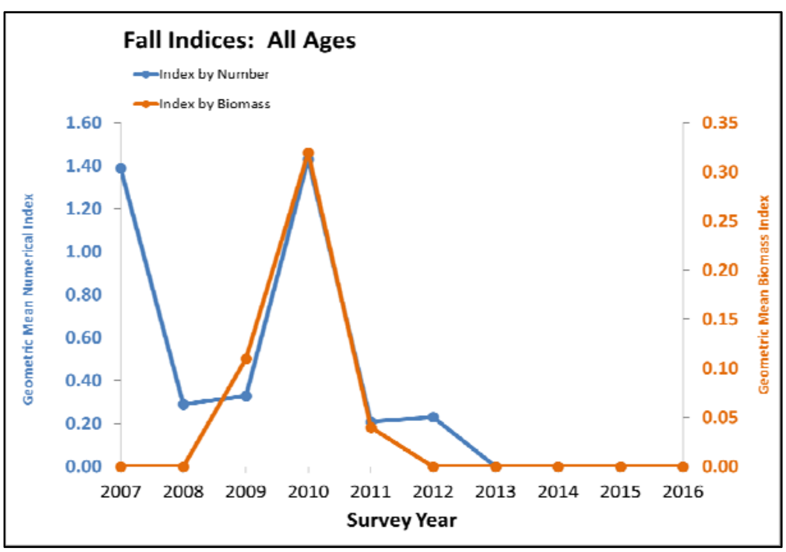


Figure 160. Spanish Mackerel length-frequency distributions, by cruise .

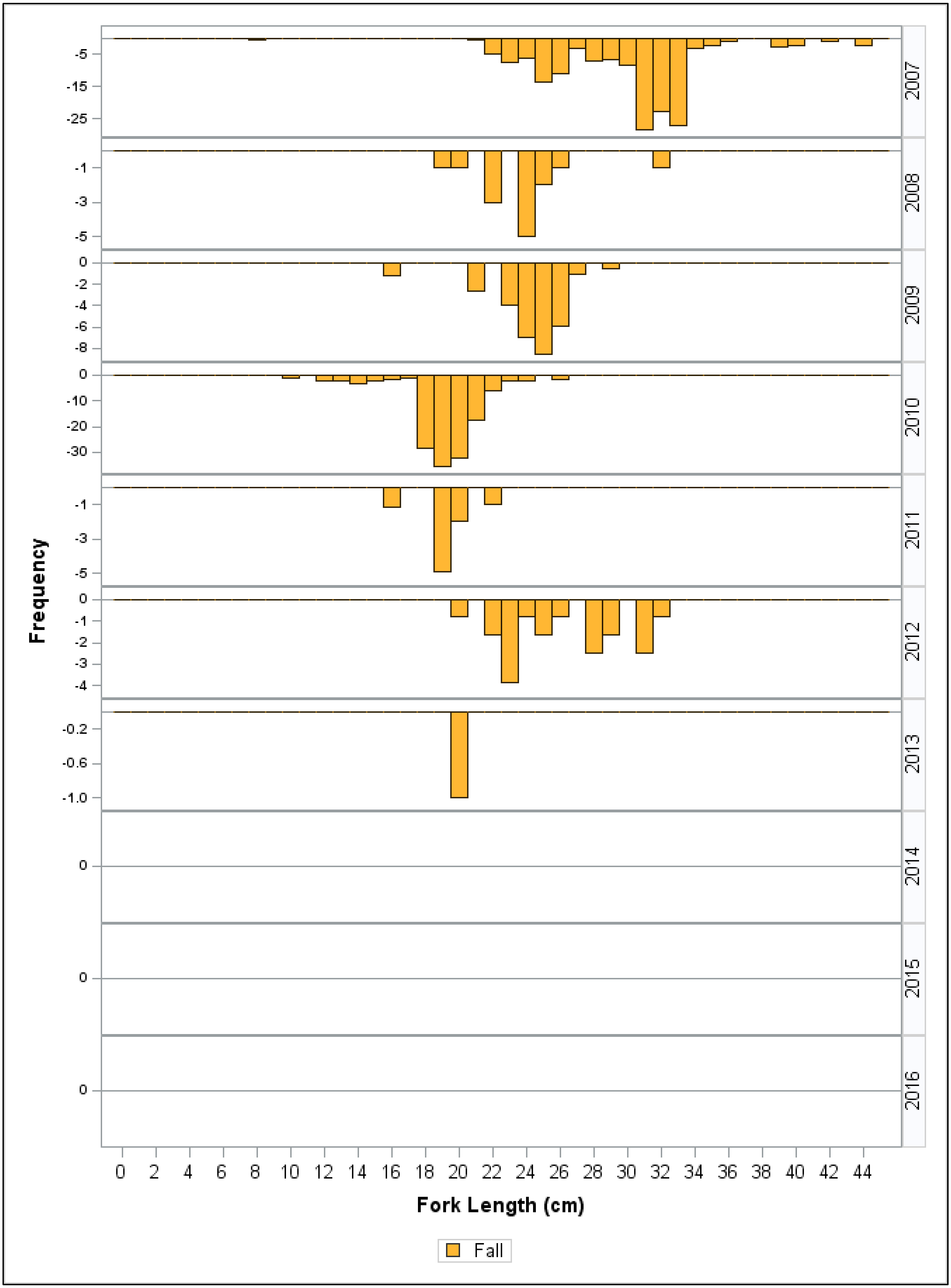
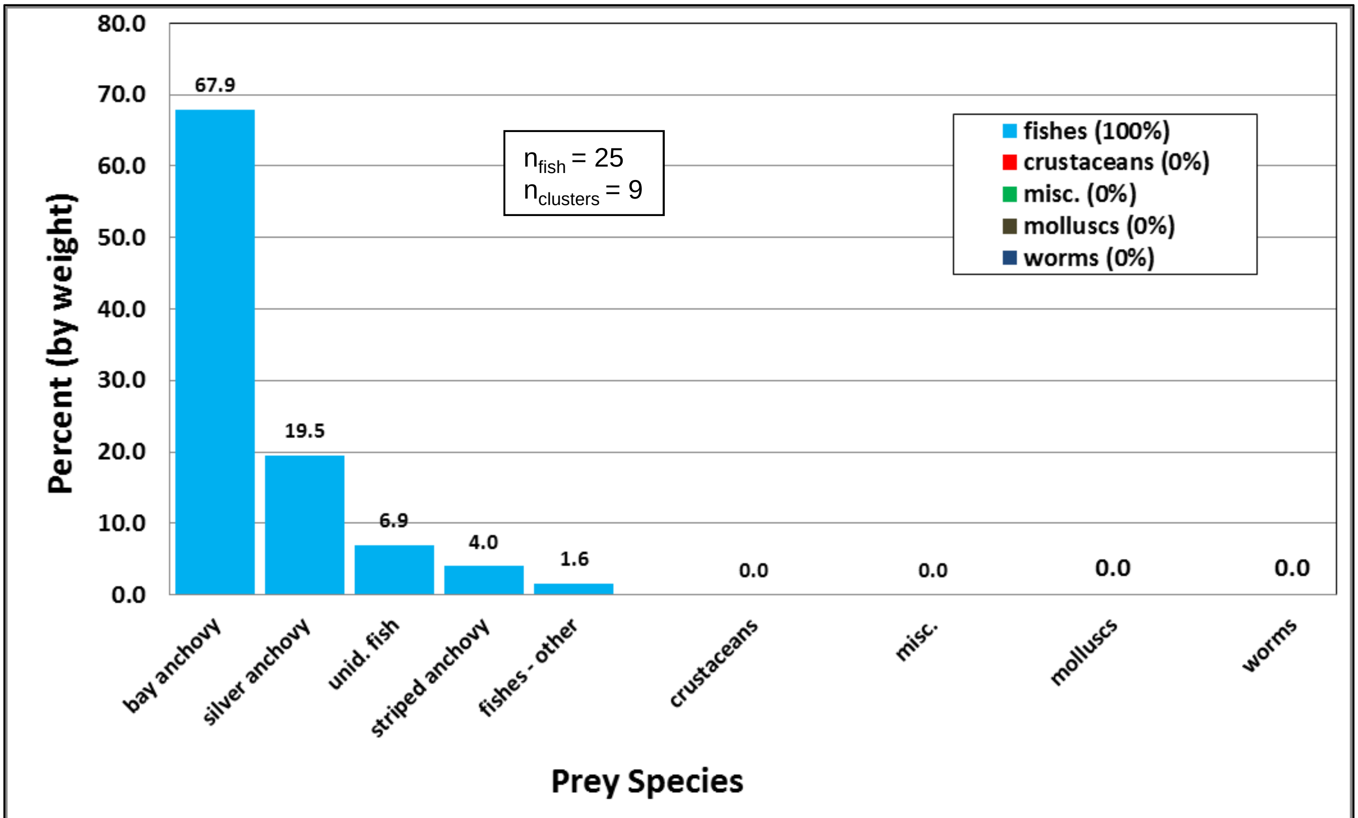
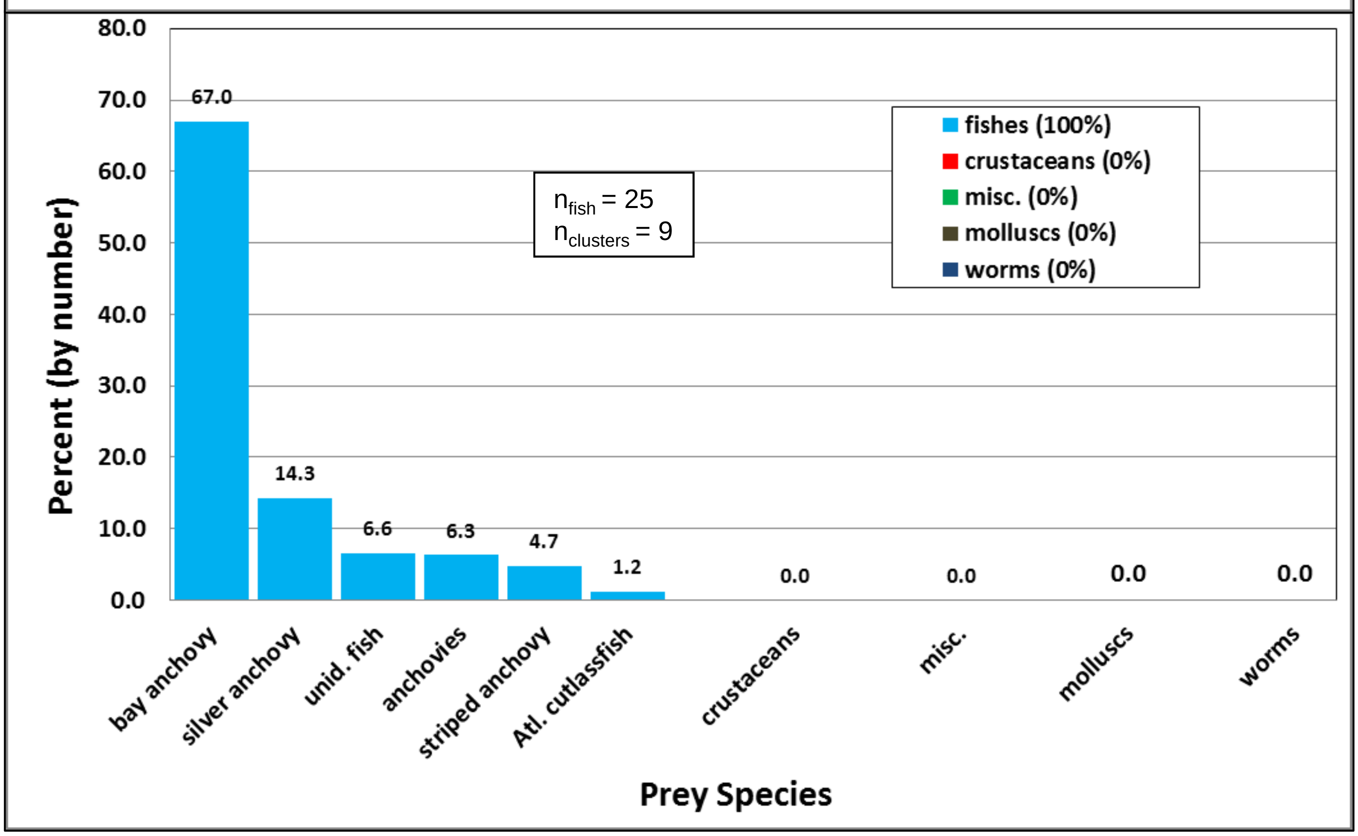


Figure 161. Spanish Mackerel diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled. Note the very small sample size.).

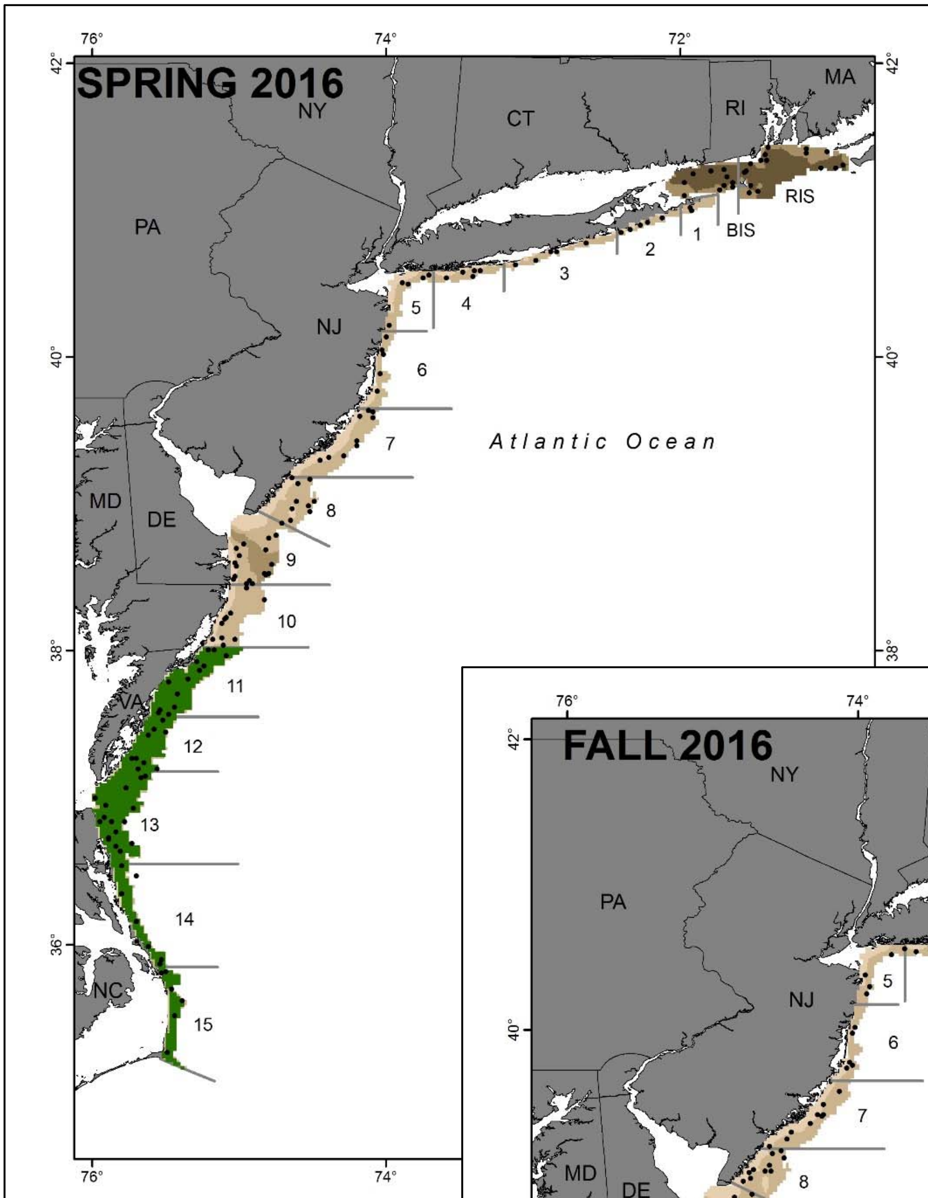


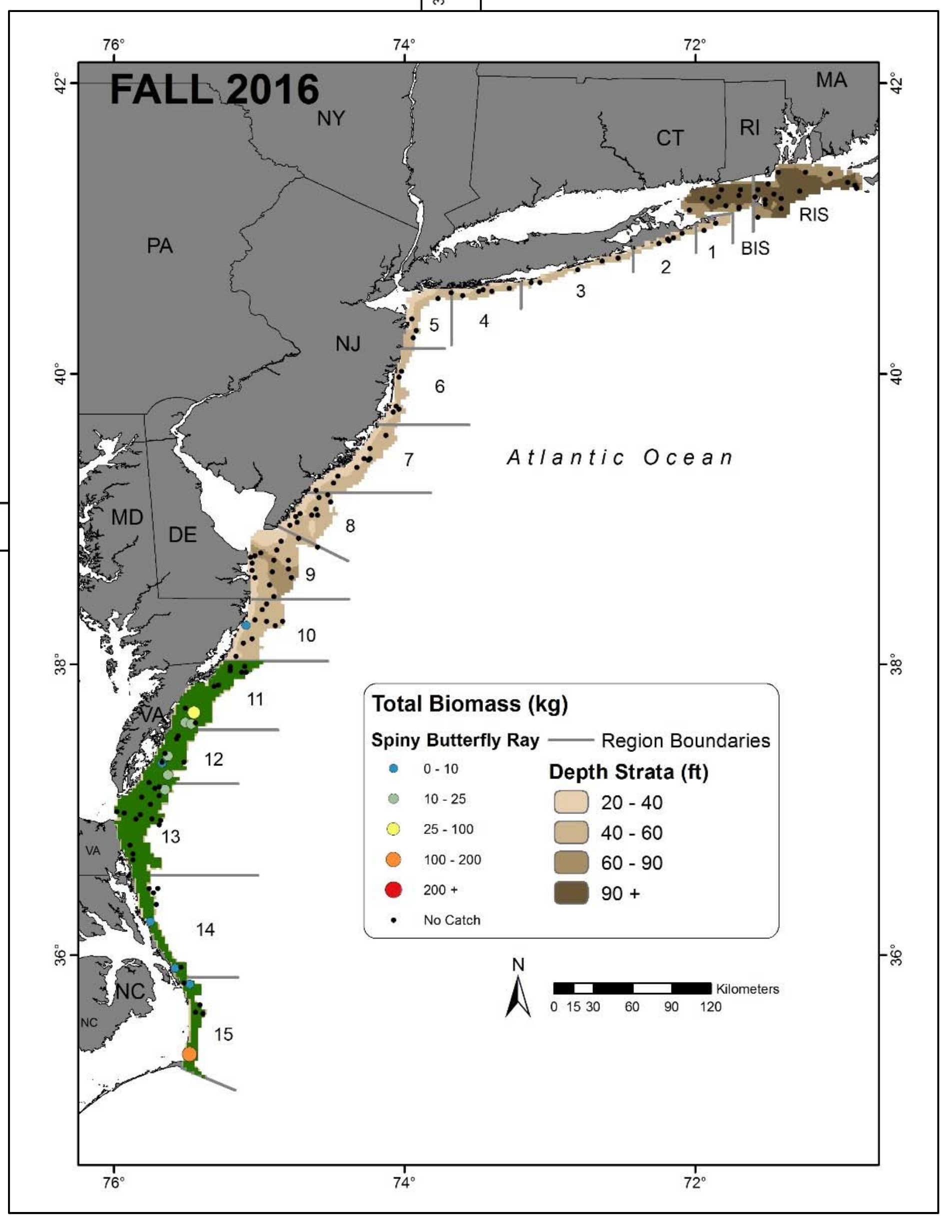


Spiny Butterfly Ray

Sampling Priority: E

Figure 162. Spiny Butterfly Ray biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

Table 56. Spiny Butterfly Ray sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0		0	N/A	N/A	N/A	N/A
	2009	0	0.0		0	N/A	N/A	N/A	N/A
	2010	0	0.0		0	N/A	N/A	N/A	N/A
	2011	0	0.0		0	N/A	N/A	N/A	N/A
	2012	8	68.9		8	6	0	0	0
	2013	0	0.0		0	N/A	N/A	N/A	N/A
	2014	0	0.0		0	N/A	N/A	N/A	N/A
	2015	0	0.0		0	N/A	N/A	N/A	N/A
	2016	0	0.0		0	N/A	N/A	N/A	N/A
Fall	2007	133	1,366.7	72.5	133	N/A	N/A	N/A	N/A
	2008	79	809.3	41.2	79	N/A	N/A	N/A	N/A
	2009	33	414.3	13.7	33	N/A	N/A	N/A	N/A
	2010	96	1,080.7	29.4	96	N/A	N/A	N/A	N/A
	2011	118	999.1	64.7	118	N/A	N/A	N/A	N/A
	2012	81	1,024.8	51.0	81	16	0	0	0
	2013	37	113.5	37.3	37	N/A	N/A	N/A	N/A
	2014	77	1,039.2	49.0	77	4	0	0	0
	2015	52	1,737.0	35.3	52	N/A	N/A	N/A	N/A
	2016	21	275.6	21.6	21	N/A	N/A	N/A	N/A

Table 57. Spiny Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	**Index**	UCI	LCI	**Index**	UCI
All	2007	56	1.04	**1.46**	1.97	4.01	**6.61**	10.56
	2008	51	0.46	**0.79**	1.19	1.56	**2.96**	5.13
	2009	53	0.05	**0.20**	0.37	0.09	**0.37**	0.72
	2010	51	0.41	**0.67**	0.98	1.11	**1.87**	2.88
	2011	51	1.04	**1.47**	1.99	2.51	**3.88**	5.80
	2012	51	0.62	**0.90**	1.23	1.71	**2.86**	4.51
	2013	51	0.26	**0.44**	0.64	0.34	**0.73**	1.24
	2014	51	0.53	**0.85**	1.23	1.85	**3.76**	6.95
	2015	51	0.33	**0.55**	0.80	1.19	**2.21**	3.71
	2016							

Figure 163. Spiny Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

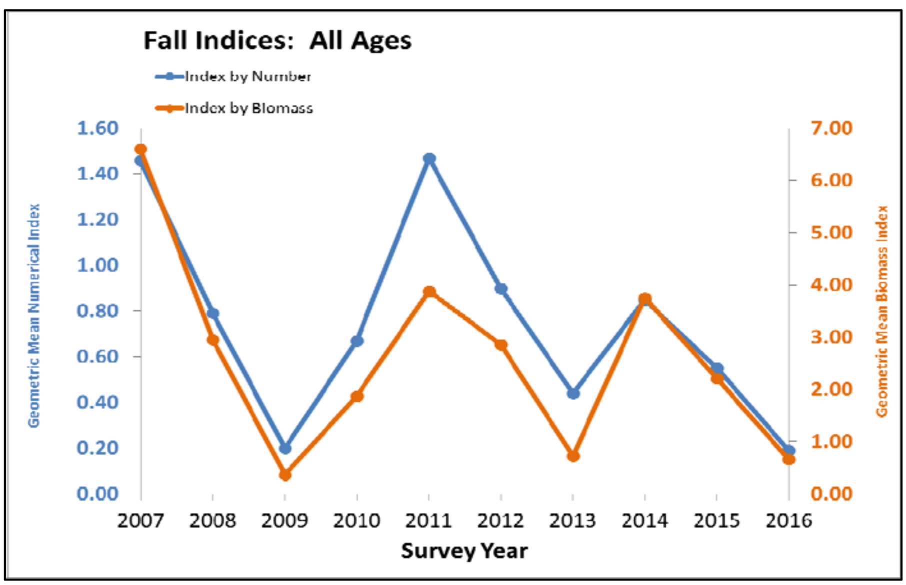


Figure 164. Spiny Butterfly Ray length-frequency distributions, by cruise.

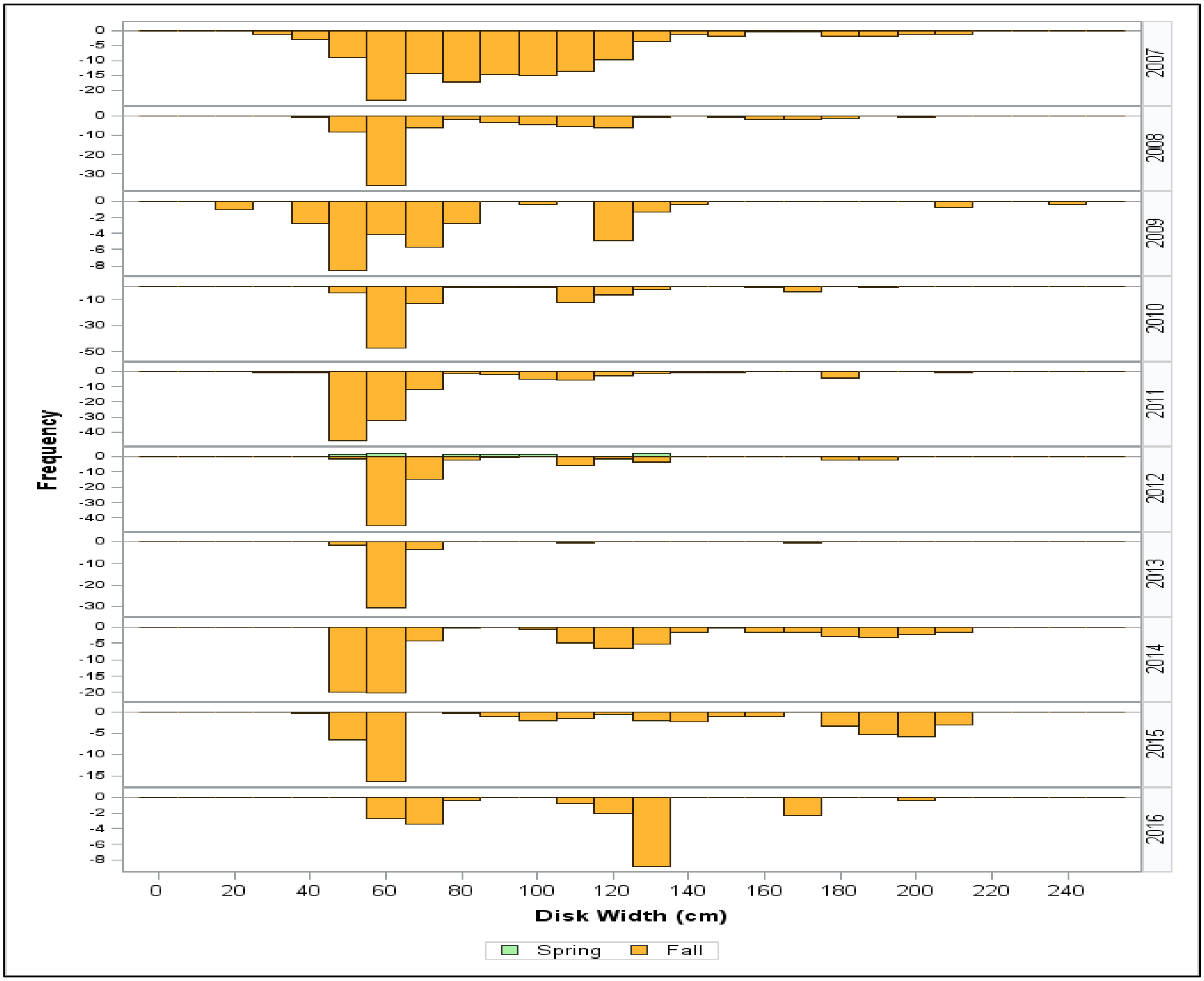
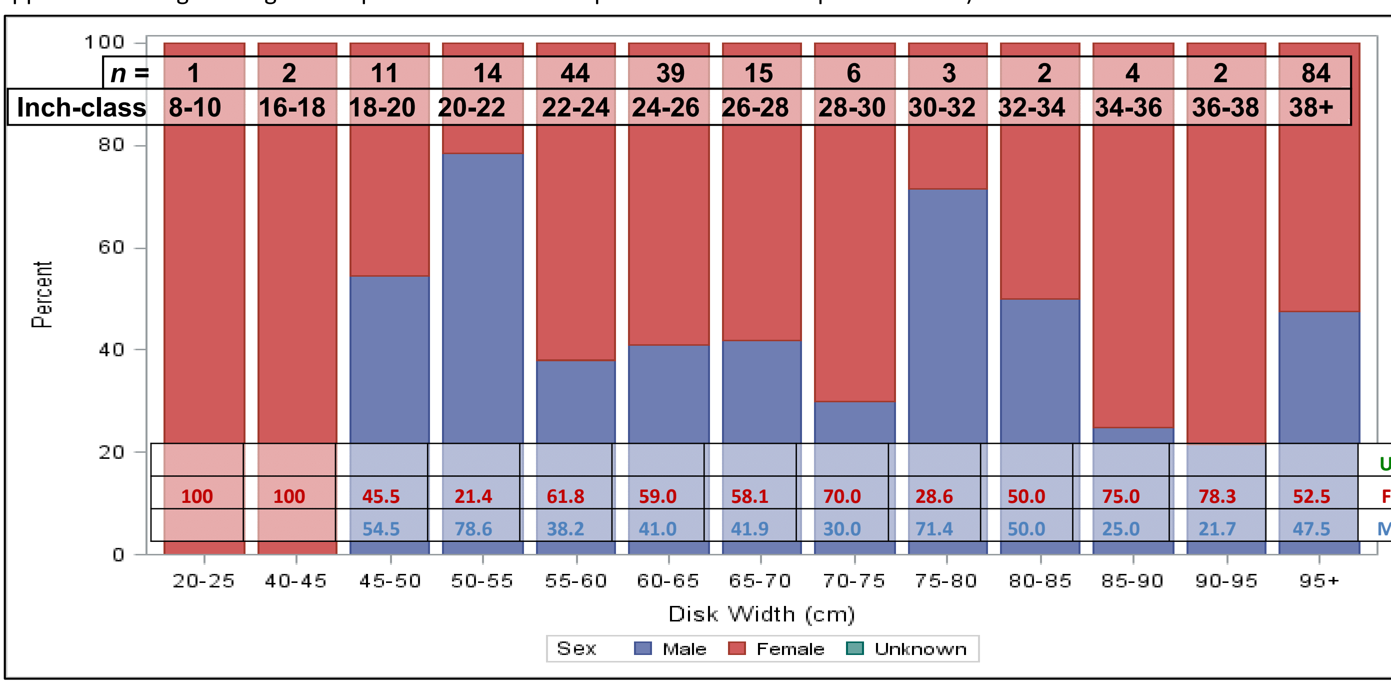


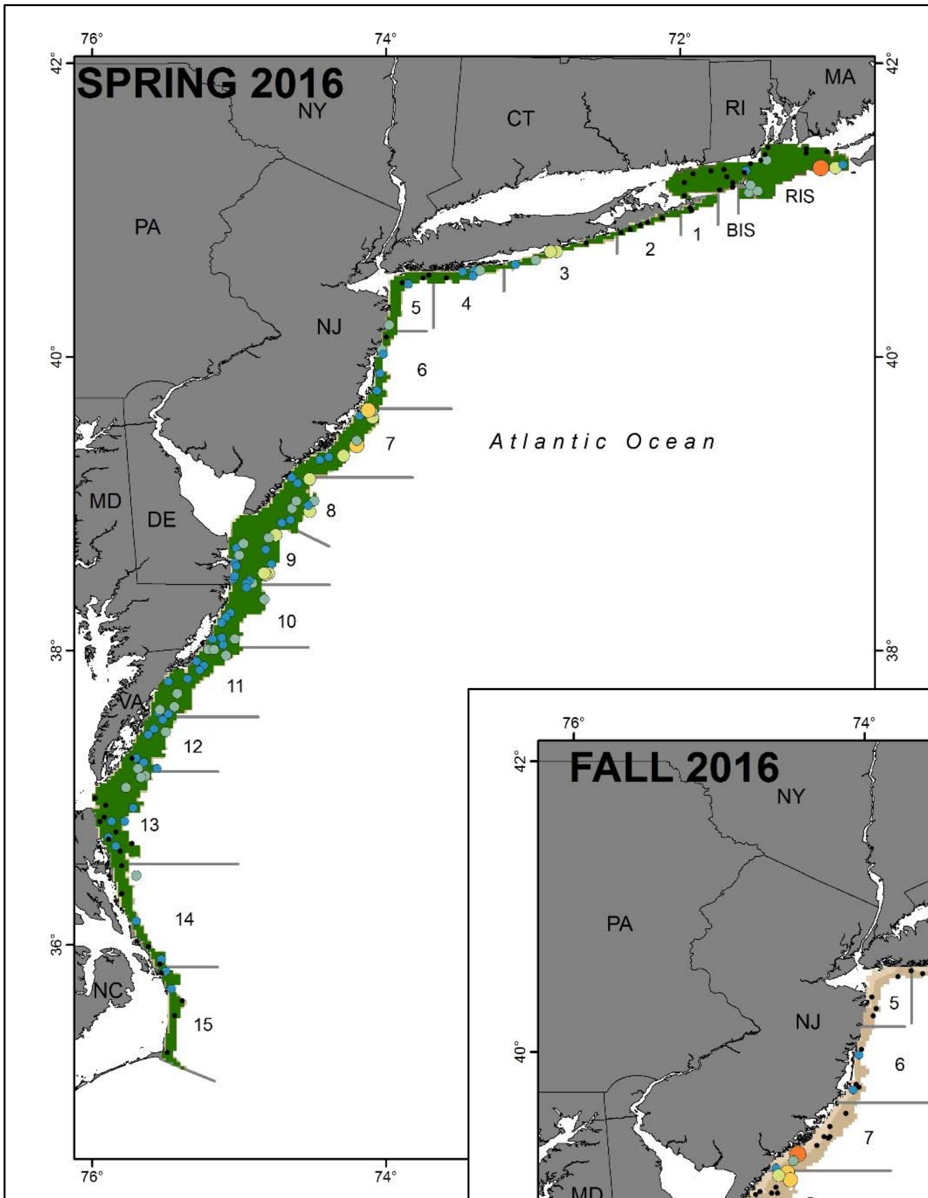
Figure 165. Spiny Butterfly Ray sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

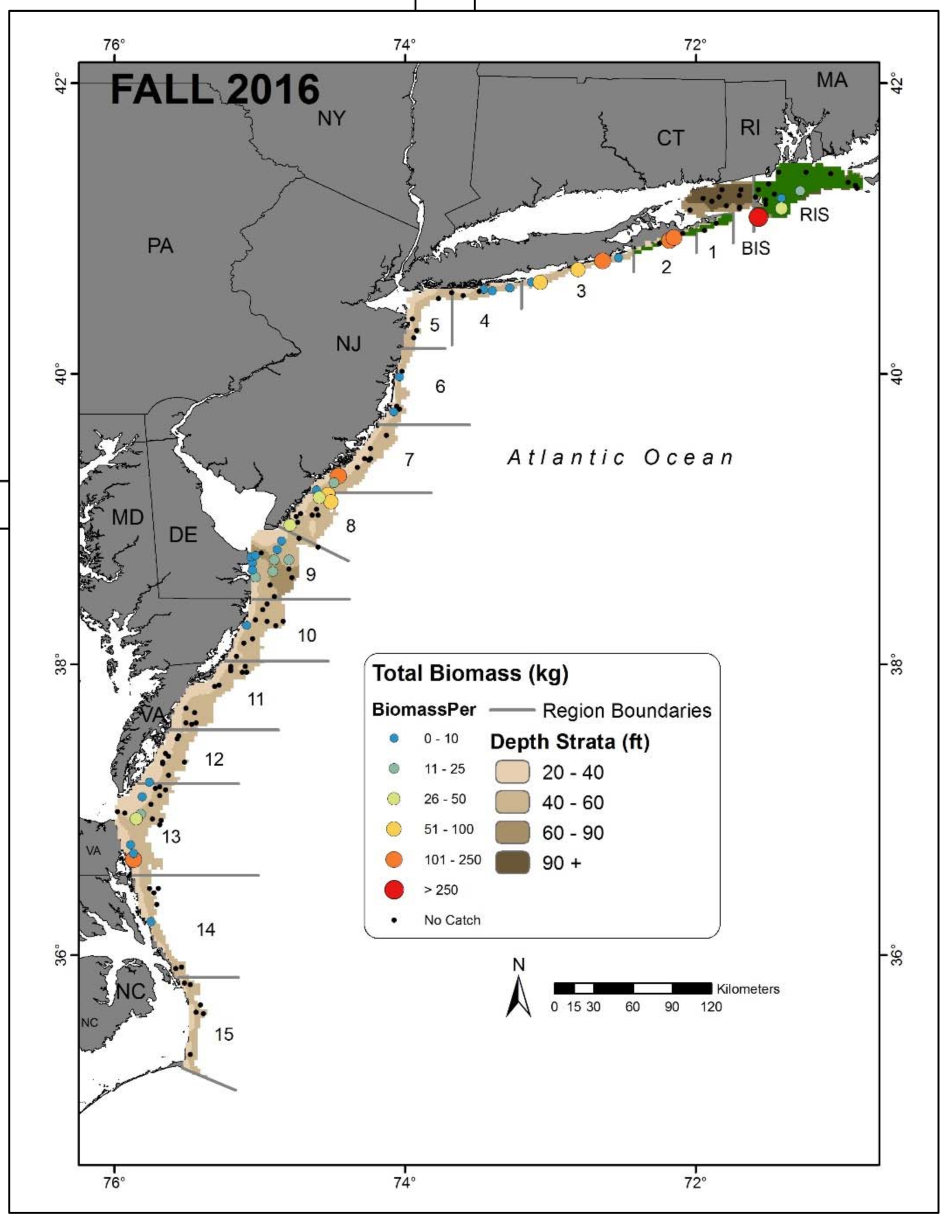


Spiny Dogfish

Sampling Priority: A

Figure 166. Spiny Dogfish biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

Table 58. Spiny Dogfish sampling rates and preserved specimen workup status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,332	3,338.2	78.0	950	325	0	247	247
	2009	1,271	3,577.5	85.3	1,137	359	0	261	250
	2010	249	804.1	39.3	249	125	0	114	108
	2011	180	548.1	44.7	180	139	0	121	114
	2012	762	2,158.1	70.0	727	264	0	231	222
	2013	1,838	4,227.8	82.7	1,738	371	0	234	228
	2014	427	1,075.2	67.3	427	252	0	165	161
	2015	989	2,966.6	66.7	738	240	0	178	178
	2016	3,061	1,321.8	68.7	3,032	345	0	218	213
Fall	2007	17	51.3	17.4	17	13	0	12	12
	2008	735	1,621.1	43.5	161	41	0	39	39
	2009	795	1,753.1	56.5	483	52	0	45	45
	2010	4	11.7	13.0	4	4	0	2	2
	2011	40	104.4	30.4	40	18	0	6	6
	2012	5	15.5	13.0	5	5	0	4	4
	2013	477	992.6	26.1	185	29	0	22	21
	2014	8	13.8	0.0	8	8	0	7	7
	2015	545	1,069.1	13.0	517	143	0	115	115
	2016	2,027	3,092.1	30.4	732	110	0	73	73

Table 59. Spiny Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	150	4.23	4.98	5.85	8.85	10.78	13.07
	2009	160	4.24	5.00	5.88	10.49	12.64	15.18
	2010	150	0.60	0.77	0.97	1.17	1.53	1.95
	2011	150	0.58	0.74	0.92	1.14	1.51	1.93
	2012	150	2.16	2.63	3.18	4.63	5.78	7.17
	2013	150	3.66	4.48	5.43	6.99	8.80	11.01
	2014	150	1.55	1.83	2.13	2.86	3.53	4.32
	2015	150	1.79	2.31	2.92	3.80	4.97	6.44
	2016	150	3.32	4.10	5.02	2.89	3.57	4.36

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	22	0.02	0.35	0.80	0.05	0.62	1.51
	2008	21	0.58	3.39	11.21	0.90	5.41	20.60
	2009	22	0.94	3.02	7.34	1.49	4.96	13.31
	2010	21	0.00	0.15	0.35	0.00	0.30	0.75
	2011	21	0.04	0.48	1.11	0.07	0.76	1.91
	2012	21	0.00	0.18	0.43	0.00	0.34	0.88
	2013	21	0.10	0.59	1.31	0.15	0.89	2.08
	2014	21	0.00	0.00	0.00	0.00	0.00	0.00
	2015	21	0.00	0.32	0.84	0.00	0.44	1.21
	2016	21	0.00	1.33	4.50	0.01	1.57	5.54

Figure 167. Spiny Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

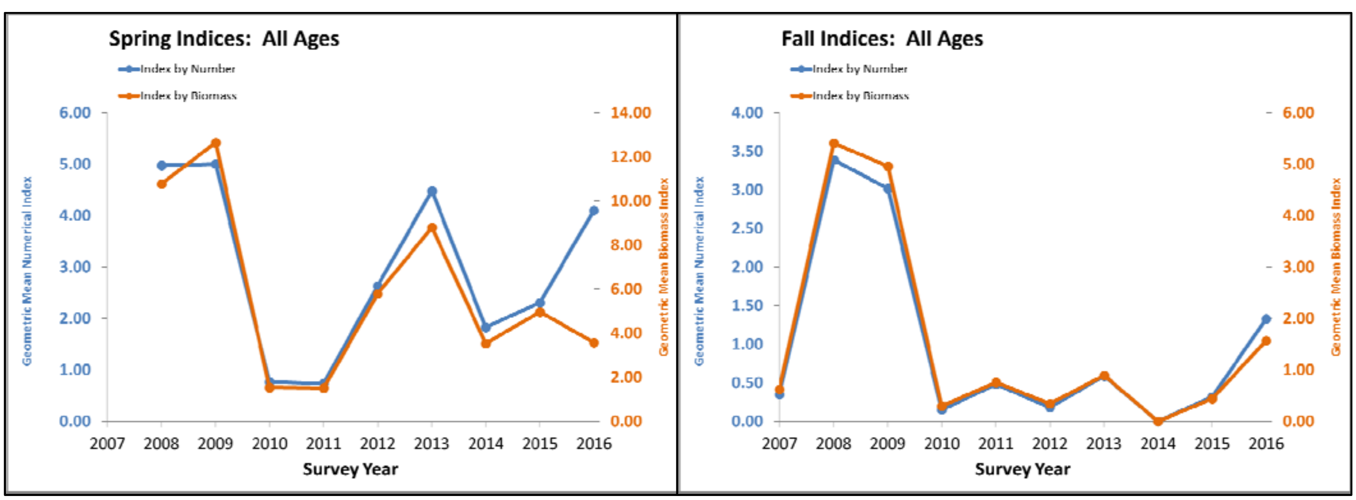


Figure 168. Spiny Dogfish length-frequency distributions, by cruise.

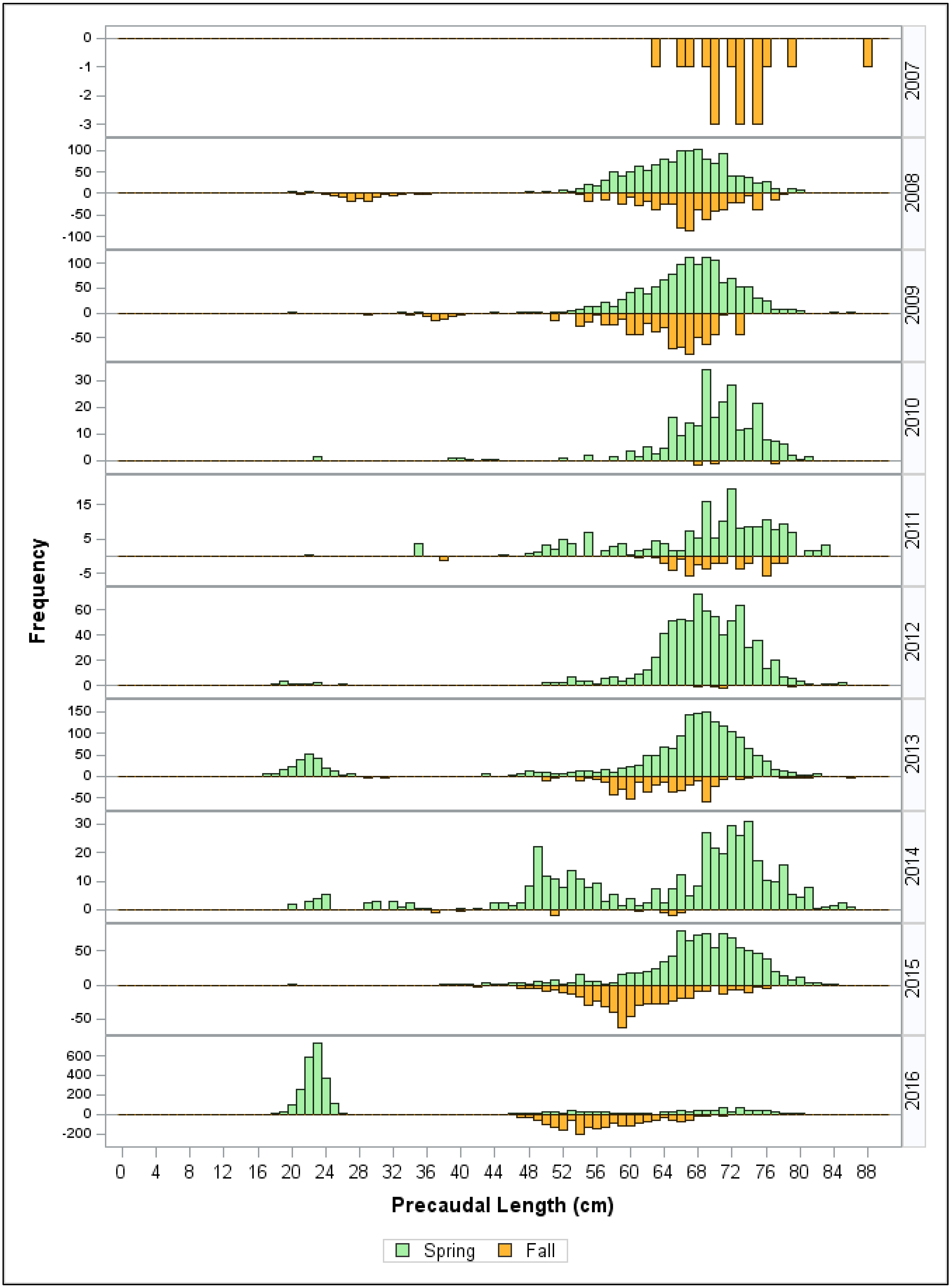


Figure 169. Spiny Dogfish length-frequency distributions, by cruise and sex.

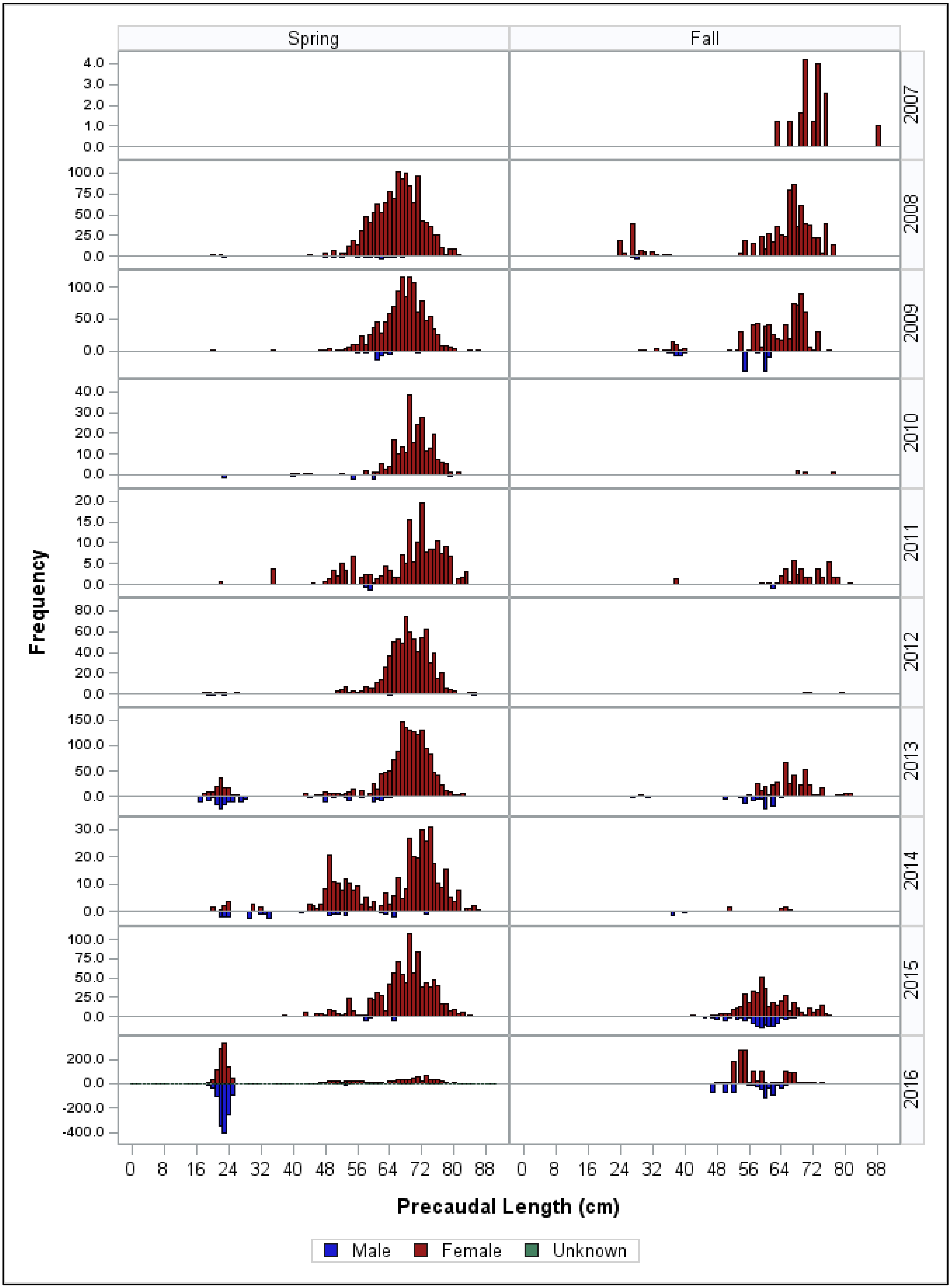


Figure 170. Spiny Dogfish sex ratio, by length group, for all cruises pooled, 2007-2016.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

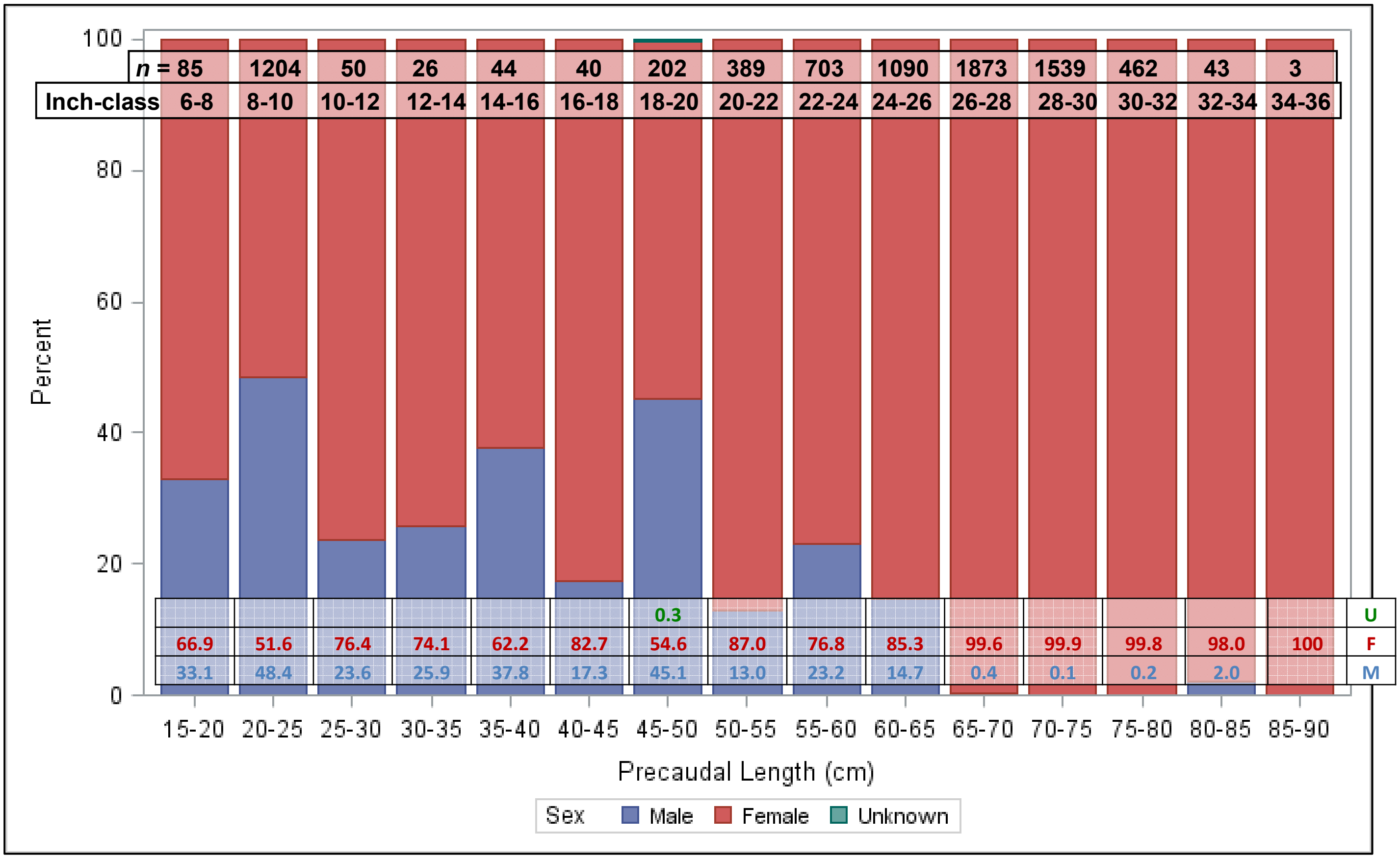


Figure 171. Spiny Dogfish maturity at length, by sex for all cruises pooled, 2007-2016.

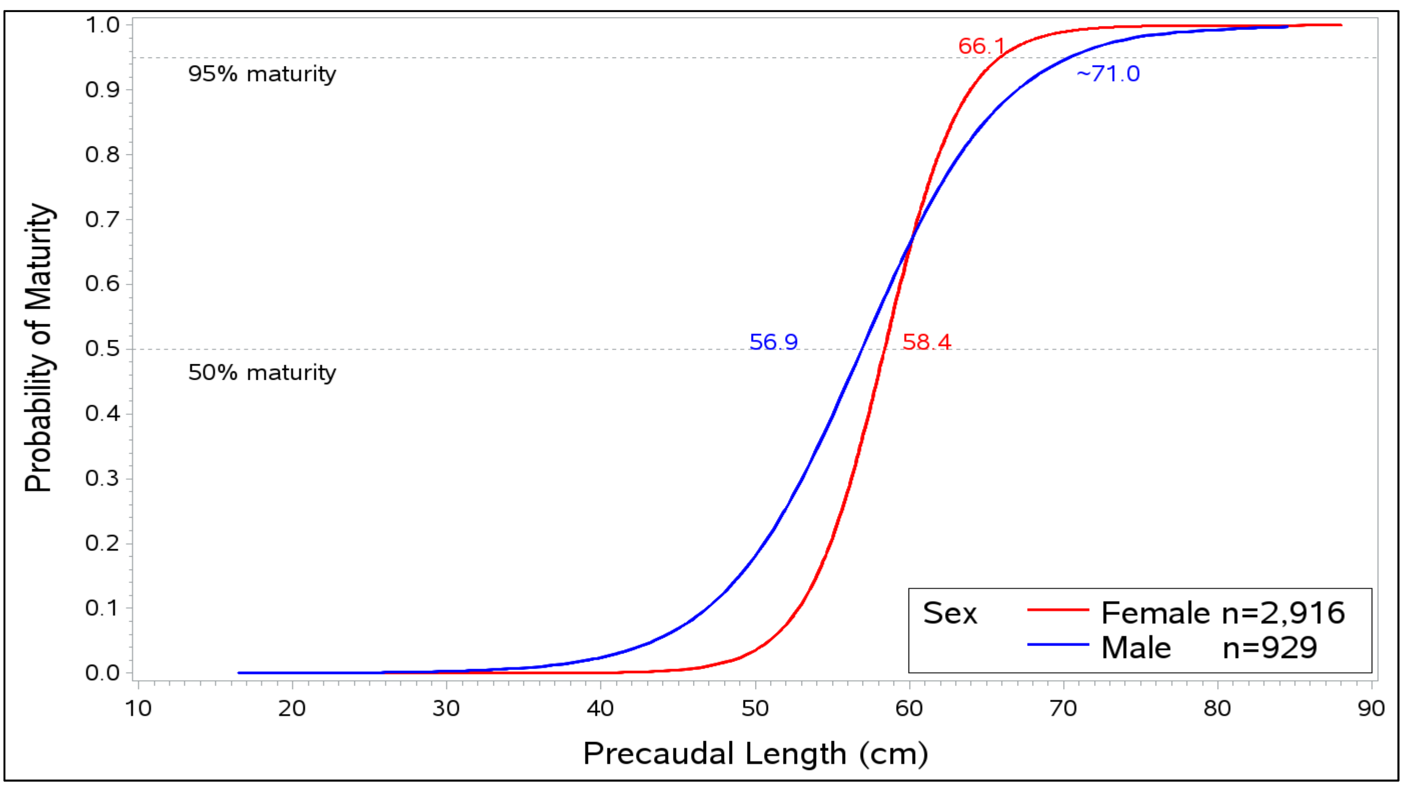


Figure 172. Spiny Dogfish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

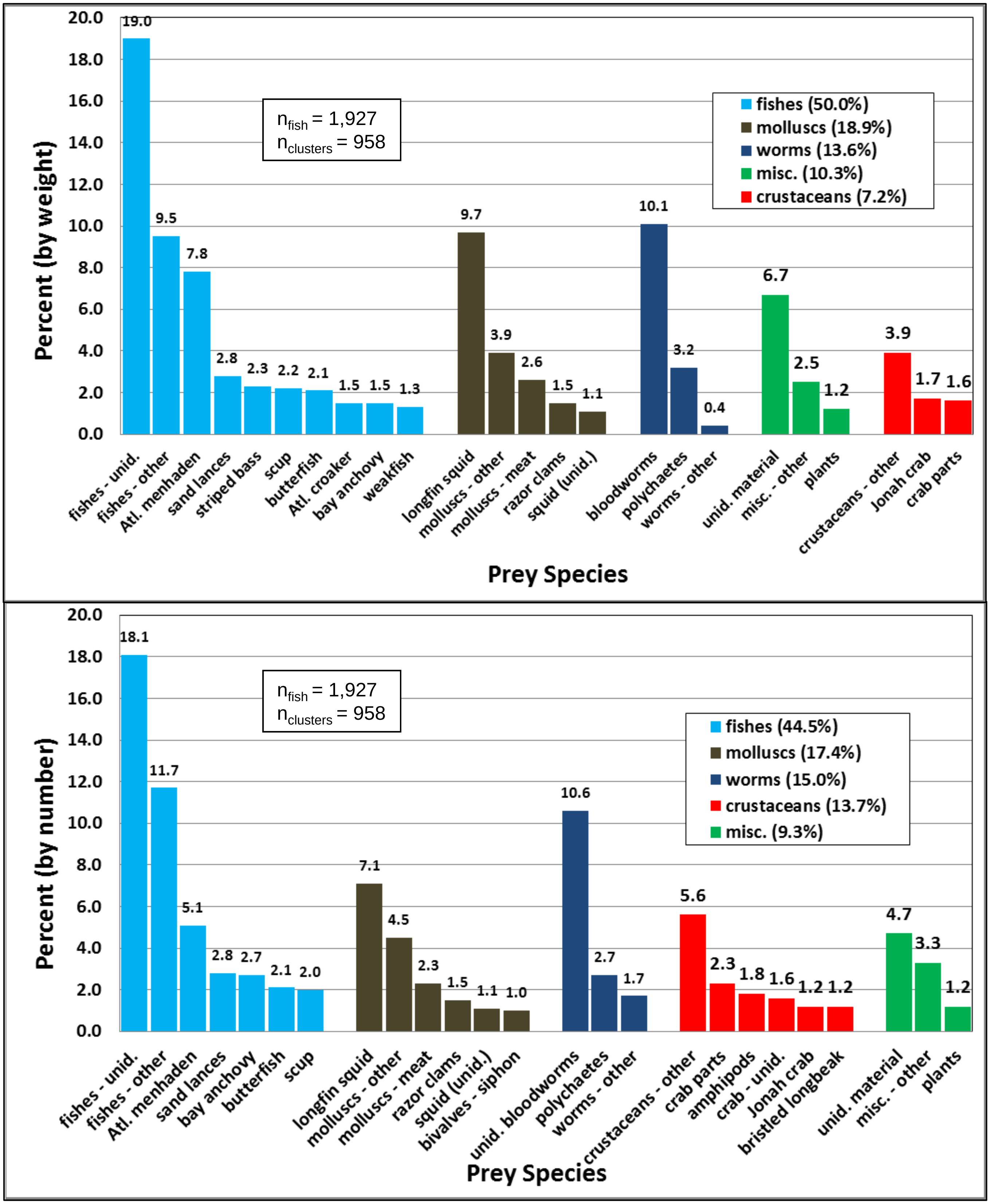
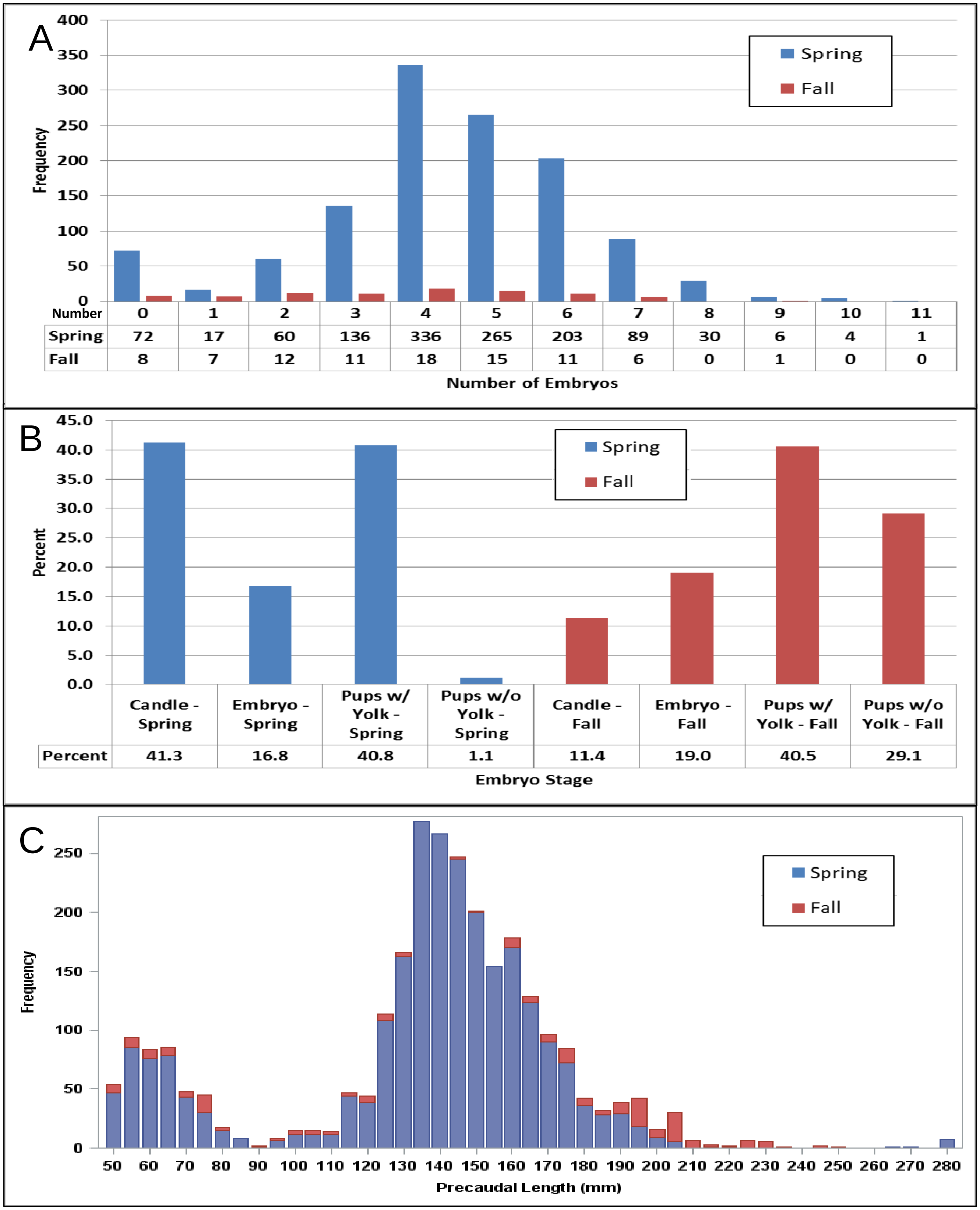
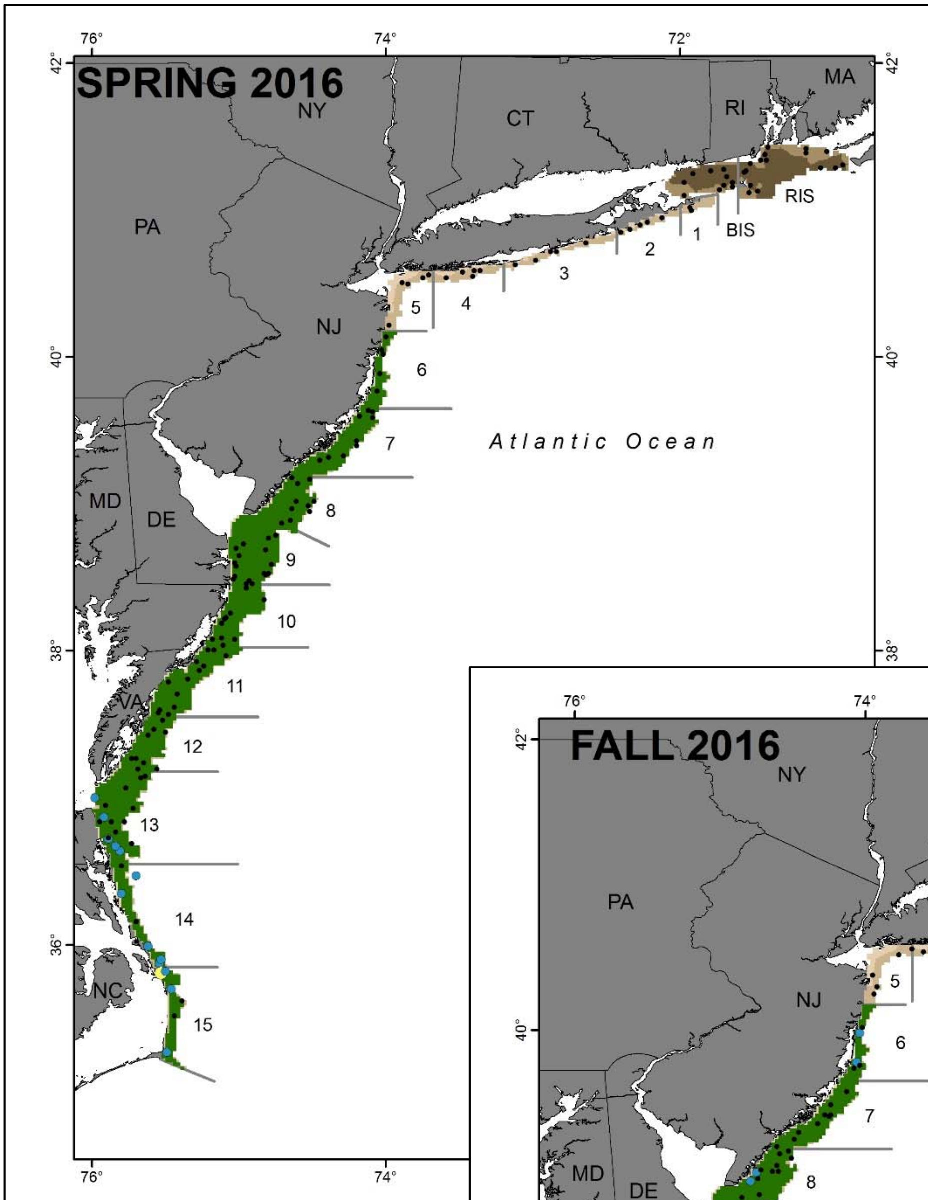


Figure 173. Spiny Dogfish reproductive data by season; A – frequency histogram of number of embryos found in females, B – frequency histogram of embryo stages, C – length-frequency histogram of embryos.

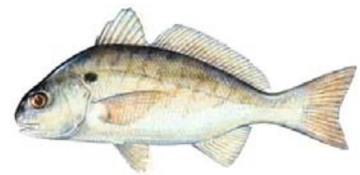


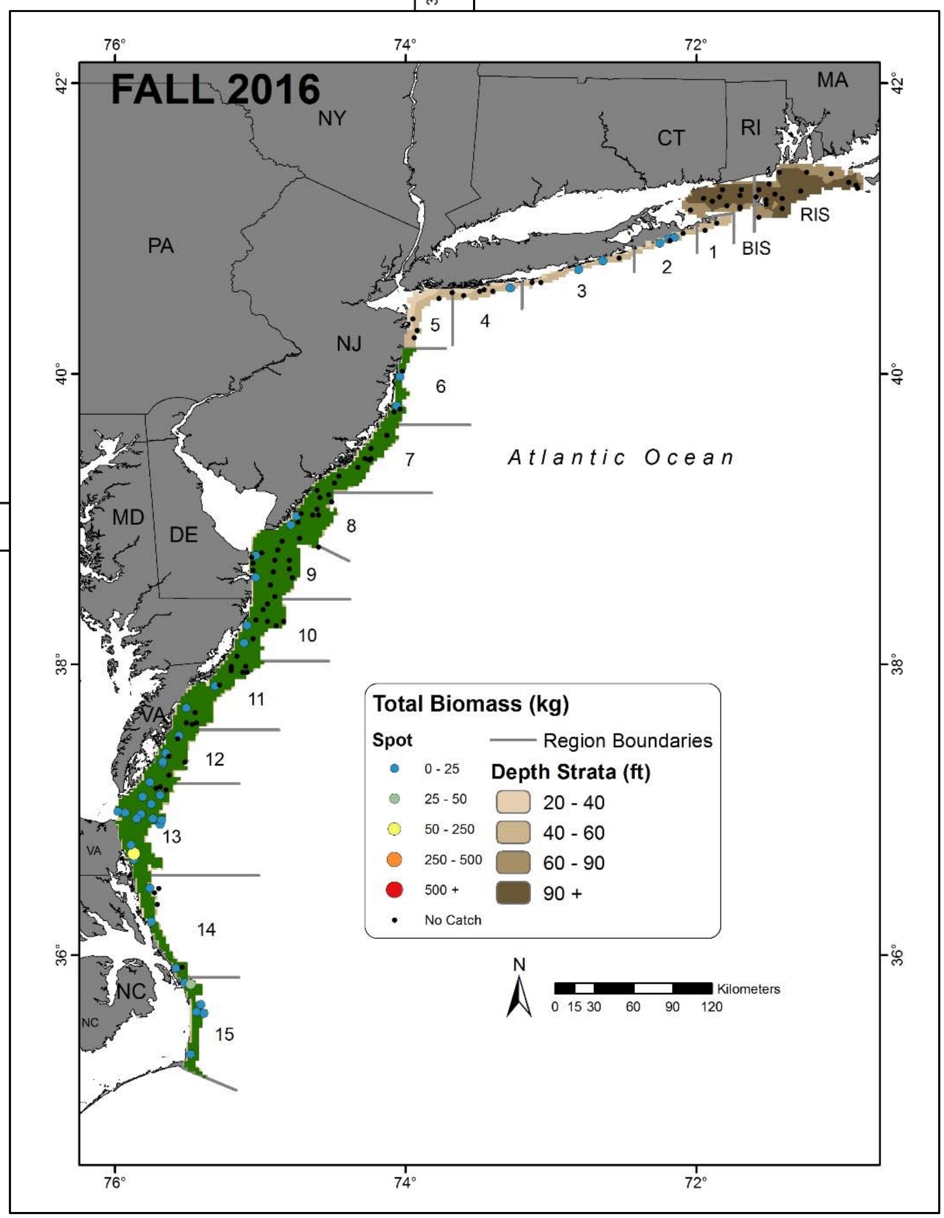


Spot

Sampling Priority: A

Figure 174. Spot biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

Table 60. Spot sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	28,561	1,059.2	69.0	1,220	61	61	N/A	N/A
	2009	29,643	824.9	62.1	3,454	59	0	N/A	N/A
	2010	19,664	822.1	41.4	894	44	44	3	3
	2011	15,390	557.0	44.8	2,416	52	52	N/A	N/A
	2012	1,600	78.0	69.0	873	49	0	14	0
	2013	71,460	2,572.1	100.0	10,725	260	0	N/A	N/A
	2014	5,960	271.6	89.7	1,734	133	0	N/A	N/A
	2015	1,222	39.1	51.7	877	44	0	N/A	N/A
	2016	2,696	115.5	48.3	291	32	0	N/A	N/A
Fall	2007	44,437	3,942.1	57.5	2,507	160	160	9	0
	2008	56,878	3,872.0	70.1	3,435	213	213	N/A	N/A
	2009	8,428	593.0	63.2	2,699	169	59	N/A	N/A
	2010	95,990	5,060.0	60.9	6,861	181	181	N/A	N/A
	2011	6,407	538.3	56.3	1,394	147	147	N/A	N/A
	2012	210,331	15,096.9	83.9	23,298	338	338	53	0
	2013	19,818	1,871.7	54.0	4,827	218	218	N/A	N/A
	2014	1,693	127.2	42.5	743	113	113	N/A	N/A
	2015	1,088	81.5	27.6	336	68	68	N/A	N/A
	2016	3,063	206.1	40.2	1,165	98	98	N/A	N/A

Table 61. Spot geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age class.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	101	1.22	1.90	2.80	0.40	0.64	0.93
	2009	107	0.96	1.70	2.72	0.26	0.54	0.87
	2010	102	0.24	0.66	1.21	0.02	0.23	0.48
	2011	102	0.79	1.45	2.37	0.24	0.49	0.79
	2012	102	0.61	0.95	1.36	0.13	0.26	0.40
	2013	102	37.58	53.72	76.63	3.00	4.15	5.62
	2014	102	1.68	2.51	3.59	0.29	0.50	0.76
	2015	102	0.38	0.59	0.84	0.08	0.14	0.21
	2016	102	0.14	0.36	0.62	0.01	0.10	0.20
0	2007							
	2008	101	0.00	0.00	0.00	0.00	0.00	0.00
	2009	107	0.00	0.00	0.00	0.00	0.00	0.00
	2010	102	0.00	0.00	0.00	0.00	0.00	0.00
	2011	102	0.00	0.00	0.00	0.00	0.00	0.00
	2012	102	0.00	0.00	0.00	0.00	0.00	0.00
	2013	102	0.00	0.00	0.00	0.00	0.00	0.00
	2014	102	0.00	0.00	0.00	0.00	0.00	0.00
	2015	102	0.00	0.00	0.00	0.00	0.00	0.00
	2016	102	0.00	0.00	0.00	0.00	0.00	0.00
1	2007							
	2008	101	1.21	1.90	2.80	0.46	0.75	1.11
	2009	107	0.96	1.70	2.72	0.28	0.57	0.92
	2010	102	0.24	0.66	1.21	0.01	0.25	0.55
	2011	102	0.79	1.45	2.37	0.24	0.51	0.84
	2012	102	0.61	0.95	1.36	0.14	0.28	0.43
	2013	102	37.32	53.29	75.93	3.24	4.47	6.06
	2014	102	1.64	2.45	3.50	0.28	0.50	0.75
	2015	102	0.37	0.59	0.83	0.07	0.13	0.19
	2016	102	0.14	0.35	0.61	0.01	0.10	0.21
2+	2007							
	2008	101	0.03	0.17	0.31	0.00	0.04	0.09
	2009	107	0.02	0.08	0.15	0.00	0.02	0.05
	2010	102	0.00	0.12	0.29	0.00	0.03	0.09
	2011	102	0.01	0.07	0.13	0.00	0.01	0.02
	2012	102	0.00	0.07	0.14	0.00	0.01	0.03
	2013	102	0.26	0.51	0.82	0.03	0.12	0.22
	2014	102	0.08	0.18	0.28	0.00	0.03	0.07
	2015	102	0.01	0.02	0.04	0.00	0.00	0.00
	2016	102	0.00	0.01	0.03	0.00	0.00	0.01

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	102	7.69	13.45	23.04	2.21	3.55	5.45
	2008	102	18.40	32.51	56.86	4.12	6.28	9.35
	2009	107	3.41	4.95	7.02	0.69	1.03	1.44
	2010	102	7.52	13.47	23.57	1.69	2.72	4.12
	2011	102	2.81	4.12	5.86	0.77	1.10	1.50
	2012	102	72.14	119.96	199.04	10.49	15.75	23.42
	2013	102	4.25	7.39	12.43	1.17	1.91	2.90
	2014	102	0.96	1.45	2.07	0.23	0.36	0.50
	2015	102	0.42	0.71	1.07	0.11	0.21	0.33
	2016	102	0.96	1.52	2.23	0.24	0.43	0.65
0	2007	102	6.82	11.84	20.07	2.86	4.82	7.78
	2008	102	17.26	30.30	52.66	5.62	9.03	14.19
	2009	107	3.14	4.54	6.40	0.65	0.99	1.41
	2010	102	7.24	12.95	22.62	1.92	3.11	4.77
	2011	102	2.35	3.42	4.82	0.74	1.12	1.59
	2012	102	65.48	108.34	178.85	9.97	14.95	22.19
	2013	102	3.55	6.18	10.34	1.00	1.66	2.53
	2014	102	0.82	1.23	1.73	0.20	0.31	0.44
	2015	102	0.38	0.66	1.00	0.10	0.25	0.42
	2016	102	0.87	1.38	2.04	0.23	0.44	0.69
1	2007	102	3.12	5.05	7.88	1.35	2.29	3.60
	2008	102	4.24	6.63	10.11	1.43	2.16	3.11
	2009	107	0.72	1.12	1.60	0.09	0.23	0.38
	2010	102	1.43	2.22	3.26	0.36	0.59	0.85
	2011	102	1.13	1.64	2.26	0.35	0.57	0.84
	2012	102	11.82	17.95	27.01	1.98	2.93	4.19
	2013	102	1.61	2.67	4.17	0.45	0.80	1.24
	2014	102	0.34	0.54	0.77	0.07	0.12	0.18
	2015	102	0.14	0.27	0.42	0.03	0.10	0.19
	2016	102	0.30	0.50	0.74	0.05	0.13	0.22
2+	2007	102	0.21	0.36	0.53	0.08	0.22	0.39
	2008	102	0.19	0.32	0.46	0.04	0.09	0.14
	2009	107	0.01	0.05	0.10	0.00	0.01	0.02
	2010	102	0.06	0.10	0.14	0.01	0.01	0.02
	2011	102	0.05	0.11	0.17	0.02	0.04	0.06
	2012	102	0.43	0.68	0.98	0.07	0.15	0.23
	2013	102	0.14	0.29	0.47	0.01	0.12	0.24
	2014	102	0.01	0.03	0.06	0.00	0.01	0.01
	2015	102	0.00	0.01	0.02	0.00	0.00	0.01
	2016	102	0.01	0.02	0.04	0.00	0.00	0.01

Figure 175. Spot geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys and by age class.

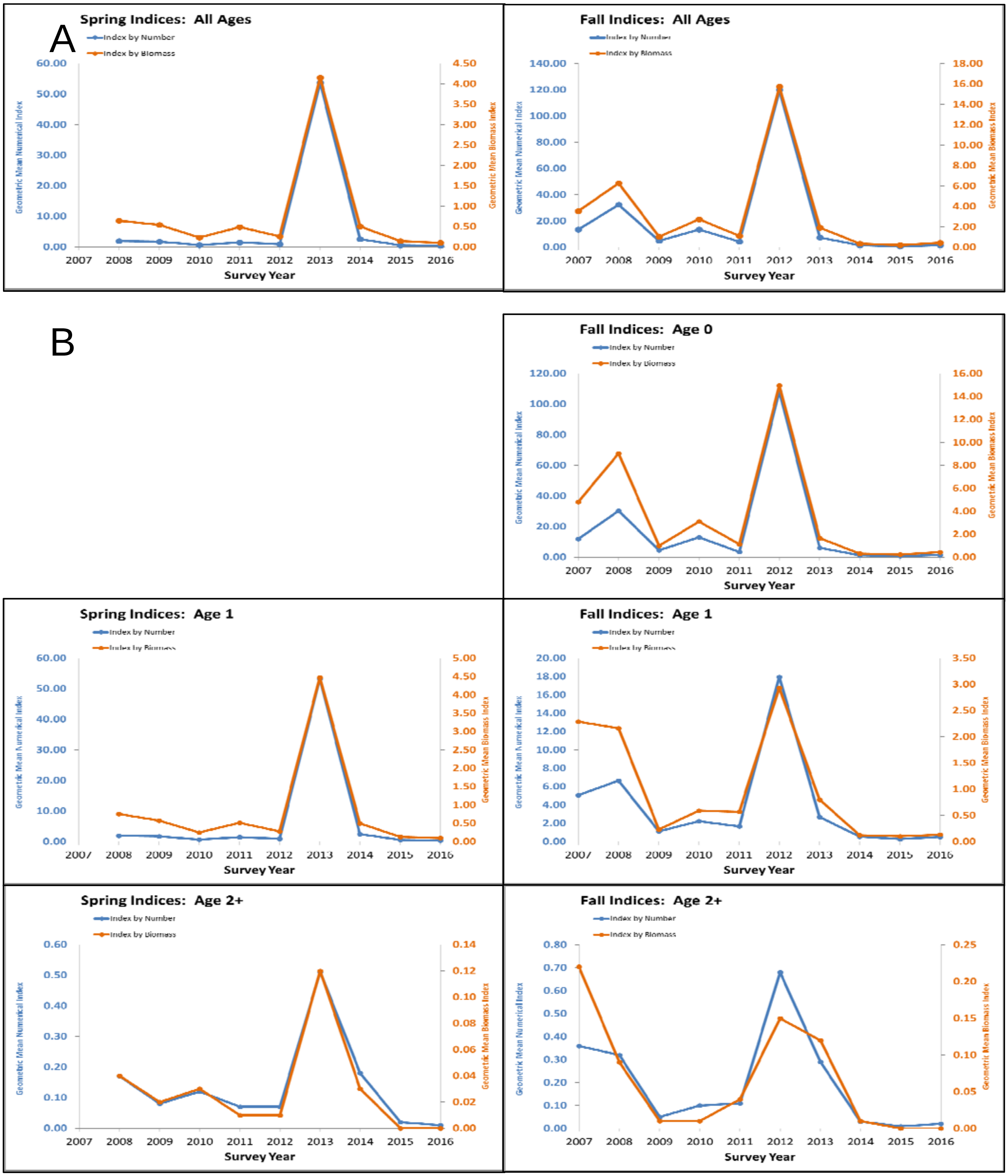


Figure 176. Spot length-frequency distributions, by cruise.

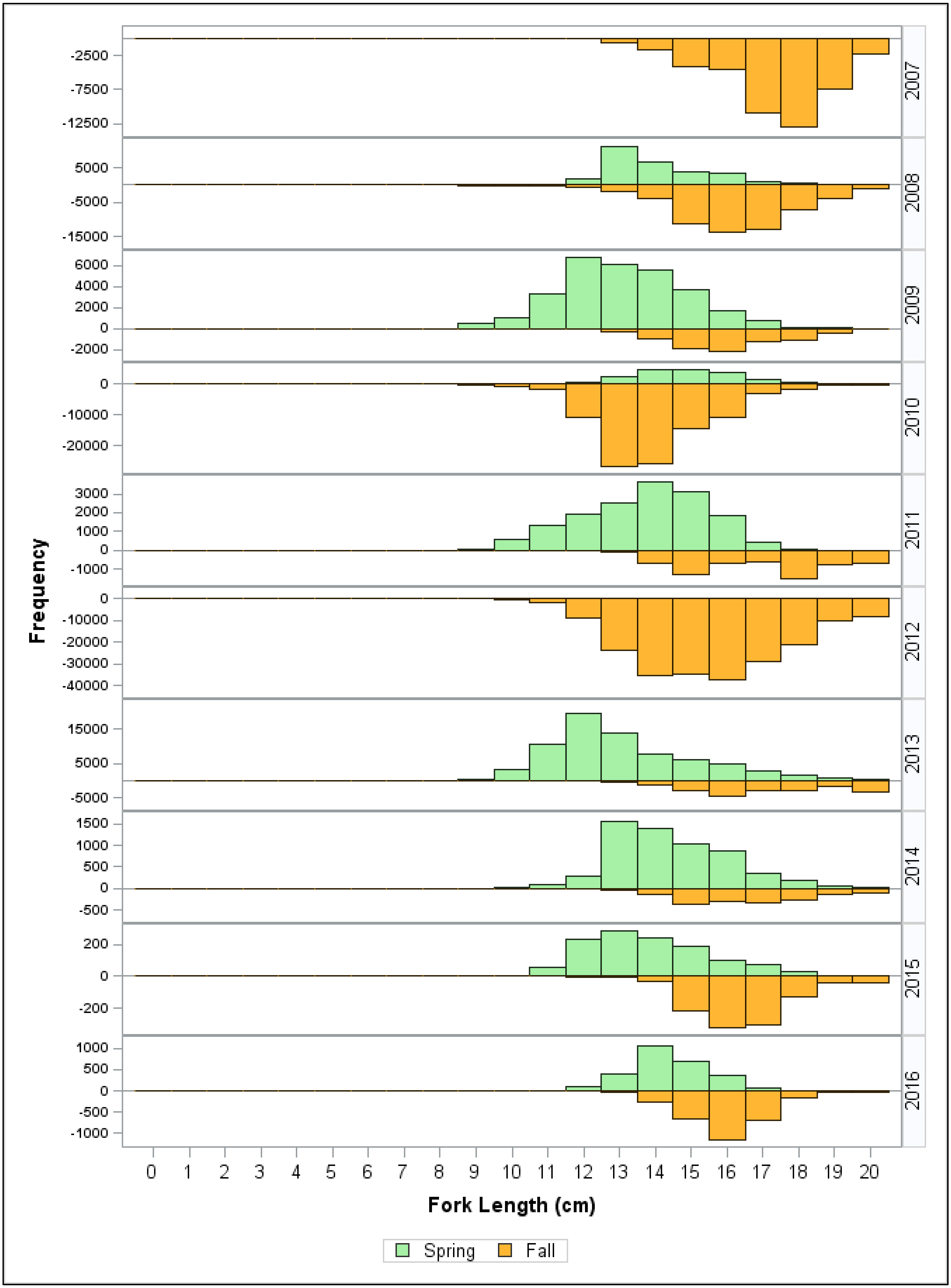


Figure 177. Spot sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

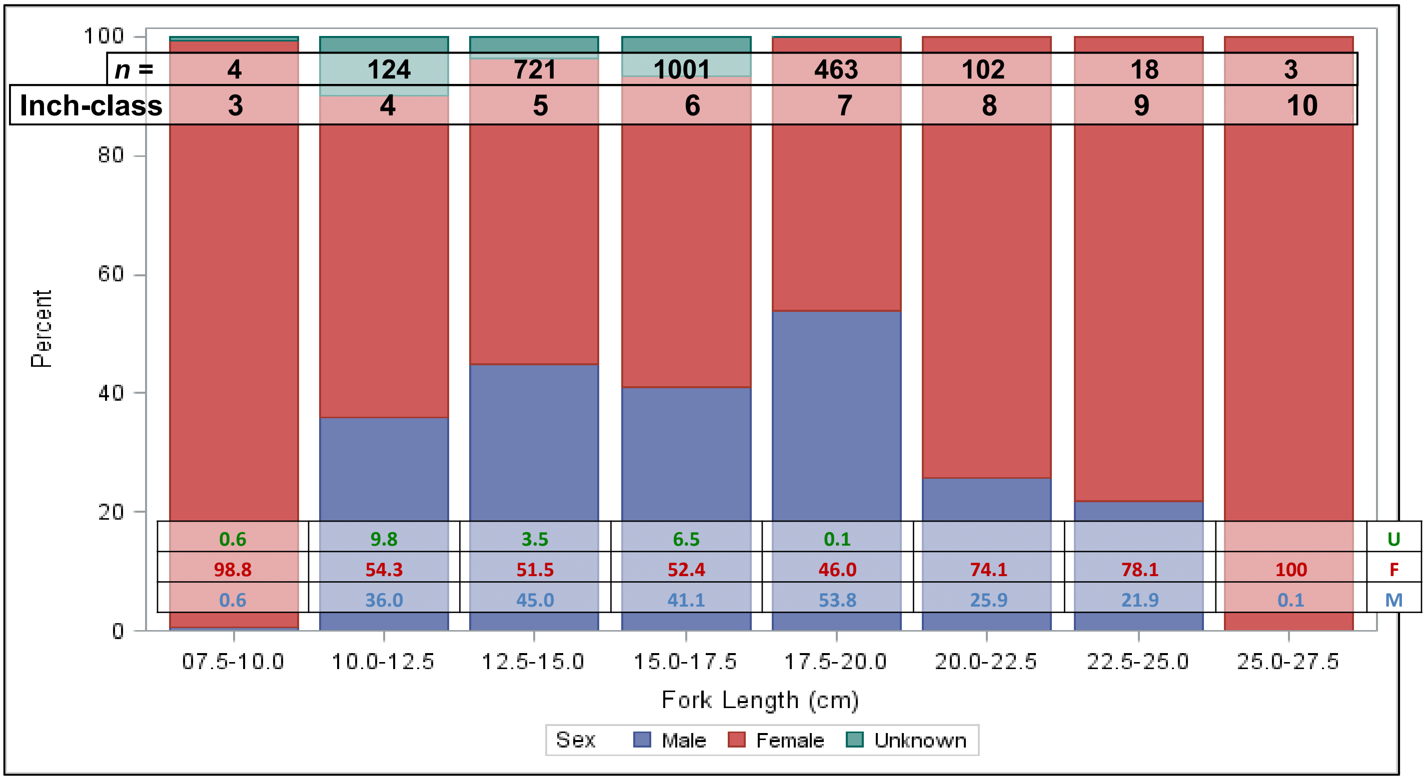
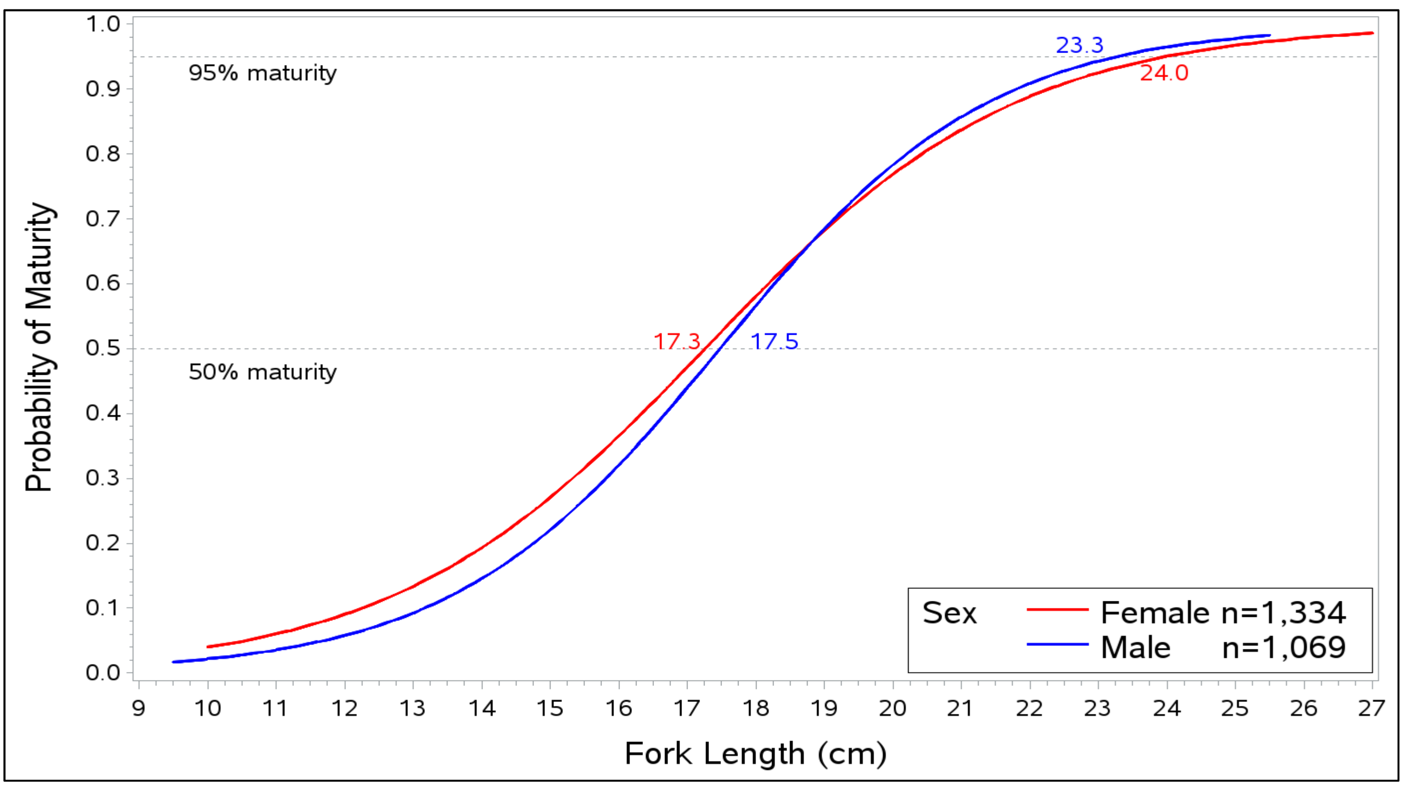


Figure 178. Spot maturity at length, by sex for all cruises pooled, 2007-2016.



Striped Anchovy

Sampling Priority: D

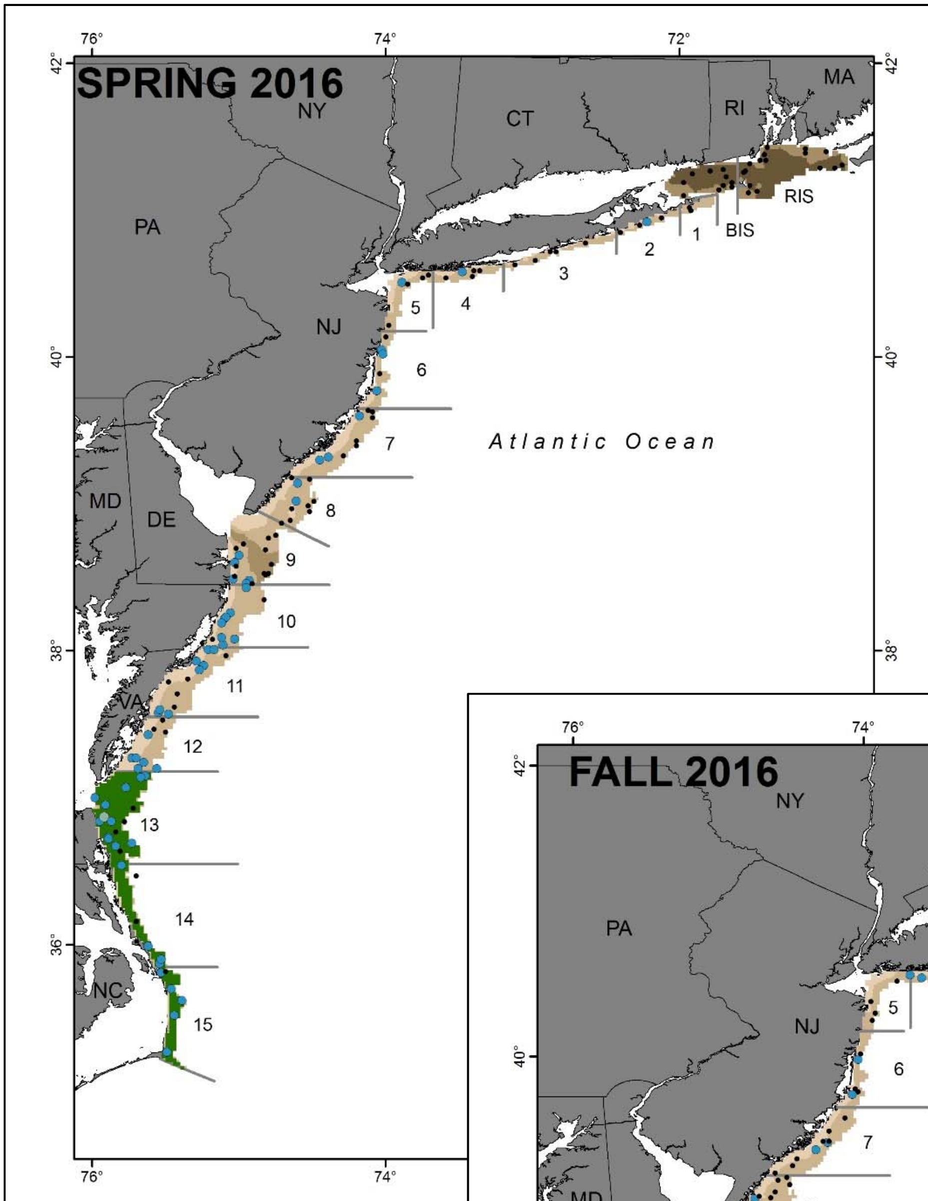


Figure 179. Striped Anchovy biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.

State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

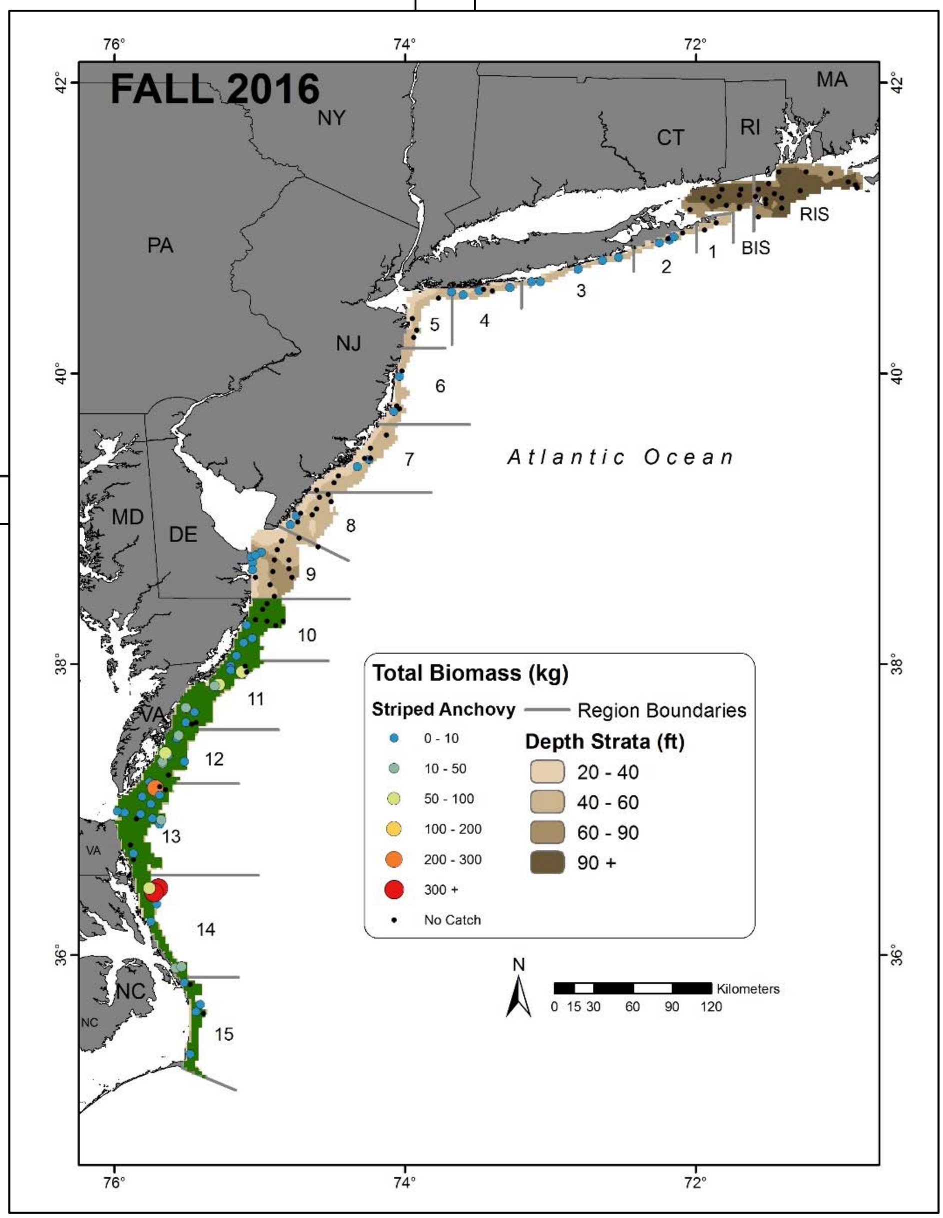


Table 62. Striped Anchovy sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,198	19.0	86.2	471	N/A	N/A	N/A	N/A
	2009	104	1.5	3.4	104	N/A	N/A	N/A	N/A
	2010	4	0.1	6.9	4	N/A	N/A	N/A	N/A
	2011	4,381	68.9	34.5	665	N/A	N/A	N/A	N/A
	2012	15,427	173.7	82.8	2,799	N/A	N/A	N/A	N/A
	2013	396	3.8	37.9	396	N/A	N/A	N/A	N/A
	2014	7	0.1	3.4	7	N/A	N/A	N/A	N/A
	2015	577	4.2	37.9	577	N/A	N/A	N/A	N/A
	2016	3,068	43.1	75.9	1,560	N/A	N/A	N/A	N/A
Fall	2007	224,369	2,519.3	90.2	4,990	N/A	N/A	N/A	N/A
	2008	84,833	1,009.1	88.5	3,357	N/A	N/A	N/A	N/A
	2009	9,820	130.8	75.4	2,407	N/A	N/A	N/A	N/A
	2010	67,774	849.8	50.8	4,418	N/A	N/A	N/A	N/A
	2011	73,546	932.5	85.2	5,704	N/A	N/A	N/A	N/A
	2012	289,800	3,064.7	91.8	17,789	N/A	N/A	N/A	N/A
	2013	40,977	587.8	70.5	4,180	N/A	N/A	N/A	N/A
	2014	81,892	1,111.4	60.7	8,377	N/A	N/A	N/A	N/A
	2015	154,838	1,696.5	63.9	6,829	N/A	N/A	N/A	N/A
	2016	98,268	1,619.4	70.5	4,609	N/A	N/A	N/A	N/A

Table 63. Striped Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	31	3.57	7.90	16.36	0.09	0.36	0.69
	2009	31	0.00	0.22	0.83	0.00	0.04	0.13
	2010	29	0.00	0.06	0.14	0.00	0.00	0.01
	2011	29	0.56	2.10	5.14	0.04	0.39	0.86
	2012	29	36.90	81.68	179.38	1.32	2.33	3.77
	2013	29	0.50	1.23	2.33	0.00	0.07	0.13
	2014	29	0.00	0.05	0.17	0.00	0.00	0.01
	2015	29	0.54	1.62	3.45	0.03	0.06	0.10
	2016	29	5.54	12.30	26.08	0.24	0.53	0.90

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	66	50.05	99.65	197.43	2.57	4.27	6.77
	2008	61	69.53	148.72	316.81	2.71	4.56	7.34
	2009	64	7.13	11.67	18.75	0.39	0.65	0.95
	2010	61	5.65	10.91	20.32	0.66	1.18	1.86
	2011	61	55.00	110.87	222.46	2.39	3.75	5.64
	2012	61	177.40	345.01	670.09	5.33	8.01	11.82
	2013	61	13.07	28.38	60.37	1.02	1.69	2.57
	2014	61	13.06	27.42	56.45	1.35	2.39	3.90
	2015	61	19.33	41.87	89.39	2.07	3.46	5.49
	2016	61	17.34	36.30	74.86	1.65	2.79	4.42

Figure 180. Striped Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

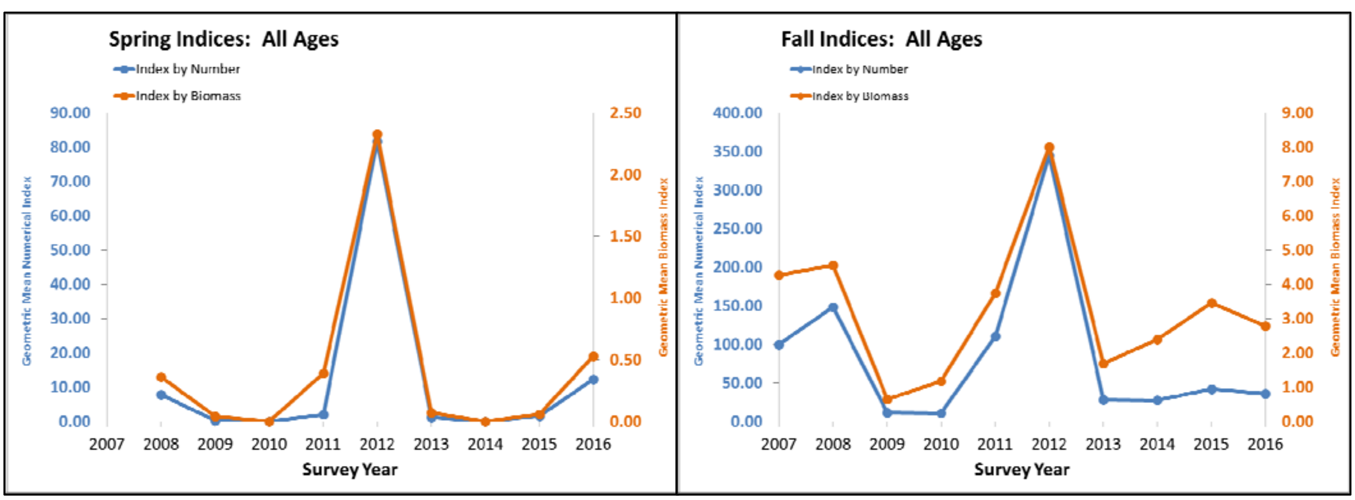
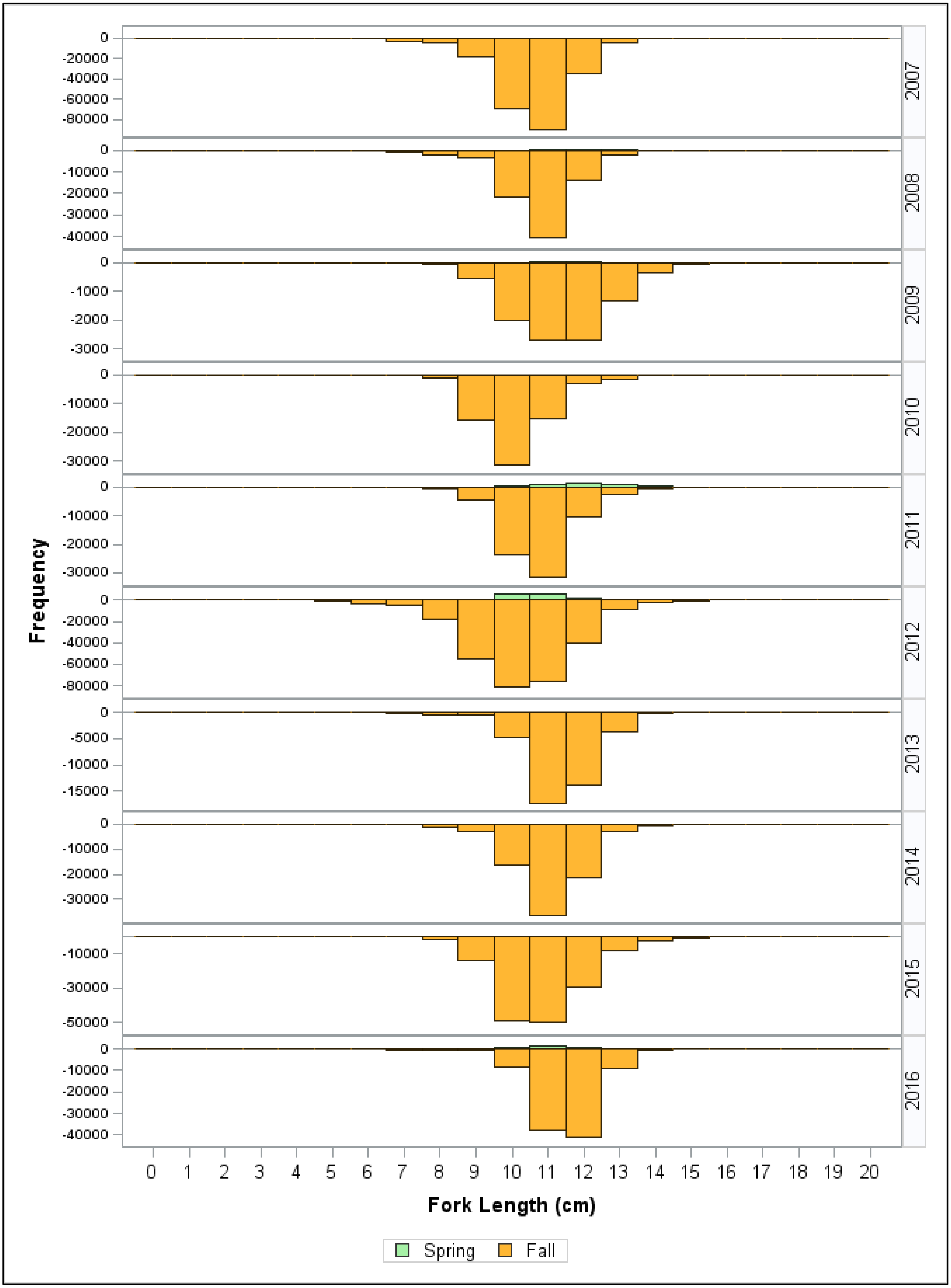


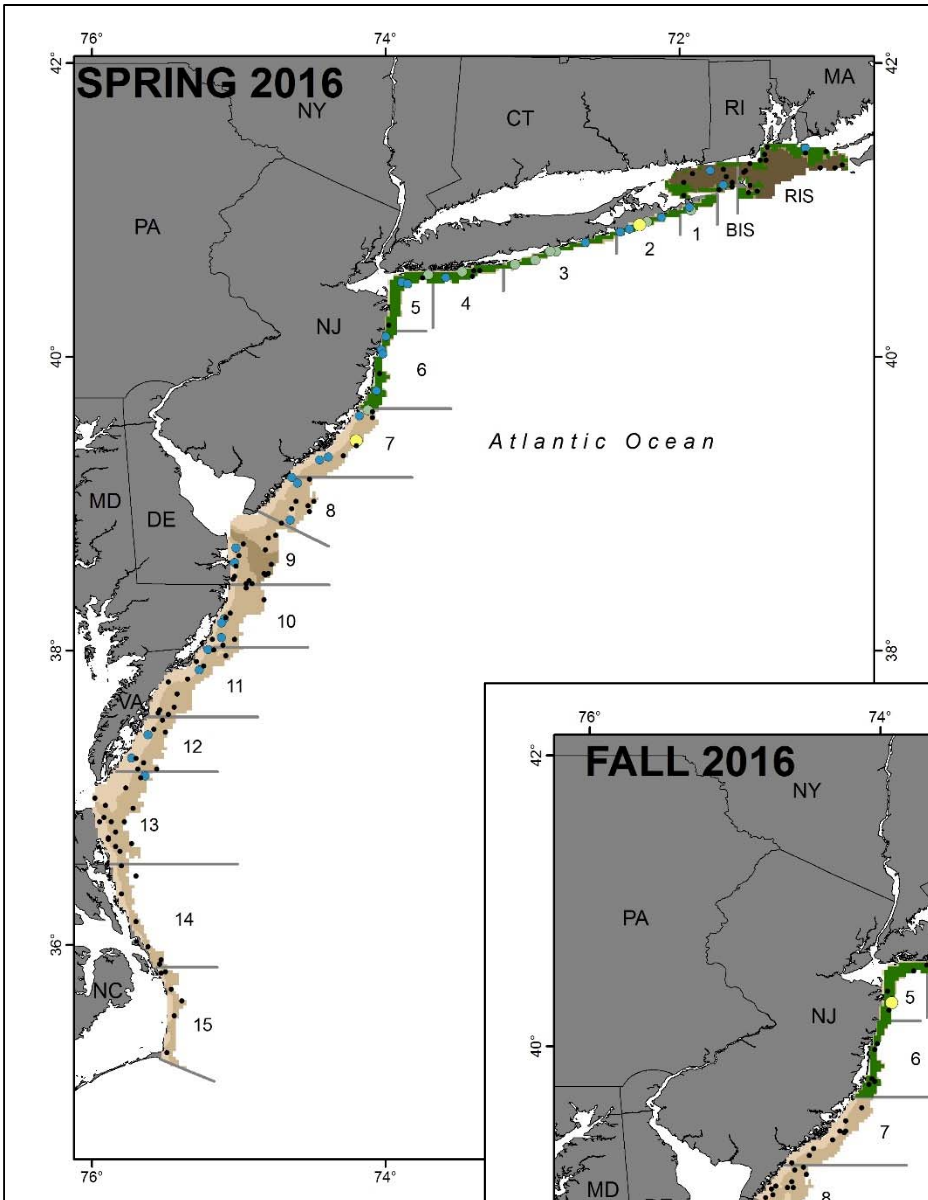
Figure 181. Striped Anchovy length-frequency distributions, by cruise.

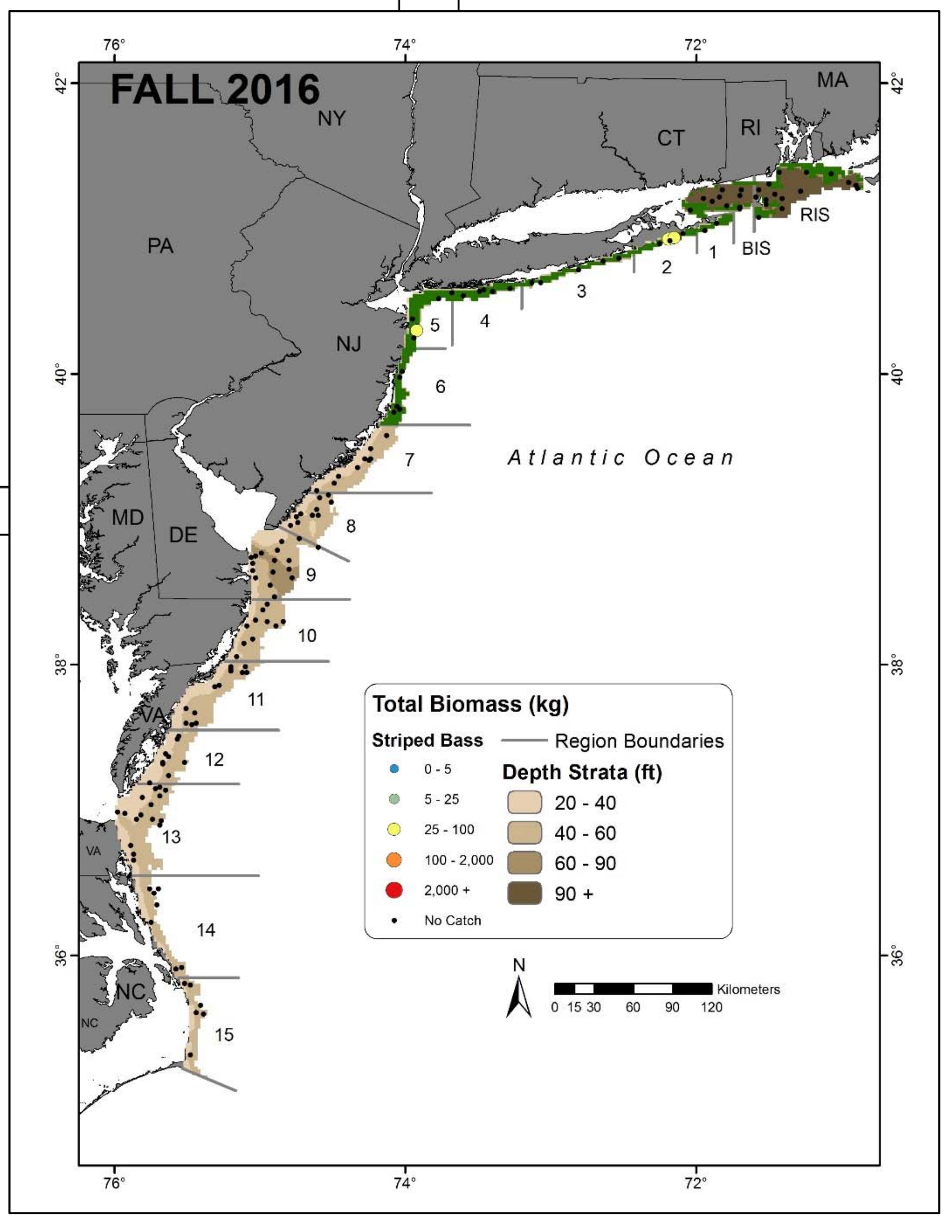


Striped Bass

Sampling Priority: A

Figure 182. Striped Bass biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[green]	[green]
		90+	[gray]	[gray]
	BIS	60-90	[green]	[green]
		90+	[gray]	[gray]
NY	01	40-60	[green]	[green]
	02	20-40	[green]	[green]
		40-60	[green]	[green]
	03	20-40	[green]	[green]
		40-60	[green]	[green]
	04	20-40	[green]	[green]
		40-60	[green]	[green]
	05	20-40	[green]	[green]
		40-60	[green]	[green]
NJ	06	20-40	[green]	[green]
		40-60	[green]	[green]
	07	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
	08	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
DE	09	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
		60-90	[gray]	[gray]
MD	10	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
VA	11	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
	12	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
	13	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
NC	14	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
	15	20-40	[gray]	[gray]
		40-60	[gray]	[gray]

[green] = used for abundance indices
[gray] = not used for abundance indices

Table 64. Striped Bass sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	40	171.1	30.2	40	39	40	33	32
	2009	162	389.3	39.6	162	78	73	48	46
	2010	32	143.2	20.8	32	25	25	17	17
	2011	43	284.3	24.5	43	42	42	23	23
	2012	7	41.7	9.4	7	7	7	5	5
	2013	37	148.2	30.2	37	36	36	19	19
	2014	45	128.2	30.2	45	40	40	21	21
	2015	4	30.4	7.5	4	4	4	3	3
	2016	210	156.6	45.3	210	130	130	67	66
Fall	2007	17	66.3	13.2	17	16	16	16	16
	2008	1,559	4,611.9	22.6	95	43	58	21	20
	2009	352	1,530.4	13.2	127	32	31	22	21
	2010	814	2,853.2	22.6	59	33	33	29	29
	2011	153	721.9	7.5	63	12	12	8	8
	2012	14	114.6	13.2	14	14	14	3	3
	2013	113	621.8	7.5	113	21	21	10	9
	2014	4	27.2	3.8	4	4	4	3	3
	2015	9	70.8	13.2	9	9	9	4	4
	2016	17	104.8	5.7	17	11	11	2	2

Table 65. Striped Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	36	0.30	0.63	1.05	0.71	1.59	2.92
	2009	42	0.35	0.85	1.55	0.68	1.62	3.09
	2010	36	0.04	0.30	0.64	0.13	0.64	1.39
	2011	36	0.19	0.41	0.68	0.51	1.06	1.82
	2012	36	0.00	0.08	0.15	0.00	0.26	0.61
	2013	35	0.11	0.25	0.40	0.22	0.65	1.22
	2014	36	0.26	0.49	0.77	0.23	0.63	1.16
	2015	36	0.00	0.04	0.07	0.00	0.12	0.26
	2016	36	0.55	0.89	1.29	0.45	0.84	1.32

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	37	0.00	0.20	0.45	0.00	0.41	0.97
	2008	36	0.17	1.13	2.89	0.44	1.90	4.85
	2009	42	0.05	0.15	0.26	0.08	0.31	0.60
	2010	36	0.02	0.72	1.89	0.27	1.38	3.46
	2011	36	0.00	0.12	0.27	0.00	0.27	0.67
	2012	36	0.01	0.14	0.28	0.05	0.40	0.86
	2013	37	0.00	0.12	0.27	0.00	0.21	0.49
	2014	36	0.00	0.01	0.02	0.00	0.02	0.06
	2015	36	0.03	0.14	0.26	0.08	0.48	1.05
	2016	36	0.00	0.10	0.24	0.00	0.25	0.74

Figure 183. Striped Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

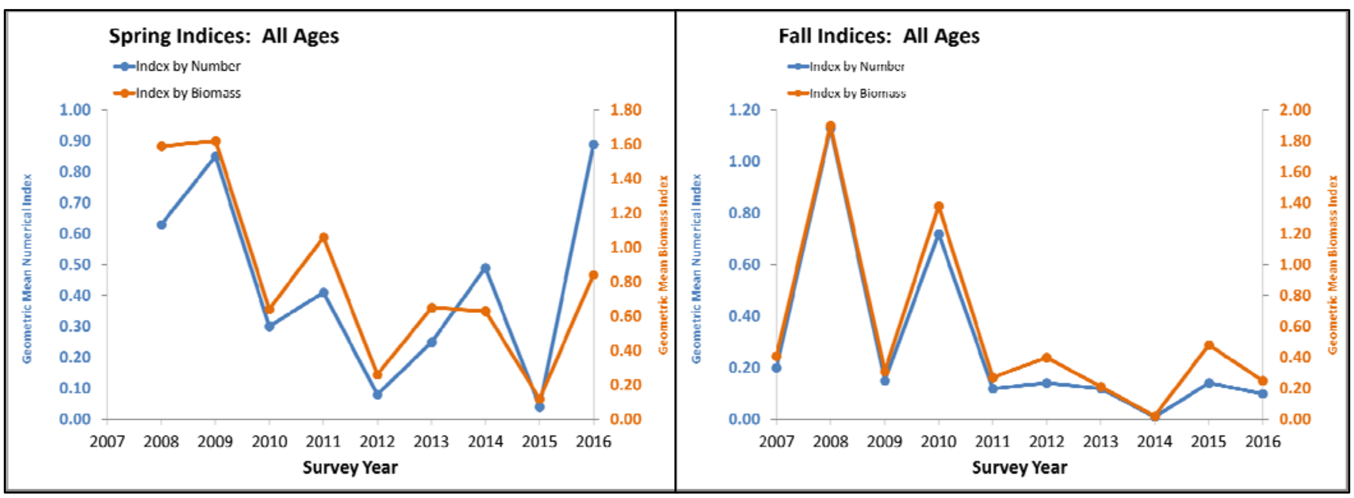


Figure 184. Striped Bass length-frequency distributions, by cruise.

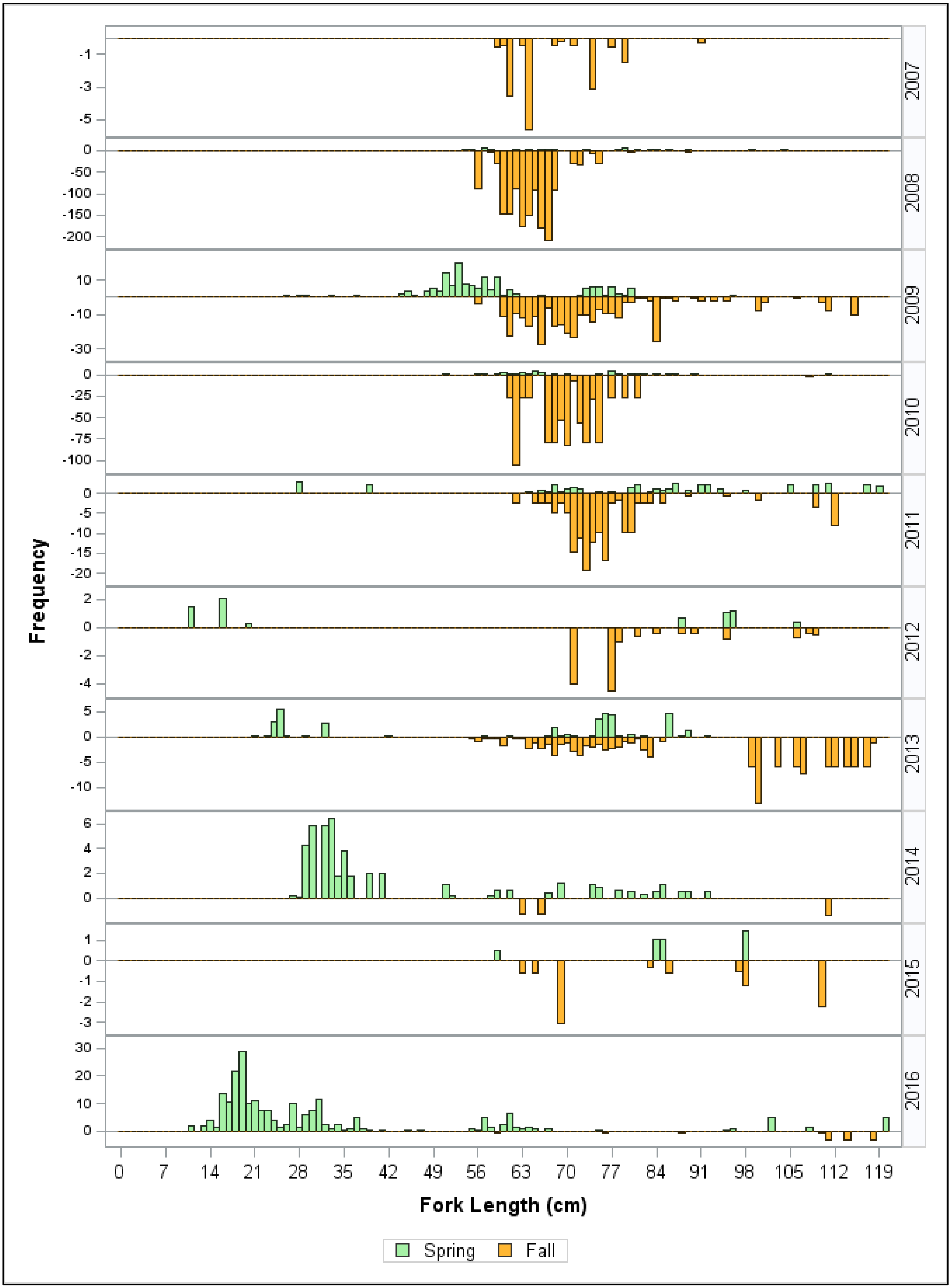


Figure 185. Striped Bass length-frequency distributions, by cruise and sex.

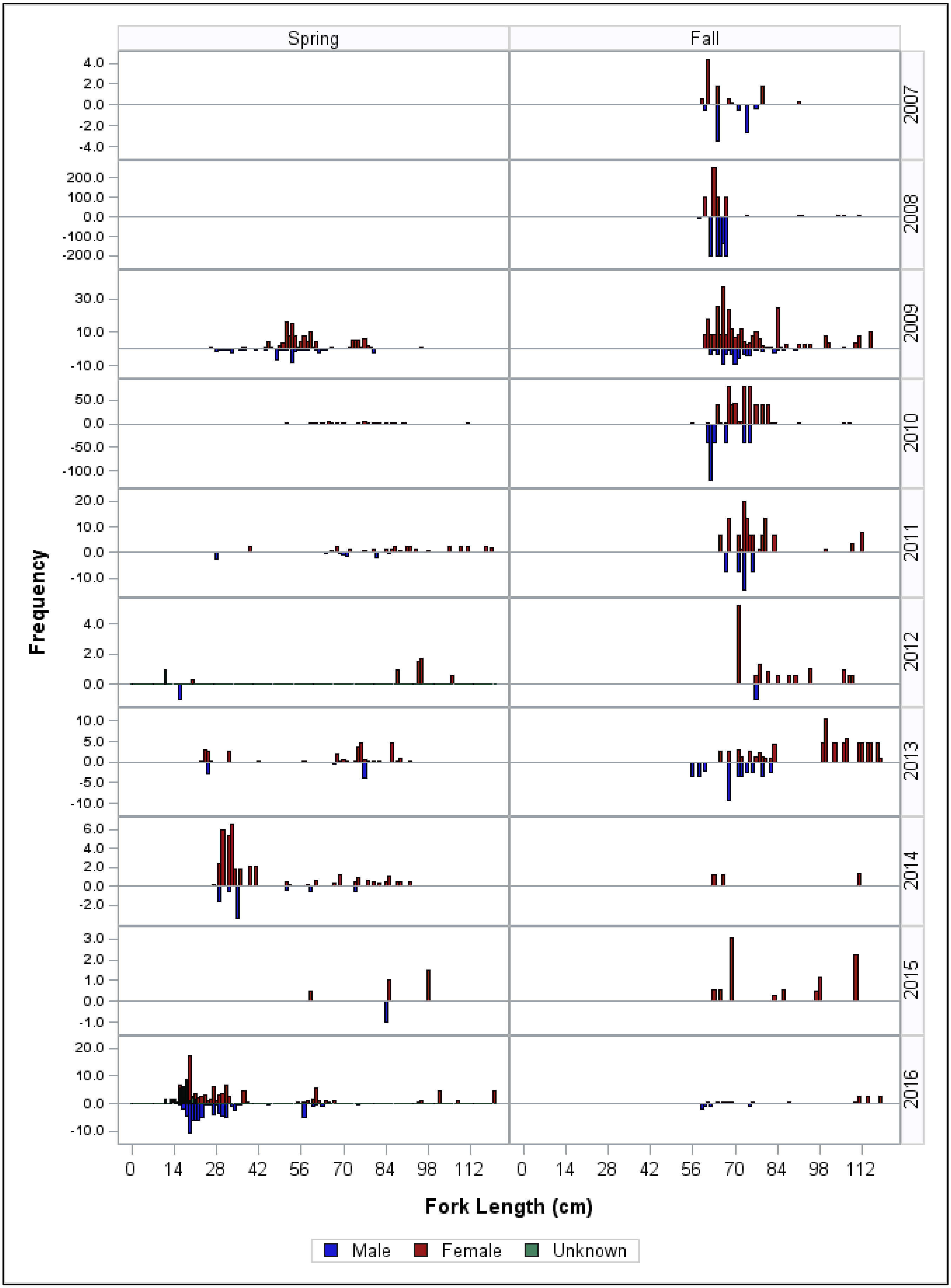


Figure 186. Striped Bass sex ratio, by length group, for all cruises pooled, 2007-2016.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

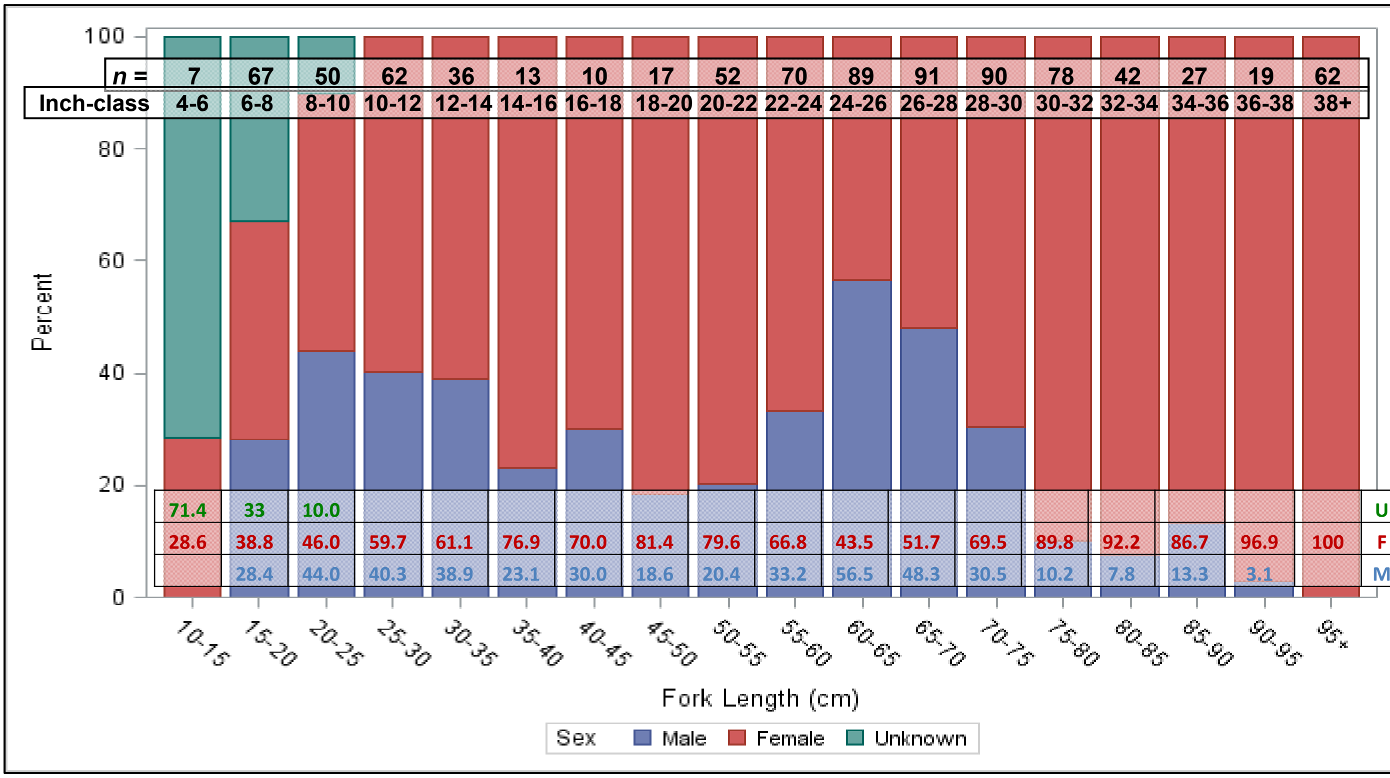


Figure 187. Striped Bass maturity at length, by sex for all cruises pooled, 2007-2016.

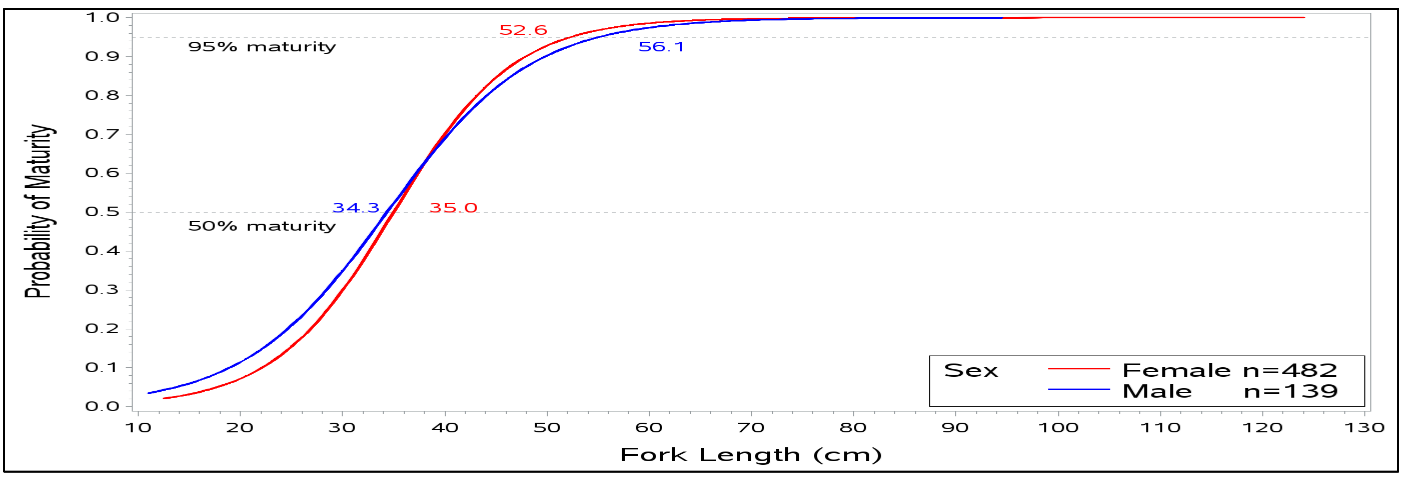


Figure 188. Striped Bass maturity at age, by sex for all cruises pooled, 2007-2016.

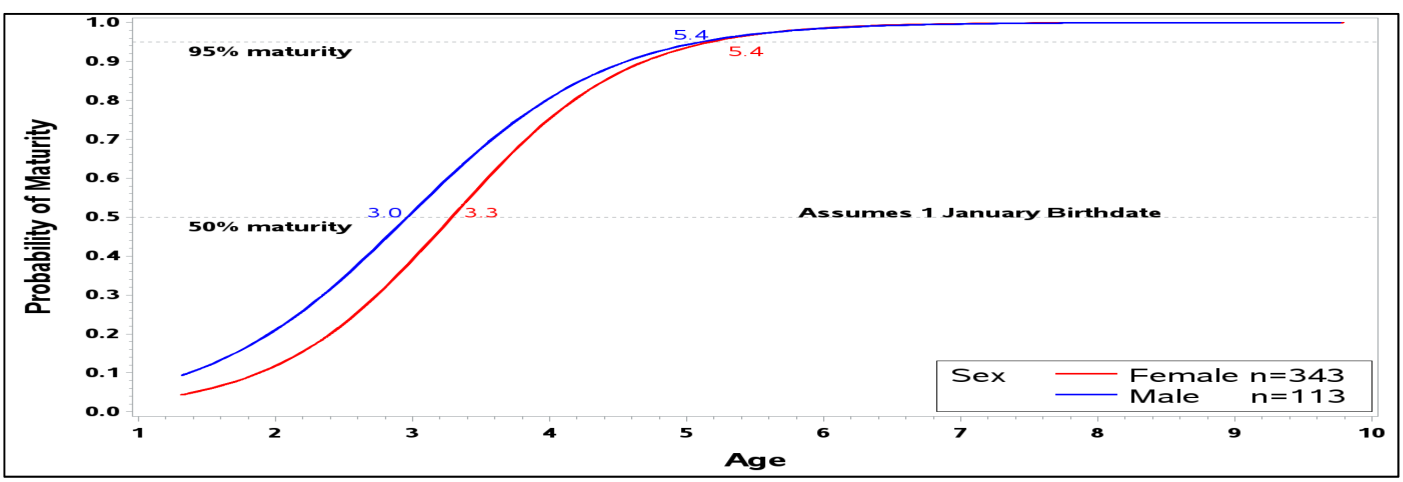
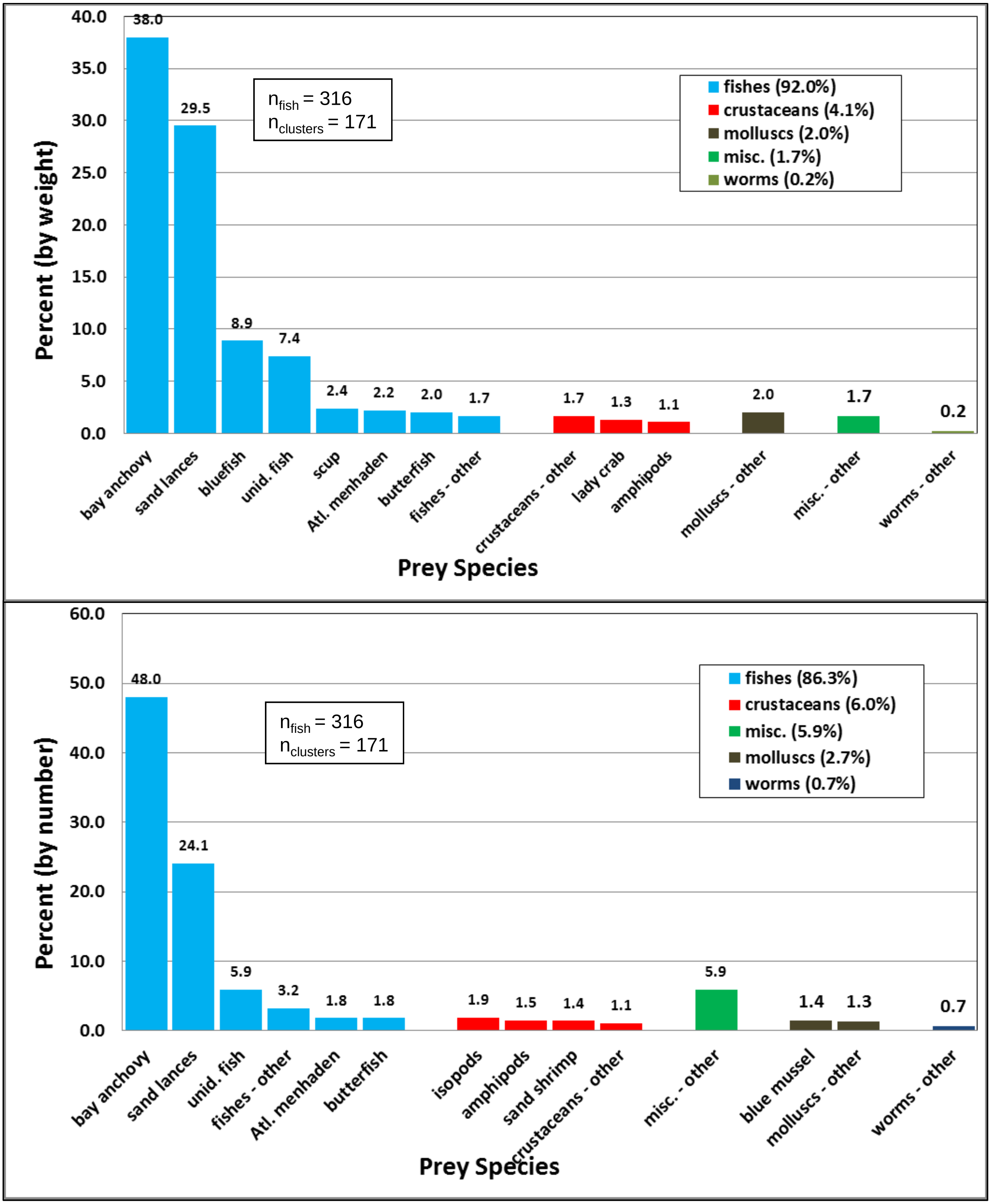


Figure 189. Striped Bass diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).



Summer Flounder

Sampling Priority: A

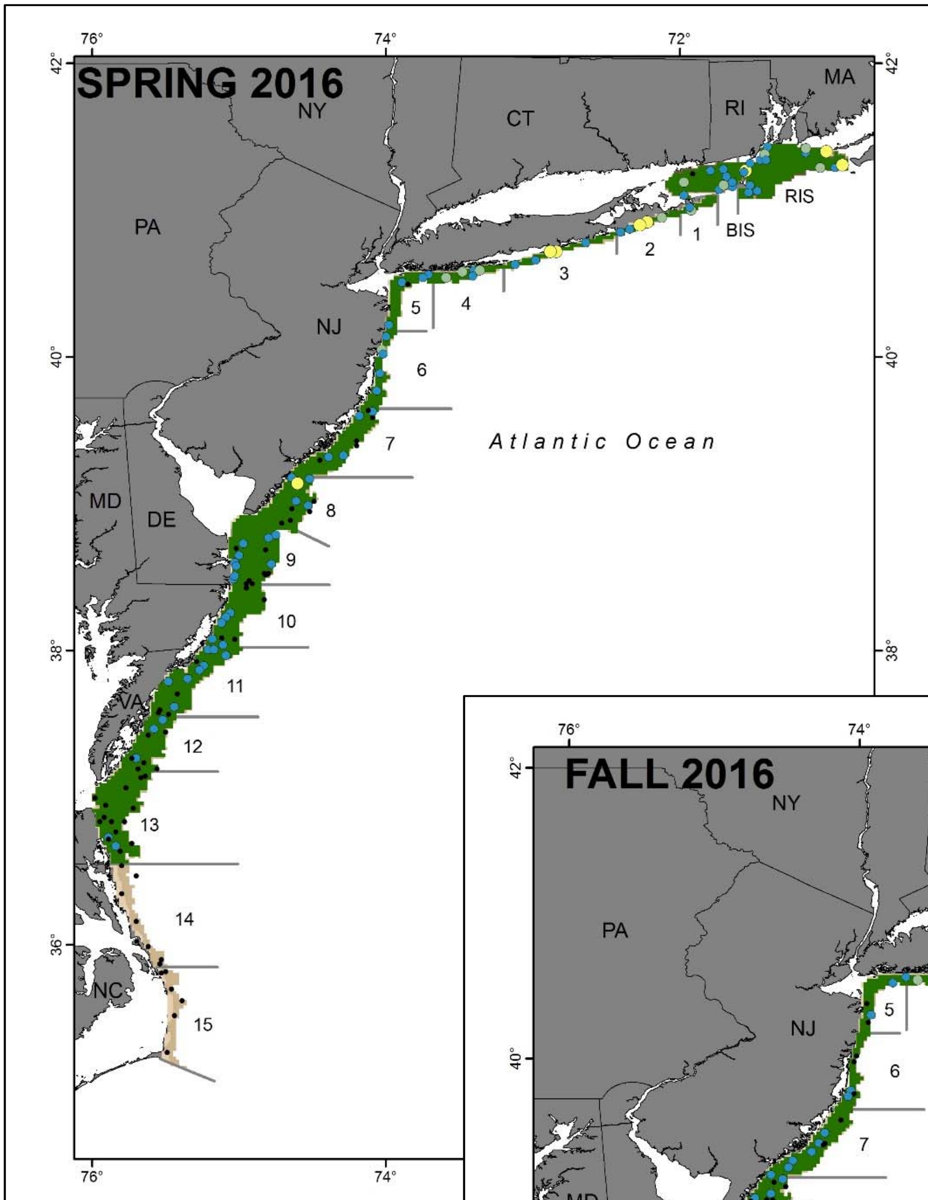
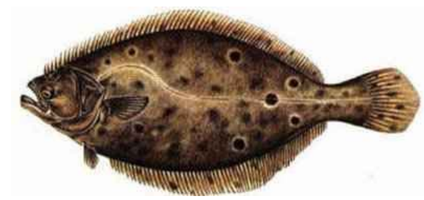


Figure 190. Summer Flounder biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

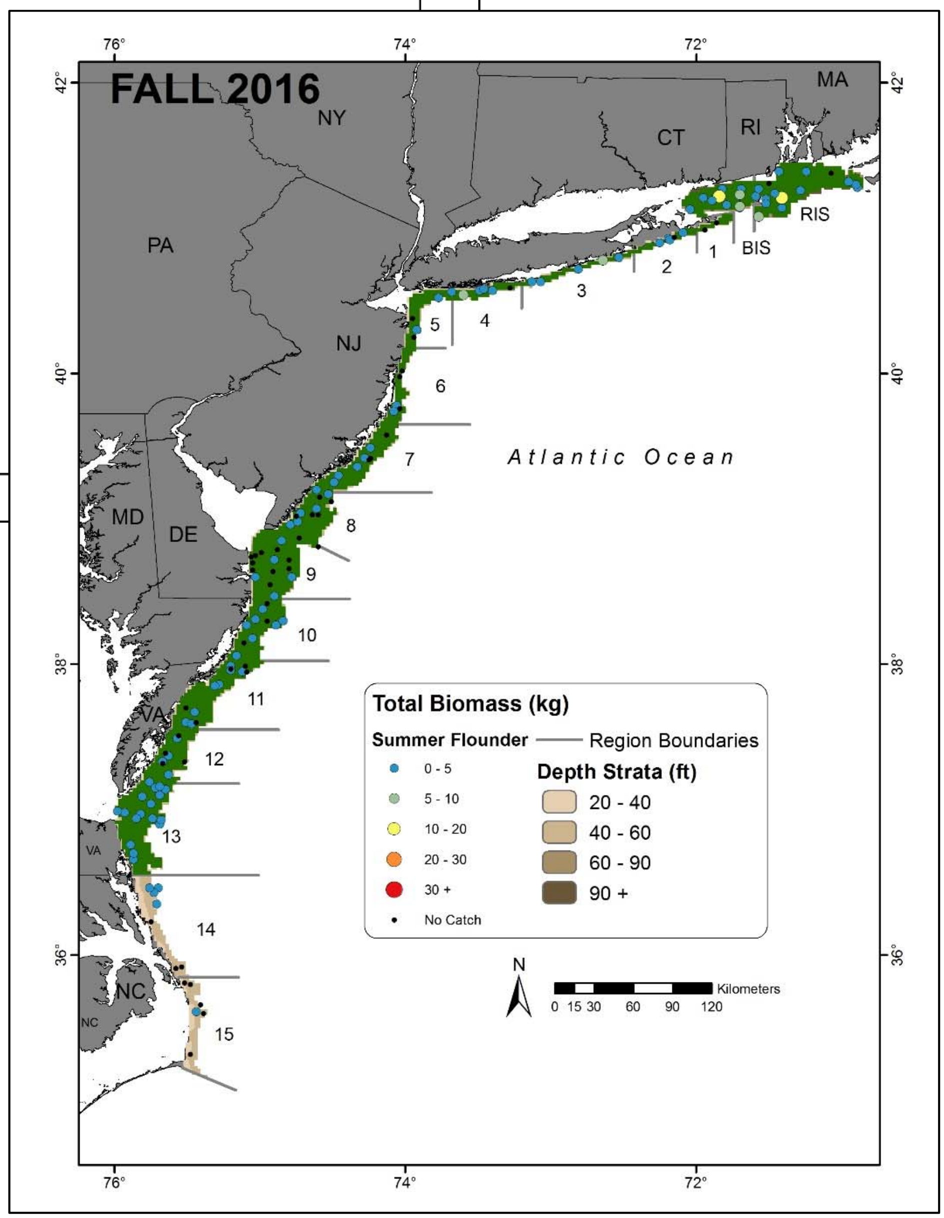


Table 66. Summer Flounder sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	768	527.0	83.9	768	522	522	375	366
	2009	977	519.3	83.2	977	623	623	363	349
	2010	705	381.9	81.0	705	493	493	310	265
	2011	1,352	636.4	80.3	1,246	547	547	254	248
	2012	427	263.3	60.6	427	263	263	118	113
	2013	520	271.7	64.2	520	303	303	156	152
	2014	503	318.3	65.7	503	383	367	144	139
	2015	562	312.8	70.8	562	429	429	171	168
	2016	527	243.9	64.2	527	339	339	155	154
Fall	2007	957	625.4	93.4	923	713	713	446	438
	2008	683	418.0	86.1	676	440	440	311	304
	2009	1,117	545.8	94.2	1,117	745	745	536	527
	2010	826	400.1	94.2	806	607	607	403	391
	2011	500	314.2	88.3	500	403	403	235	225
	2012	759	508.0	86.1	759	561	561	322	315
	2013	335	142.9	77.4	335	303	303	159	152
	2014	426	168.5	81.8	426	377	377	182	180
	2015	351	179.5	70.1	351	330	330	138	136
	2016	301	152.4	68.6	301	279	279	126	126

Table 67. Summer Flounder geometric mean indices of abundance, for all specimens captured (by number and biomass) and by age-class for spring and fall NEAMAP surveys.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	137	2.58	3.05	3.59	1.53	1.81	2.12
	2009	145	2.07	2.51	3.00	1.23	1.50	1.79
	2010	137	1.82	2.25	2.75	1.05	1.27	1.53
	2011	137	2.66	3.17	3.75	1.39	1.65	1.94
	2012	137	0.86	1.07	1.30	0.62	0.77	0.94
	2013	137	1.13	1.34	1.57	0.70	0.83	0.97
	2014	137	1.26	1.54	1.86	0.76	0.94	1.13
	2015	137	1.37	1.70	2.07	0.81	0.99	1.20
	2016	137	1.21	1.57	1.99	0.72	0.93	1.18
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	137	0.56	0.70	0.86	0.18	0.22	0.27
	2009	145	0.66	0.85	1.06	0.18	0.24	0.30
	2010	137	0.58	0.78	1.00	0.17	0.23	0.29
	2011	137	0.77	0.97	1.19	0.24	0.30	0.36
	2012	137	0.16	0.24	0.33	0.05	0.08	0.12
	2013	137	0.23	0.31	0.39	0.05	0.06	0.08
	2014	137	0.36	0.46	0.57	0.10	0.13	0.15
	2015	137	0.39	0.51	0.65	0.11	0.14	0.17
	2016	137	0.36	0.54	0.74	0.11	0.16	0.22
2	2007							
	2008	137	0.98	1.15	1.33	0.54	0.63	0.73
	2009	145	0.67	0.83	0.99	0.37	0.44	0.53
	2010	137	0.73	0.89	1.06	0.35	0.43	0.51
	2011	137	1.19	1.43	1.70	0.56	0.67	0.79
	2012	137	0.35	0.46	0.57	0.17	0.24	0.30
	2013	137	0.36	0.45	0.55	0.16	0.21	0.26
	2014	137	0.53	0.66	0.81	0.24	0.31	0.38
	2015	137	0.60	0.74	0.90	0.29	0.36	0.43
	2016	137	0.57	0.72	0.87	0.26	0.33	0.41
3	2007							
	2008	137	0.34	0.39	0.45	0.23	0.27	0.32
	2009	145	0.41	0.49	0.58	0.33	0.40	0.48
	2010	137	0.34	0.41	0.48	0.23	0.29	0.35
	2011	137	0.62	0.74	0.86	0.41	0.49	0.58
	2012	137	0.22	0.29	0.37	0.16	0.22	0.28
	2013	137	0.34	0.42	0.51	0.24	0.30	0.36
	2014	137	0.28	0.35	0.43	0.20	0.26	0.31
	2015	137	0.37	0.45	0.54	0.25	0.31	0.37
	2016	137	0.28	0.35	0.43	0.17	0.22	0.28

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	137	3.61	4.19	4.83	2.21	2.62	3.07
	2008	137	2.23	2.70	3.25	1.40	1.69	2.01
	2009	145	4.15	4.99	5.96	2.08	2.44	2.85
	2010	137	3.38	3.98	4.65	1.68	1.99	2.33
	2011	137	2.13	2.53	2.98	1.23	1.50	1.79
	2012	137	2.81	3.29	3.82	1.55	1.82	2.13
	2013	137	1.25	1.51	1.80	0.52	0.63	0.75
	2014	137	1.64	2.00	2.40	0.71	0.88	1.06
	2015	137	1.23	1.53	1.87	0.63	0.78	0.95
	2016							
0	2007	137	0.61	0.76	0.91	0.15	0.19	0.24
	2008	137	0.33	0.46	0.61	0.07	0.11	0.15
	2009	145	1.11	1.42	1.78	0.23	0.30	0.37
	2010	137	0.87	1.10	1.35	0.21	0.27	0.33
	2011	137	0.34	0.44	0.56	0.08	0.10	0.12
	2012	137	0.23	0.31	0.39	0.02	0.03	0.04
	2013	137	0.35	0.44	0.53	0.06	0.07	0.08
	2014	137	0.73	0.92	1.12	0.16	0.20	0.24
	2015	137	0.36	0.50	0.64	0.09	0.12	0.15
	2016							
1	2007	137	1.24	1.46	1.71	0.51	0.62	0.74
	2008	137	0.84	1.04	1.26	0.42	0.53	0.64
	2009	145	1.04	1.25	1.49	0.45	0.54	0.64
	2010	137	1.11	1.32	1.55	0.45	0.54	0.64
	2011	137	0.70	0.86	1.02	0.33	0.40	0.47
	2012	137	0.44	0.55	0.67	0.10	0.12	0.14
	2013	137	0.40	0.52	0.64	0.13	0.17	0.21
	2014	137	0.34	0.43	0.53	0.17	0.21	0.26
	2015	137	0.51	0.64	0.77	0.24	0.30	0.36
	2016							
2	2007	137	0.51	0.61	0.72	0.34	0.42	0.50
	2008	137	0.70	0.85	1.02	0.49	0.60	0.73
	2009	145	0.83	0.98	1.15	0.61	0.72	0.84
	2010	137	0.66	0.79	0.94	0.45	0.55	0.65
	2011	137	0.53	0.65	0.77	0.34	0.42	0.50
	2012	137	0.70	0.83	0.97	0.36	0.43	0.50
	2013	137	0.26	0.33	0.41	0.14	0.19	0.23
	2014	137	0.26	0.33	0.40	0.16	0.21	0.26
	2015	137	0.27	0.33	0.39	0.19	0.24	0.29
	2016							
3	2007	137	0.59	0.71	0.83	0.58	0.71	0.84
	2008	137	0.22	0.27	0.32	0.19	0.23	0.29
	2009	145	0.33	0.40	0.47	0.31	0.39	0.47
	2010	137	0.27	0.33	0.40	0.25	0.32	0.40
	2011	137	0.28	0.34	0.41	0.24	0.30	0.37
	2012	137	0.79	0.93	1.08	0.61	0.72	0.84
	2013	137	0.13	0.17	0.20	0.09	0.12	0.15
	2014	137	0.10	0.14	0.18	0.08	0.12	0.16
	2015	137	0.10	0.13	0.17	0.09	0.13	0.17
	2016							

Table 67. cont.

Spring Survey

4	2007							
	2008	137	0.53	0.63	0.75	0.48	0.59	0.71
	2009	145	0.20	0.24	0.28	0.21	0.25	0.30
	2010	137	0.16	0.20	0.25	0.15	0.20	0.24
	2011	137	0.29	0.35	0.41	0.22	0.28	0.34
	2012	137	0.13	0.18	0.22	0.11	0.15	0.19
	2013	137	0.25	0.31	0.37	0.20	0.24	0.29
	2014	137	0.22	0.28	0.34	0.20	0.26	0.32
	2015	137	0.14	0.18	0.23	0.13	0.18	0.23
	2016	137	0.10	0.14	0.17	0.09	0.13	0.17
5	2007							
	2008	137	0.19	0.24	0.29	0.23	0.28	0.35
	2009	145	0.15	0.18	0.21	0.18	0.22	0.27
	2010	137	0.10	0.13	0.16	0.12	0.16	0.19
	2011	137	0.11	0.15	0.18	0.11	0.15	0.20
	2012	137	0.07	0.10	0.12	0.09	0.12	0.15
	2013	137	0.09	0.11	0.14	0.09	0.12	0.16
	2014	137	0.09	0.13	0.16	0.11	0.15	0.20
	2015	137	0.09	0.12	0.15	0.10	0.14	0.18
	2016	137	0.06	0.09	0.11	0.07	0.10	0.14
6	2007							
	2008	137	0.11	0.14	0.18	0.15	0.20	0.25
	2009	145	0.08	0.11	0.13	0.11	0.15	0.19
	2010	137	0.06	0.08	0.10	0.08	0.12	0.15
	2011	137	0.06	0.08	0.10	0.07	0.11	0.15
	2012	137	0.05	0.06	0.08	0.06	0.09	0.12
	2013	137	0.05	0.07	0.08	0.06	0.09	0.12
	2014	137	0.06	0.08	0.10	0.07	0.11	0.14
	2015	137	0.05	0.07	0.10	0.06	0.10	0.13
	2016	137	0.04	0.06	0.07	0.05	0.08	0.11
7+	2007							
	2008	137	0.10	0.13	0.17	0.15	0.21	0.28
	2009	145	0.07	0.09	0.12	0.10	0.15	0.20
	2010	137	0.06	0.08	0.11	0.09	0.13	0.18
	2011	137	0.05	0.07	0.10	0.07	0.12	0.18
	2012	137	0.05	0.08	0.11	0.08	0.15	0.21
	2013	137	0.05	0.07	0.09	0.07	0.11	0.16
	2014	137	0.05	0.07	0.10	0.08	0.12	0.16
	2015	137	0.04	0.07	0.10	0.06	0.12	0.18
	2016	137	0.04	0.06	0.09	0.06	0.12	0.17

Fall Survey

4	2007	137	0.27	0.33	0.39	0.32	0.41	0.51
	2008	137	0.09	0.13	0.18	0.12	0.17	0.23
	2009	145	0.20	0.25	0.31	0.25	0.33	0.41
	2010	137	0.07	0.10	0.14	0.10	0.16	0.23
	2011	137	0.16	0.21	0.25	0.19	0.25	0.31
	2012	137	0.42	0.51	0.59	0.44	0.54	0.65
	2013	137	0.07	0.10	0.13	0.07	0.10	0.14
	2014	137	0.12	0.17	0.22	0.11	0.17	0.23
	2015	137	0.02	0.04	0.06	0.03	0.06	0.09
	2016							
5	2007	137	0.13	0.16	0.20	0.19	0.25	0.31
	2008	137	0.06	0.08	0.10	0.08	0.11	0.14
	2009	145	0.10	0.13	0.15	0.14	0.19	0.24
	2010	137	0.07	0.09	0.11	0.09	0.13	0.18
	2011	137	0.06	0.08	0.10	0.09	0.12	0.16
	2012	137	0.11	0.13	0.16	0.15	0.20	0.25
	2013	137	0.01	0.02	0.03	0.01	0.03	0.05
	2014	137	0.02	0.03	0.04	0.03	0.05	0.07
	2015	137	0.02	0.04	0.05	0.03	0.05	0.07
	2016							
6	2007	137	0.06	0.08	0.10	0.10	0.14	0.18
	2008	137	0.03	0.04	0.05	0.04	0.06	0.08
	2009	145	0.05	0.06	0.08	0.08	0.11	0.15
	2010	137	0.03	0.04	0.06	0.05	0.07	0.10
	2011	137	0.03	0.04	0.05	0.05	0.08	0.11
	2012	137	0.05	0.07	0.08	0.08	0.12	0.15
	2013	137	0.01	0.01	0.02	0.01	0.02	0.04
	2014	137	0.01	0.01	0.02	0.01	0.02	0.04
	2015	137	0.01	0.02	0.02	0.01	0.03	0.04
	2016							
7+	2007	137	0.04	0.07	0.10	0.08	0.15	0.21
	2008	137	0.01	0.03	0.05	0.03	0.07	0.12
	2009	145	0.03	0.05	0.08	0.06	0.12	0.17
	2010	137	0.02	0.04	0.06	0.03	0.08	0.12
	2011	137	0.03	0.05	0.08	0.06	0.12	0.19
	2012	137	0.03	0.06	0.08	0.07	0.13	0.19
	2013	137	0.00	0.01	0.01	0.00	0.02	0.03
	2014	137	0.00	0.01	0.01	0.00	0.02	0.03
	2015	137	0.00	0.02	0.03	0.00	0.04	0.07
	2016							

Figure 191. Summer Flounder geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.

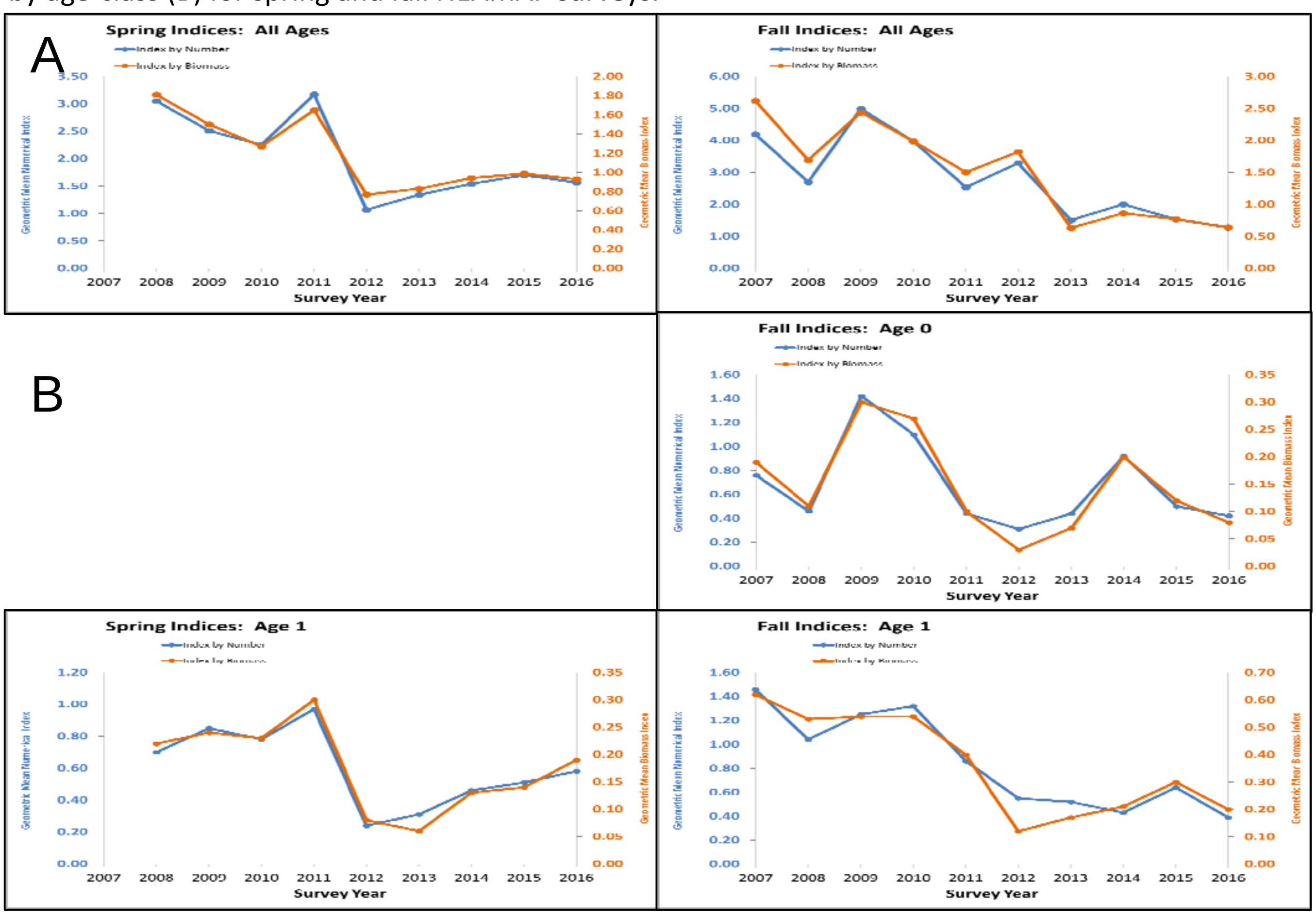


Figure 191. Cont.

Figure 192. Summer Flounder length-frequency distributions, by cruise.

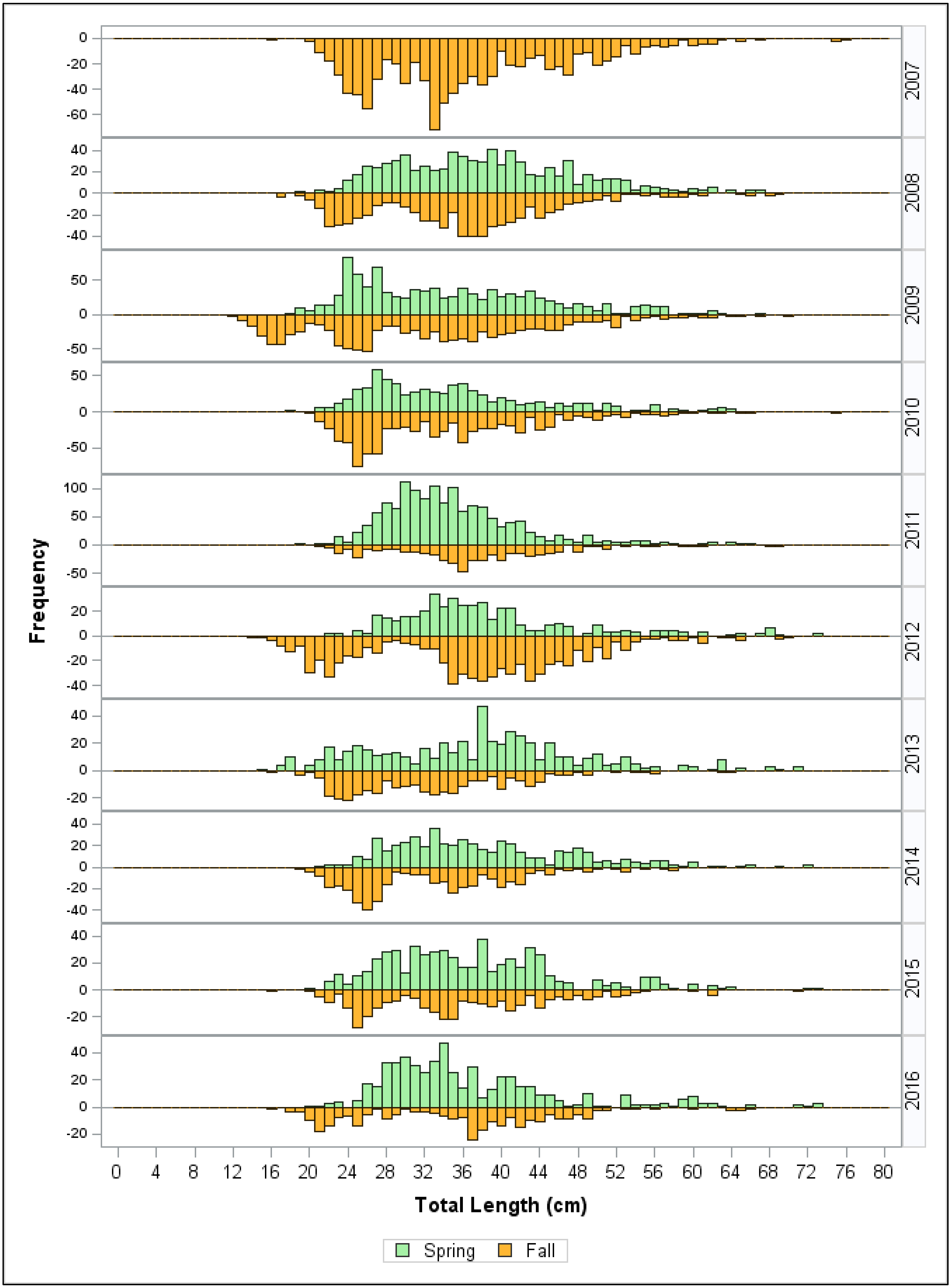


Figure 193. Summer Flounder length-frequency distributions, by cruise and sex.

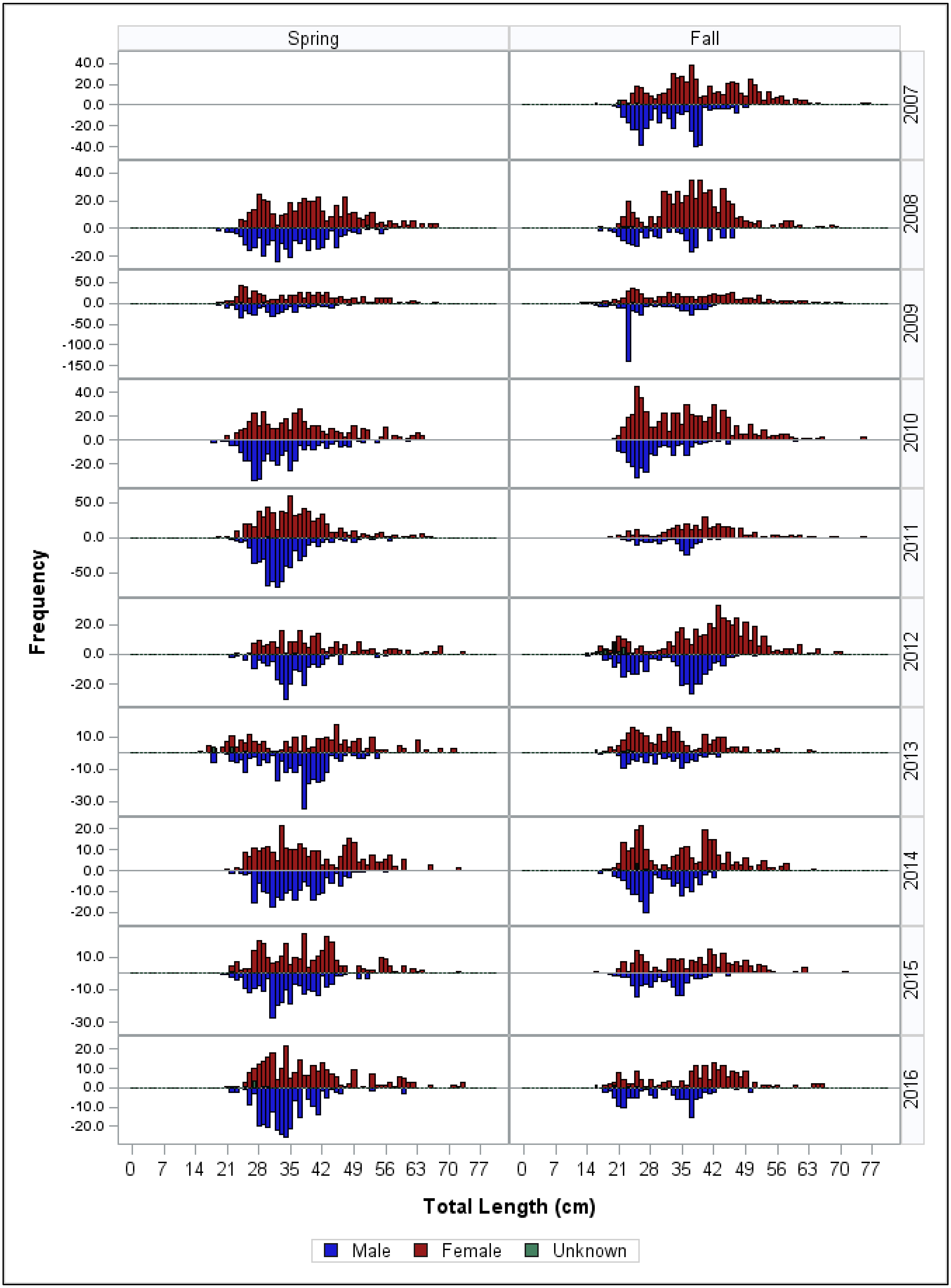


Figure 194. Summer flounder age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

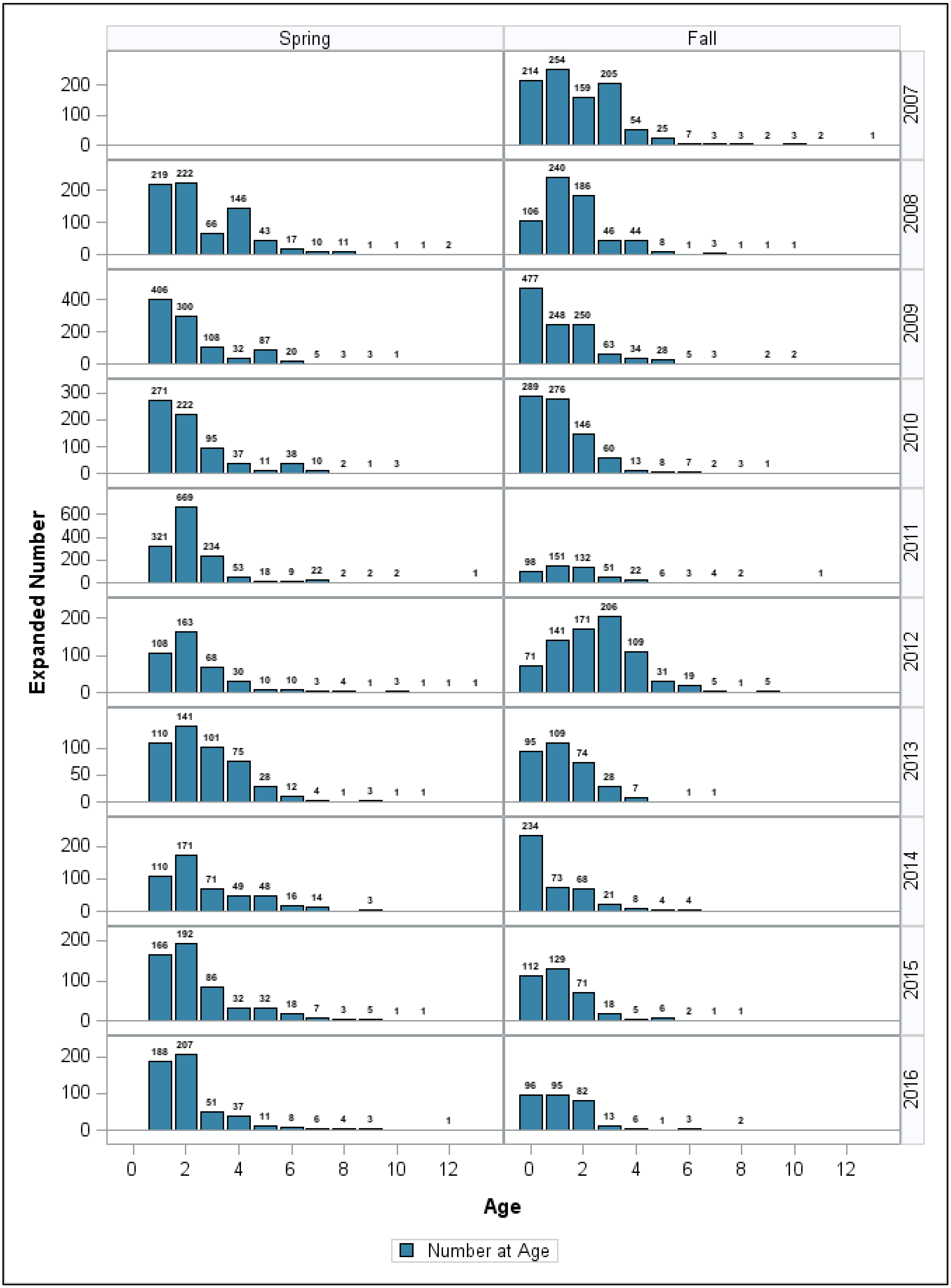


Figure 195. Summer flounder catch-at-age standardized to 3,000 trawl minutes, by cruise..

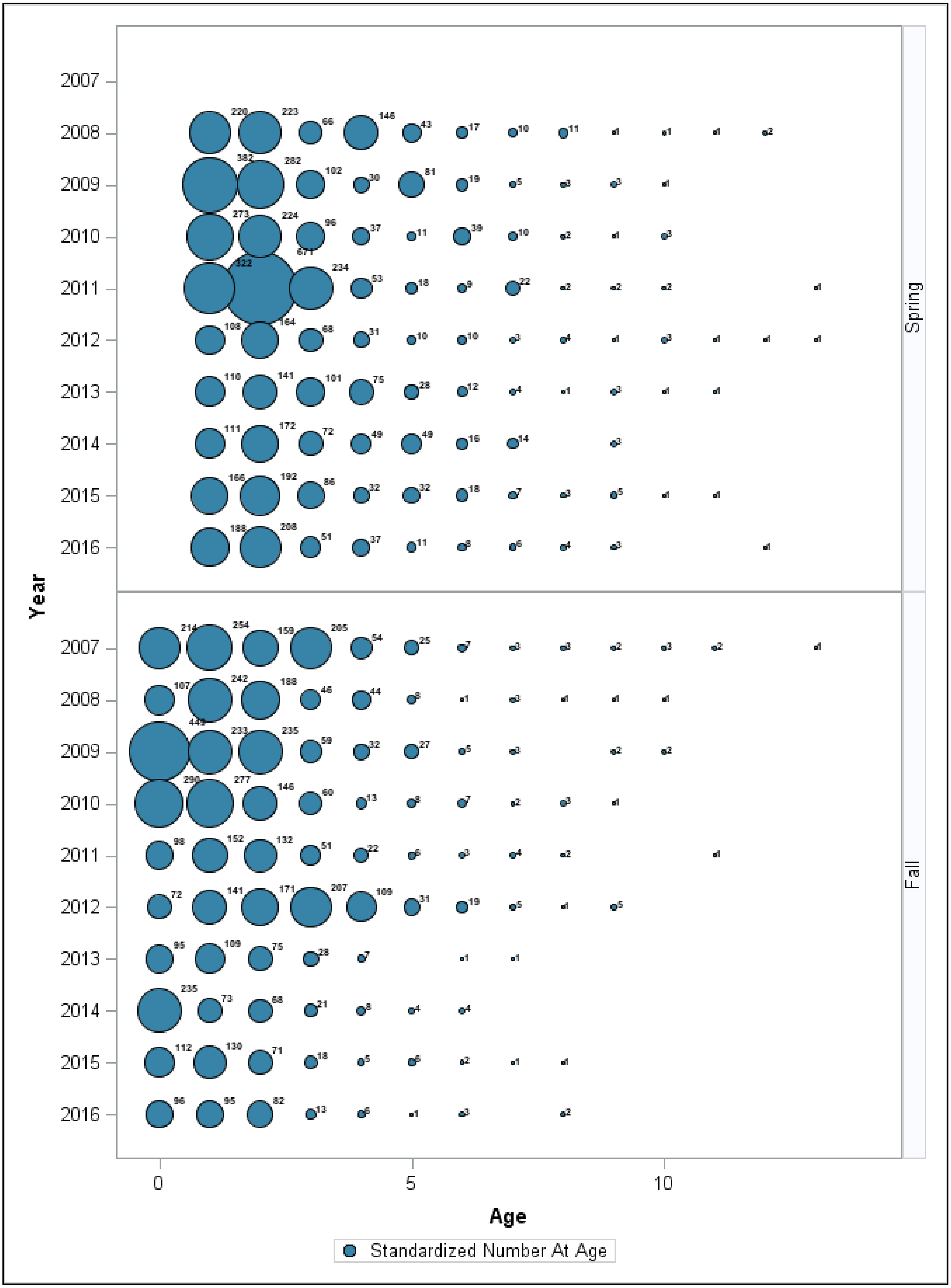


Figure 196. Summer Flounder sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

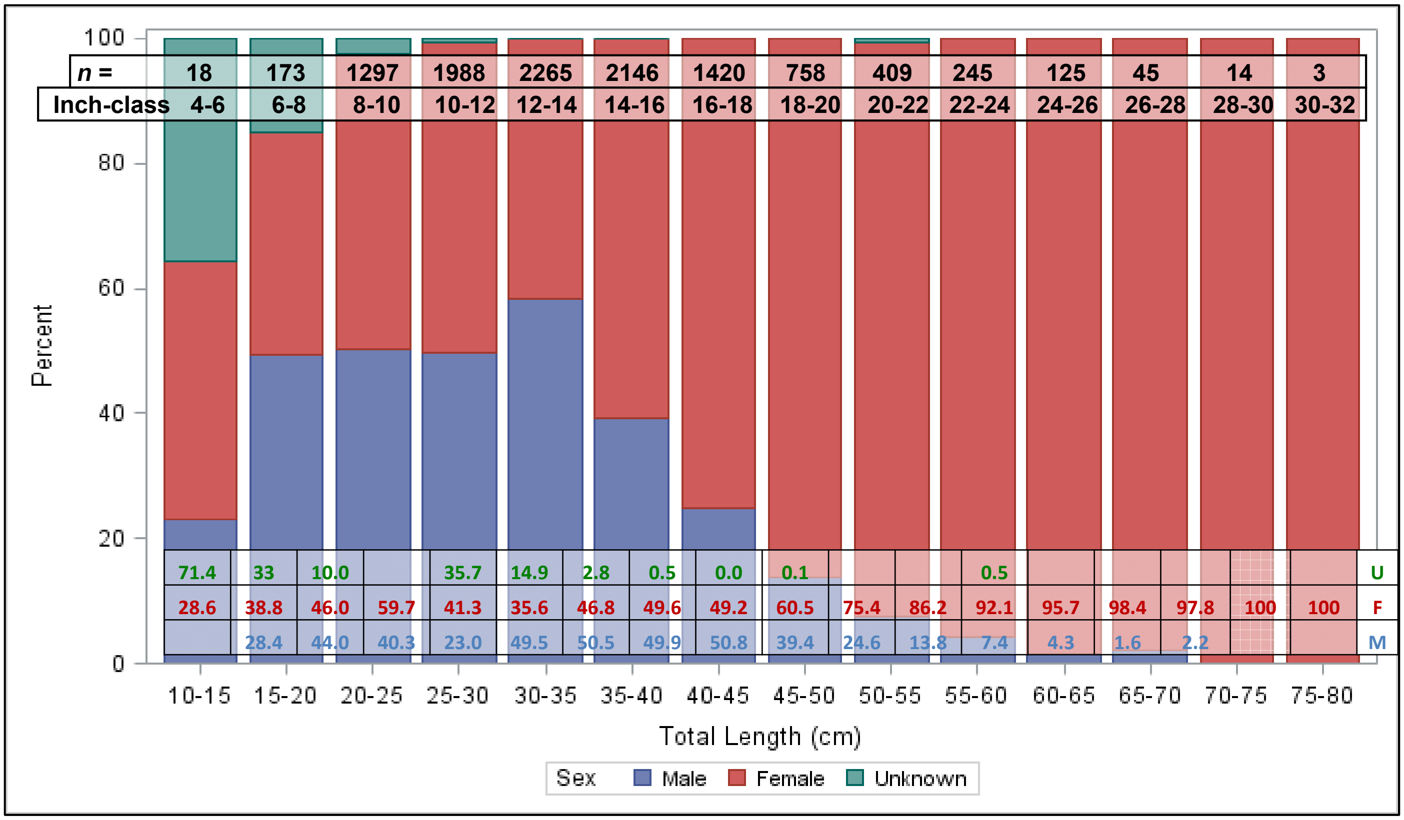


Figure 197. Summer Flounder maturity at length, by sex for all cruises pooled, 2007-2016.

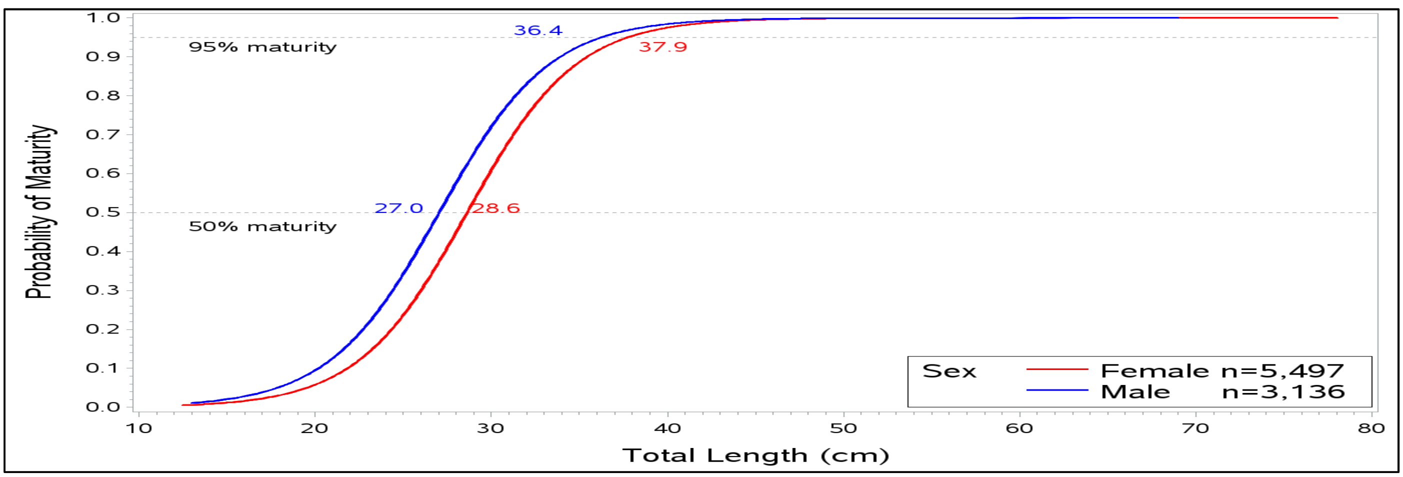


Figure 198. Summer Flounder maturity at age, by sex for all cruises pooled, 2007-2016.

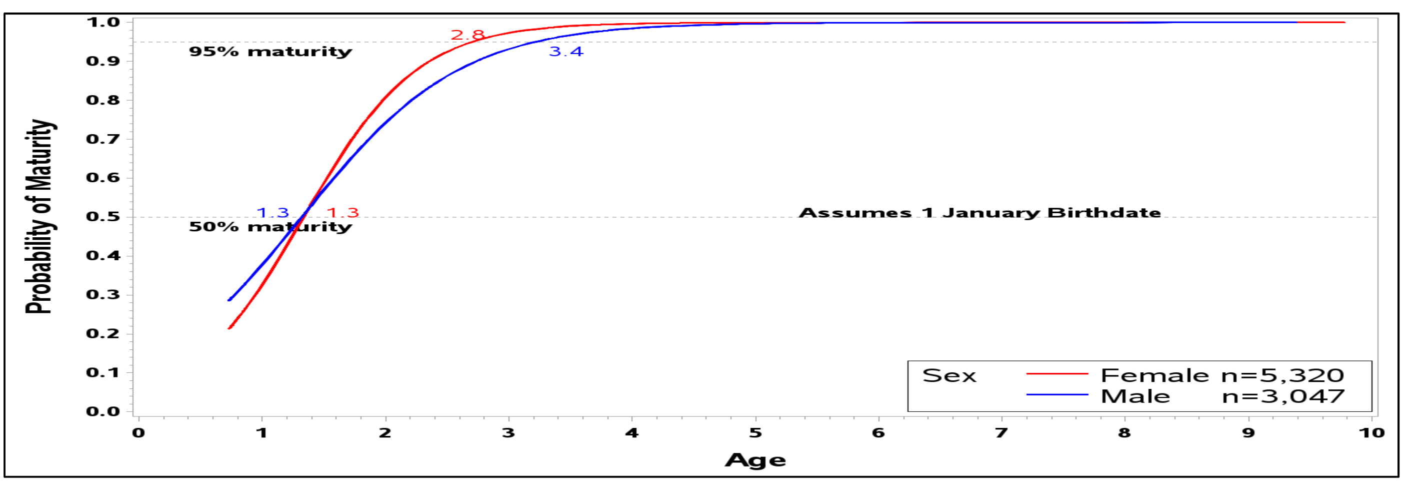
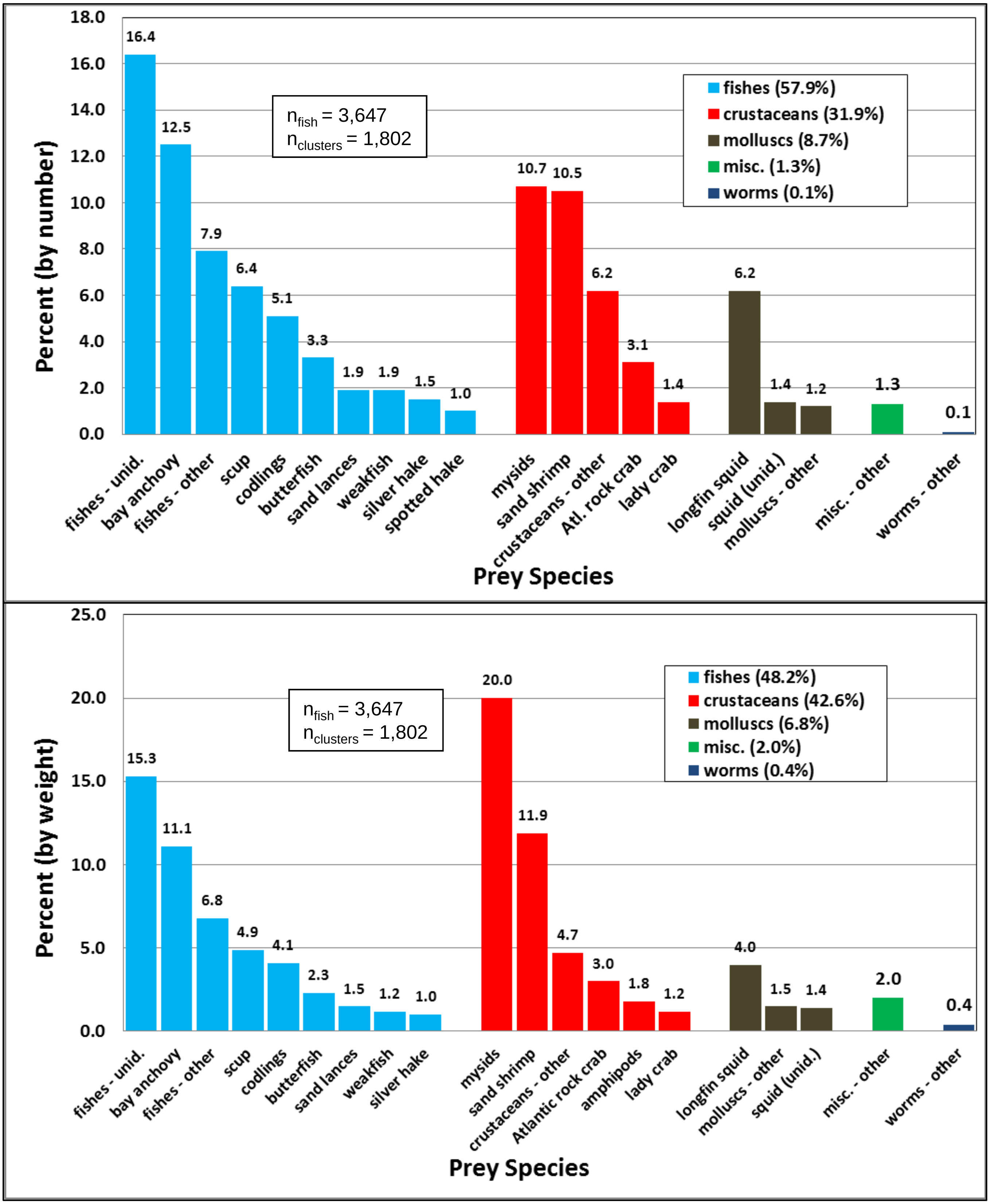


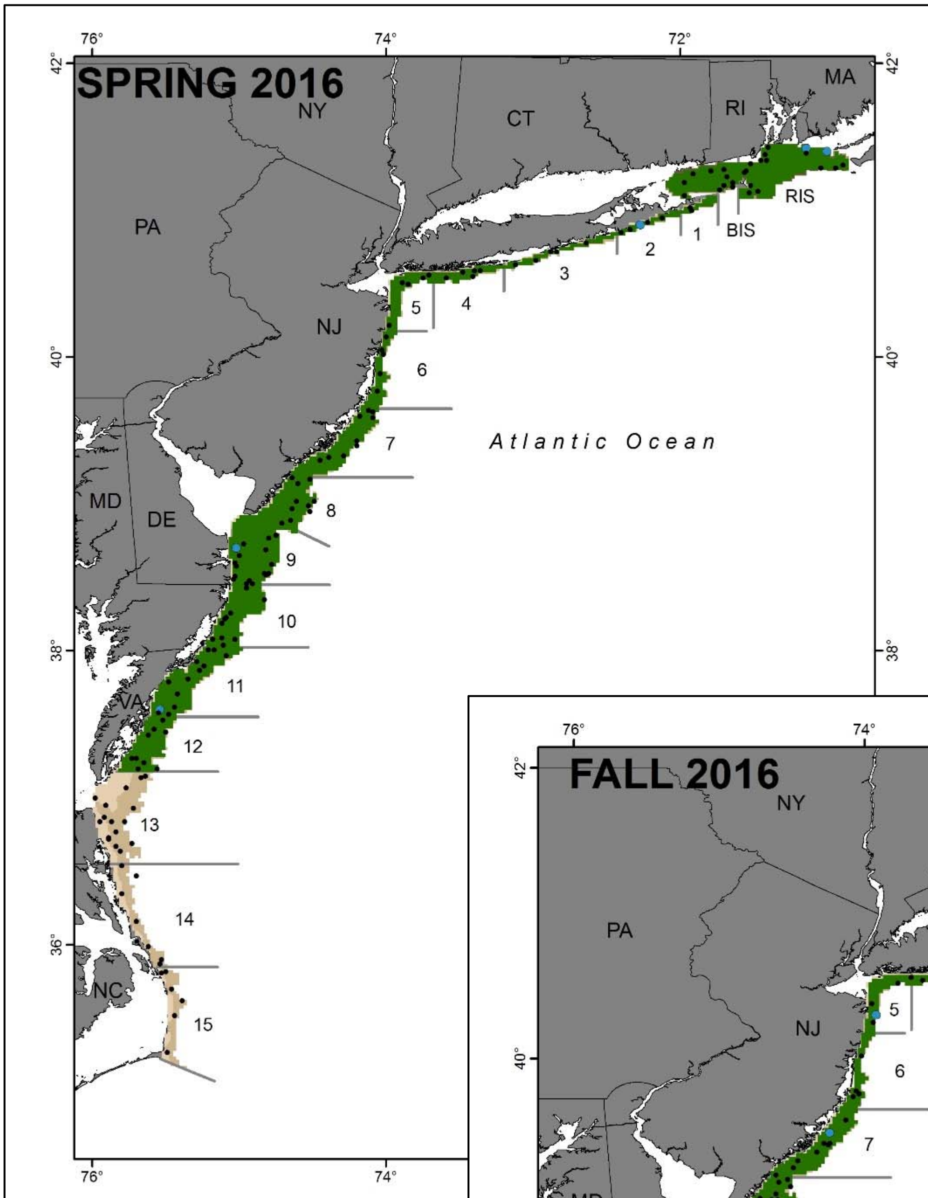
Figure 199. Summer Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

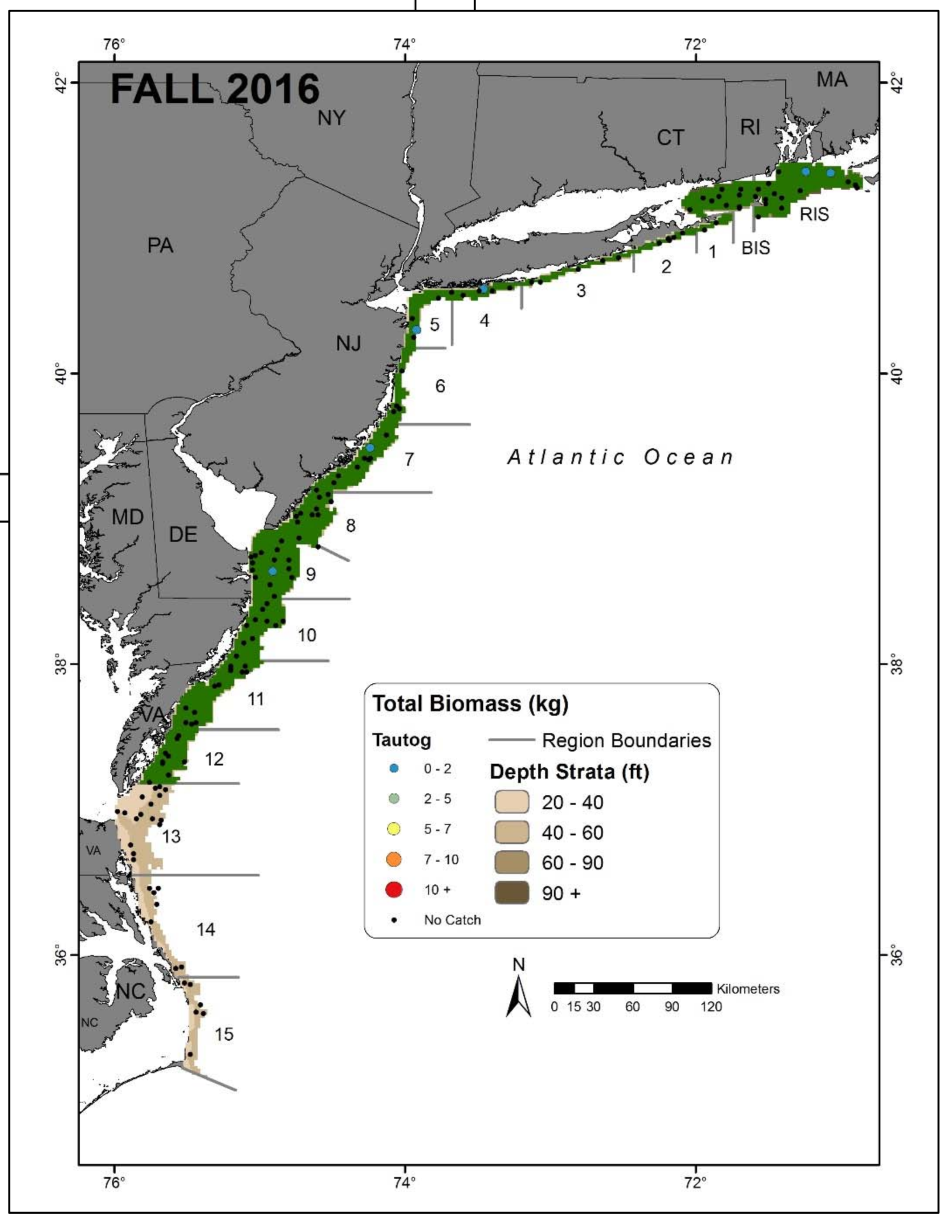


Tautog

Sampling Priority: A

Figure 200. Tautog biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(gray) = not used for abundance indices

Table 68. Tautog sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	8	16.0	5.8	8	8	0	8	8
	2009	16	31.0	6.6	16	15	0	15	15
	2010	14	15.6	4.1	14	14	0	12	9
	2011	5	10.5	2.5	5	5	0	5	5
	2012	21	21.1	3.3	21	13	0	11	11
	2013	17	23.3	5.0	17	17	0	13	13
	2014	7	9.3	5.0	7	7	0	6	6
	2015	9	10.9	5.0	9	9	0	8	8
	2016	6	3.7	4.1	6	6	0	4	4
Fall	2007	4	3.7	2.5	4	4	0	4	4
	2008	137	59.2	7.4	69	27	0	26	26
	2009	39	43.0	5.0	39	20	0	19	19
	2010	25	24.3	7.4	25	24	0	23	23
	2011	12	11.8	0.8	12	12	0	12	0
	2012	37	30.3	2.5	37	18	0	16	16
	2013	6	3.5	3.3	6	6	0	6	0
	2014	32	16.9	3.3	32	15	0	10	10
	2015	2	2.3	0.8	2	2	0	2	1
	2016	9	5.1	6.6	9	9	0	4	4

Table 69. Tautog geometric mean indices of abundance, for all specimens captured for spring and fall NEAMAP surveys.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	0.01	0.04	0.07	38.70	0.01	0.04	0.07
	2009	0.01	0.07	0.12	38.80	0.02	0.09	0.17
	2010	0	0.06	0.12	49.60	0.00	0.06	0.13
	2011	0	0.02	0.05	59.20	0.00	0.03	0.08
	2012	0	0.05	0.12	60.90	0.00	0.06	0.13
	2013	0.01	0.07	0.14	43.80	0.00	0.08	0.16
	2014	0	0.03	0.05	45.60	0.00	0.03	0.06
	2015	0.01	0.05	0.09	41.40	0.01	0.05	0.10
	2016	0	0.03	0.06	46.50	0.00	0.02	0.04

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	119	0.00	0.02	0.05	0.00	0.02	0.05
	2008	121	0.02	0.10	0.20	0.03	0.10	0.19
	2009	129	0.00	0.08	0.17	0.00	0.07	0.17
	2010	121	0.03	0.10	0.16	0.02	0.08	0.15
	2011	121	0.00	0.03	0.08	0.00	0.03	0.08
	2012	121	0.00	0.06	0.13	0.00	0.05	0.12
	2013	121	0.00	0.04	0.07	0.00	0.02	0.05
	2014	121	0.00	0.03	0.06	0.00	0.02	0.05
	2015	121	0.00	0.01	0.03	0.00	0.01	0.04
	2016	121	0.02	0.05	0.10	0.00	0.03	0.06

Figure 201. Tautog geometric mean indices of abundance, for all specimens captured for spring and fall NEAMAP surveys.

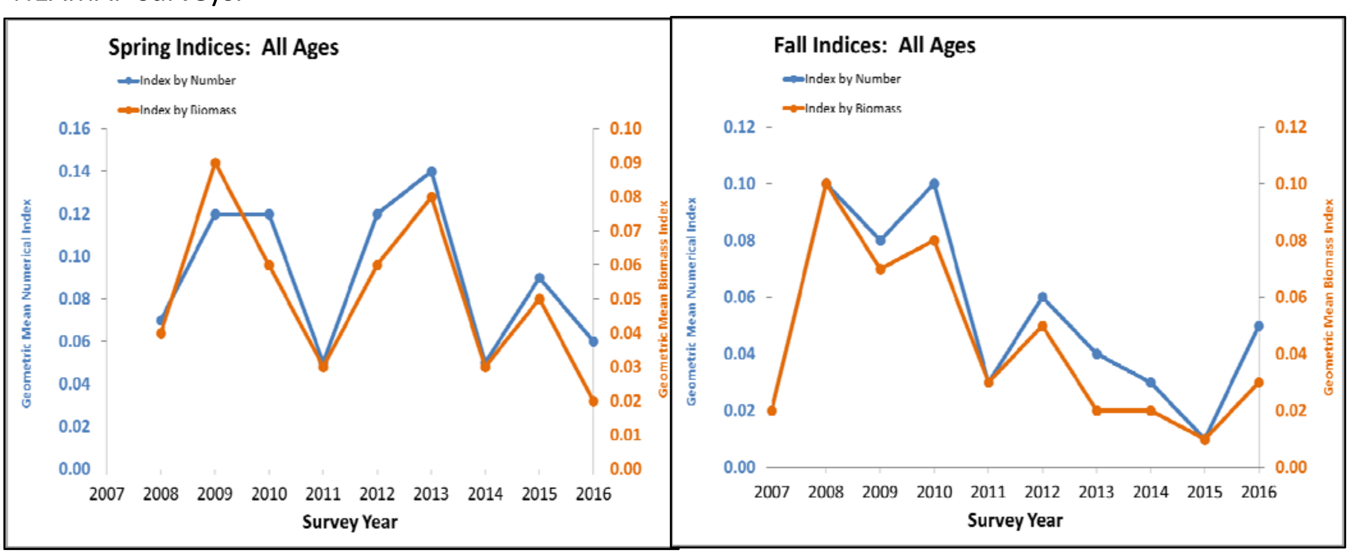


Figure 202. Tautog length-frequency distributions, by cruise.

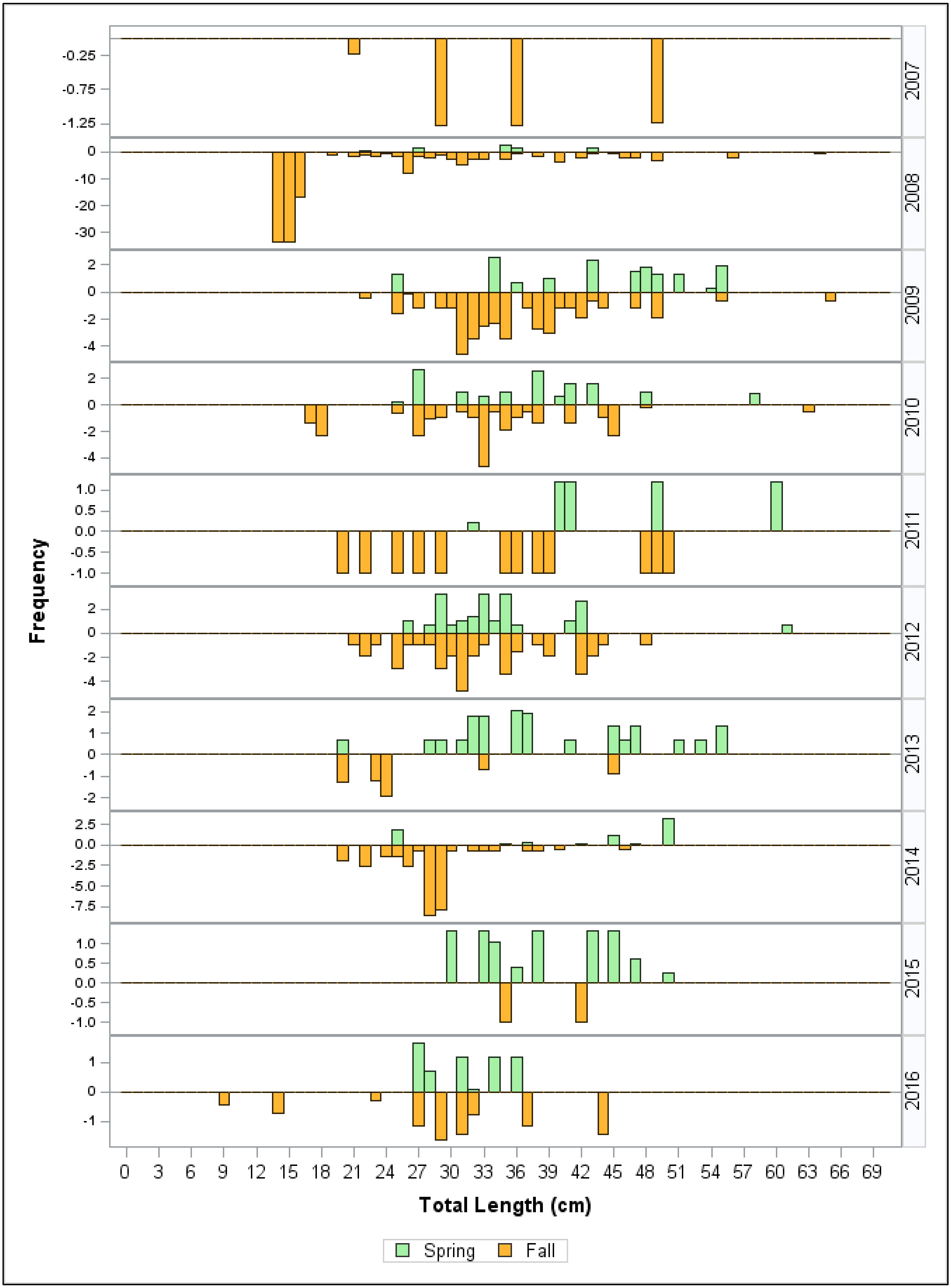


Figure 203. Tautog length-frequency distributions, by cruise and sex.

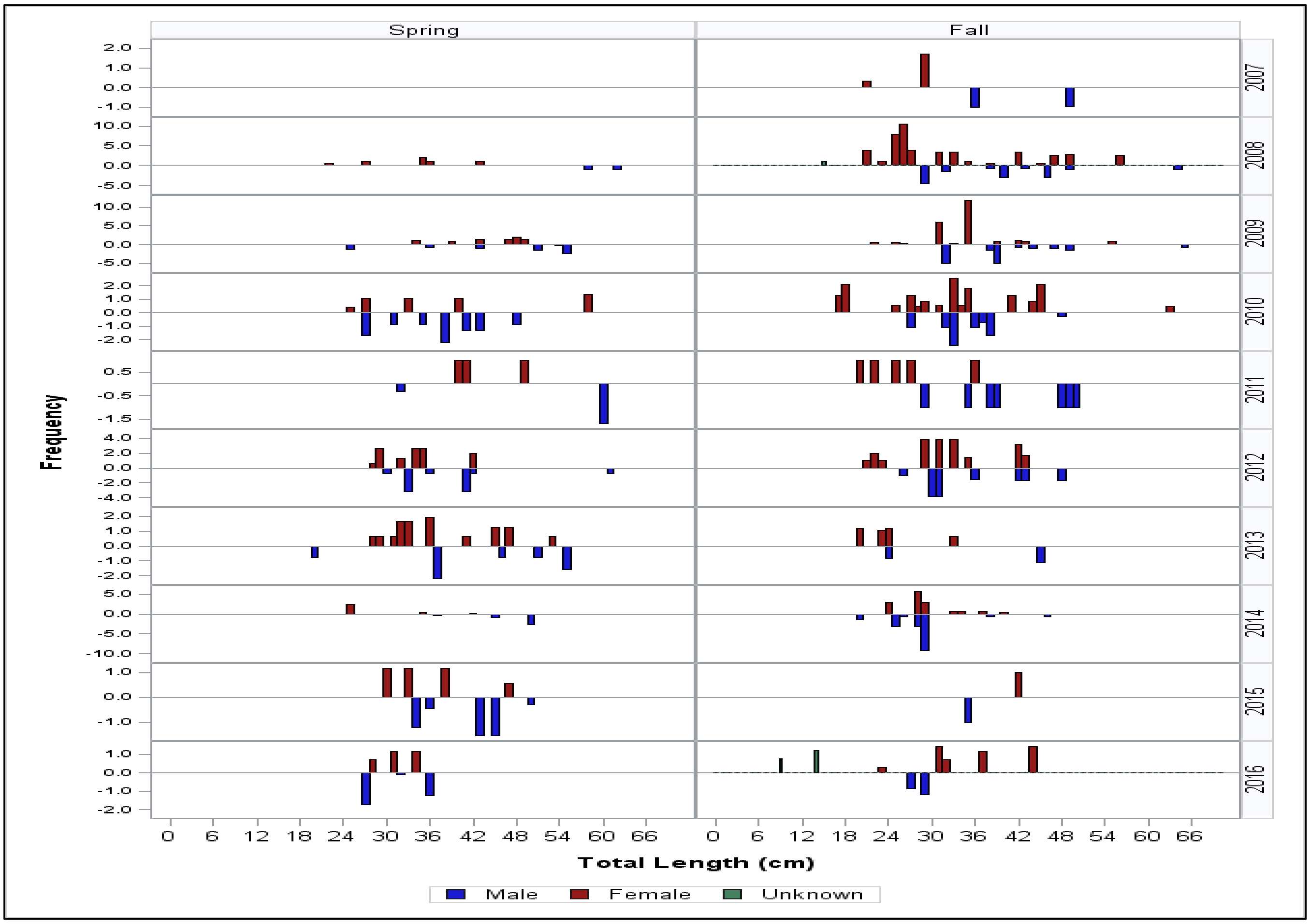


Figure 204. Tautog maturity at length, by sex for all cruises pooled, 2007-2016.

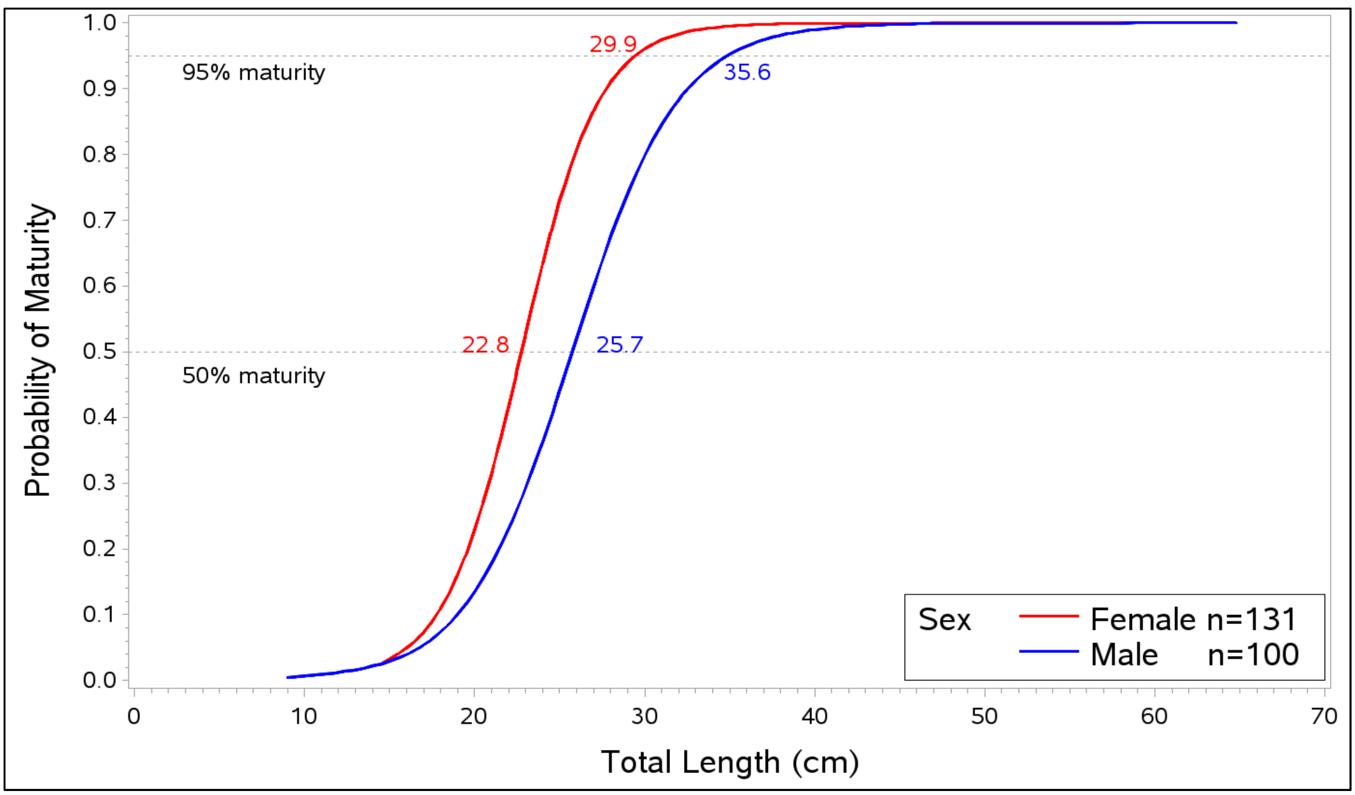
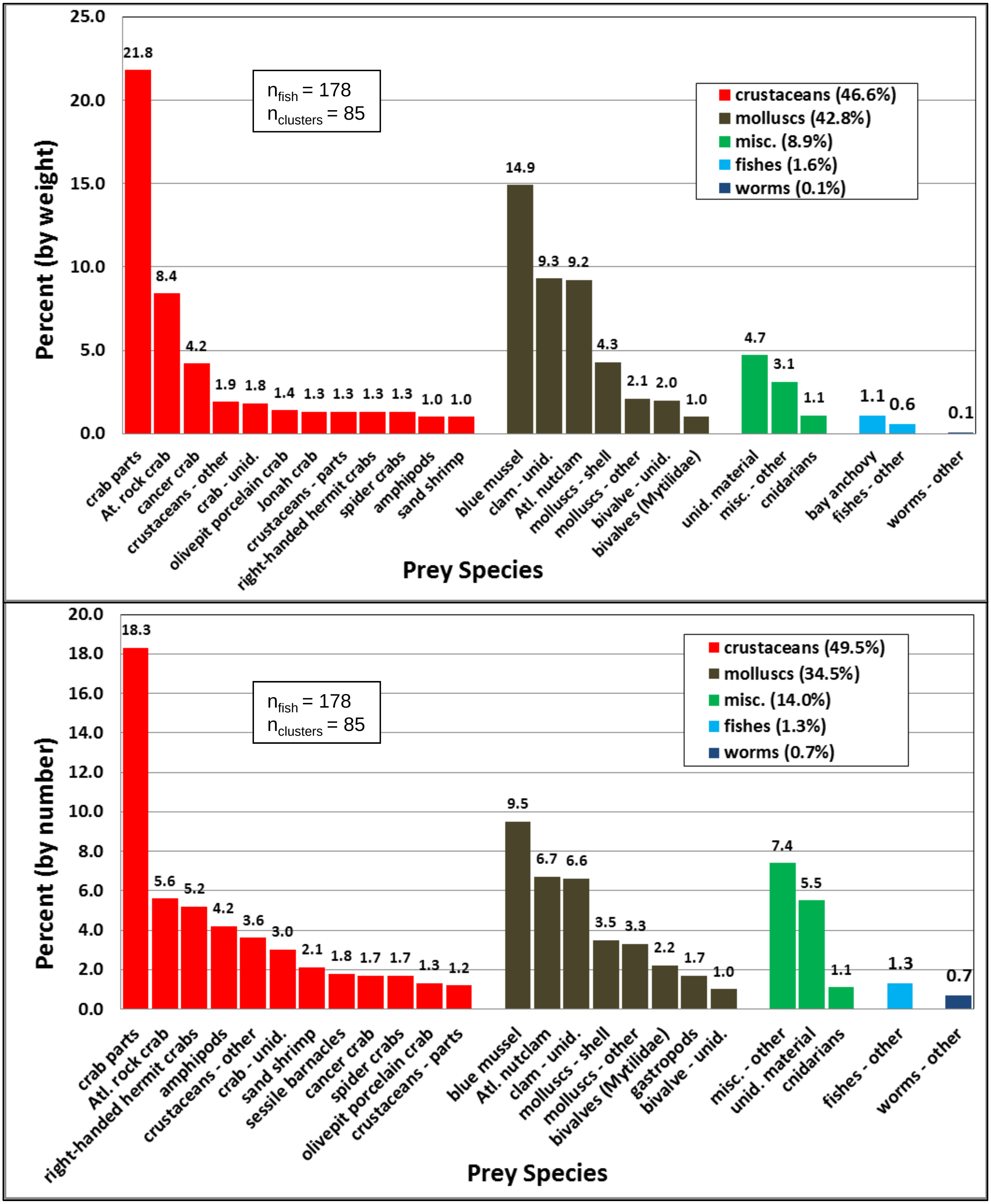
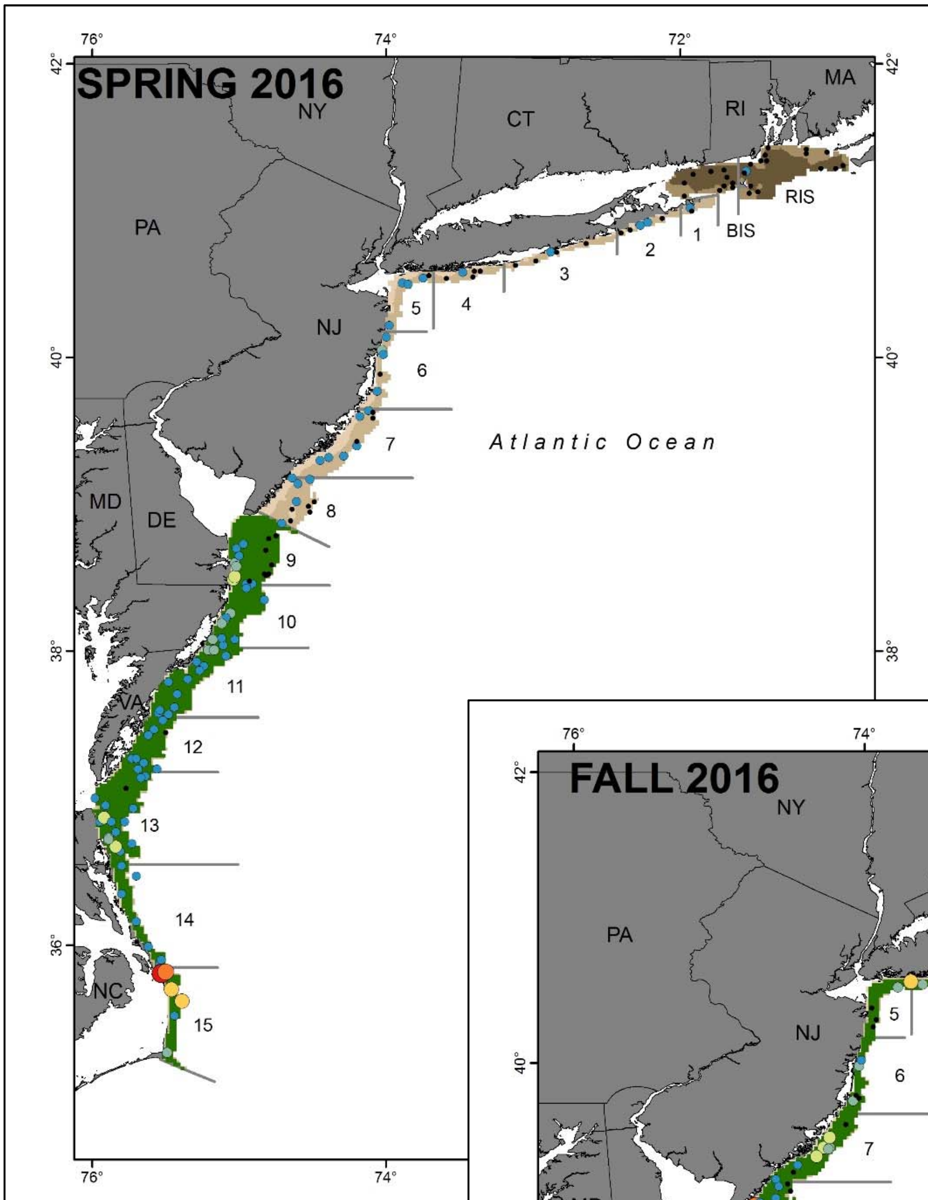


Figure 205. Tautog diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

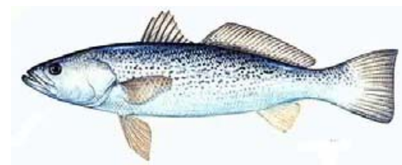


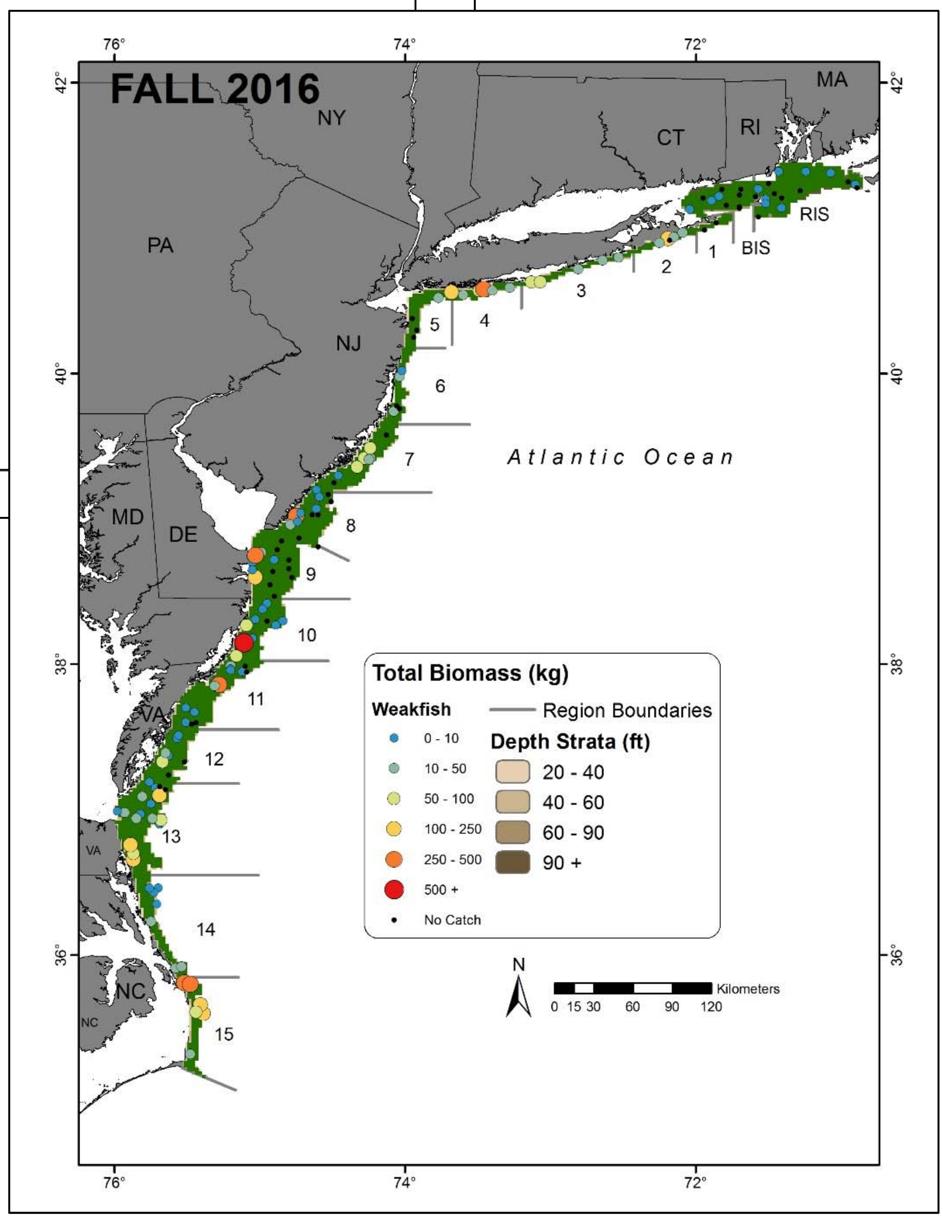


Weakfish

Sampling Priority: A

Figure 206. Weakfish biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices

= not used for abundance indices

Table 70. Weakfish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	39,580	2,198.8	100.0	2,174	305	305	279	277
	2009	8,785	339.3	92.3	1,654	189	189	143	136
	2010	18,192	864.9	84.6	1,717	259	259	184	164
	2011	28,701	1,476.6	92.3	2,633	227	227	113	110
	2012	21,602	1,047.0	100.0	4,054	326	326	212	209
	2013	3,404	269.9	100.0	2,019	386	386	276	274
	2014	3,718	183.2	92.3	350	122	122	72	69
	2015	6,411	288.0	100.0	2,584	268	267	139	137
	2016	26,628	1,614.9	100.0	6,491	438	438	264	260
Fall	2007	60,990	4,168.1	56.0	5,747	572	572	472	468
	2008	44,779	3,990.4	52.0	3,879	464	464	333	320
	2009	96,394	5,556.9	62.7	13,012	872	872	648	628
	2010	80,684	5,795.7	59.3	8,115	611	611	464	455
	2011	115,594	7,556.3	65.3	10,062	797	797	644	621
	2012	58,568	4,606.2	71.3	11,478	793	793	594	577
	2013	24,265	1,596.8	62.7	8,982	607	607	394	376
	2014	76,485	5,128.1	49.3	11,805	625	625	369	365
	2015	126,350	7,591.1	67.3	13,148	661	661	316	313
	2016	78,029	5,813.3	68.0	14,800	615	615	331	328

Table 71. Weakfish geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP surveys.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	**Index**	UCI	LCI	**Index**	UCI
All	2007							
	2008	106	4.85	6.63	8.95	1.02	1.42	1.88
	2009	113	1.19	1.80	2.57	0.25	0.40	0.58
	2010	107	1.97	3.07	4.57	0.35	0.64	1.00
	2011	107	1.76	2.84	4.35	0.40	0.74	1.16
	2012	107	5.99	8.75	12.61	1.14	1.68	2.36
	2013	107	4.08	5.51	7.33	0.71	0.99	1.31
	2014	107	0.41	0.66	0.97	0.07	0.17	0.28
	2015	107	1.70	2.46	3.42	0.37	0.55	0.75
	2016	107	10.60	14.86	20.68	1.66	2.25	2.98
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
	2014							
	2015							
	2016							
1	2007							
	2008	106	3.94	5.40	7.30	0.99	1.44	1.99
	2009	113	0.92	1.42	2.07	0.19	0.35	0.53
	2010	107	1.75	2.76	4.15	0.29	0.64	1.08
	2011	107	1.41	2.32	3.58	0.31	0.65	1.08
	2012	107	4.62	6.89	10.07	0.91	1.40	2.03
	2013	107	1.95	2.69	3.61	0.30	0.50	0.72
	2014	107	0.23	0.46	0.72	0.01	0.13	0.26
	2015	107	1.34	1.95	2.71	0.26	0.41	0.58
	2016	107	9.09	12.78	17.81	1.48	2.04	2.71
2+	2007							
	2008	106	1.79	2.43	3.21	0.50	0.81	1.17
	2009	113	0.46	0.72	1.02	0.07	0.15	0.22
	2010	107	0.43	0.74	1.11	0.04	0.23	0.45
	2011	107	0.75	1.23	1.84	0.18	0.41	0.69
	2012	107	1.69	2.49	3.52	0.36	0.62	0.93
	2013	107	2.64	3.55	4.68	0.44	0.66	0.90
	2014	107	0.18	0.33	0.49	0.02	0.12	0.24
	2015	107	0.58	0.88	1.24	0.13	0.22	0.31
	2016	107	1.60	2.27	3.10	0.33	0.50	0.69

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	**Index**	UCI	LCI	**Index**	UCI
All	2007	150	7.27	11.09	16.68	2.10	2.98	4.11
	2008	150	6.33	9.57	14.24	2.07	2.97	4.13
	2009	160	18.36	26.90	39.21	4.19	5.73	7.73
	2010	150	6.62	10.37	15.97	2.01	2.97	4.24
	2011	150	14.99	22.70	34.11	3.83	5.36	7.38
	2012	150	12.70	19.17	28.67	2.90	4.02	5.46
	2013	150	5.68	8.63	12.88	1.50	2.13	2.91
	2014	150	6.23	9.56	14.41	2.05	2.92	4.03
	2015	150	13.22	19.26	27.86	3.44	4.70	6.33
	2016	150	10.91	16.28	24.07	3.00	4.16	5.65
0	2007	150	4.25	6.33	9.23	1.50	2.21	3.12
	2008	150	3.83	5.66	8.19	1.51	2.22	3.14
	2009	160	12.46	18.05	25.98	3.04	4.23	5.78
	2010	150	4.56	7.14	10.91	1.46	2.20	3.18
	2011	150	8.79	13.34	20.01	2.49	3.58	5.00
	2012	150	7.77	11.63	17.18	1.90	2.67	3.66
	2013	150	3.47	5.44	8.27	0.86	1.30	1.83
	2014	150	4.49	6.91	10.41	1.59	2.29	3.19
	2015	150	9.86	14.27	20.48	2.89	3.90	5.16
	2016	150	5.96	8.90	13.08	1.75	2.41	3.24
1	2007	150	3.43	5.05	7.26	1.52	2.29	3.31
	2008	150	4.36	6.47	9.43	2.05	3.04	4.35
	2009	160	4.64	6.90	10.06	1.84	2.74	3.91
	2010	150	3.18	4.88	7.27	1.47	2.23	3.23
	2011	150	8.01	11.56	16.51	2.70	3.85	5.34
	2012	150	6.20	8.87	12.53	1.84	2.59	3.55
	2013	150	2.11	3.01	4.17	0.61	0.86	1.15
	2014	150	3.07	4.46	6.34	1.20	1.74	2.42
	2015	150	5.70	7.98	11.03	1.72	2.34	3.10
	2016	150	5.48	8.01	11.52	1.69	2.39	3.26
2+	2007	150	2.16	3.13	4.41	1.22	1.86	2.67
	2008	150	0.70	1.07	1.52	0.32	0.53	0.78
	2009	160	1.51	2.14	2.92	0.59	0.88	1.21
	2010	150	0.44	0.65	0.90	0.22	0.35	0.49
	2011	150	3.41	4.69	6.34	1.38	1.94	2.64
	2012	150	2.36	3.27	4.41	0.91	1.30	1.78
	2013	150	1.60	2.23	3.01	0.50	0.70	0.92
	2014	150	0.57	0.83	1.14	0.23	0.35	0.49
	2015	150	0.46	0.68	0.94	0.19	0.36	0.54
	2016	150	0.80	1.14	1.53	0.27	0.41	0.56

Figure 207. Weakfish geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.

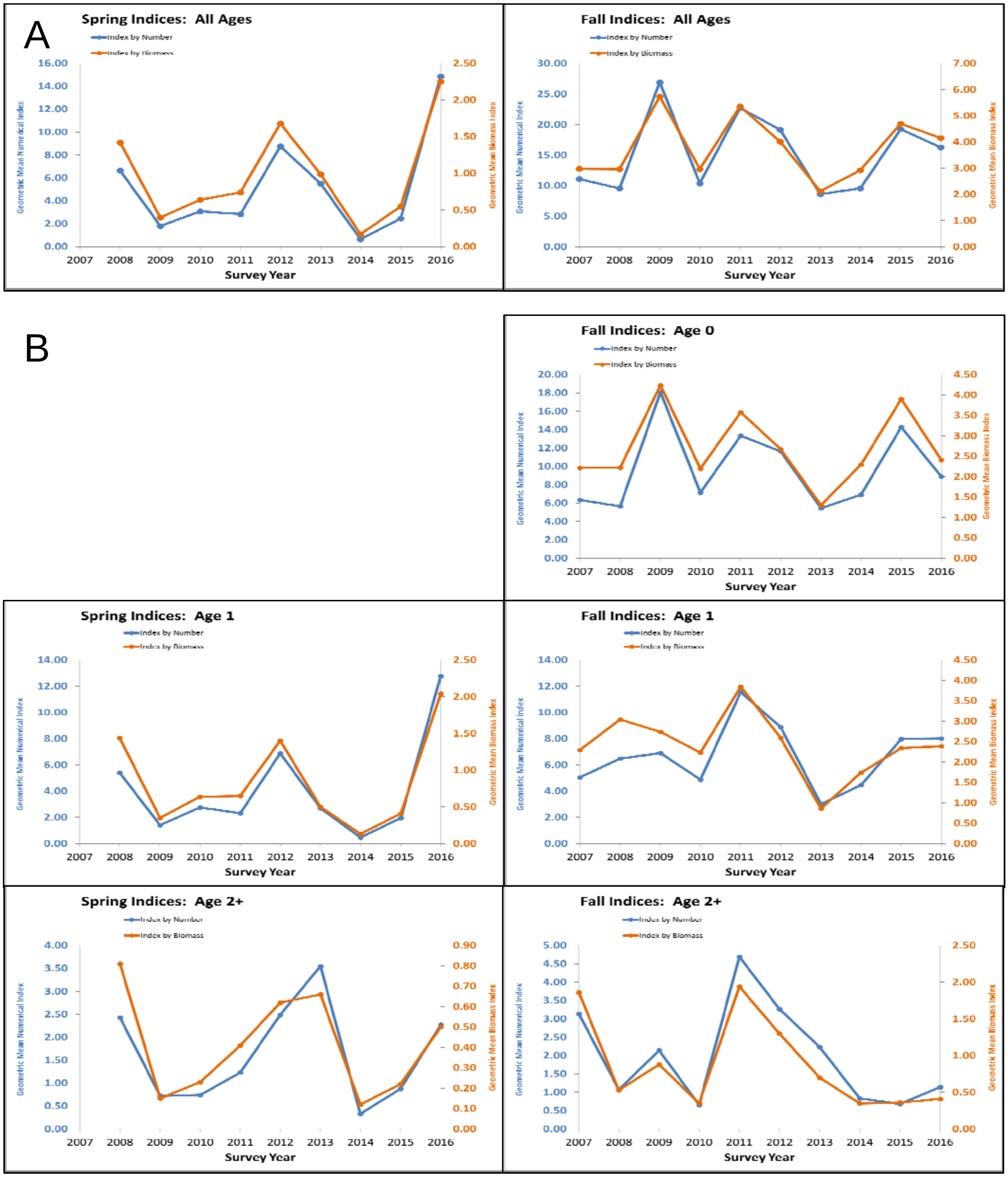


Figure 208. Weakfish length-frequency distributions, by cruise.

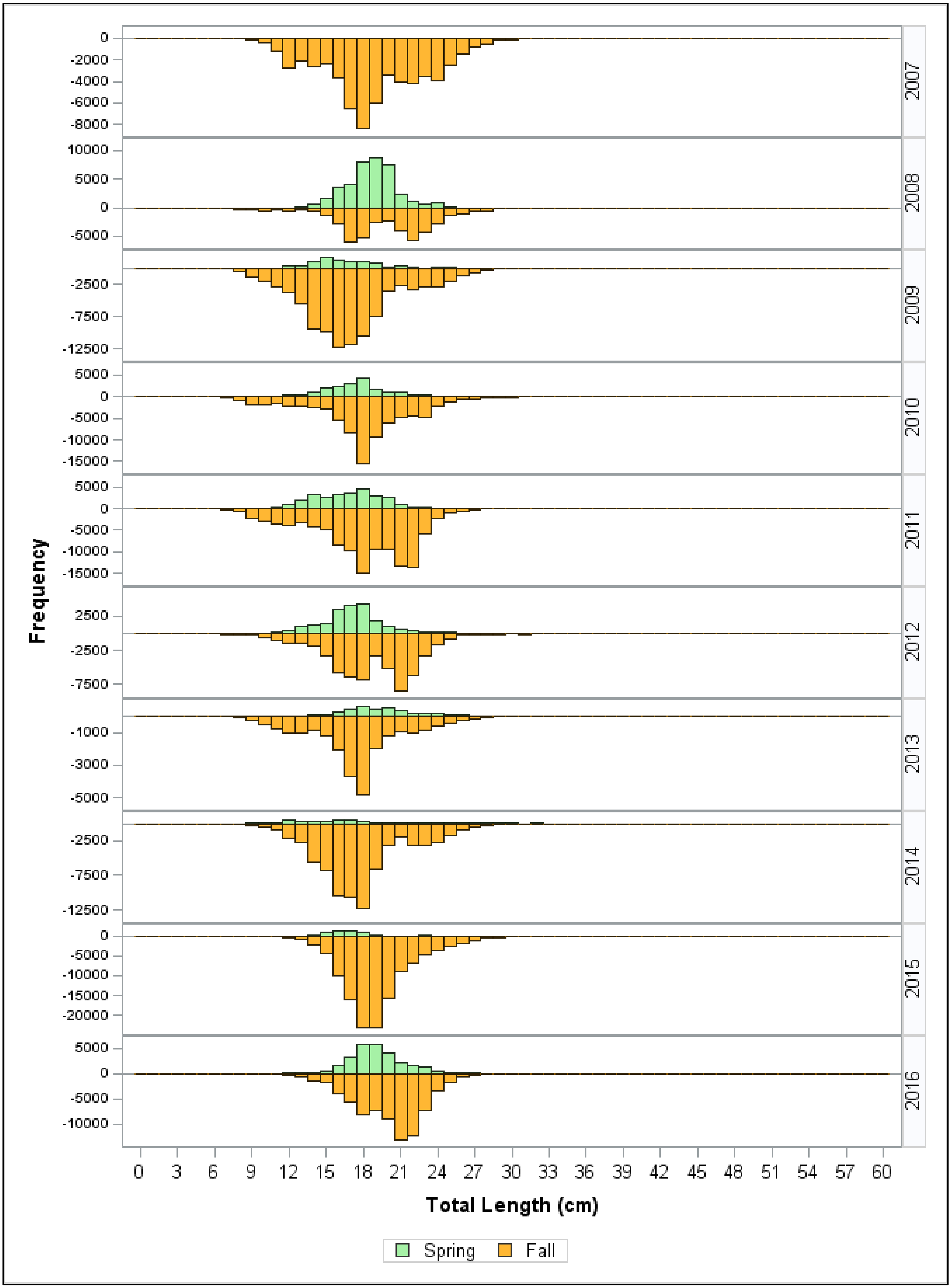


Figure 209. Weakfish length-frequency distributions, by cruise and sex.

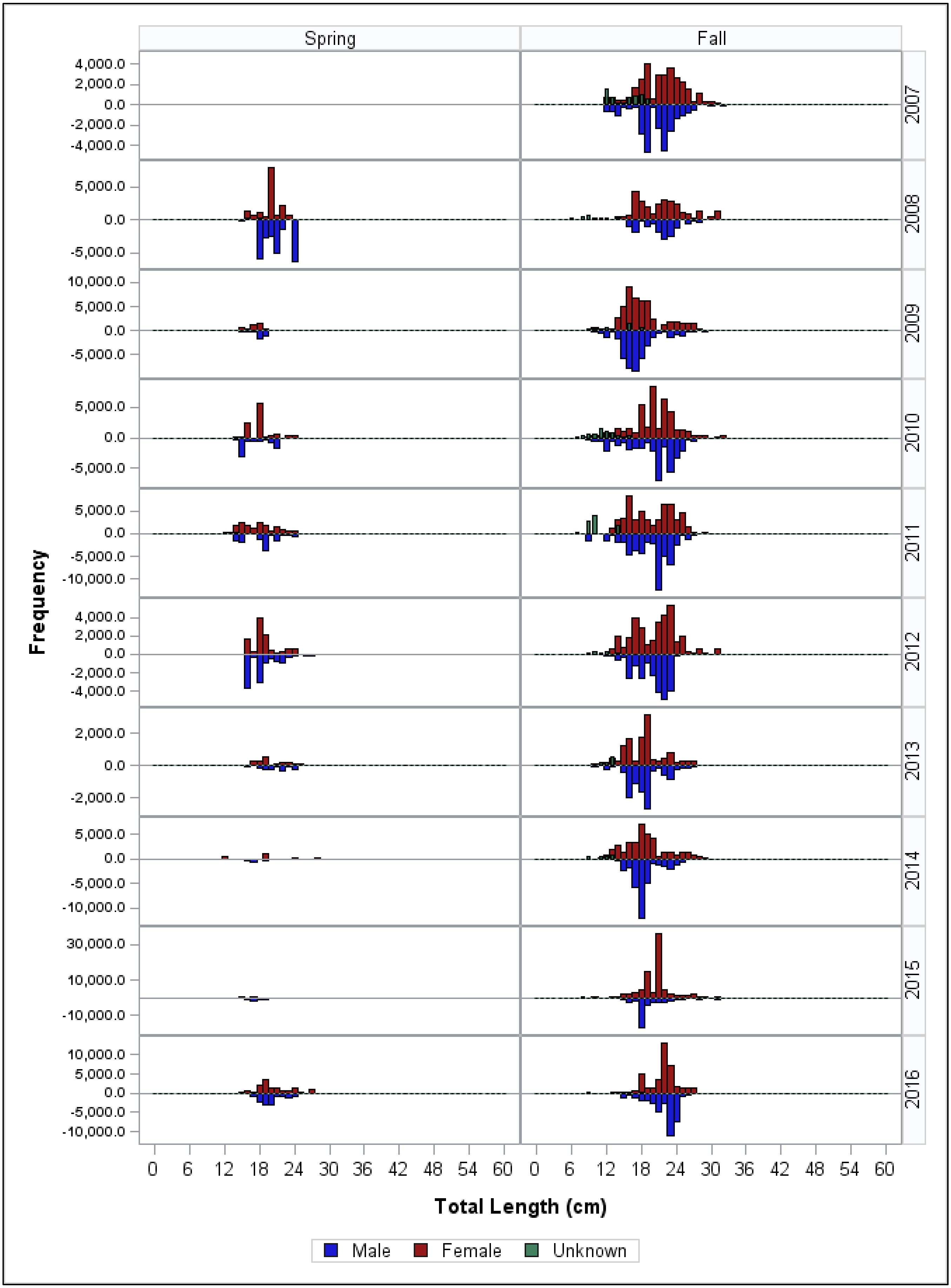


Figure 210. Weakfish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

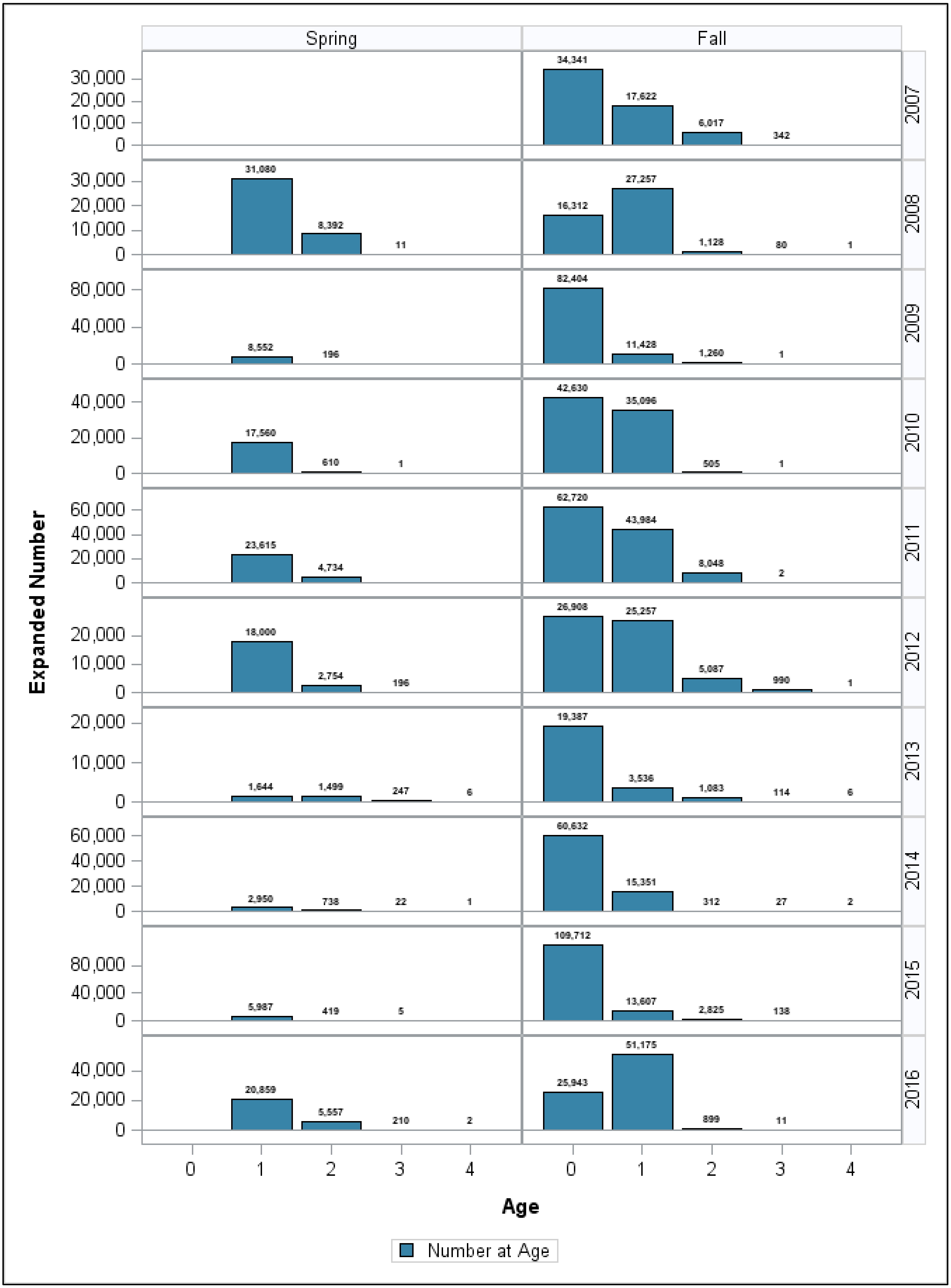


Figure 211. Weakfish catch-at-age standardized to 3,000 trawl minutes, by cruise.

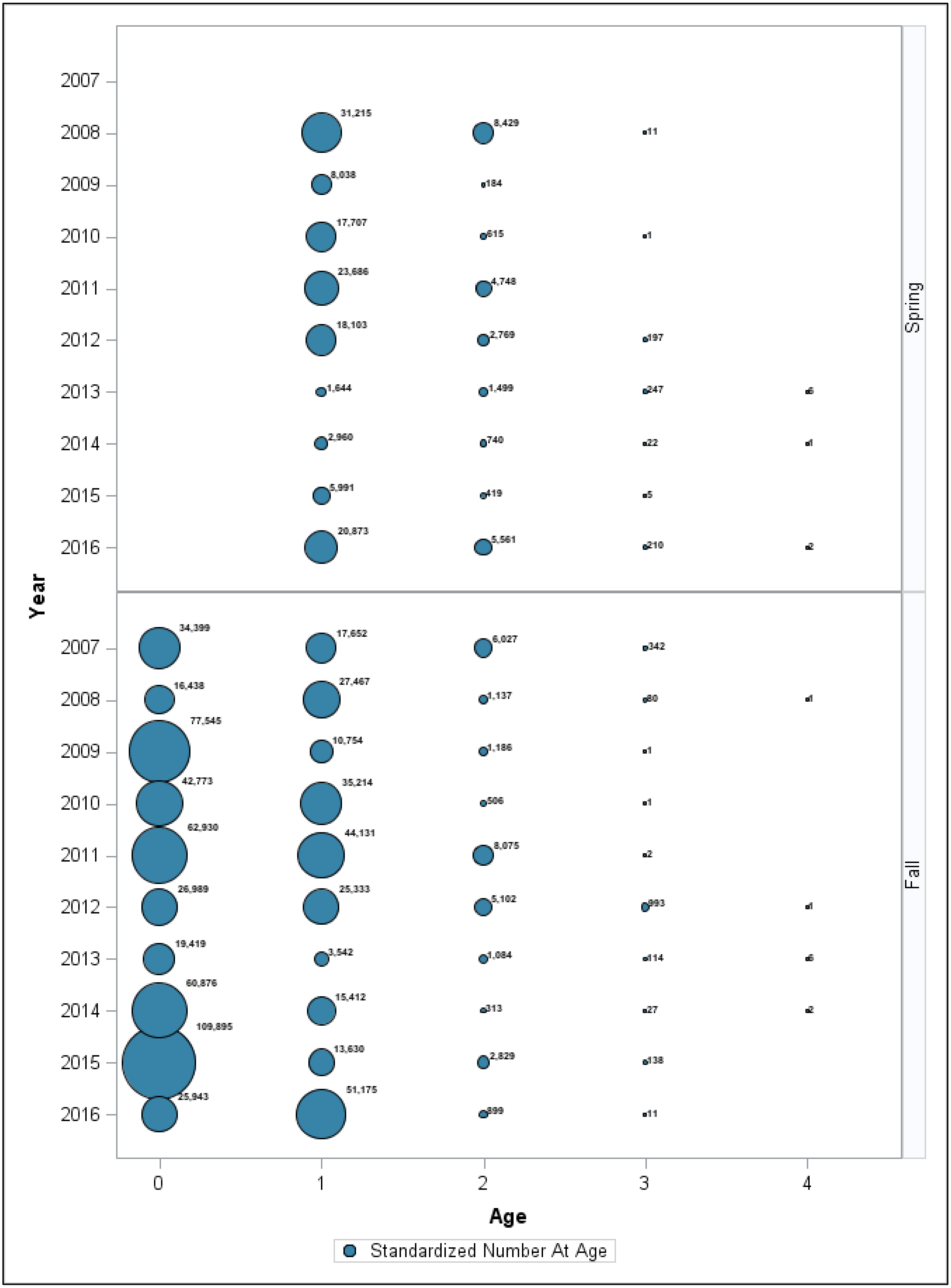


Figure 212. Weakfish sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

Figure 213. Weakfish maturity at length, by sex for all cruises pooled, 2007-2016.

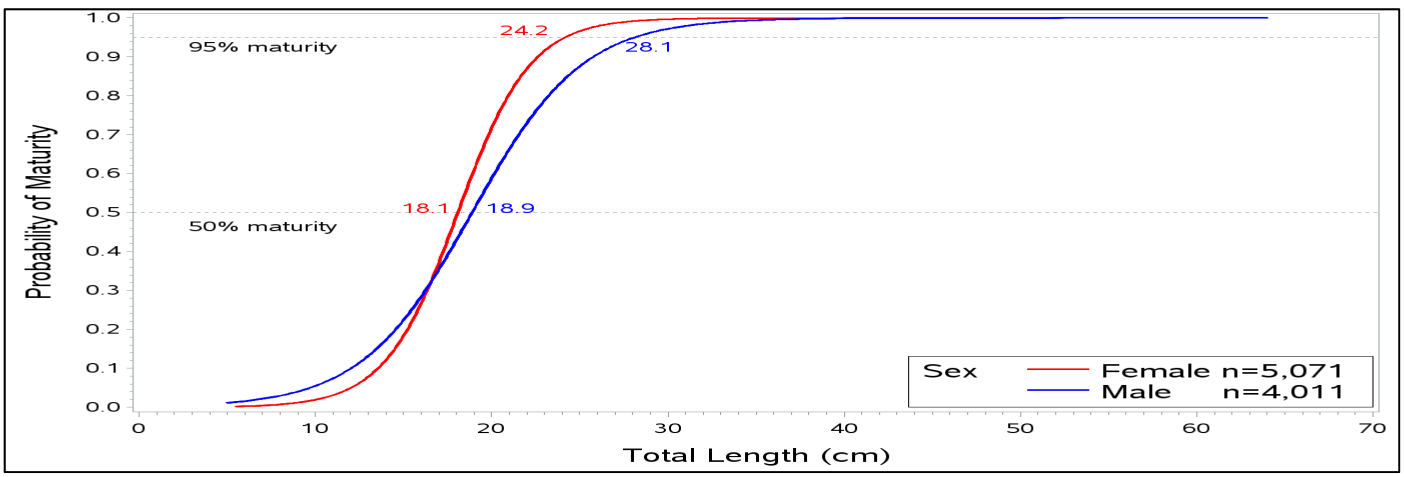


Figure 214. Weakfish maturity at age, by sex for all cruises pooled, 2007-2016.

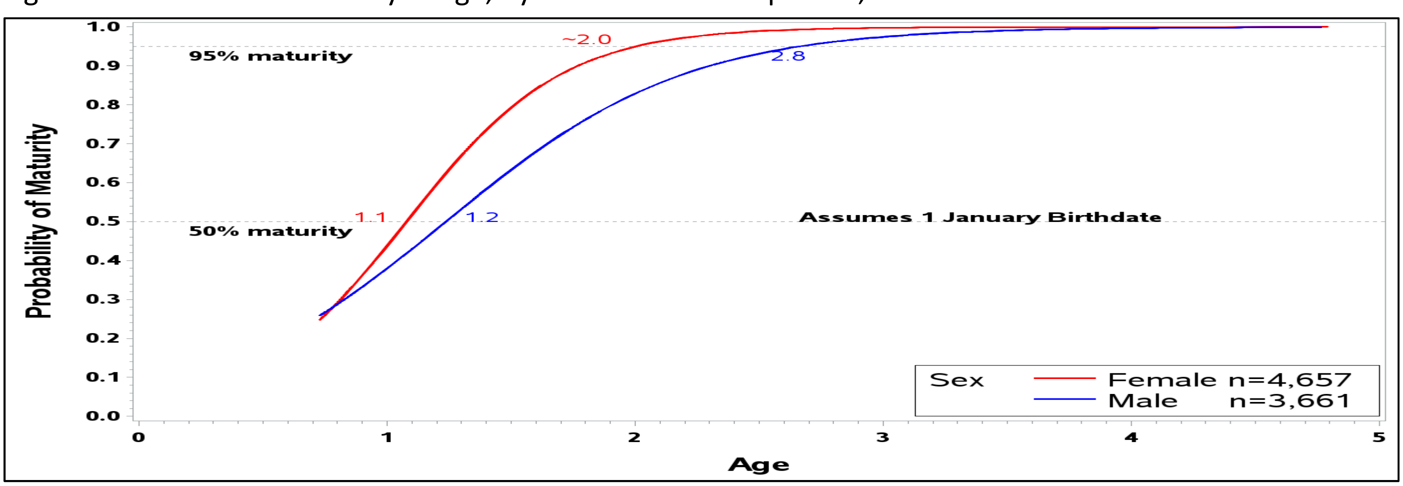
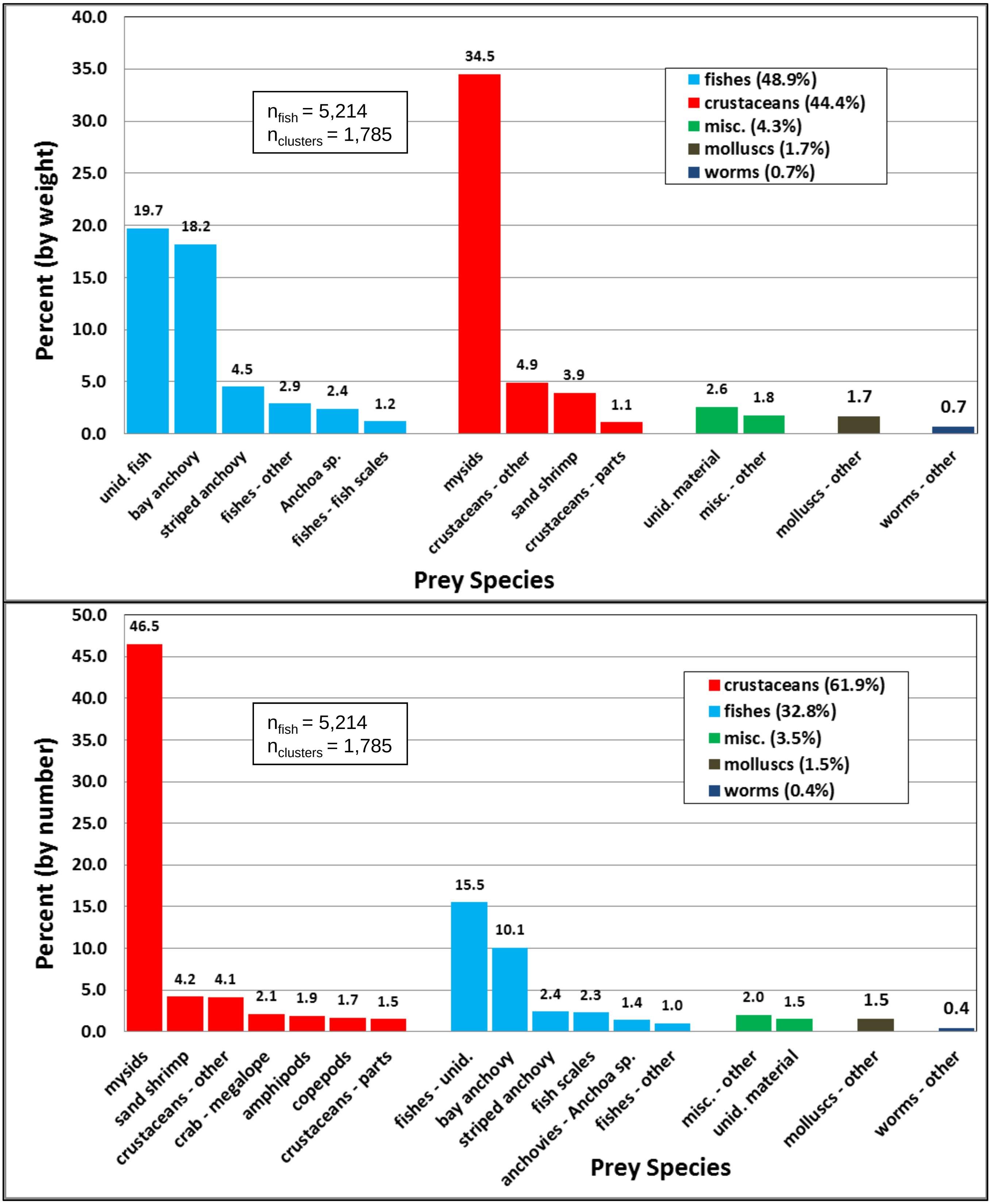


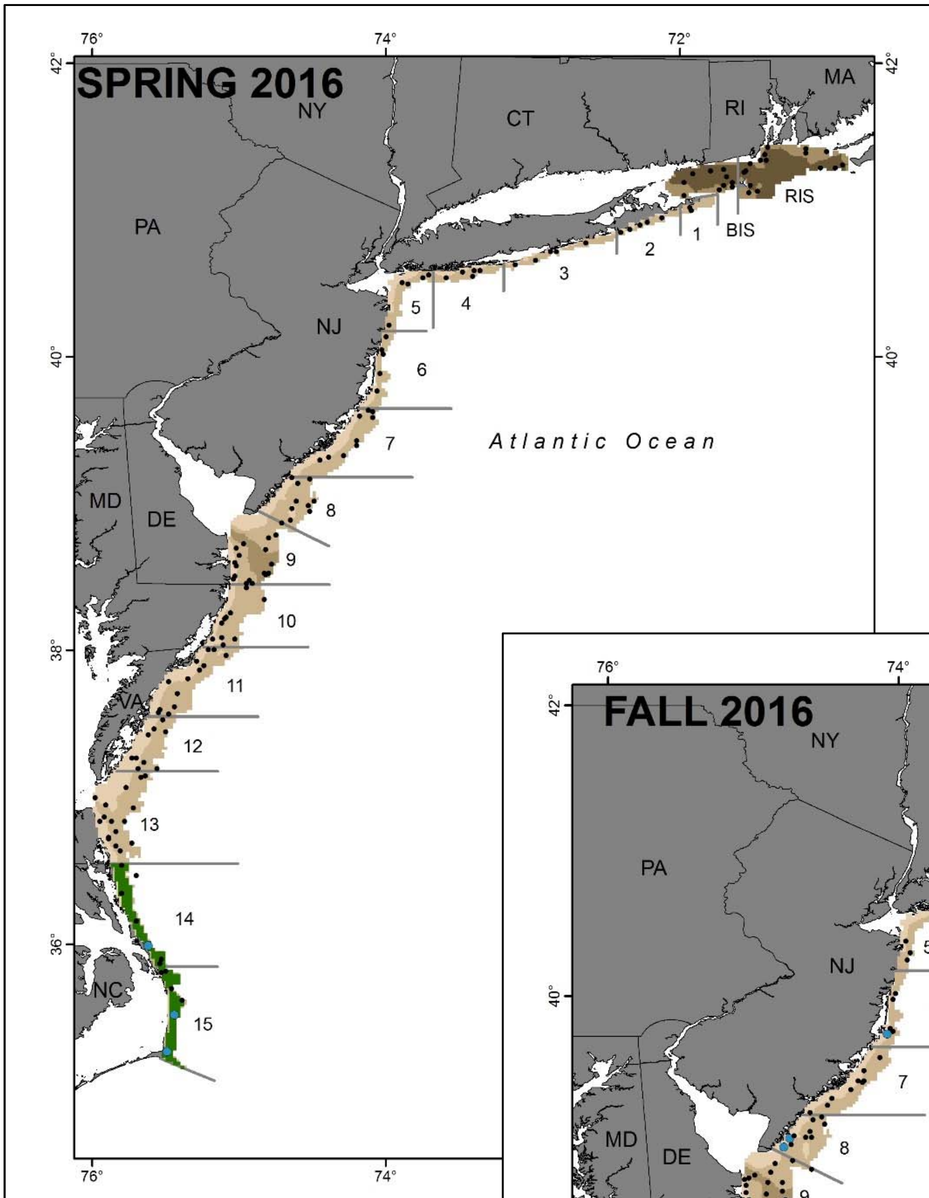
Figure 215. Weakfish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

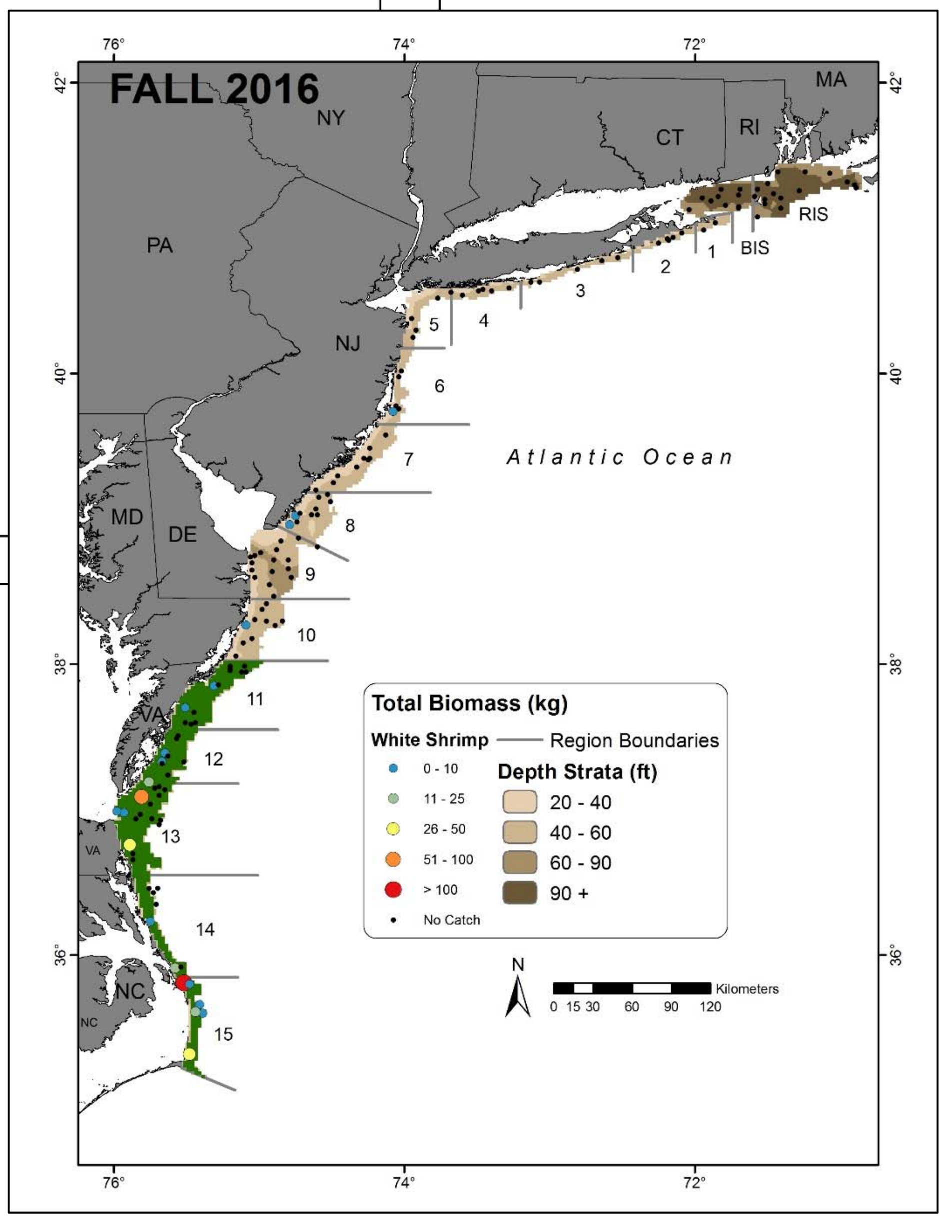


White Shrimp

Sampling Priority: E

Figure 216. White Shrimp biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices

(gray) = not used for abundance indices

Table 72. White Shrimp sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2009	23	0.7	23.1	23	N/A	N/A	N/A	N/A
	2010	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2011	0	0.0	0.0	0	N/A	N/A	N/A	N/A
	2012	4	0.2	7.7	4	N/A	N/A	N/A	N/A
	2013	109	2.8	53.8	109	N/A	N/A	N/A	N/A
	2014	0	0.0	0.0	109	N/A	N/A	N/A	N/A
	2015	2	0.1	7.7	2	N/A	N/A	N/A	N/A
	2016	80	2.2	23.1	80	N/A	N/A	N/A	N/A
Fall	2007	48	1.8	13.7	20	N/A	N/A	N/A	N/A
	2008	753	19.7	31.4	267	N/A	N/A	N/A	N/A
	2009	451	6.6	29.4	451	N/A	N/A	N/A	N/A
	2010	3,312	87.2	27.5	521	N/A	N/A	N/A	N/A
	2011	16	0.5	7.8	16	N/A	N/A	N/A	N/A
	2012	839	18.0	37.3	839	N/A	N/A	N/A	N/A
	2013	974	22.5	25.5	534	N/A	N/A	N/A	N/A
	2014	852	18.0	13.7	582	N/A	N/A	N/A	N/A
	2015	3,188	95.8	27.5	1,039	N/A	N/A	N/A	N/A
	2016	44,074	594.0	33.3	2,015	N/A	N/A	N/A	N/A

Table 73. White Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	13	0.00	0.00	0.00	0.00	0.00	0.00
	2009	15	0.00	0.22	0.58	0.00	0.02	0.06
	2010	13	0.00	0.00	0.00	0.00	0.00	0.00
	2011	13	0.00	0.00	0.00	0.00	0.00	0.00
	2012	13	0.00	0.07	0.21	0.00	0.01	0.02
	2013	13	0.80	1.76	3.24	0.03	0.11	0.21
	2014	13	0.00	0.00	0.00	0.00	0.00	0.00
	2015	13	0.00	0.06	0.19	0.00	0.01	0.02
	2016	13	0.00	0.63	1.98	0.00	0.08	0.22

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	56	0.06	0.17	0.29	0.00	0.02	0.03
	2008	51	0.37	0.98	1.85	0.04	0.15	0.28
	2009	53	0.44	0.95	1.64	0.02	0.07	0.12
	2010	51	0.50	1.26	2.40	0.06	0.30	0.60
	2011	51	0.00	0.09	0.20	0.00	0.01	0.02
	2012	51	0.73	1.49	2.57	0.07	0.17	0.28
	2013	51	0.22	0.69	1.33	0.01	0.13	0.27
	2014	51	0.19	0.36	0.56	0.03	0.07	0.12
	2015	51	0.82	2.02	3.99	0.17	0.45	0.78
	2016	51	1.45	3.07	5.77	0.35	0.75	1.27

Figure 217. White Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

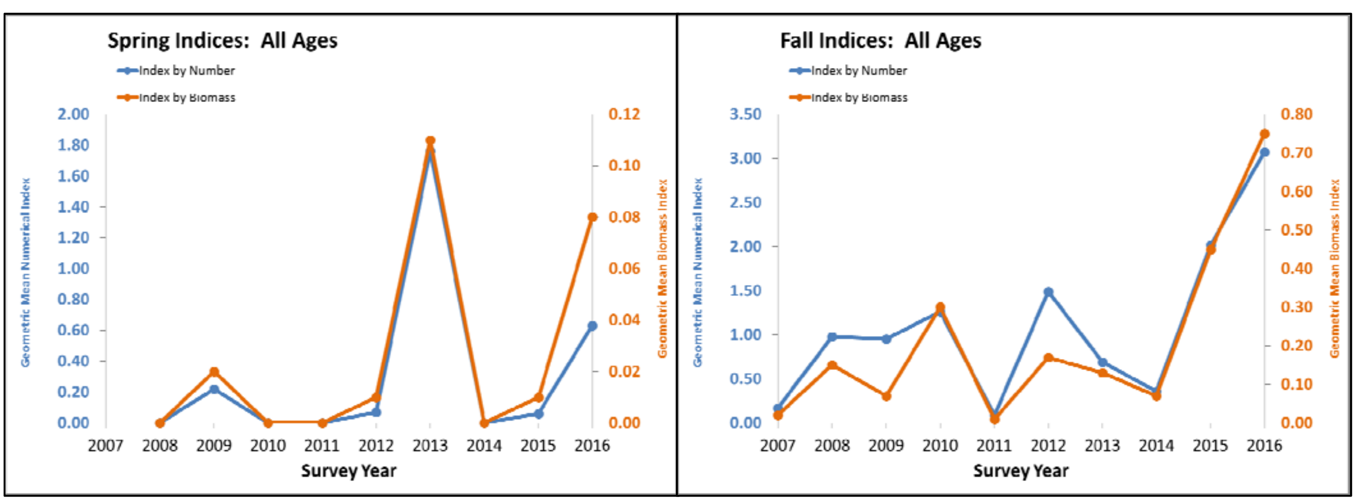
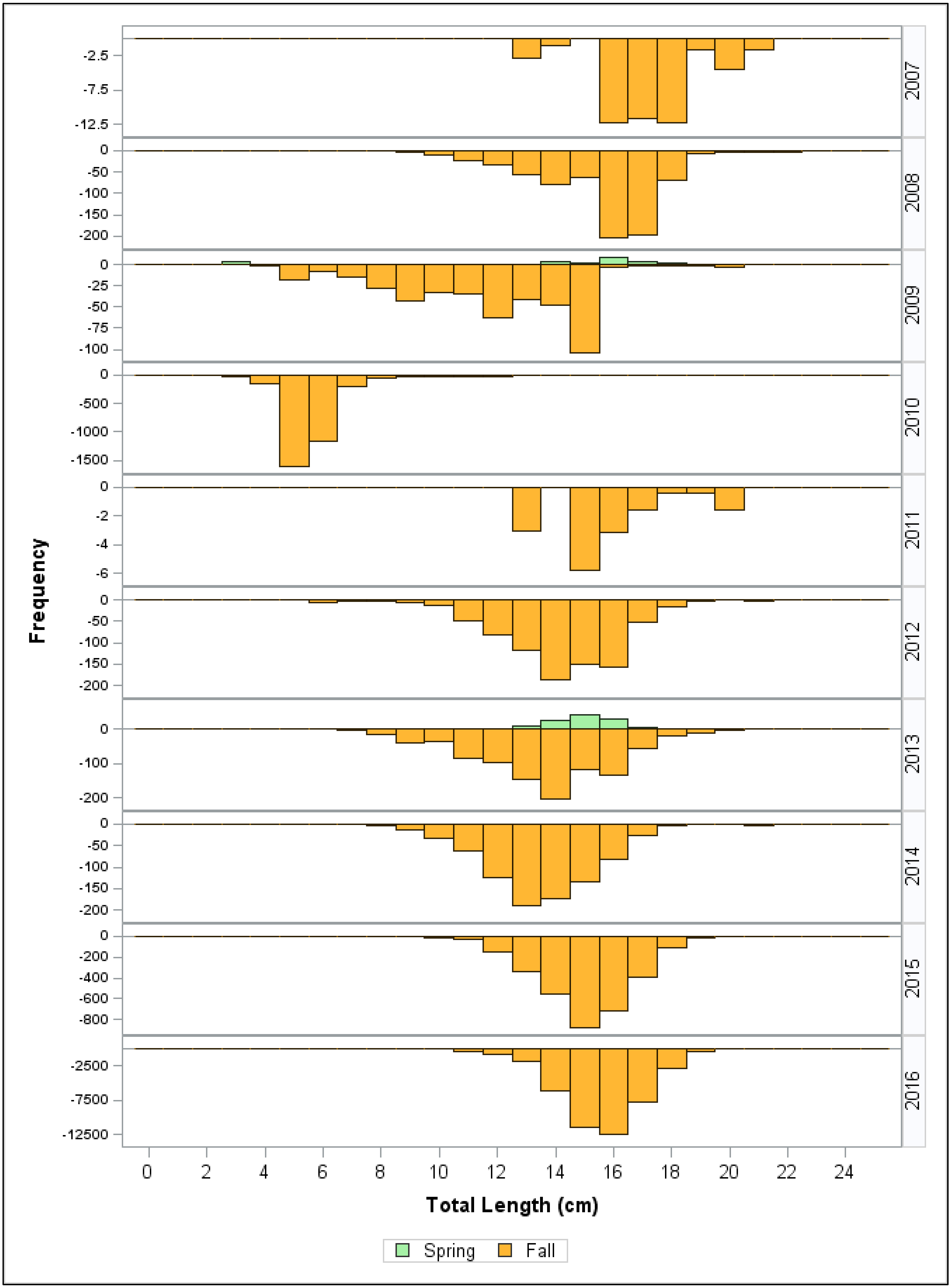
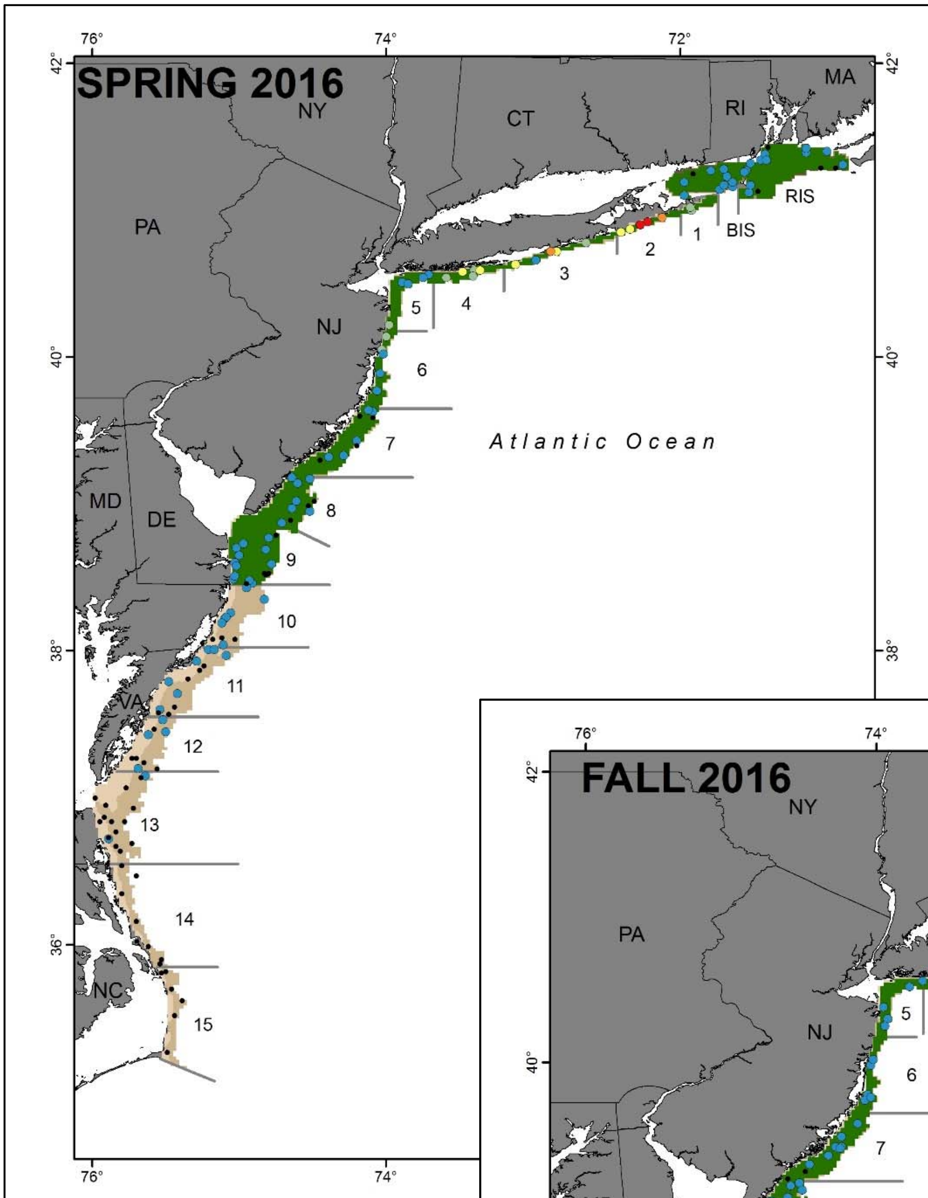


Figure 218. White Shrimp length-frequency distributions, by cruise.

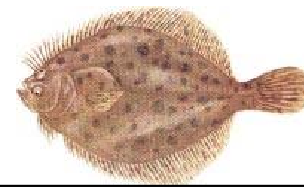


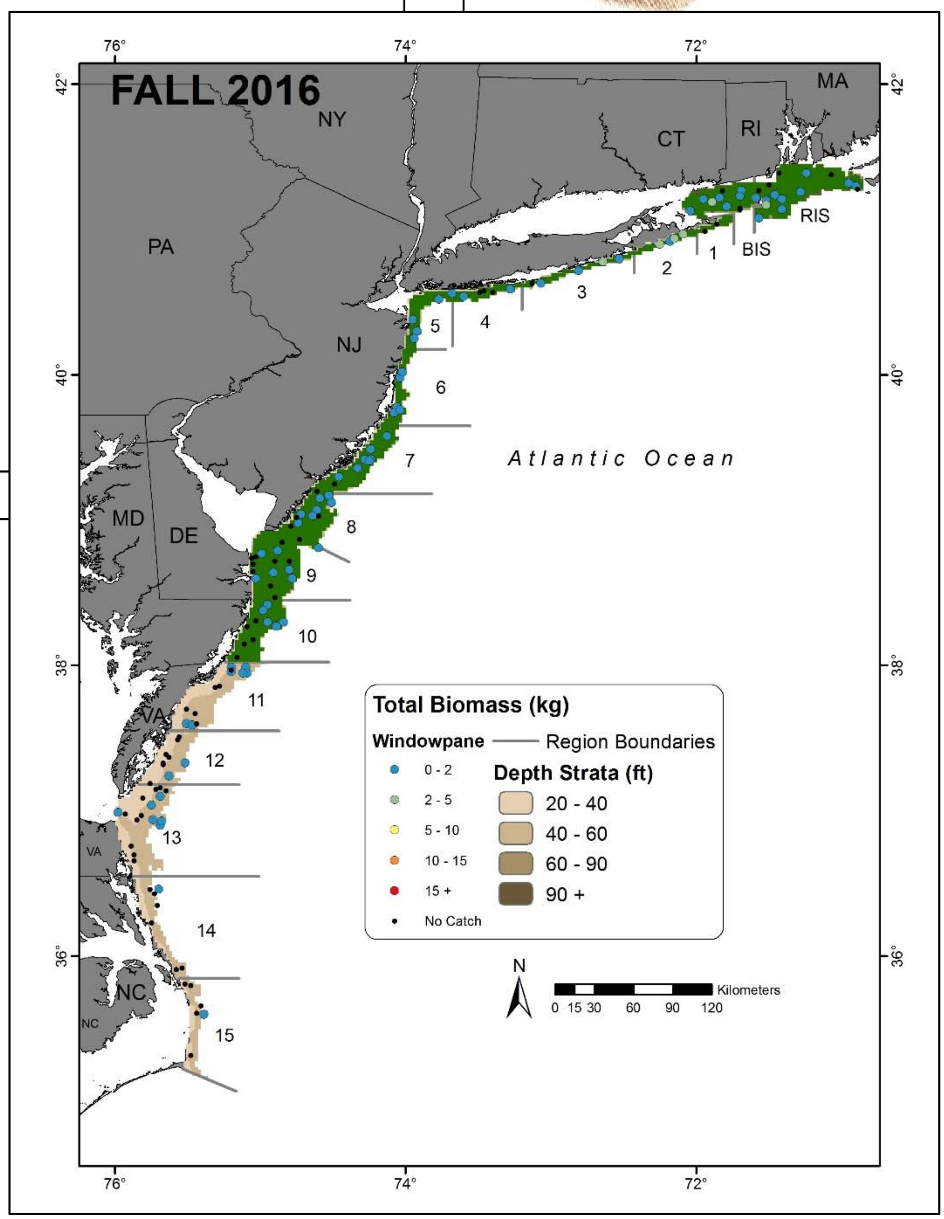


Windowpane Flounder

Sampling Priority: A (As of 2012)

Figure 219. Windowpane Flounder biomass (kg) collected at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.





State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	used	used
		90+	used	used
	BIS	60-90	used	used
		90+	used	used
NY	01	40-60	used	used
	02	20-40	used	used
		40-60	used	used
	03	20-40	used	used
		40-60	used	used
	04	20-40	used	used
		40-60	used	used
	05	20-40	used	used
		40-60	used	used
NJ	06	20-40	used	used
		40-60	used	used
	07	20-40	used	used
		40-60	used	used
	08	20-40	used	used
		40-60	used	used
DE	09	20-40	used	used
		40-60	used	used
		60-90	used	used
MD	10	20-40	not used	used
		40-60	not used	used
VA	11	20-40	not used	not used
		40-60	not used	not used
	12	20-40	not used	not used
		40-60	not used	not used
	13	20-40	not used	not used
		40-60	not used	not used
NC	14	20-40	not used	not used
		40-60	not used	not used
	15	20-40	not used	not used
		40-60	not used	not used

(green) = used for abundance indices
(grey) = not used for abundance indices

Table 74. Windowpane Flounder sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	756	191.0	78.7	697	0	0	0	0
	2009	1,067	268.2	82.0	868	0	0	0	0
	2010	1,065	237.1	69.7	847	0	0	0	0
	2011	936	214.0	78.7	936	0	0	0	0
	2012	994	232.7	79.8	994	299	0	211	192
	2013	904	187.7	82.0	840	339	0	218	207
	2014	443	109.0	74.2	417	250	0	137	134
	2015	585	127.8	77.5	585	282	0	133	130
	2016	745	153.8	80.9	651	294	0	91	90
Fall	2007	744	114.0	86.9	694	0	0	0	0
	2008	475	79.4	72.7	410	0	0	0	0
	2009	1,133	198.2	83.8	1,133	0	0	0	0
	2010	1,208	172.9	86.9	1,033	0	0	0	0
	2011	1,202	189.3	87.9	1,202	0	0	0	0
	2012	856	137.7	85.9	856	354	0	240	233
	2013	416	63.4	73.7	416	244	0	154	142
	2014	427	57.0	71.7	427	235	0	106	105
	2015	465	70.7	81.8	465	298	0	120	119
	2016	317	57.9	65.7	317	228	0	114	114

Table 75. Windowpane flounder geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	85	2.99	3.86	4.90	0.94	1.18	1.44
	2009	96	2.51	3.12	3.84	0.78	0.97	1.18
	2010	89	2.11	2.83	3.72	0.67	0.84	1.03
	2011	89	2.42	3.12	3.95	0.75	0.95	1.17
	2012	89	2.30	2.92	3.66	0.64	0.82	1.02
	2013	89	2.06	2.67	3.40	0.58	0.73	0.90
	2014	89	1.39	1.74	2.14	0.43	0.53	0.64
	2015	89	1.85	2.36	2.97	0.54	0.67	0.82
	2016	89	2.01	2.48	3.02	0.51	0.61	0.71

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	94	3.23	4.13	5.22	0.63	0.79	0.96
	2008	99	1.28	1.70	2.18	0.30	0.40	0.51
	2009	107	3.56	4.61	5.92	0.83	1.05	1.30
	2010	99	4.23	5.51	7.11	0.84	1.06	1.31
	2011	99	4.46	5.75	7.34	0.96	1.20	1.48
	2012	99	2.95	3.85	4.97	0.60	0.79	1.01
	2013	99	1.73	2.29	2.98	0.38	0.50	0.63
	2014	99	1.54	2.08	2.74	0.33	0.44	0.56
	2015	99	1.85	2.34	2.91	0.37	0.46	0.56
	2016	99	1.12	1.46	1.86	0.27	0.35	0.42

Figure 220. Windowpane Flounder geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

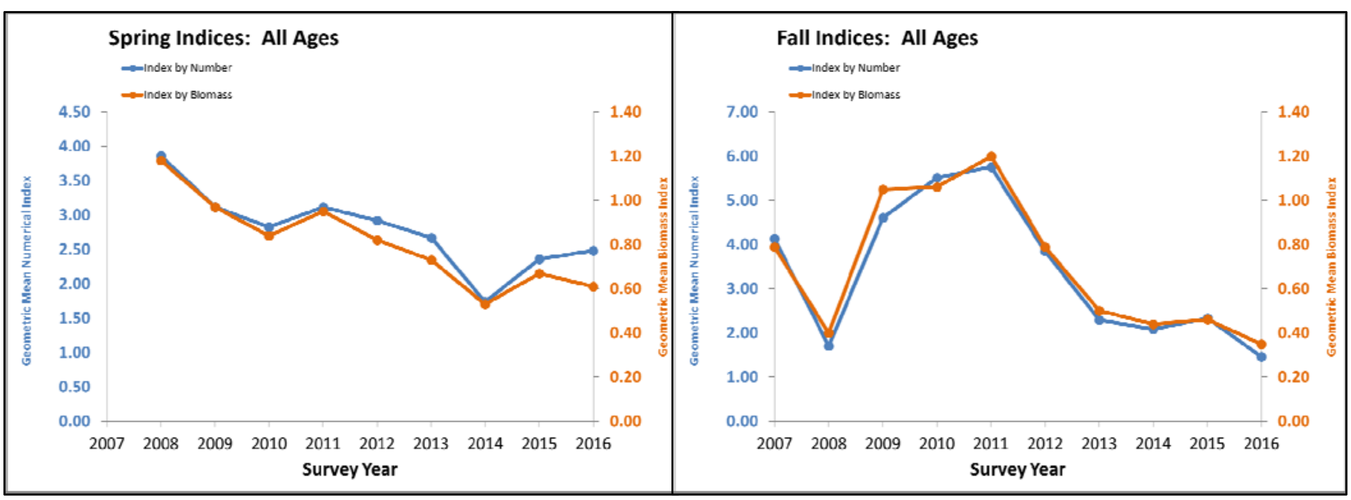


Figure 221. Windowpane Flounder length-frequency distributions, by cruise.

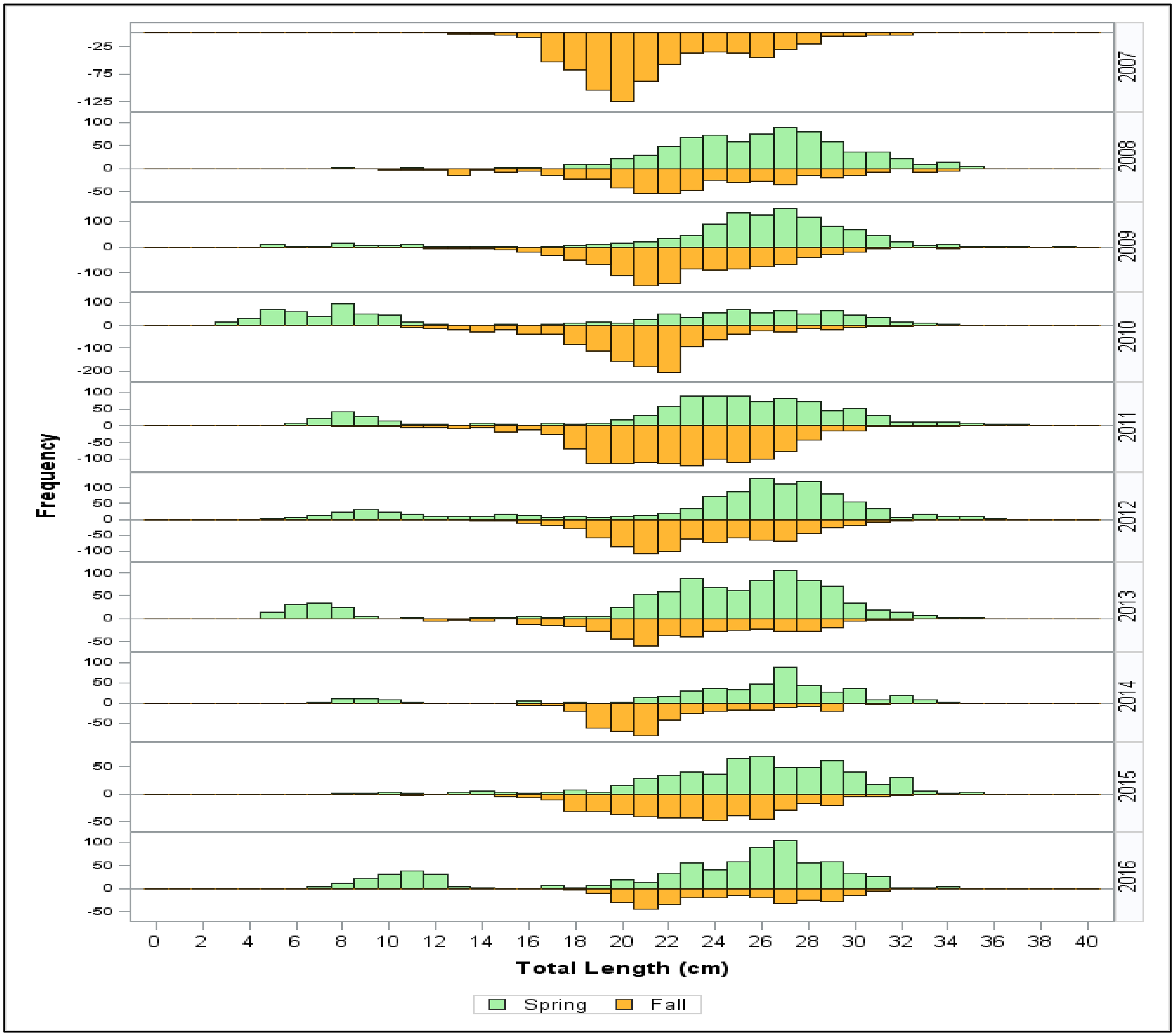


Figure 222. Windowpane Flounder length-frequency distributions, by cruise and sex.

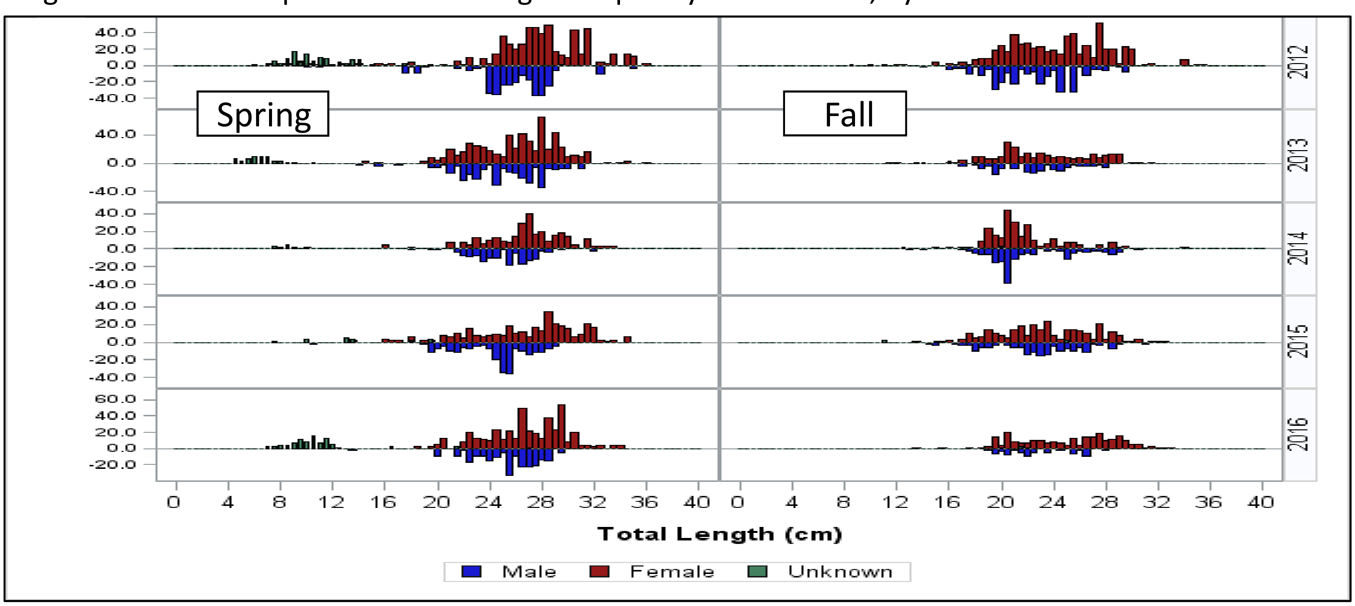


Figure 223. Windowpane Flounder sex ratio, by length group, for all cruises pooled, 2012-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

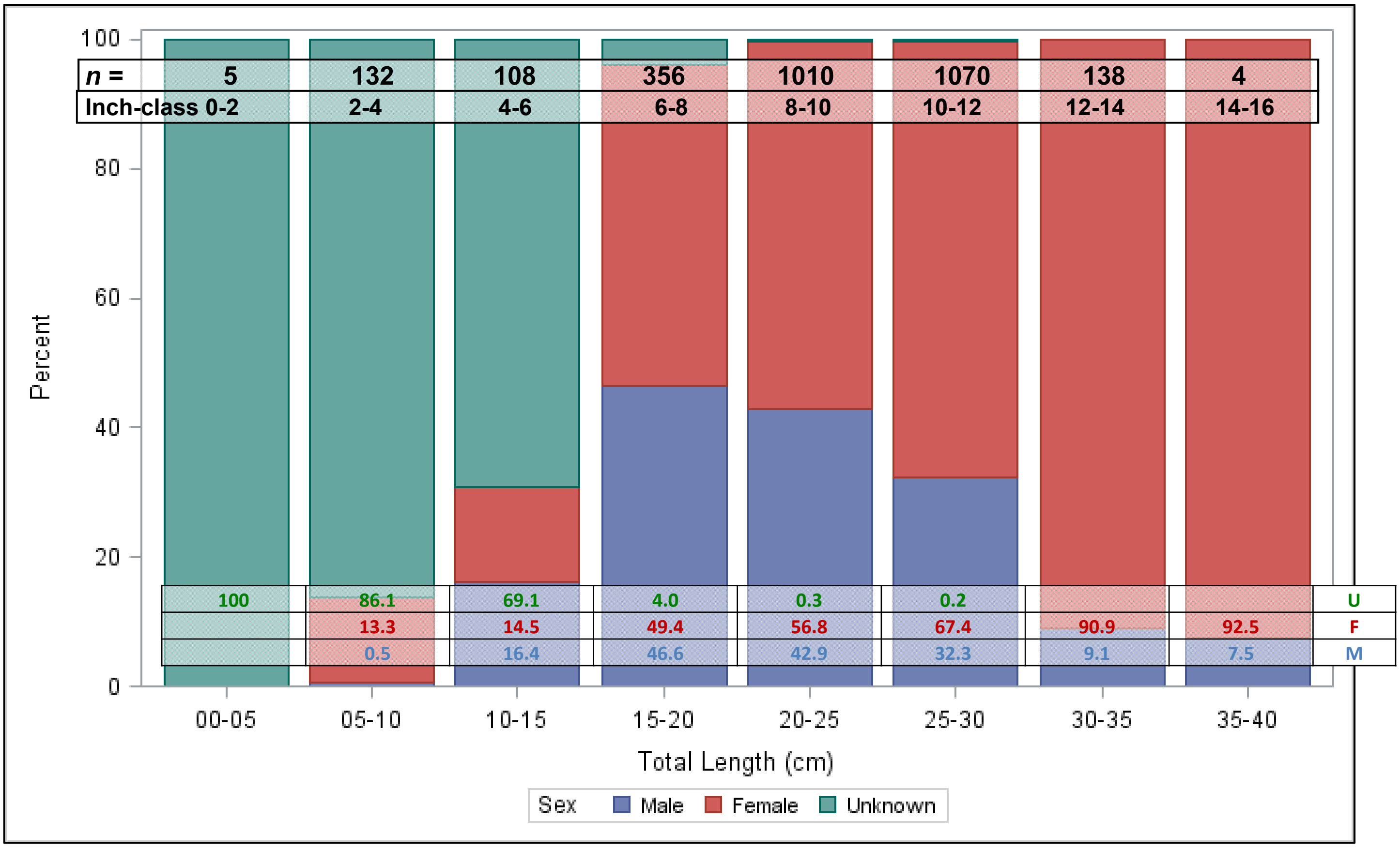


Figure 224. Windowpane Flounder maturity at length, by sex for all cruises pooled, 2012-2016.

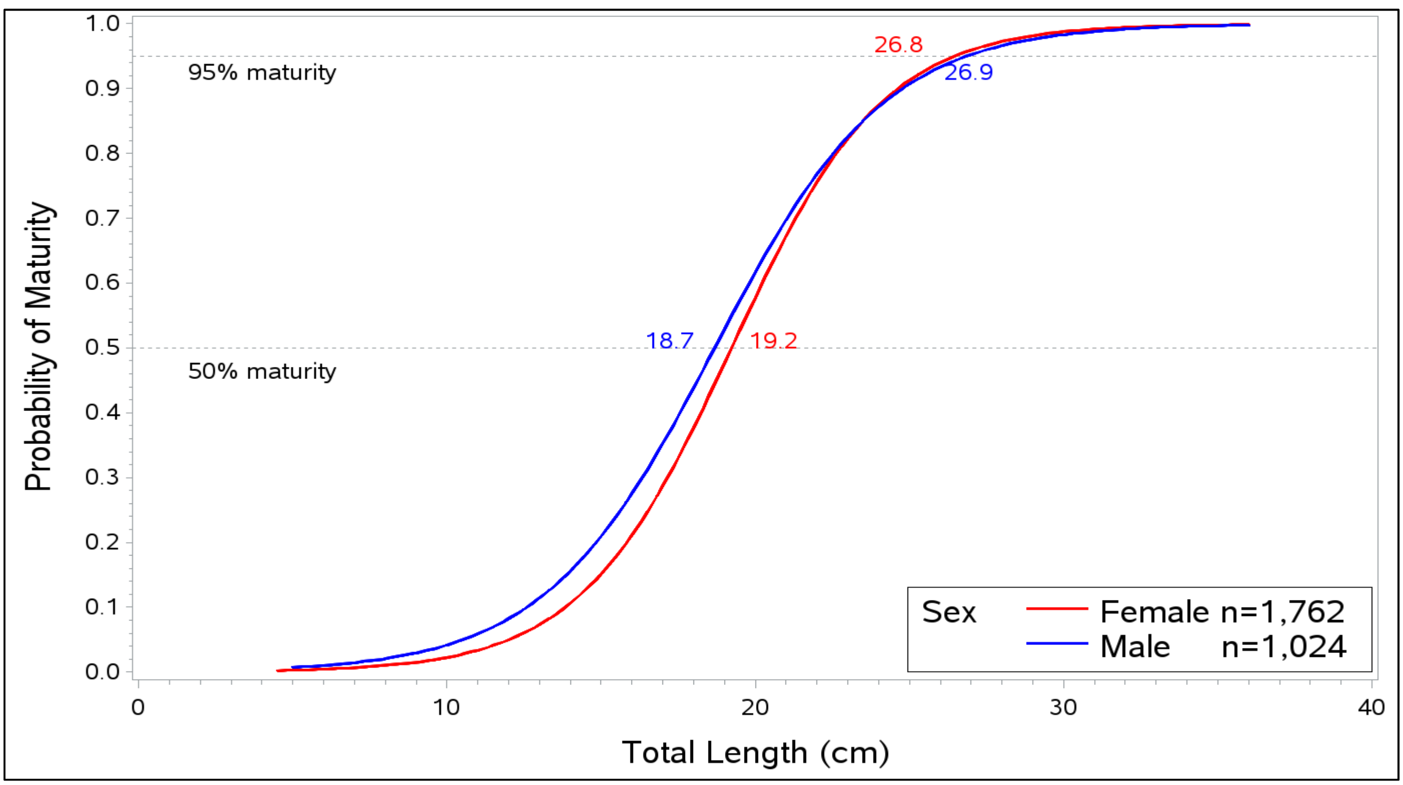
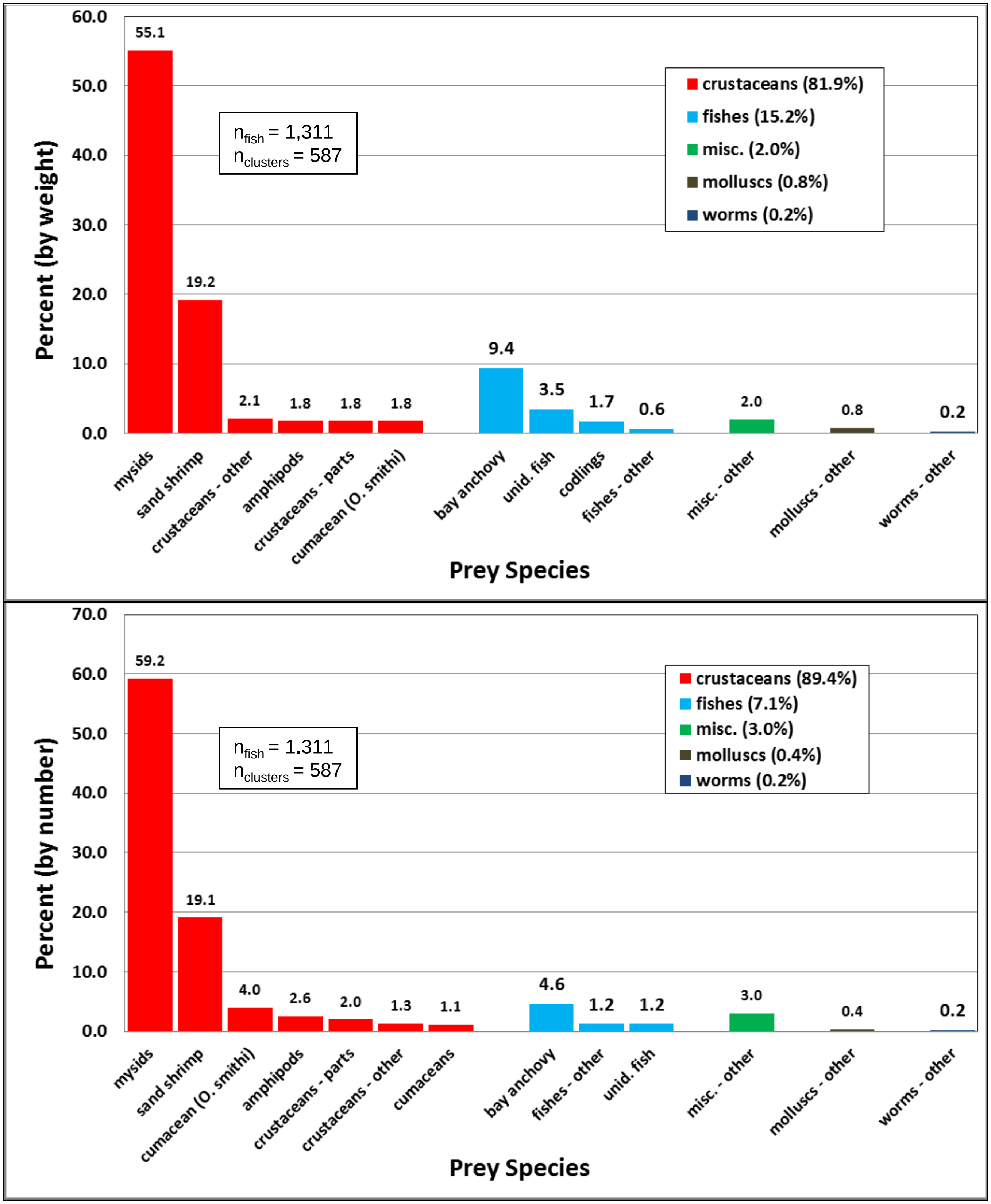


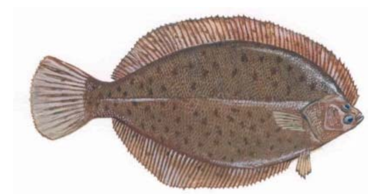
Figure 225. Windowpane Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2012-2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

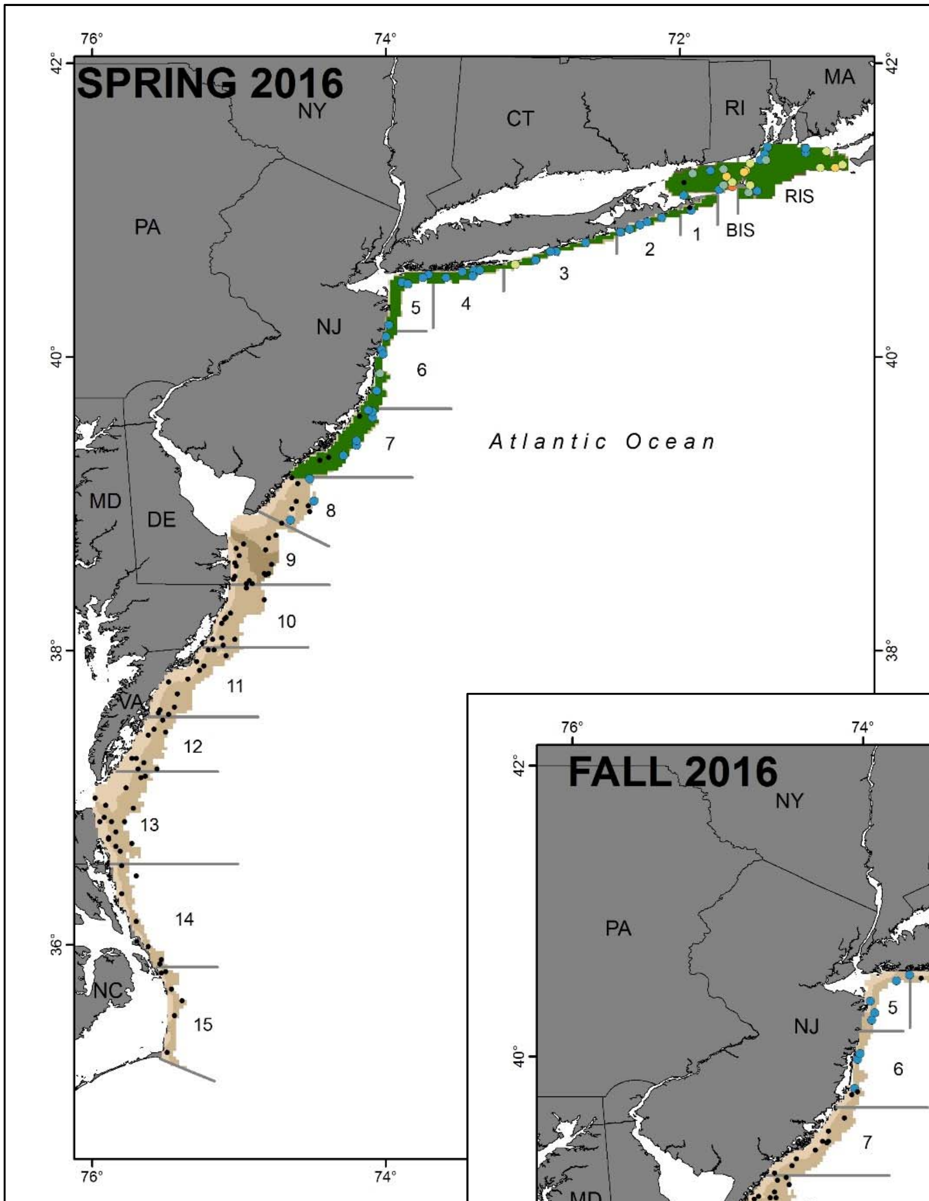


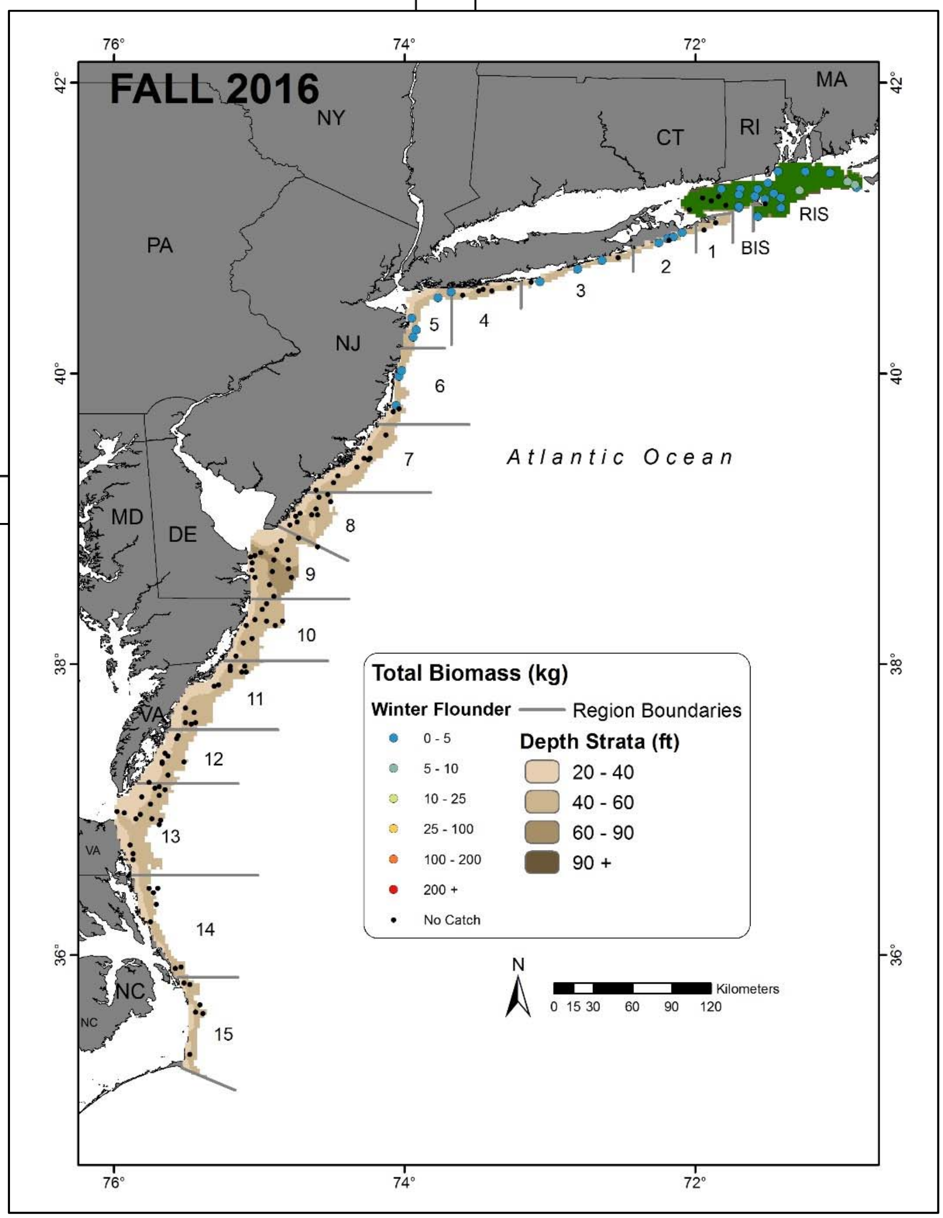
Winter Flounder

Sampling Priority: A

Figure 226. Winter Flounder biomass (kg) collected at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[green]	[green]
		90+	[green]	[green]
	BIS	60-90	[green]	[green]
		90+	[green]	[green]
NY	01	40-60	[gray]	[green]
	02	20-40	[gray]	[green]
		40-60	[gray]	[green]
	03	20-40	[gray]	[green]
		40-60	[gray]	[green]
	04	20-40	[gray]	[green]
		40-60	[gray]	[green]
	05	20-40	[gray]	[green]
		40-60	[gray]	[green]
NJ	06	20-40	[gray]	[green]
		40-60	[gray]	[green]
	07	20-40	[gray]	[green]
		40-60	[gray]	[green]
	08	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
DE	09	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
		60-90	[gray]	[gray]
MD	10	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
VA	11	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
	12	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
	13	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
NC	14	20-40	[gray]	[gray]
		40-60	[gray]	[gray]
	15	20-40	[gray]	[gray]
		40-60	[gray]	[gray]

[green] = used for abundance indices

[gray] = not used for abundance indices

Table 76. Winter Flounder sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,863	554.1	96.8	1,525	466	466	450	444
	2009	1,954	629.7	88.9	1,746	543	531	526	513
	2010	1,504	578.8	92.1	1,504	548	536	495	444
	2011	1,672	589.5	90.5	1,549	464	464	424	409
	2012	1,481	477.9	81.0	1,481	353	341	296	287
	2013	978	391.3	82.5	978	326	326	282	277
	2014	762	263.0	81.0	762	323	323	281	279
	2015	916	321.2	84.1	916	371	371	305	299
	2016	1,780	523.1	90.5	1,780	484	484	344	341
Fall	2007	392	99.1	69.2	392	119	117	116	116
	2008	670	142.0	80.8	522	137	137	133	131
	2009	558	127.4	100.0	558	214	211	178	178
	2010	264	72.3	80.8	264	150	145	108	106
	2011	572	179.9	88.5	572	173	173	125	119
	2012	232	63.3	53.8	232	97	85	63	61
	2013	150	60.4	57.7	150	93	93	62	61
	2014	144	36.3	57.7	144	76	76	43	42
	2015	309	82.8	73.1	309	166	166	67	67
	2016	221	56.9	76.9	221	145	145	43	43

Table 77. Winter Flounder geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP surveys.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	64	8.60	11.88	16.29	3.00	4.19	5.72
	2009	69	9.61	12.64	16.55	3.78	4.94	6.37
	2010	63	9.62	12.82	17.00	3.90	5.22	6.88
	2011	63	8.07	11.11	15.16	3.54	4.77	6.32
	2012	63	4.30	6.37	9.24	1.69	2.58	3.76
	2013	63	4.31	6.13	8.56	2.02	2.90	4.05
	2014	63	3.61	4.91	6.57	1.49	2.12	2.92
	2015	63	4.34	5.80	7.66	1.66	2.30	3.10
	2016	63	8.03	10.95	14.80	2.58	3.61	4.94
1	2007							
	2008	64	2.76	3.78	5.08	0.34	0.52	0.73
	2009	69	1.06	1.58	2.24	0.16	0.28	0.42
	2010	63	1.52	2.11	2.84	0.19	0.27	0.35
	2011	63	1.05	1.53	2.12	0.14	0.23	0.33
	2012	63	1.40	2.22	3.32	0.28	0.50	0.76
	2013	63	0.88	1.31	1.84	0.15	0.24	0.34
	2014	63	1.09	1.61	2.26	0.14	0.24	0.34
	2015	63	1.06	1.62	2.33	0.11	0.20	0.31
	2016	63	2.63	3.73	5.15	0.39	0.55	0.73
2	2007							
	2008	64	2.70	3.80	5.22	1.01	1.43	1.95
	2009	69	4.54	6.08	8.05	1.49	2.01	2.63
	2010	63	3.35	4.45	5.84	1.10	1.46	1.89
	2011	63	3.54	4.95	6.79	1.28	1.78	2.40
	2012	63	1.68	2.58	3.78	0.65	1.05	1.55
	2013	63	1.47	2.09	2.87	0.54	0.79	1.07
	2014	63	0.95	1.38	1.90	0.35	0.55	0.77
	2015	63	1.62	2.31	3.17	0.58	0.88	1.23
	2016	63	4.20	5.67	7.55	1.41	1.95	2.62
3	2007							
	2008	64	1.35	1.90	2.58	0.62	0.89	1.21
	2009	69	1.84	2.38	3.02	0.83	1.09	1.39
	2010	63	3.27	4.37	5.74	1.62	2.16	2.81
	2011	63	2.04	2.72	3.54	0.95	1.28	1.67
	2012	63	1.35	2.04	2.93	0.67	1.05	1.51
	2013	63	1.41	2.03	2.81	0.69	1.00	1.38
	2014	63	1.05	1.48	1.99	0.51	0.73	1.00
	2015	63	0.66	0.96	1.31	0.31	0.47	0.66
	2016	63	1.12	1.58	2.15	0.50	0.75	1.05
4	2007							
	2008	64	1.79	2.49	3.37	0.98	1.37	1.84
	2009	69	0.84	1.10	1.39	0.43	0.58	0.74
	2010	63	1.05	1.41	1.84	0.61	0.83	1.09
	2011	63	1.36	1.84	2.43	0.81	1.12	1.48
	2012	63	0.40	0.67	0.98	0.23	0.41	0.61
	2013	63	0.51	0.75	1.02	0.32	0.48	0.65
	2014	63	0.36	0.53	0.73	0.22	0.33	0.46
	2015	63	0.33	0.51	0.72	0.21	0.34	0.48
	2016	63	0.39	0.64	0.93	0.25	0.43	0.63
5	2007							
	2008	64	0.68	0.96	1.28	0.39	0.58	0.79
	2009	69	1.21	1.64	2.15	0.76	1.05	1.39
	2010	63	0.59	0.81	1.06	0.37	0.53	0.71
	2011	63	0.54	0.76	1.01	0.38	0.54	0.73
	2012	63	0.29	0.51	0.77	0.19	0.34	0.51
	2013	63	0.64	0.93	1.27	0.45	0.66	0.90
	2014	63	0.42	0.64	0.89	0.29	0.45	0.64
	2015	63	0.30	0.47	0.66	0.19	0.31	0.45
	2016	63	0.34	0.57	0.83	0.22	0.38	0.57
6	2007							
	2008	64	0.49	0.70	0.94	0.28	0.43	0.60
	2009	69	0.82	1.14	1.52	0.55	0.78	1.03
	2010	63	0.67	0.93	1.24	0.48	0.69	0.93
	2011	63	0.34	0.50	0.66	0.25	0.36	0.48
	2012	63	0.30	0.52	0.77	0.19	0.35	0.52
	2013	63	0.44	0.65	0.88	0.30	0.45	0.62
	2014	63	0.30	0.47	0.65	0.20	0.32	0.46
	2015	63	0.28	0.45	0.64	0.20	0.33	0.48
	2016	63	0.31	0.53	0.78	0.21	0.38	0.57
7+	2007							
	2008	64	0.18	0.29	0.42	0.13	0.23	0.34
	2009	69	0.33	0.47	0.62	0.27	0.39	0.52
	2010	63	0.42	0.63	0.87	0.36	0.55	0.77
	2011	63	0.45	0.67	0.92	0.38	0.58	0.80
	2012	63	0.27	0.47	0.69	0.20	0.35	0.53
	2013	63	0.40	0.60	0.82	0.30	0.46	0.64
	2014	63	0.25	0.42	0.61	0.17	0.33	0.50
	2015	63	0.32	0.53	0.78	0.27	0.47	0.70
	2016	63	0.28	0.51	0.78	0.21	0.42	0.66

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	26	2.08	4.18	7.69	0.88	1.68	2.83
	2008	26	5.02	9.09	15.90	1.53	2.62	4.18
	2009	26	5.61	9.62	16.08	1.39	2.46	4.01
	2010	26	2.48	4.49	7.66	0.84	1.49	2.38
	2011	26	5.16	8.82	14.65	1.89	3.24	5.24
	2012	26	1.42	2.81	4.99	0.62	1.17	1.90
	2013	26	0.86	1.94	3.64	0.44	0.98	1.73
	2014	26	1.43	2.46	3.92	0.51	0.86	1.29
	2015	26	2.85	4.50	6.85	1.09	1.61	2.25
	2016	26	2.01	3.46	5.62	0.63	1.10	1.71
1	2007	26	1.26	2.62	4.79	0.38	0.78	1.30
	2008	26	3.94	7.05	12.13	0.98	1.73	2.78
	2009	26	3.29	5.86	9.95	0.64	1.17	1.89
	2010	26	1.29	2.45	4.19	0.29	0.53	0.82
	2011	26	2.31	3.84	6.10	0.51	0.90	1.40
	2012	26	0.86	1.84	3.32	0.24	0.54	0.90
	2013	26	0.43	1.07	2.00	0.14	0.37	0.65
	2014	26	1.06	1.88	3.02	0.30	0.56	0.88
	2015	26	1.69	2.81	4.39	0.47	0.76	1.11
	2016	26	1.28	2.29	3.75	0.28	0.52	0.81
2	2007	26	0.72	1.35	2.23	0.28	0.52	0.81
	2008	26	1.06	1.82	2.87	0.36	0.69	1.10
	2009	26	1.74	3.06	5.01	0.56	1.04	1.66
	2010	26	0.95	1.71	2.77	0.36	0.66	1.01
	2011	26	2.77	4.72	7.68	1.15	1.91	2.93
	2012	26	0.59	1.15	1.90	0.26	0.50	0.78
	2013	26	0.23	0.59	1.07	0.10	0.26	0.44
	2014	26	0.41	0.69	1.02	0.13	0.24	0.36
	2015	26	0.98	1.50	2.14	0.36	0.53	0.73
	2016	26	0.59	1.05	1.64	0.20	0.40	0.63
3	2007	26	0.52	1.10	1.91	0.32	0.69	1.17
	2008	26	0.36	0.77	1.30	0.17	0.42	0.73
	2009	26	0.43	0.84	1.37	0.20	0.41	0.66
	2010	26	0.50	0.91	1.44	0.27	0.50	0.78
	2011	26	0.61	1.10	1.73	0.36	0.68	1.07
	2012	26	0.23	0.47	0.75	0.14	0.29	0.46
	2013	26	0.24	0.57	0.97	0.16	0.37	0.63
	2014	26	0.10	0.28	0.48	0.04	0.16	0.29
	2015	26	0.58	0.84	1.15	0.23	0.34	0.47
	2016	26	0.13	0.28	0.47	0.06	0.15	0.24
4+	2007	26	0.06	0.19	0.34	0.04	0.14	0.25
	2008	26	0.15	0.44	0.81	0.08	0.28	0.52
	2009	26	0.12	0.31	0.54	0.06	0.21	0.38
	2010	26	0.08	0.22	0.38	0.05	0.17	0.30
	2011	26	0.44	0.88	1.45	0.32	0.69	1.16
	2012	26	0.23	0.45	0.72	0.16	0.33	0.53
	2013	26	0.15	0.38	0.65	0.11	0.30	0.53
	2014	26	0.02	0.11	0.22	0.00	0.08	0.16
	2015	26	0.19	0.40	0.65	0.14	0.34	0.57
	2016	26	0.08	0.25	0.44	0.05	0.20	0.38

Figure 227. Winter Flounder geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.

Figure 227. cont.

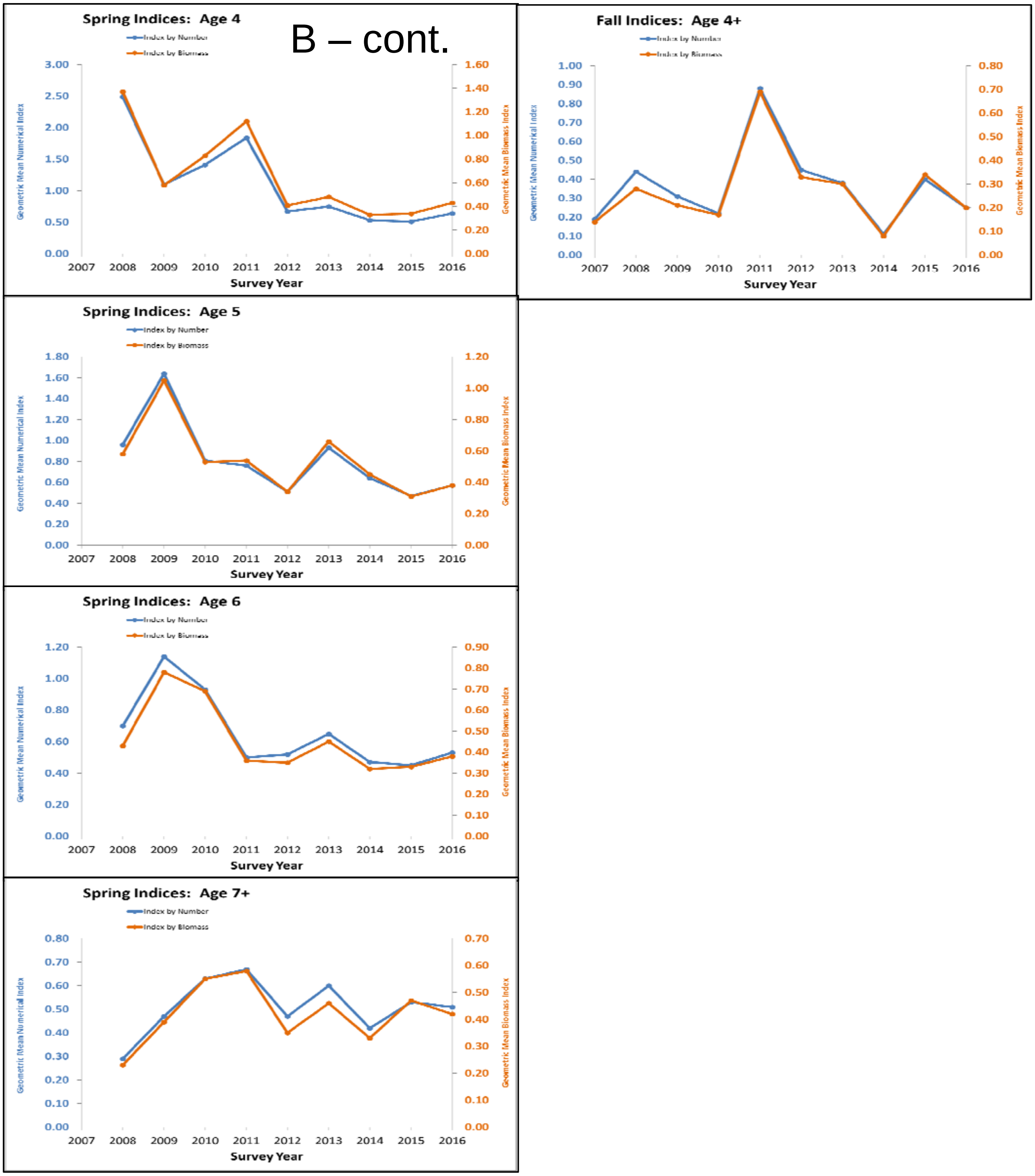


Figure 228. Winter Flounder length-frequency distributions, by cruise.

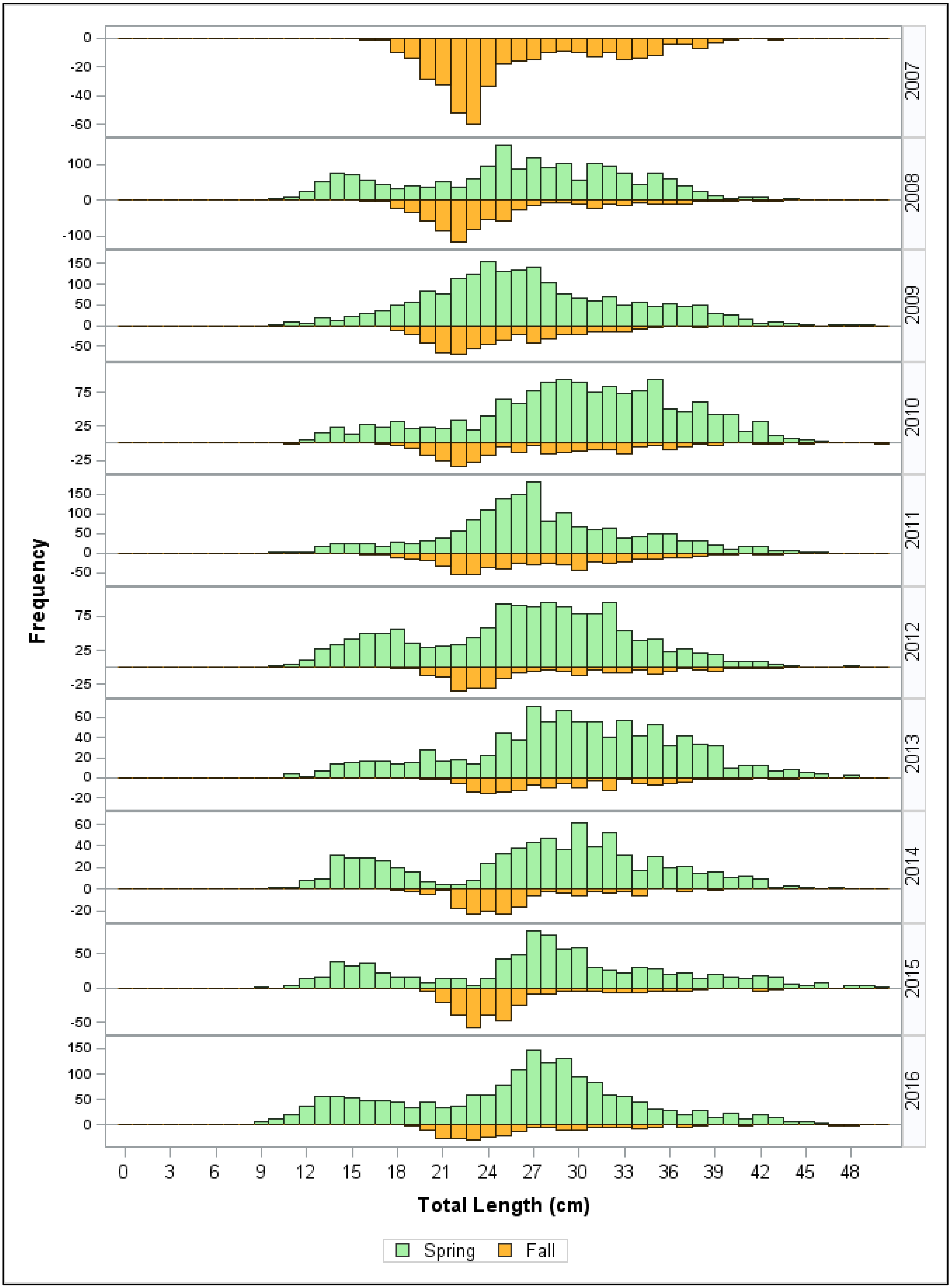


Figure 229. Winter Flounder length-frequency distributions, by cruise and sex.

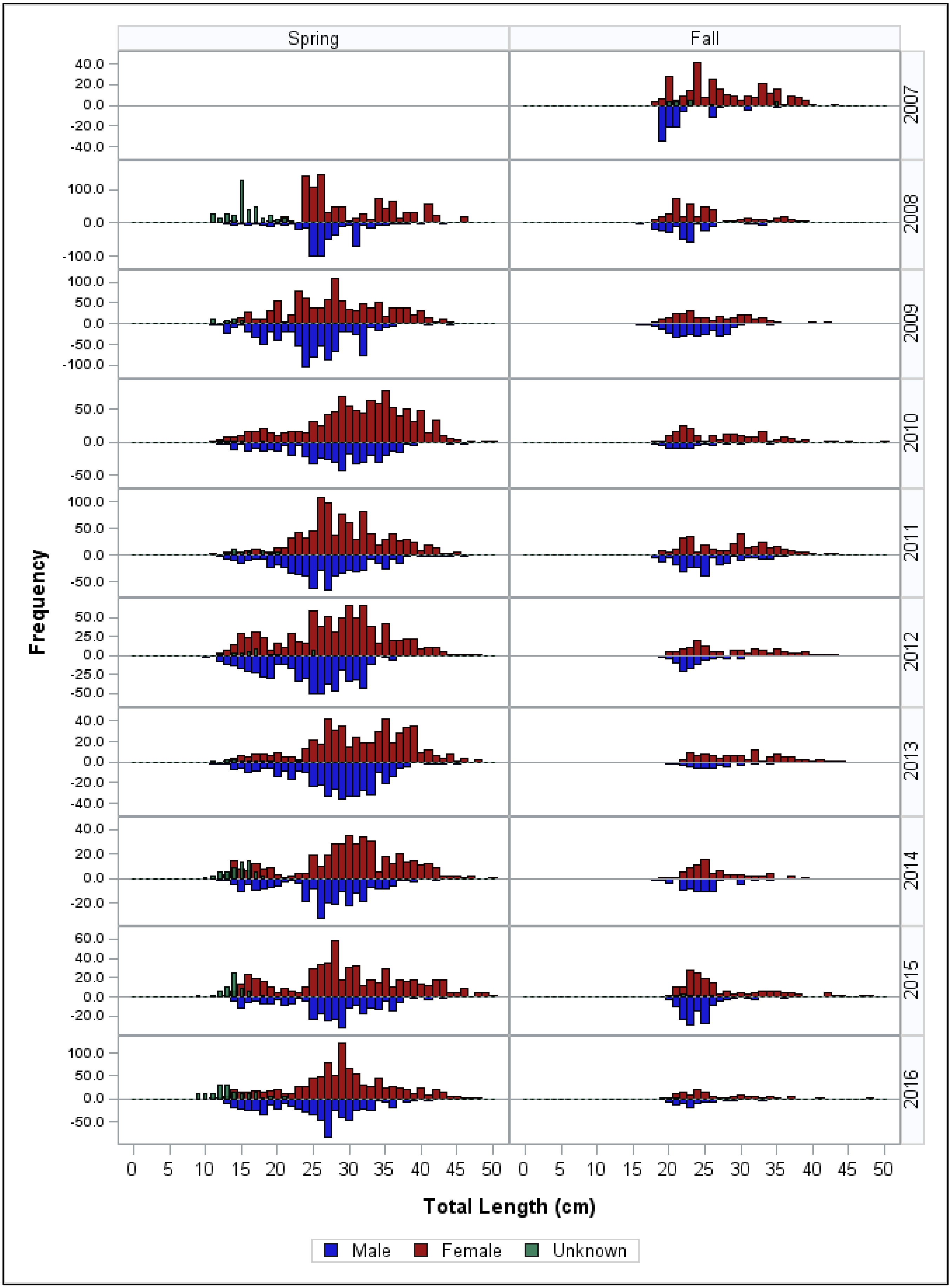


Figure 230. Winter Flounder age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar. (Values in red were generated by application of age-length keys.)

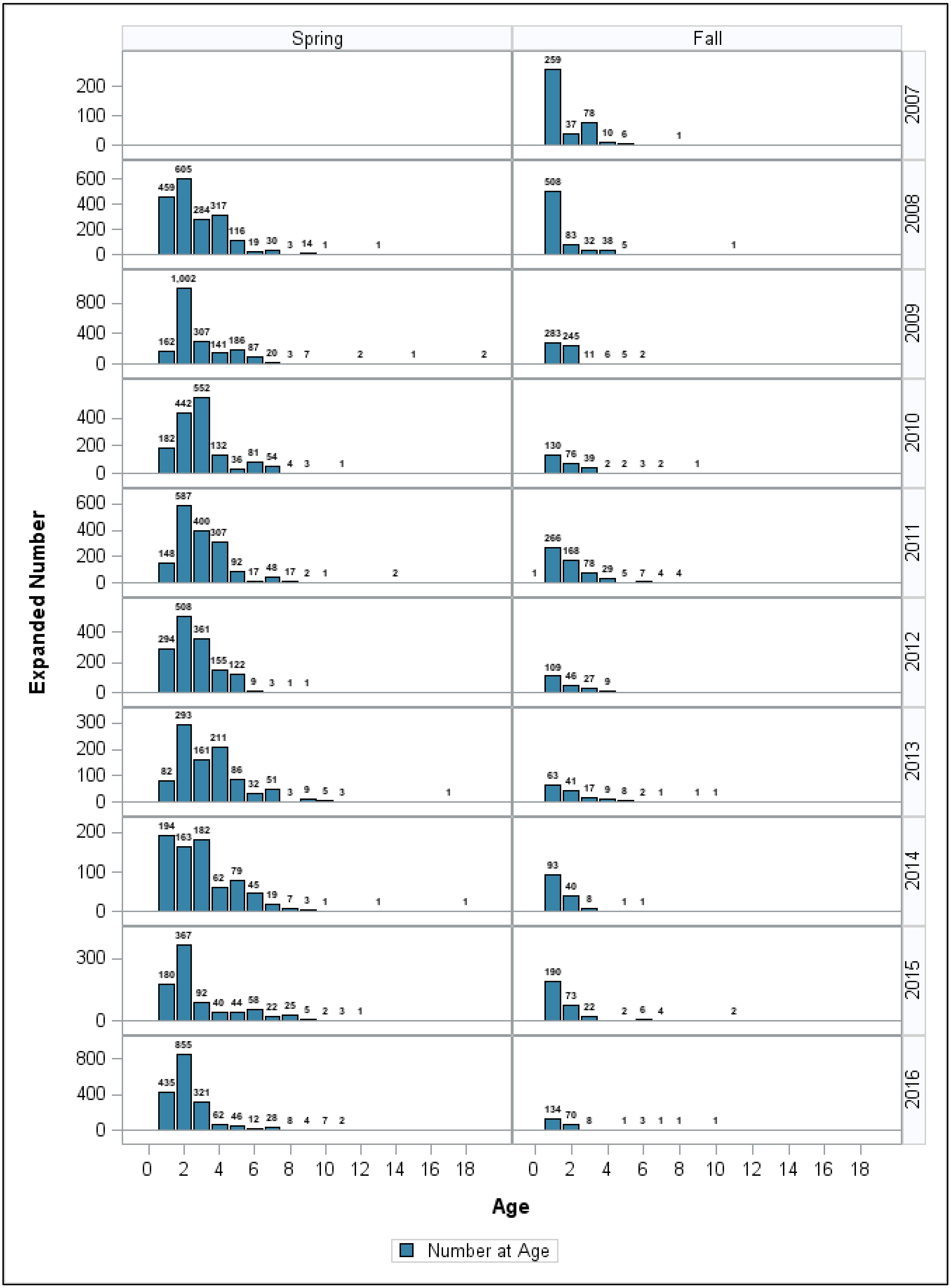


Figure 231. Winter Flounder catch-at-age standardized to 3,000 trawl minutes, by cruise.

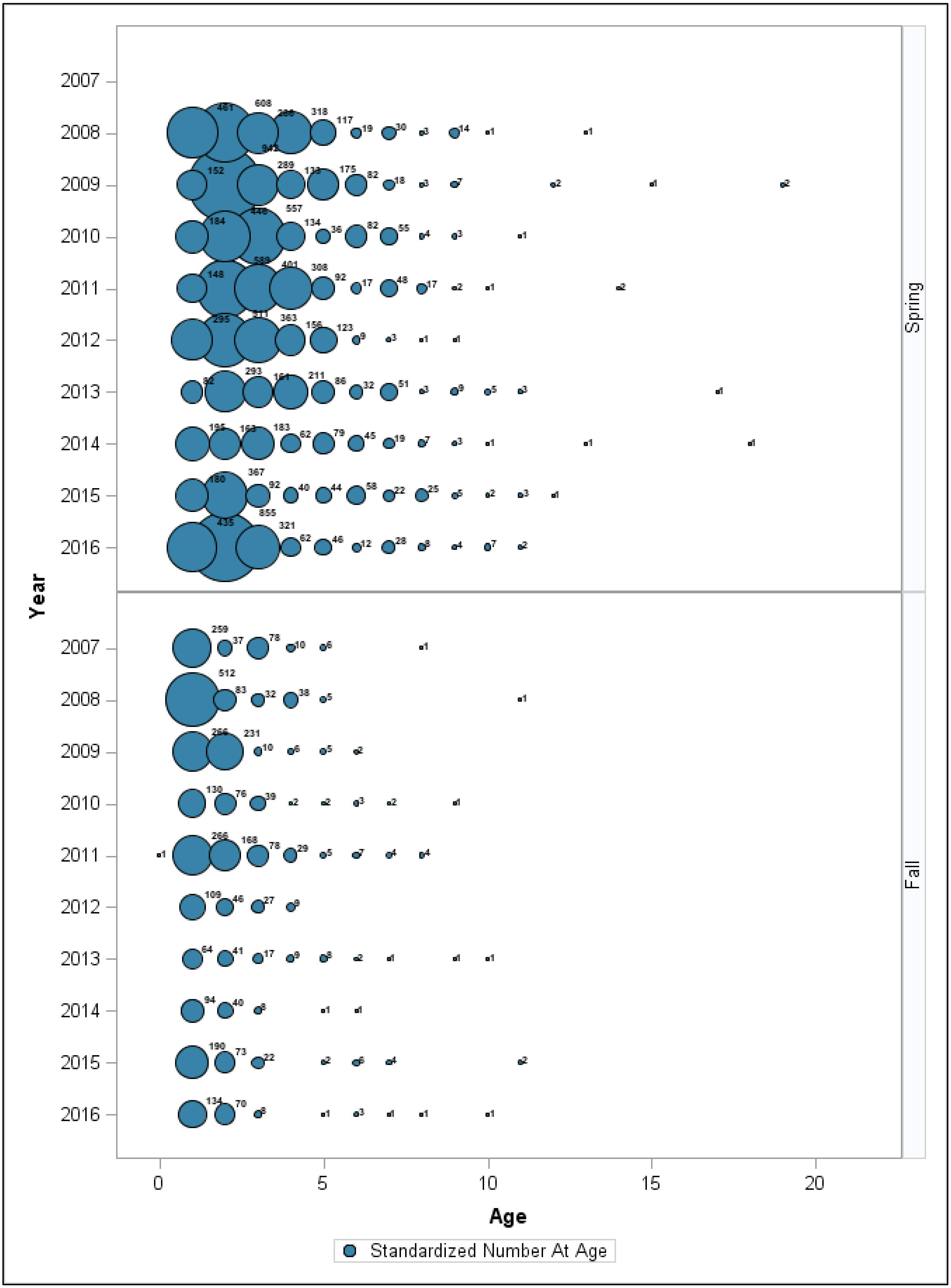


Figure 232. Winter Flounder sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

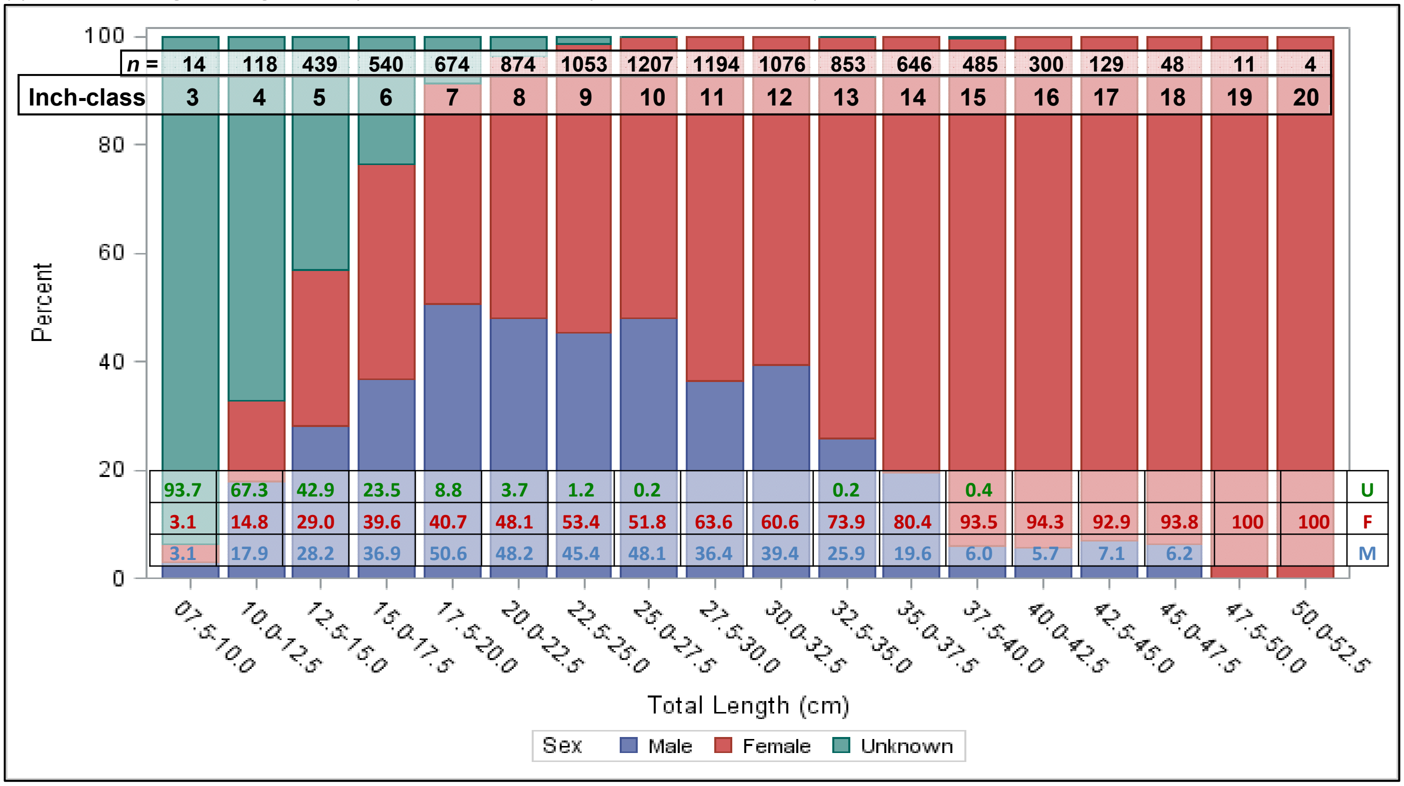


Figure 233. Winter Flounder maturity at length, by sex for all cruises pooled, 2007-2016.

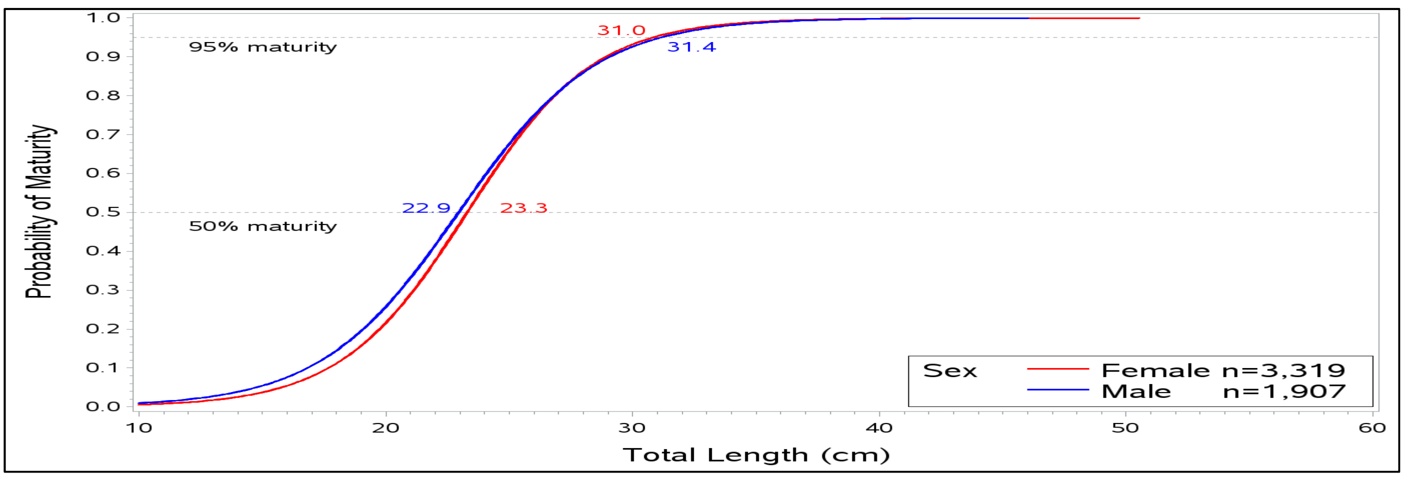


Figure 234. Winter Flounder maturity at age, by sex for all cruises pooled, 2007-2016.

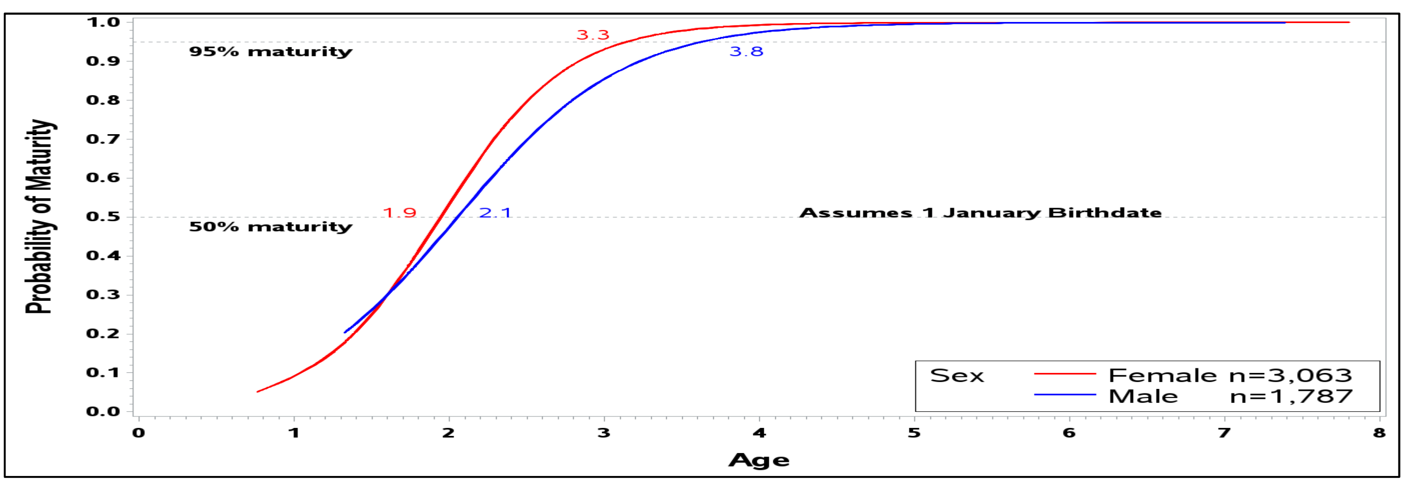
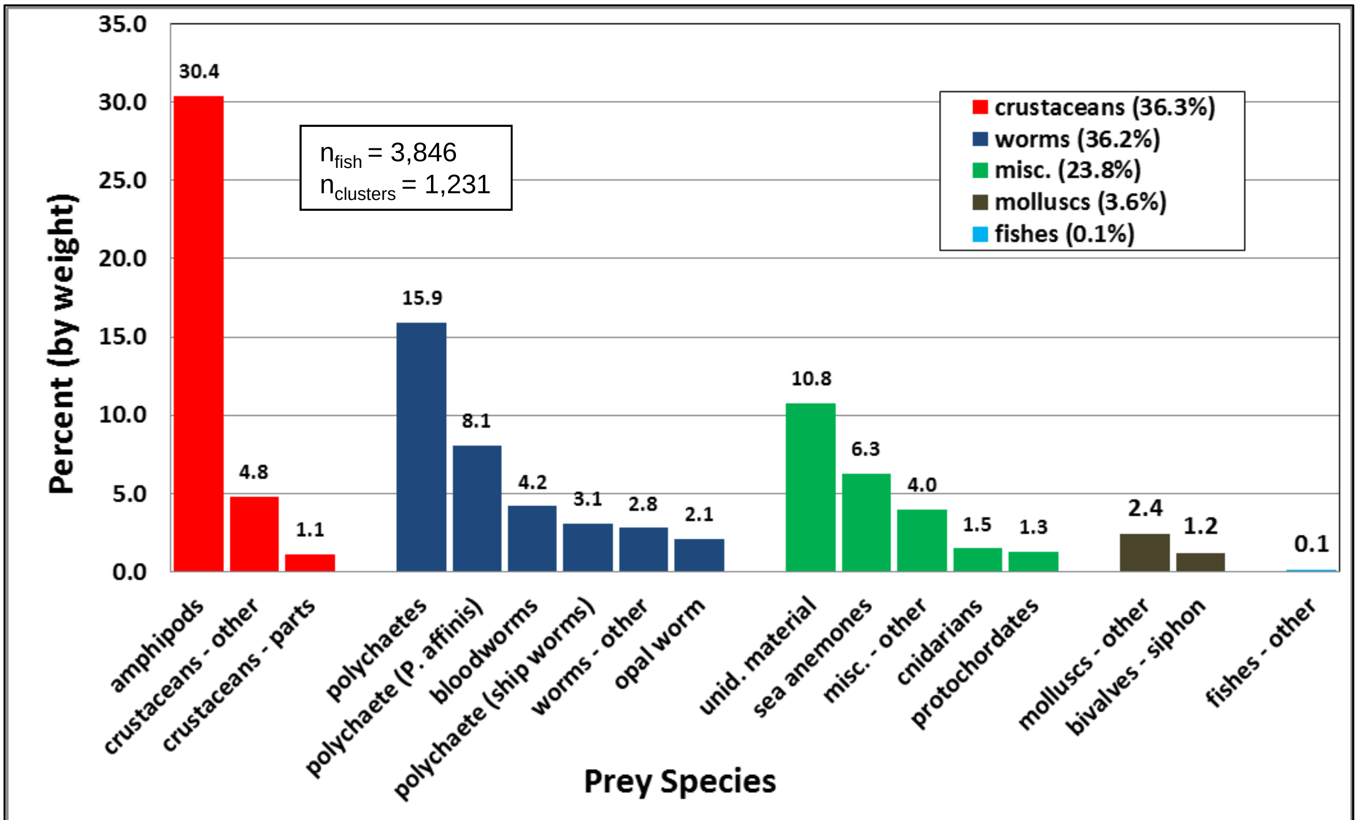
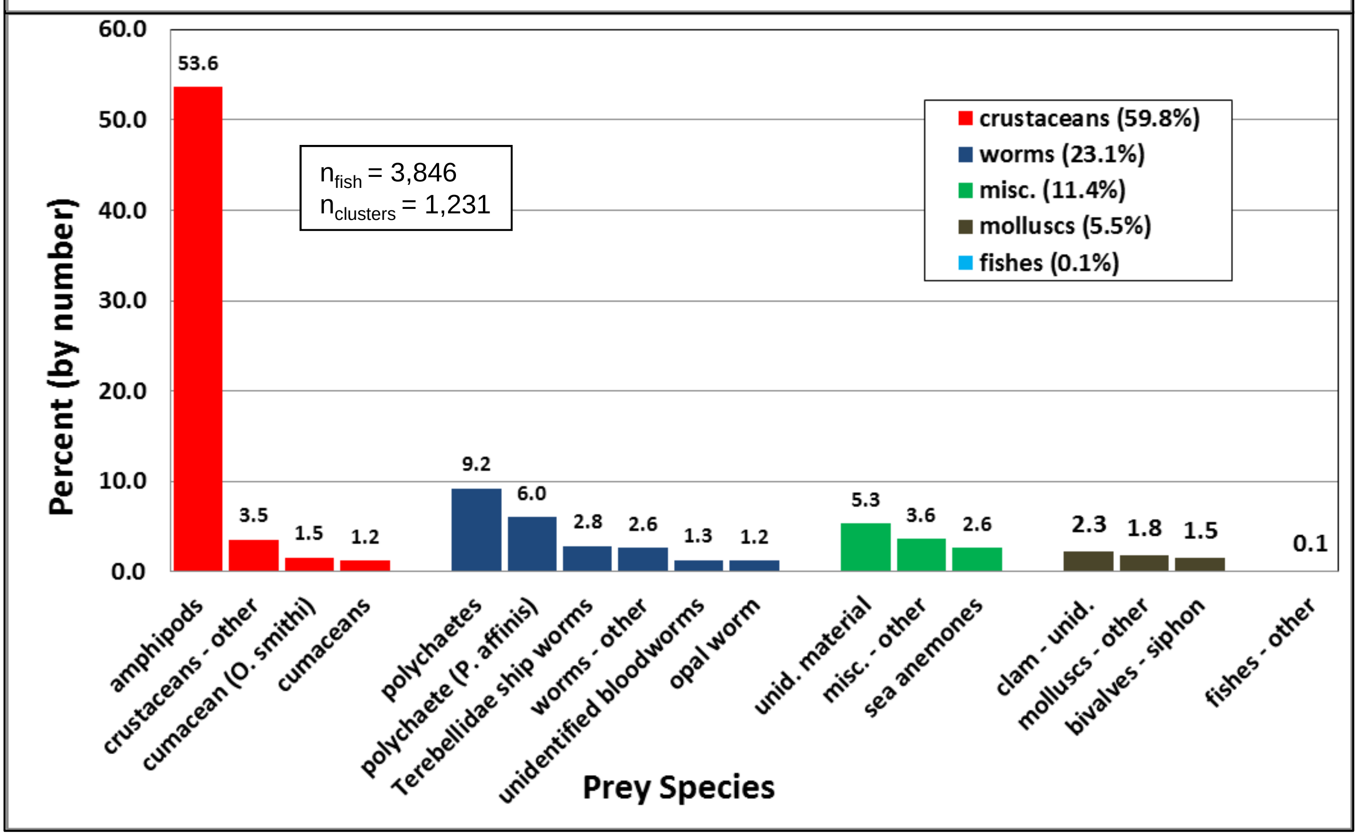


Figure 235. Winter Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

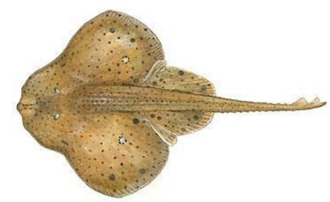


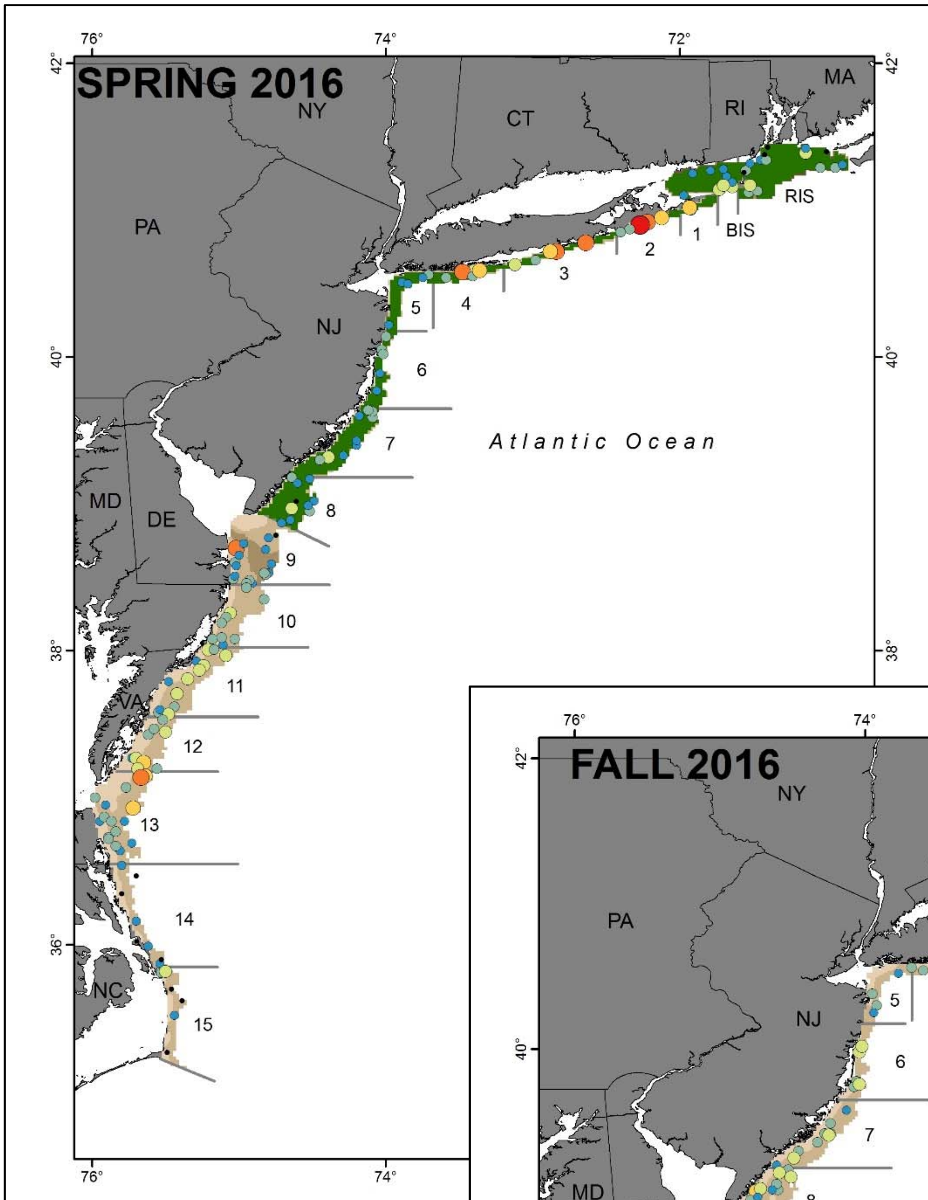


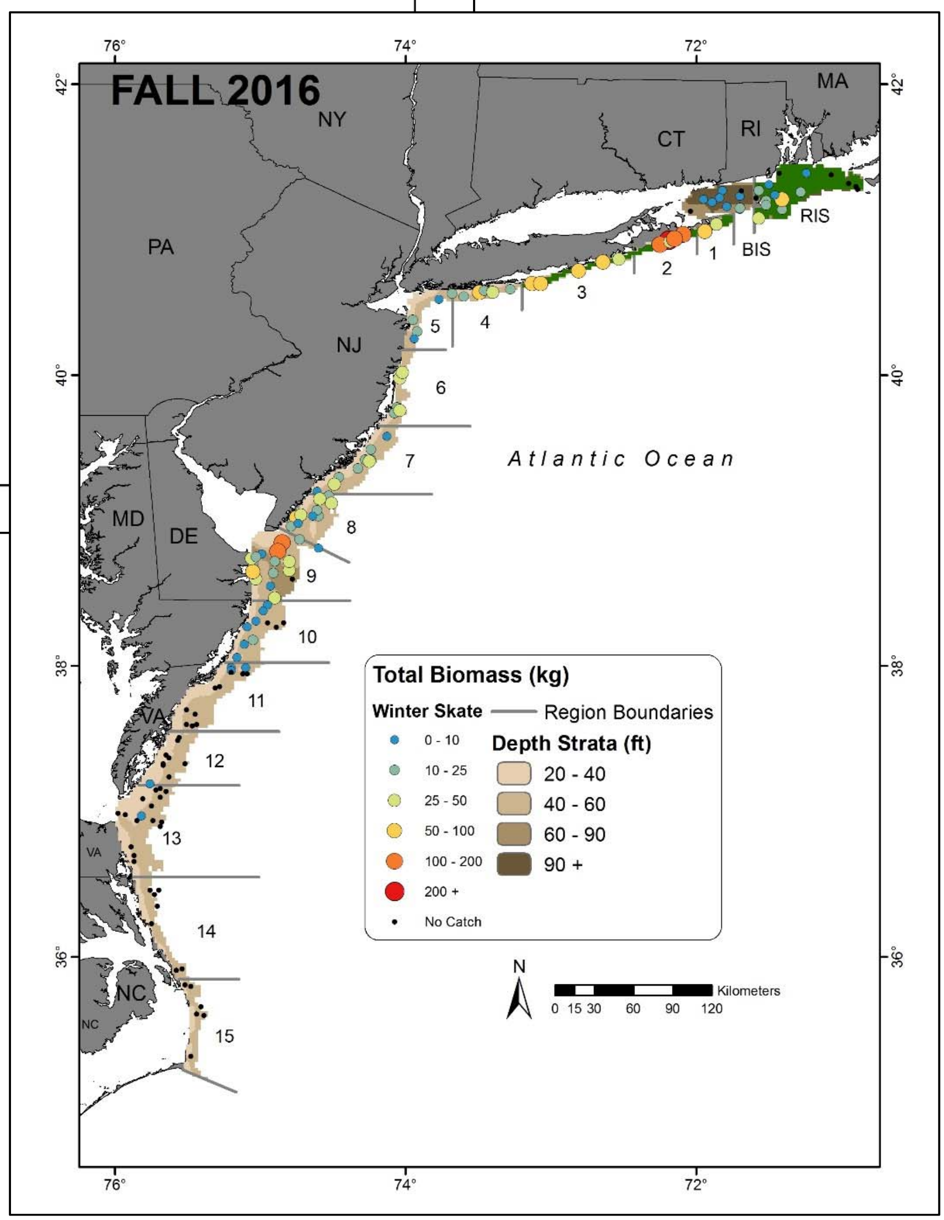
Winter Skate

Sampling Priority: A

Figure 236. Winter Skate biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	used	used
		90+	used	used
	BIS	60-90	used	not used
		90+	used	not used
NY	01	40-60	used	used
	02	20-40	used	used
		40-60	used	used
	03	20-40	used	used
		40-60	used	used
	04	20-40	used	not used
		40-60	used	not used
	05	20-40	used	not used
		40-60	used	not used
NJ	06	20-40	used	not used
		40-60	used	not used
	07	20-40	used	not used
		40-60	used	not used
	08	20-40	used	not used
		40-60	used	not used
DE	09	20-40	not used	not used
		40-60	not used	not used
		60-90	not used	not used
MD	10	20-40	not used	not used
		40-60	not used	not used
VA	11	20-40	not used	not used
		40-60	not used	not used
	12	20-40	not used	not used
		40-60	not used	not used
	13	20-40	not used	not used
		40-60	not used	not used
NC	14	20-40	not used	not used
		40-60	not used	not used
	15	20-40	not used	not used
		40-60	not used	not used

(green) = used for abundance indices
(gray) = not used for abundance indices

Table 78. Winter Skate sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,716	3,174.2	94.4	1,217	320	0	302	300
	2009	3,595	6,849.8	95.8	1,778	374	0	346	338
	2010	1,547	3,985.6	90.3	851	287	0	276	268
	2011	2,271	4,413.2	93.1	1,540	275	0	226	225
	2012	3,775	5,265.6	97.2	1,914	295	0	243	228
	2013	3,029	3,419.3	97.2	2,915	416	0	353	351
	2014	2,999	3,862.8	97.2	1,862	383	0	292	285
	2015	2,468	3,852.8	95.8	2,082	376	0	305	301
	2016	1,953	3,381.7	93.1	1,676	370	0	258	253
Fall	2007	951	925.3	103.6	735	171	0	160	159
	2008	624	929.3	100.0	404	120	0	115	115
	2009	1,787	4,040.1	96.4	623	123	0	108	108
	2010	1,177	2,169.6	92.9	806	122	0	104	102
	2011	1,304	1,453.8	96.4	1,021	129	0	98	93
	2012	1,259	1,146.8	92.9	835	121	0	85	83
	2013	1,535	1,644.3	92.9	981	169	0	135	123
	2014	1,243	1,462.7	82.1	1,177	193	0	101	101
	2015	1,060	1,558.9	92.9	986	152	0	84	82
	2016	1,583	2,720.1	78.6	1,315	254	0	124	123

Table 79. Winter Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	**Index**	UCI	LCI	**Index**	UCI
All	2007							
	2008	73	7.97	9.88	12.19	10.32	12.99	16.28
	2009	79	8.27	10.35	12.90	12.27	15.96	20.67
	2010	72	4.24	5.37	6.73	9.12	11.57	14.61
	2011	72	5.67	7.41	9.61	10.63	13.76	17.75
	2012	72	9.81	12.26	15.27	12.73	16.29	20.76
	2013	72	8.81	11.70	15.44	9.70	12.77	16.72
	2014	72	9.32	11.71	14.65	11.70	14.70	18.41
	2015	72	6.98	9.06	11.67	8.95	11.73	15.29
	2016	72	4.61	5.93	7.56	6.19	8.24	10.87

Fall Survey

Age	Year	n	Numerical Index			Biomass Index		
			LCI	**Index**	UCI	LCI	**Index**	UCI
	2007	29	7.63	12.51	20.14	8.51	12.95	19.47
	2008	28	6.77	9.95	14.45	9.20	13.04	18.32
	2009	31	5.21	7.78	11.42	7.91	12.25	18.71
	2010	28	6.35	12.10	22.36	7.44	14.71	28.25
	2011	28	9.75	17.73	31.62	10.00	17.55	30.29
	2012	28	8.51	14.41	23.96	8.25	13.98	23.24
	2013	28	7.72	15.49	30.19	6.22	12.74	25.14
	2014	28	3.35	5.91	9.96	3.68	6.66	11.53
	2015	28	5.95	10.98	19.68	6.77	13.15	24.75
	2016	28	3.14	6.17	11.43	4.21	8.43	16.08

Figure 237. Winter Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

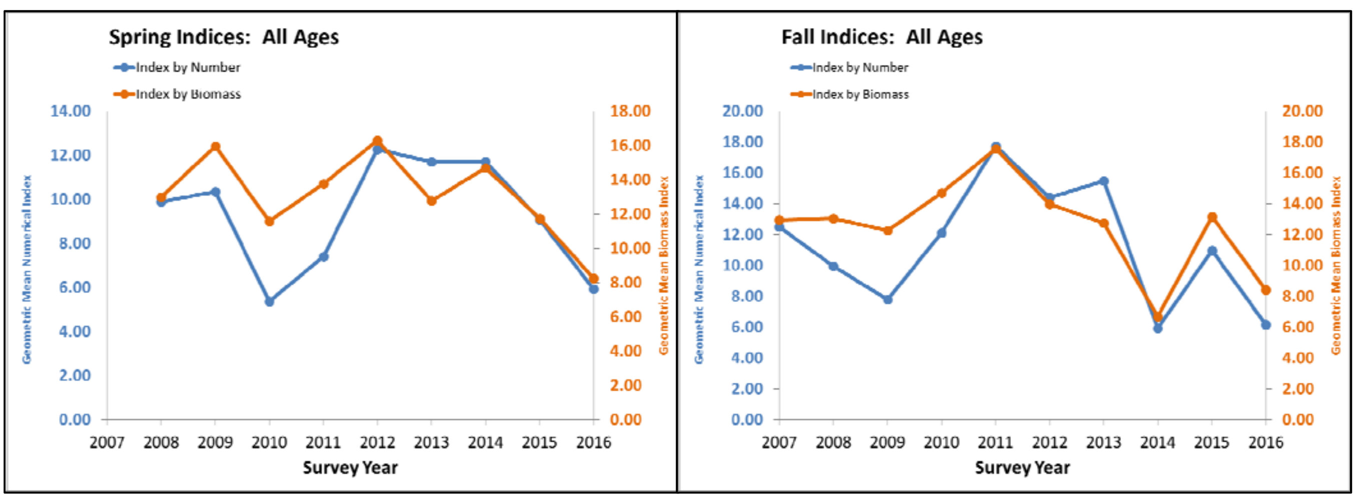


Figure 238. Winter Skate length-frequency distributions, by cruise.

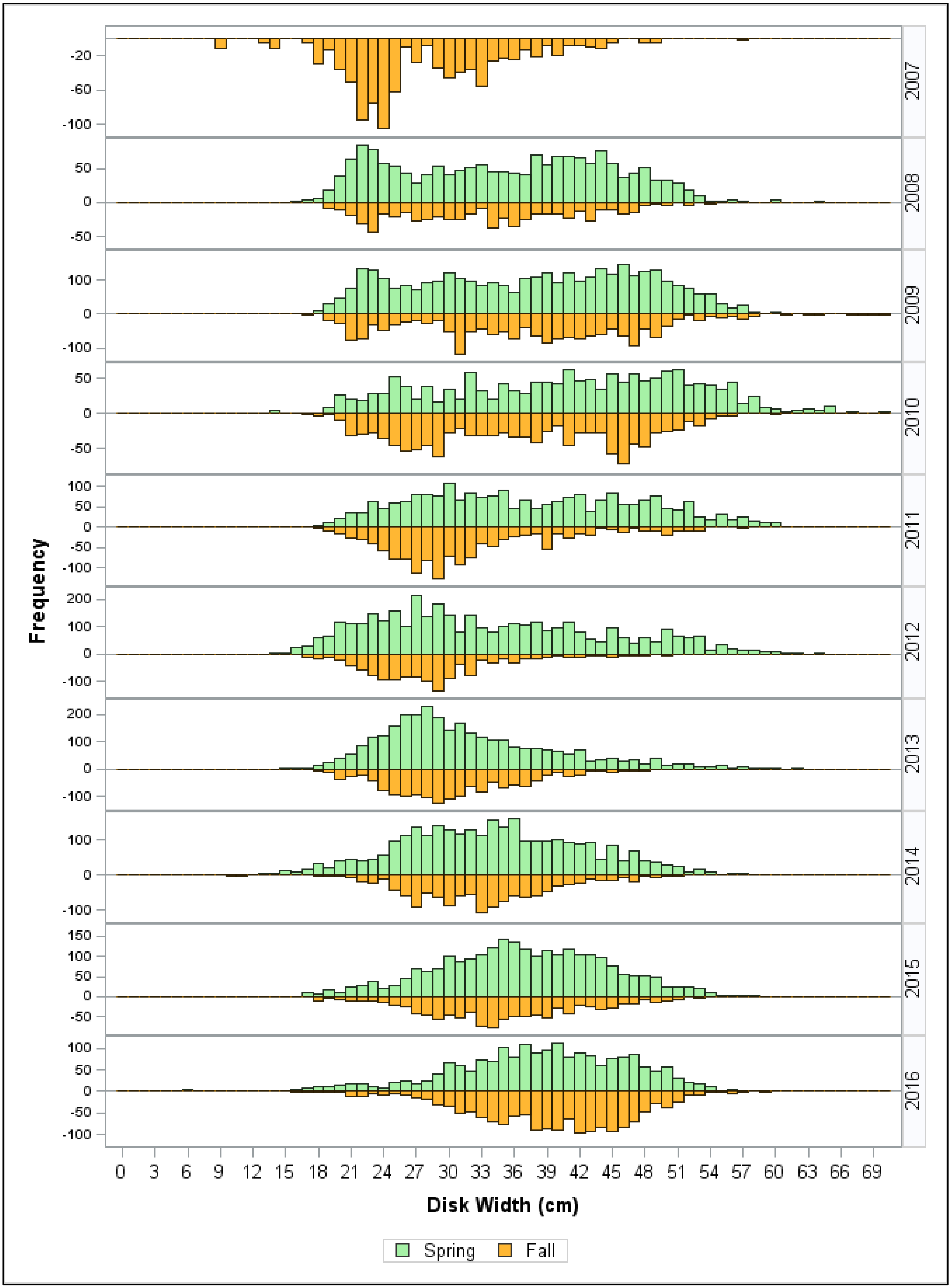


Figure 239. Winter Skate length-frequency distributions, by cruise and sex.

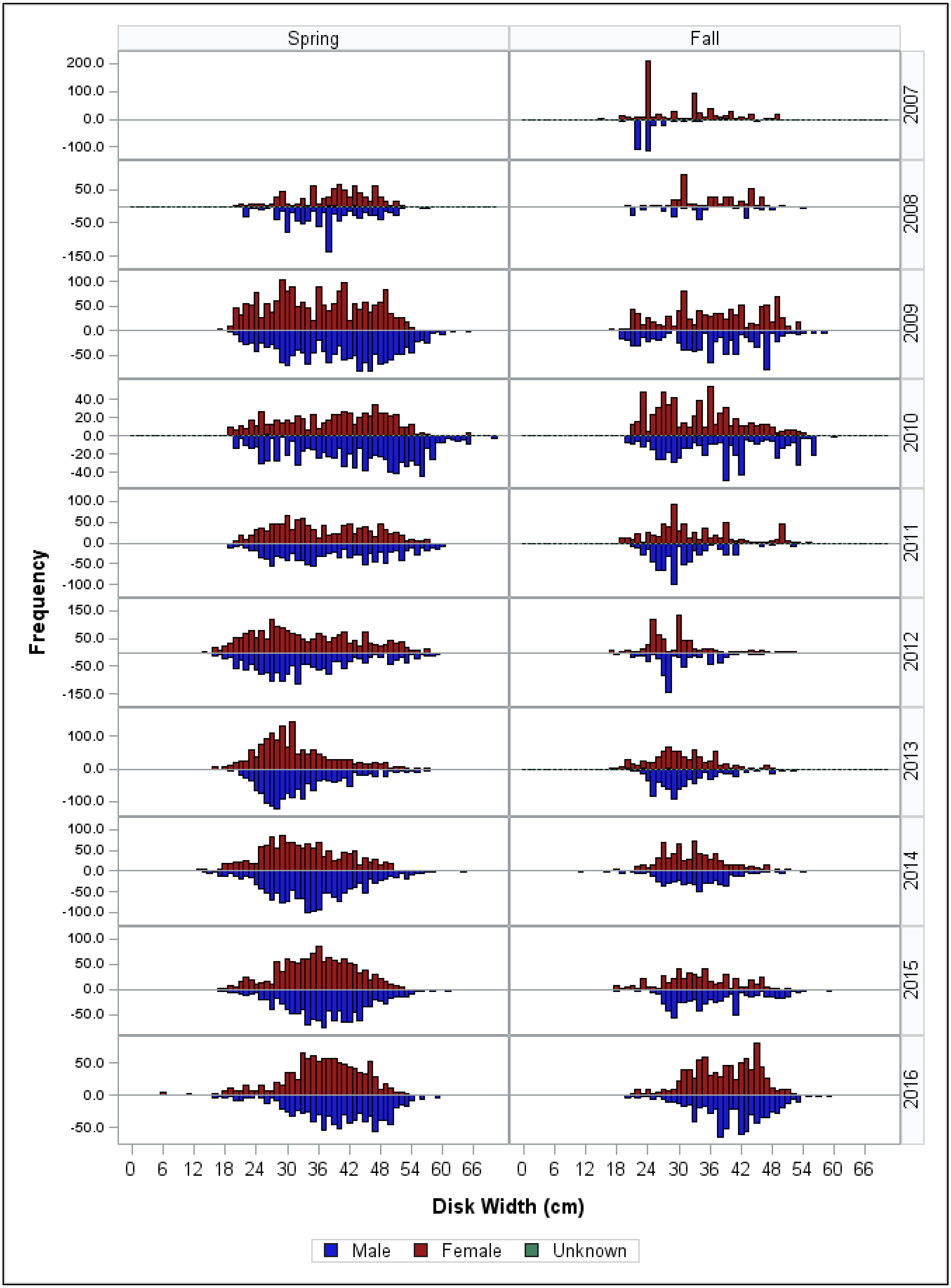


Figure 240. Winter Skate sex ratio, by length group, for all cruises pooled, 2007-2016.
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.).

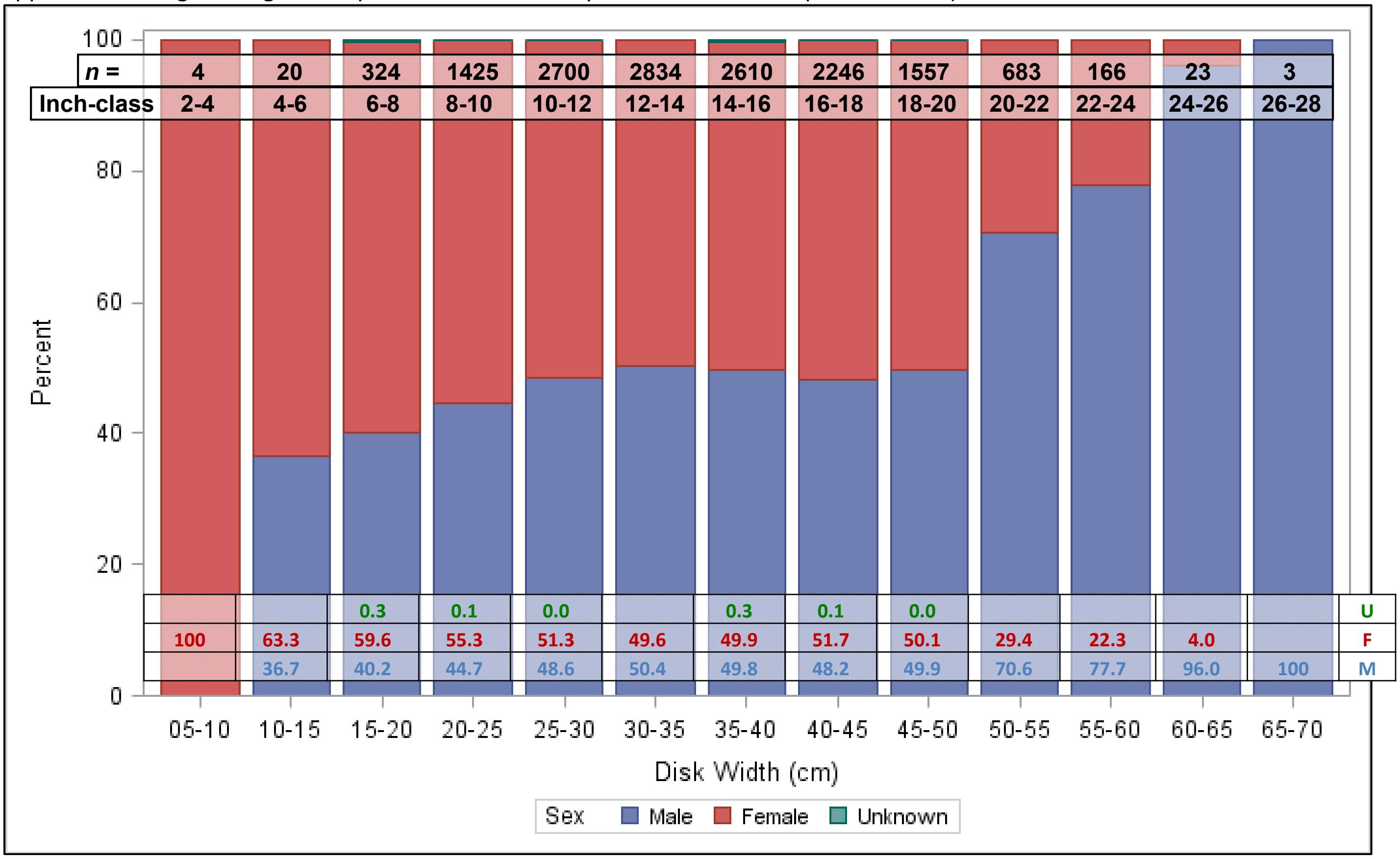


Figure 241. Winter Skate maturity at length, by sex for all cruises pooled, 2007-2016.

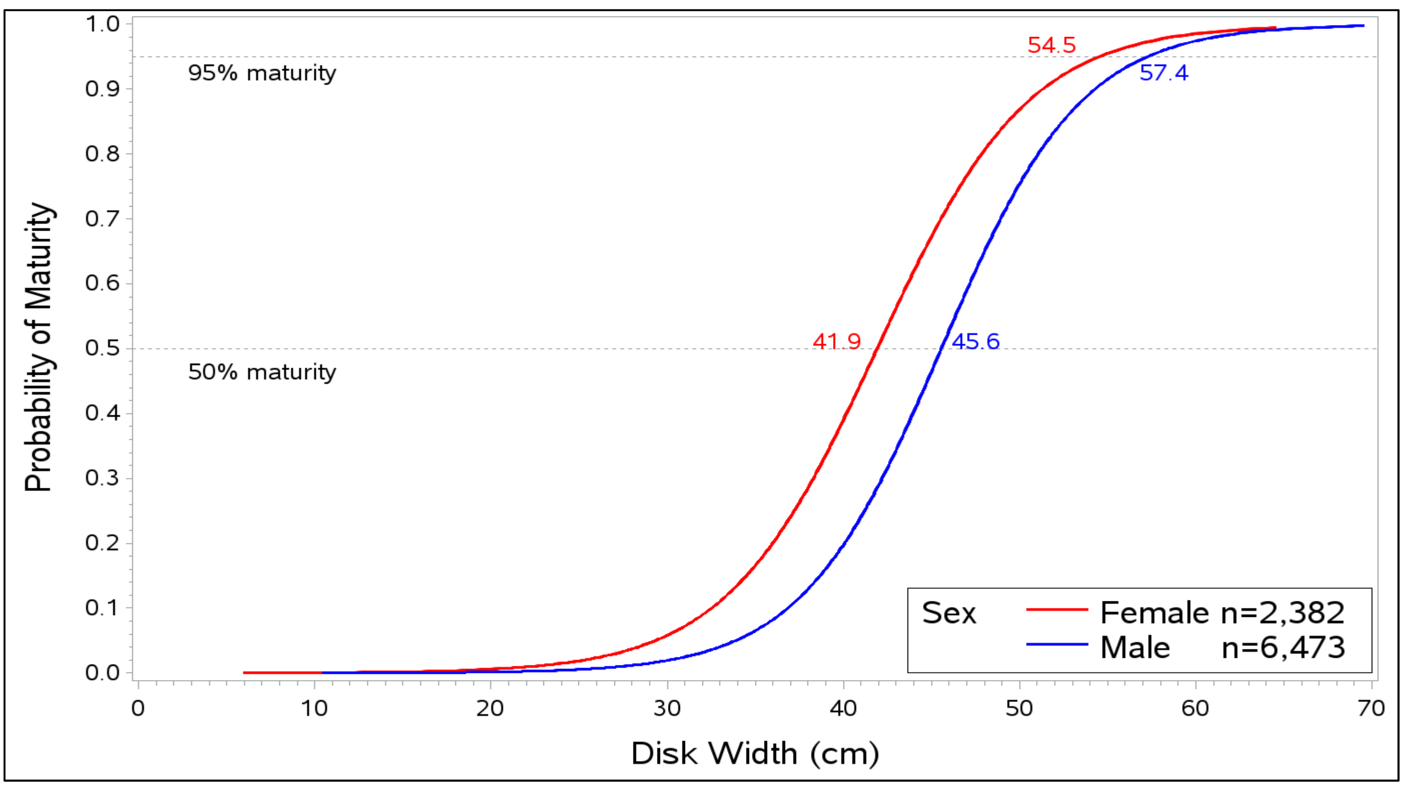
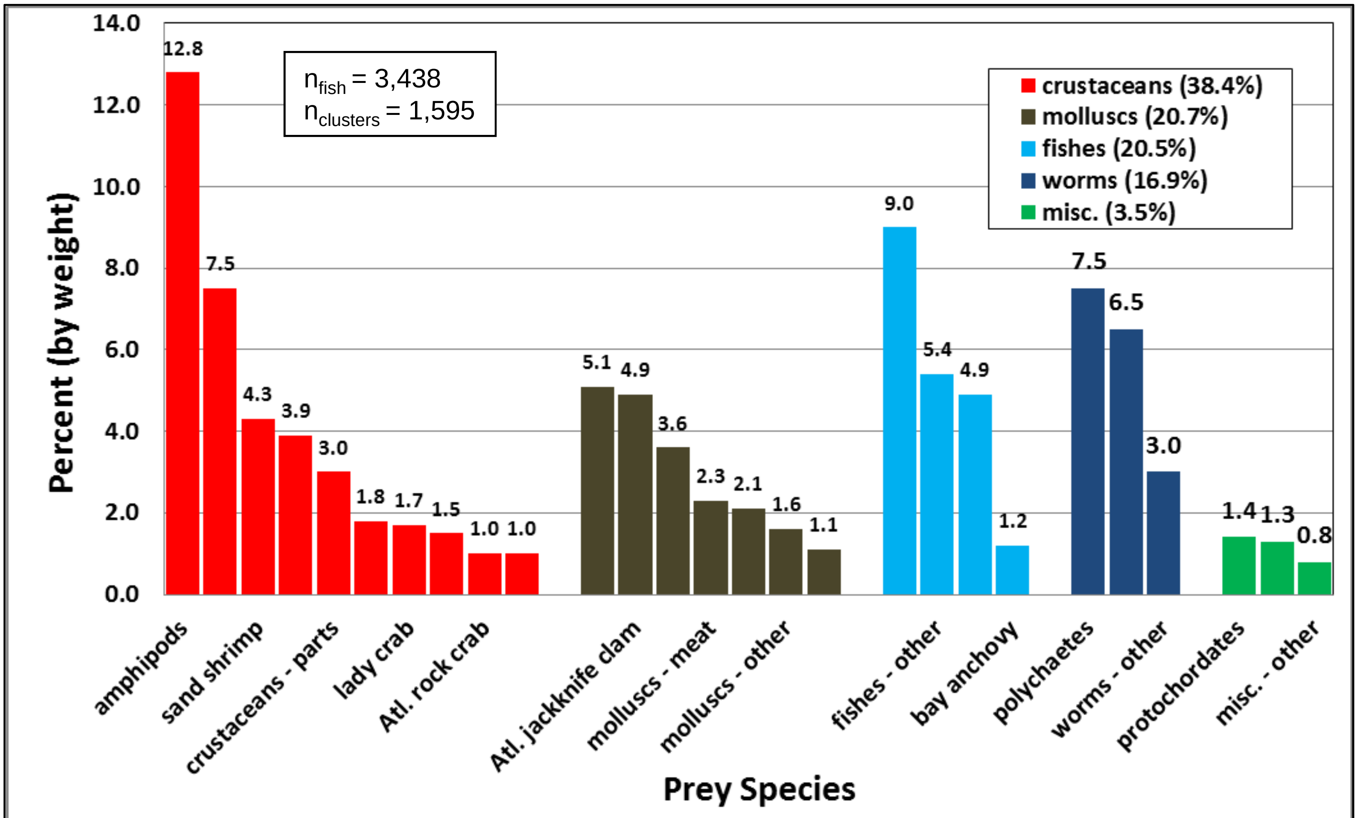
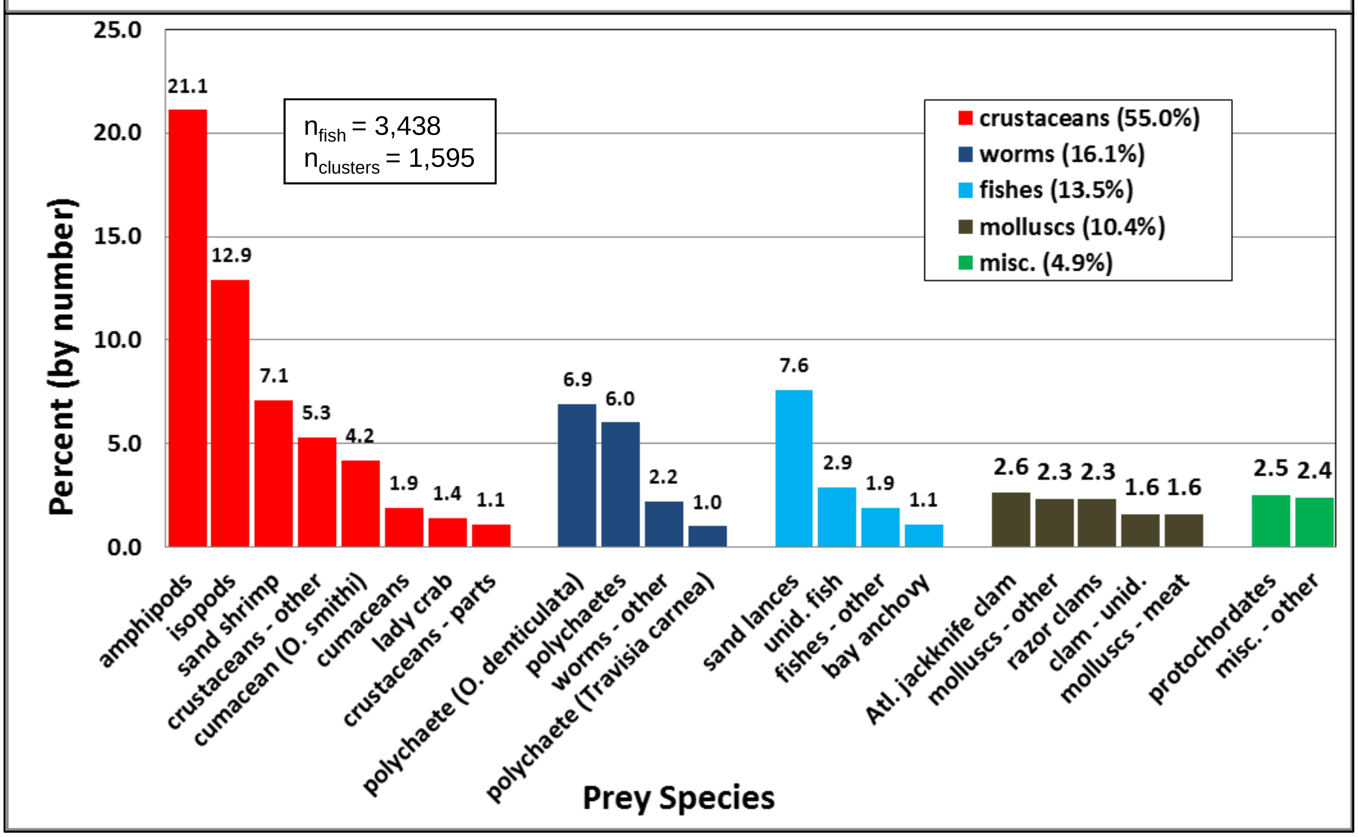


Figure 242. Winter Skate diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).

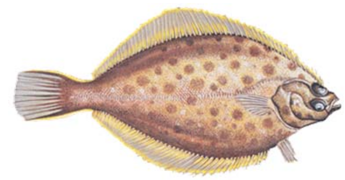


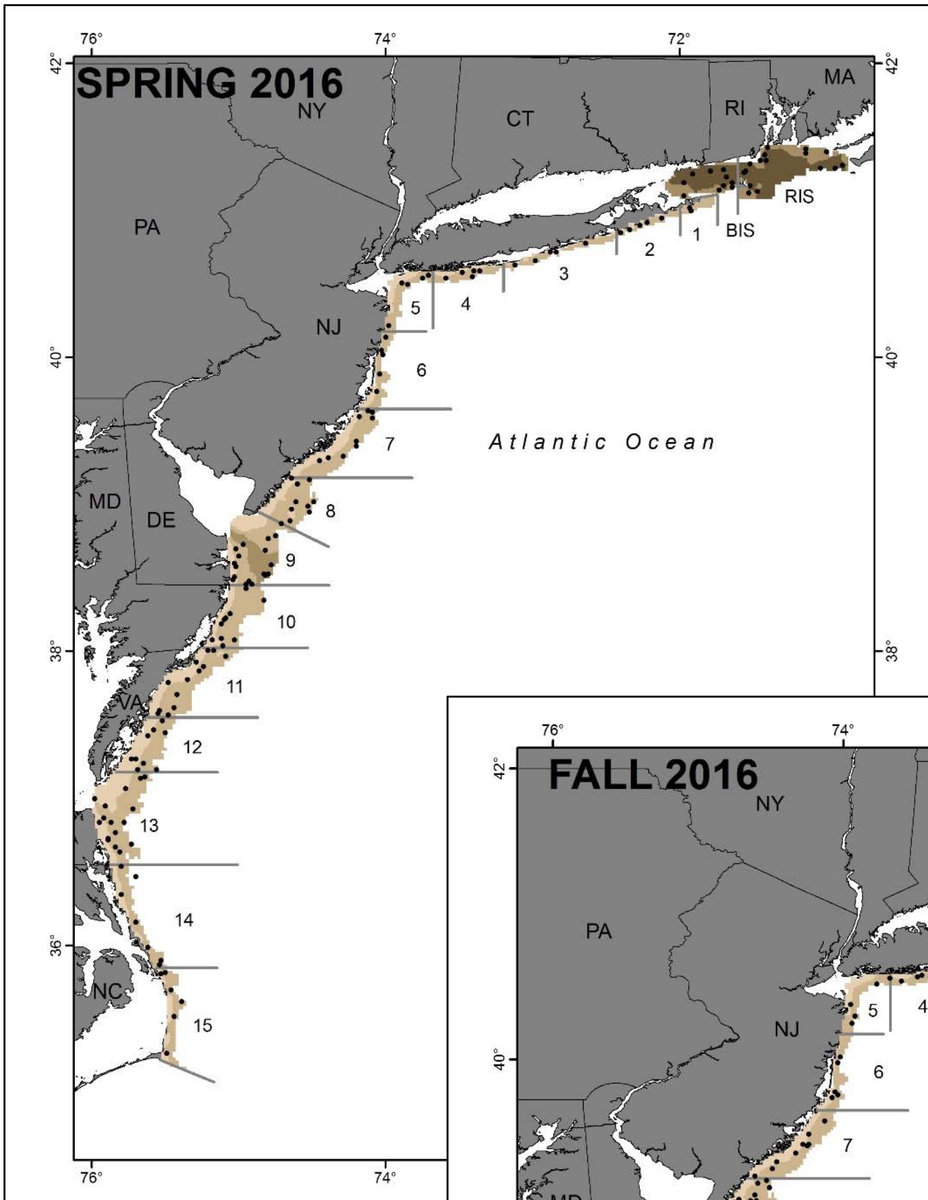


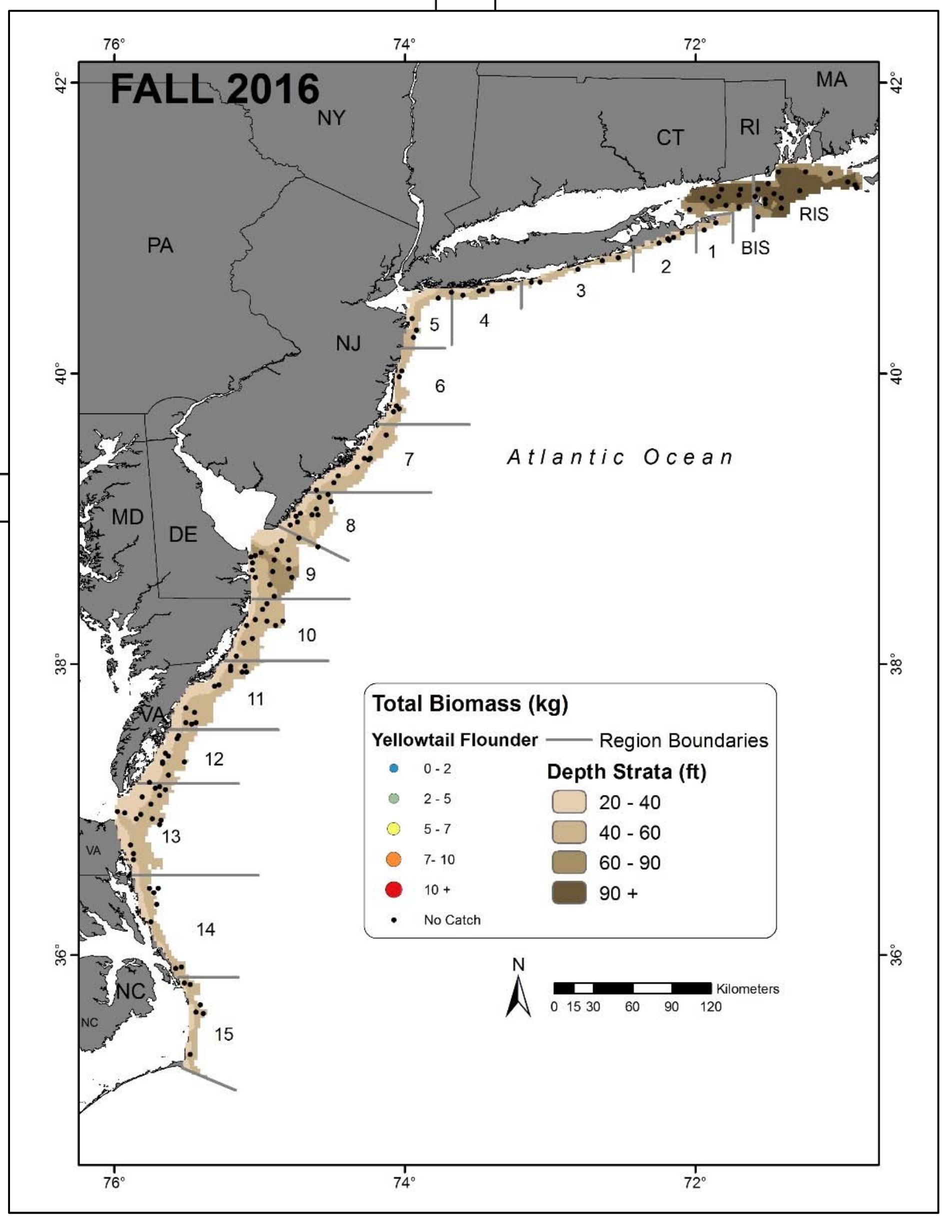
Yellowtail Flounder

Sampling Priority: A

Figure 243. Yellowtail Flounder biomass (kg) at each sampling site for 2016 NEAMAP cruises and strata used for calculation of abundance indices.







State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
	04	20-40		
		40-60		
	05	20-40		
		40-60		
NJ	06	20-40		
		40-60		
	07	20-40		
		40-60		
	08	20-40		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
		40-60		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
	15	20-40		
		40-60		

(green) = used for abundance indices
(gray) = not used for abundance indices

Table 80. Yellowtail Flounder sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Presence at Index Stations (%)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1	0.3	N/A	1	1	0	0	0
	2009	52	21.3	N/A	52	19	0	19	19
	2010	36	19.3	N/A	36	21	0	20	20
	2011	2	0.7	N/A	2	1	0	1	1
	2012	26	9.9	N/A	26	21	0	21	21
	2013	15	6.6	N/A	15	11	0	10	10
	2014	10	4.6	N/A	10	10	0	10	10
	2015	8	4.2	N/A	8	8	0	8	8
	2016	0	0.0	N/A	0	0	0	0	0
Fall	2007	1	0.1	N/A	1	1	0	1	1
	2008	2	0.3	N/A	2	2	0	2	2
	2009	1	0.2	N/A	1	1	0	1	1
	2010	0	0.0	N/A	0	0	0	0	0
	2011	1	0.1	N/A	1	1	0	1	1
	2012	0	0.0	N/A	0	0	0	0	0
	2013	0	0.0	N/A	0	0	0	0	0
	2014	0	0.0	N/A	0	0	0	0	0
	2015	0	0.0	N/A	0	0	0	0	0
	2016	0	0.0	N/A	0	0	0	0	0

Figure 244. Yellowtail Flounder length-frequency distributions, by cruise.

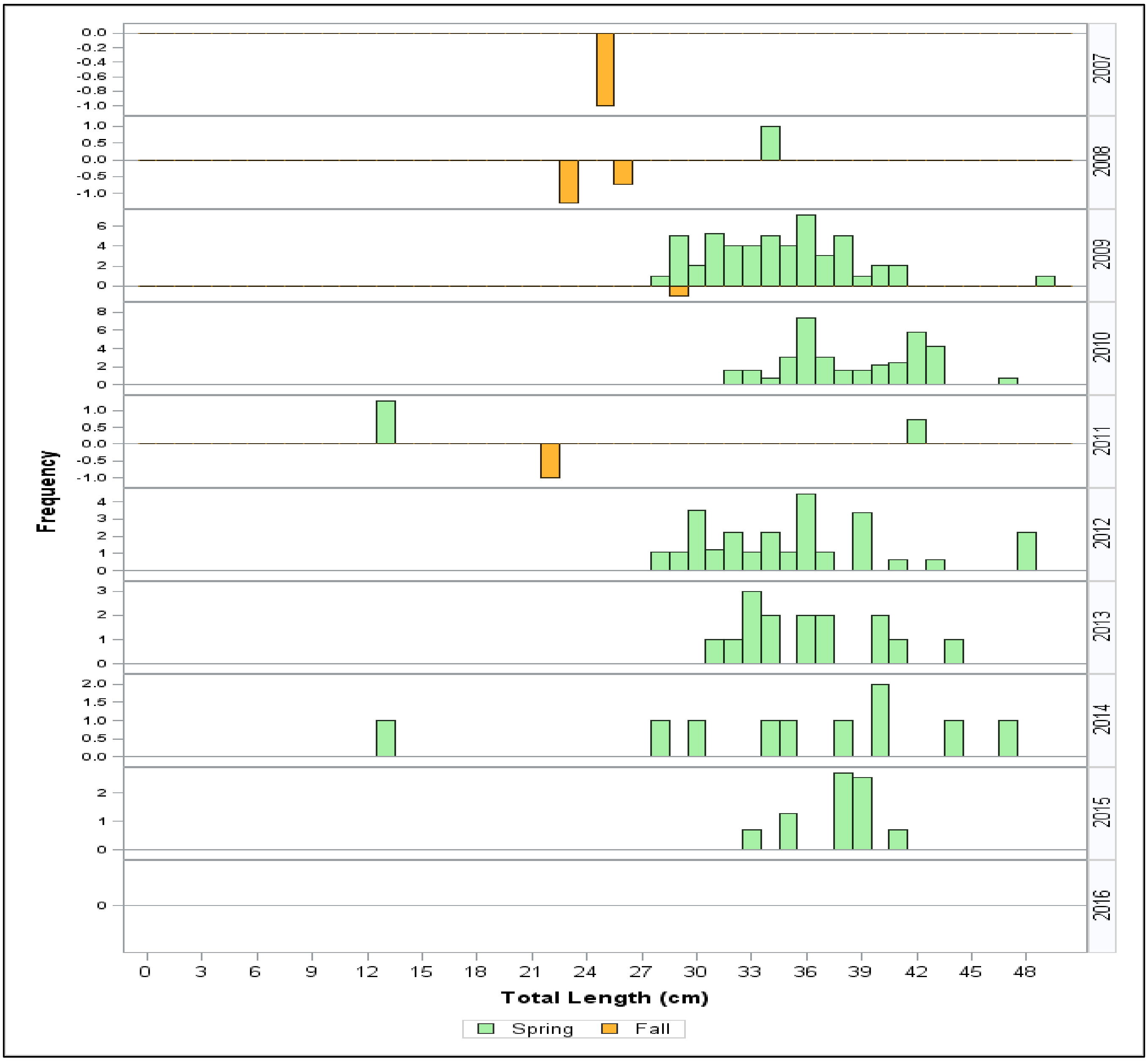


Figure 245. Yellowtail Flounder length-frequency distributions, by cruise and sex.

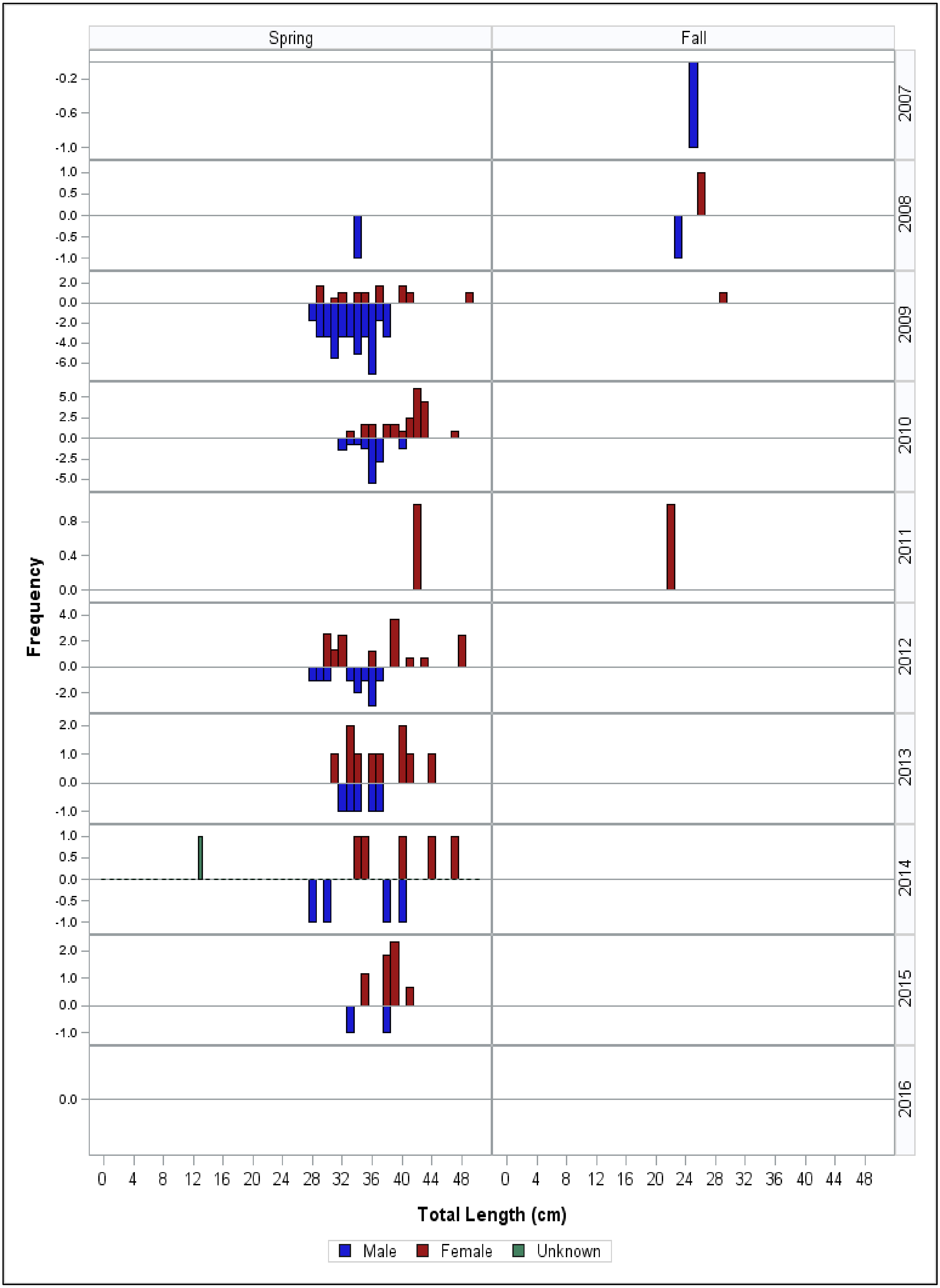


Figure 246. Yellowtail Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2016 (The number of fish sampled for diet is given by n_{fish}, while $n_{clusters}$ indicates the number of clusters of this species sampled.).