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Northeast Area Monitoring and Assessment Program (NEAMAP) Mid-Atlantic Nearshore Trawl Program Progress Report: Fall 2007 Survey Data Summary

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NEAMAP ASMFC Progress Report

I. **Project Title:** Data collection and analysis in support of multispecies stock assessments in the mid-Atlantic: Northeast Area Monitoring and Assessment Program Nearshore Trawl Program.

II. **Grantee State and Contact Name:** Virginia/Virginia Institute of Marine Science – Christopher F. Bonzek

III. **Project Period:** 1 August 2005 – 31 May 2009
Reporting Period: 1 August 2007 – 31 January 2008

IV. **Project Description:** This is a new fisheries-independent bottom trawl survey operating in the near coastal ocean waters of the Mid-Atlantic region. The survey is an element of the ASMFC Northeast Area Monitoring and Assessment Program (NEAMAP) and is designed to sample fishes and invertebrates from coastal waters bounded by the 20ft.and 60ft. depth contours between Montauk, New York and Cape Hatteras, North Carolina and waters between the 60ft.and 120ft. depth contours in Rhode Island Sound and Block Island Sound using a bottom trawl. The main objective of the survey is the estimation of biomass, length and age structures, various other assessment related parameters and diet compositions of select finfishes inhabiting the area.

V. **Project Summary/Accomplishments:** The fall 2007 survey was successfully completed during a research cruise which occurred between 27 September and 20 October 2007. A total of 150 stations, the target number, were sampled. About 1.1 million individual fishes weighing almost 50,000kg and representing about 130 species (including selected invertebrates which where processed similarly to fishes) were captured. Individual length measurements were recorded for over 73,000 specimens. Lab processing is proceeding on the 5,150 otoliths and 3,905 stomach samples which were collected (2,433 otoliths and 1,930 stomachs have been fully processed as of the date of this report). A full report is attached to this standard project summary.

VI. **Challenges/Changes:** Beyond completion of laboratory samples, no significant challenges remain for this contract segment.

VII. **Participants:** Primary program personnel remain unchanged.

VIII. **Quality Assurance:** Previous progress reports provided brief descriptions of quality assurance procedures in selecting fishing gear, conducting fishing operations, and processing the catch. These are interwoven into the attached report as well. Data collected during the survey have been processed through several data quality checks which were previously developed for other survey work and new checks developed specifically for NEAMAP.

IX. **Funding Status:** Expenditures have been generally in line with expectations. We anticipate sufficient funds will be available until Research Set Aside Program funds are dispersed later in 2008.

X. **Future Activities:** The future of this program is dependent upon continued funding. We anticipate sufficient funds to complete both the spring and fall 2008 cruises.

XI. **Presentations/Public Outreach:** Since completion of field sampling, presentations of survey results have been (or will be) made as follows:

- February 2008: Mid-Atlantic Fishery Management Council
- February 2008: Cape May NJ Party and Charter Boat Association
- February 2008: NMFS NEFSC Trawl Advisory Panel
- February 2008: Bass Pro Shops Fishing Classic (Hampton, VA), Booth exhibit
- March 2008: NEAMAP Operations Committee
- March 2008: NEAMAP Board
- April 2008: New England Fishery Management Council

Introduction

Concerns regarding the status of fishery-independent data collection from the 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 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 had 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 where current sampling is either inadequate or absent 2) coordinating data collection amongst 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 intended to operate in the coastal zone of the Middle 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 has been sampling from Cape Hatteras to the U.S. / Canadian border in waters less than 91.4m since 1963, few stations are sampled in waters less than 27.4m due to the sizes of the sampling area and 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). This new NEAMAP Inshore Trawl Survey is intended to fill the aforementioned gap in fishery-independent survey coverage, which is consistent with the program goals.

In early 2005, the ASMFC made $250,000 of "plus-up" funds that it had received through the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) available for pilot work in an effort to assess the viability of the NEAMAP Inshore Trawl Survey. The Virginia Institute of Marine Science provided the sole response to the Commission's request for proposals and was awarded the funding in August 2005. Two brief pre-pilot cruises and the full pilot cruise were conducted in 2006 (Bonzek et al., 2007).

Early in 2007 ASMFC bundled funds from a combination of sources which were sufficient to begin full scale sampling operations in the fall of 2007. This report summarizes results from the fall 2007 cruise.

Two significant changes to the area sampled by the NEAMAP Nearshore Trawl Program occurred prior to the fall 2007 cruise:

- In 2007 NEFSC took delivery of the *FSV Henry B. Bigelow*, began preliminary sampling operations, and determined that the vessel could safely operate in waters as shallow as 18.3m. NEFSC then made a determination 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 survey coastal sampling (i.e., Montauk to Cape Hatteras) should be realigned to coincide with the inshore boundary of the NEFSC survey, and that NEAMAP should discontinue sampling between the 18.3m and 27.4m contours along the coast.

- NEFSC contributed significant funds toward NEAMAP full implementation with the provision that the additional under-sampled areas of Block Island Sound and Rhode Island Sound be added to the NEAMAP sampling area. These areas are deeper than other NEAMAP regions but from a 'distance from shore' standpoint are within the range covered by NEAMAP in other states.

Methods

Station Selection

Primary consideration in regards to survey stratification was consistency with the NMFS bottom trawl surveys. However, those surveys will be redesigned and re-stratified for 2009 (and beyond) and so re-stratification for the inshore NEAMAP areas was open for consideration as well.

Examination of existing NMFS strata revealed that the major divisions among survey areas (latitudinal divisions from New Jersey to the south, longitudinal divisions off Long Island) generally corresponded well with major estuarine outflow areas. Therefore these boundary definitions, with minor modifications so that regional boundaries would more closely correspond to state borders, were used for the NEAMAP survey. However, examination of the current NMFS depth stratum definitions reveals that in some areas (primarily off the southern states) current stratum boundaries do not correspond well to actual depth contours. Depth stratum assignments were redrawn using depth sounding data from the National Ocean Service using depth strata 20ft.-40ft. and 40ft.-60ft. Finally, each stratum was subdivided into a grid pattern of potential sampling locations, with each cell measuring 1.5 x 1.5 minutes (2.25sq. nm).

The number of stations (cells) selected for each stratum was assigned by proportional sampling according to surface area within the stratum, with a minimum of two stations per stratum. During the pilot cruise, an equal number of stations was selected for each depth stratum within a particular region. This assured that sufficient sampling occurred in the small, shallow strata closest to shore. As the large offshore (60ft. – 90ft.) strata were not sampled in the fall of 2007, this procedure was no longer required and straight proportional sampling was implemented.

Species Priority Lists

During the survey design phase, the NEAMAP Operations Committee developed a set of species priority lists. Priority 'A' species were to be subjected to the full processing procedure (see *Procedures at Each Station* below) at each station in which they were collected. Compared to the list used for the 2006 pilot survey, several Priority 'A' species were added due to the expanded survey area (should lead to collections of additional species of management importance) and the requests of the Mid-Atlantic Fisheries Management Council. Priority 'B' species were to be sampled for full processing as time allowed. Priority 'C' species would only be taken for full processing if sampling of A and B species would not be affected. These three categories might be summarized as 'must have' 'great to have' and 'nice to have,' respectively. All other species (here called Priority 'D') were to have aggregate weights recorded and all or an appreciable subsample to be measured. A fifth category ('E') was later defined, including species which required special handling. This category included sharks (other than dogfish) and sturgeon, which were measured, tagged, and released; and selected invertebrates which were processed similarly to Priority D fish species. Species included in categories A-C are presented below (Table 1).

Table 1. Species priority lists (categories A-C only).

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

Gear Performance

Wingspread, doorspread, and headrope height were measured on each tow during the fall 2007 cruise using a digital Netmind Trawl Monitoring System. Wingspread sensors were positioned on the middle net 'jib' in accordance with NFMS procedures. The headrope sensor was mounted at the midpoint of the headrope. A catch sensor was mounted in the cod-end, set to signal when the catch reached roughly 5,000lbs. GPS coordinates and vessel speed were recorded every 60 seconds using the ship's chartplotting software. These data can be used to plot tow tracks for each station. The same computer used to record Netmind readings was also employed to plot station locations (and the corners of each sampling cell) and to run the countdown clock for each tow.

Procedures at Each Station

All fishing operations were conducted during daylight hours. Each tow was 20 minutes in duration with a target tow speed of between 2.9 and 3.3 knots. No tows were truncated due to known hangs in the tow path, surface traffic etc. One tow was terminated at 15 minutes due to an anticipated (and realized – 6,400kg) large catch, as indicated by triggering of the catch sensor midway through the tow.

At each station several standard parameters were recorded. These included:

- All necessary station identification parameters (date, station number, stratum, depth).
- All necessary vessel operation parameters (beginning and ending GPS position, beginning and ending tow times, compass course, engine RPMs).
- All necessary gear identification and operational parameters (net type code and net number, door type code and door numbers, amount of cable deployed).
- Atmospheric and weather data (air temperature, wind speed, wind direction, general weather state, sea state, barometric pressure).
- Hydrographic data at the surface and at the bottom (water temperature, salinity, and dissolved oxygen).

Upon arrival near a sampling cell, the Captain and Chief Scientist jointly determined the desired starting point and tow path. Flexibility was allowed with regard to these parameters such that a clear tow could be accomplished while staying within the boundaries of the defined cell.

Hydrographic data were taken prior to the beginning of each tow, except rarely when taking these readings would have delayed the tow until after sunset; in these cases hydrographic data were recorded at the completion of the tow.

Vessel crew were responsible for all aspects of deployment and retrieval of the fishing gear. Due to the relatively shallow waters, 75fm. or less of warp was set out at all stations. One scientist was present in the wheelhouse during deployment and retrieval. The Captain signaled when the gear was fully set (winch brakes engaged), at which time the Netmind software and the countdown clock were both activated. At the conclusion of each tow, the scientist signaled the Captain when the clock reached zero, haulback commenced, and the Netmind recording software was stopped. Vessel crew dumped the catch into one of two enclosed locations on deck for sorting.

The catch was sorted by species and modal size group. Aggregate biomass (kg) was measured for each species-size group combination. For priority A species, and often for priority B and C species, a subsample of five individuals from each group was selected for full processing (see next paragraph). For certain common priority B species including spot (*Leiostomus xanthurus*), Atlantic croaker (*Micropogonias undulatus*), skates, rays, and dogfish only three individuals per group were sampled for full laboratory processing.

Data collected from each subsampled specimen included length (to the nearest millimeter), total and eviscerated weight (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, for which previous sampling indicated that little useful data could be obtained from the stomach contents) 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. All specimens not selected for the complete processing were weighed (aggregate weight), and individual length measurements were recorded for either all or a large proportion, in accordance with approved subsampling procedures when necessary.

Laboratory Methods

Otoliths (or, depending upon the species, other appropriate ageing structures) were (and are being) prepared according to methodology established for other VIMS surveys. 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 using two *Buehler* diamond wafering blades and a low speed *Isomet* saw. The section was then mounted on a glass slide and covered with *Crystal Bond*. If necessary, the section was wet-sanded to an appropriate thickness before being covered with *Crystal Bond*. Some smaller, fragile otoliths were read whole. Both sectioned and whole otoliths were most commonly read using transmitted light under a dissecting microscope. Age was determined as the mode of three independent readings, one by each of three readers.

Stomach samples were (and are being) analyzed according to standard procedures (Hyslop 1980). Prey were identified to the lowest possible taxon. Experienced laboratory personnel are able to process, on average, approximately 30 to 40 stomachs per person per day.

Analytical Methods (Abundance)

Estimates of abundance are expressed in terms of minimum trawlable number or biomass according to the general formula:

$$N = \frac{cA}{a}, \qquad (1)$$

where N is the minimum number (or biomass) of fish present within the sampling area that are susceptible to the sampling gear, c is the mean number (or weight) of fish captured per tow, a is the area swept by one trawl tow, and A is the total survey area.

Specifically, abundance was calculated in accordance with standard stratified random sampling:

$$\hat{N} = \sum_{s=1}^{n_s} A_s \hat{\bar{N}}_s \, , \qquad (2)$$

where A_s is the area of stratum s, n_s is the total number of strata in which striped bass were captured, and $\hat{\bar{N}}_s$ is an estimate of the mean area-swept catch in stratum s given by:

$$\hat{\bar{N}}_s = \frac{\sum_{i=1}^{n_{t,s}} \frac{c_i}{\hat{a}_i}}{n_{t,s}} \, , \qquad (3)$$

In equation (3), c_i and $\hat{a}_i$ represent the catch (number or weight) and an estimate of the trawl area-swept at sampling location *i*, respectively, and $n_{t,s}$ is the number of tows in stratum *s*. Note that the a_i estimates were calculated using vessel GPS data for distance towed and net mensuration gear for measurements of net opening (an average value was calculated from the measurements taken during each tow). As no correction is made for gear efficiency these estimates represent the minimum number (or biomass) of fish present within the sampling area that are susceptible to the sampling gear.

This method produces estimates of abundance for each stratum, which are totaled to produce estimates for the entire survey area. As regional stratum boundaries were drawn to generally correspond with state borders, estimates of abundance (and certain other stock parameters) can be produced on a state-specific basis. While usually not biologically meaningful, for some parameters it was considered worthwhile to present results in this way due to the potential usefulness for fishery managers.

Analytical Methods (Sex Ratios)
Sex ratios were determined by summation of data from fully processed specimens. For this and several other stock parameters, data from fully processed specimens are expanded to the entire sample (i.e., catch level) for parameter estimation. Because workup procedures result in differential subsampling rates among size groups, failure to account for such factors would bias resulting stock parameter estimates. In the NEAMAP database each specimen has a calculated expansion factor associated with it which represents the number of fish that the specimen represents in the total sample for that station.

Analytical Methods (Length Frequency)
Length frequency histograms were designed using 10mm bins and the expansion factors as previously described. Length bins were identified using the bin midpoint (e.g. the 250mm bin represents individuals between 245mm and 254mm).

Analytical Methods (Length-Weight Regressions)
Power regressions for length-weight relationships were calculated and plotted by sex as well as both sexes combined. No tests for differences in growth by sex were performed. No expansion factors were used in these calculations as they do not depend on subsampling rates.

Analytical Methods (Maturity Regressions)
Logistic regressions were calculated and plotted separately for males and females. No expansion factors were used in these calculations as they do not depend on subsampling rates.

Analytical Methods (Diets)
Diets for each species were determined by estimating the mean proportional contribution of prey type (*k*) to predator (*x*) by weight or number ($W_{k,x}$) using the following equation:

$$W_{k,x} = \frac{\sum_{i=1}^{n} M_{i,x} q_{i,k,x}}{\sum_{i=1}^{n} M_{i,x}}, \qquad (4)$$

where

$$q_{i,k,x} = \frac{w_{i,k,x}}{w_{i,x}}, \qquad (5)$$

where $M_{i,x}$ is the number of predator *x* captured at station *i*, $w_{i,k,x}$ is the total weight (or number) of prey type *k* encountered in the stomachs of predator *x* collected at station *i*, and $w_{i,x}$ is the total weight (or number) of all prey items encountered in these stomachs (Buckel et al. 1999). This cluster sampling estimator was used since trawl collections yield a cluster of each predator at each station.

Results

Gear Performance
As was the case during the pilot survey and prior work, the 4-seam net performed consistently within the expected parameters (Figure 1). The addition of doorspread sensors provided valuable supplementary information. Mounting these sensors onto the relatively small trawl doors however (Figure 2), decreased the efficiency (i.e., spreading power) of the doors, and early in the cruise wingspread measurements were 1-2m less than previously achieved. Slight modifications to the warp and backstrap attachment points on the doors, combined with additional scope, brought the net back within specifications and provided the expected door spread measurements.

Discounting the early stations at which the gear was slightly underspread, there did not appear to be an increasing trend in either the doorspread or wingspread measurements as was observed in the 2006 pilot survey. The same net was used for the fall 2007 survey as was used for the pilot survey. We will monitor whether this phenomenon appears in future surveys using new nets.

No major gear damage occurred during the survey.

Stations Sampled
Based on a specified sampling rate of one station per 30sq.nm, the target number of stations to be sampled was 150 for the entire sampling area (1,938 cells x 2.25sq.mi. per cell / 30 stations per sq.nm. = 145 stations) and 150 stations were successfully occupied. The number of stations available and the number sampled in each stratum is given (Table 2).

Of the 150 stations sampled, 129 were sampled within the specified primary sampling cell and 21 were chosen from the available randomly selected alternate sites, due to issues such as known hangs or other obstructions, fixed gear, or vessel traffic. One extra station was occupied in Region 12 (Virginia) to make up for one station not sampled in BI Sound (data from this station were assigned to Region 12, not to BI Sound). The highest number of alternate stations occupied was in BI Sound (2 out of 10) and RI Sound (7 out of 17) due to a high degree of caution, to unfamiliarity with the area, and to a relatively small number of towable locations in this area. For future surveys we anticipate obtaining a better sample of known towable locations through cooperation with local industry representatives. A region-by-region summary of these results is presented (Table 3). Maps comparing selected and actual stations sampled are shown (Figure 3).

Table 2. Number of available sample cells and number sampled in each stratum.

Region	State*	Stations Sampled								Stations per sq. nm.
		20ft.-40ft.		40ft. – 60ft.		60ft. – 90ft.		90ft. – 120ft.		
		Stations sampled	Total cells	Stations sampled	Total cells	Stations sampled	Total cells	Stations sampled	Total cells	
RI Sound	RI					6	85	11	161	32.6
BI Sound	RI					4	42	5	88	32.5
1	NY	0	0	2	19					21.4
2	NY	2	8	3	19					12.2
3	NY	2	16	3	28					19.8
4	NY	2	16	3	29					20.3
5	NY	2	27	3	45					32.4
6	NJ	2	20	3	42					27.9
7	NJ	4	49	6	97					32.9
8	NJ	2	32	7	90					30.5
9	DE	4	53	8	113					31.1
10	MD	2	33	8	114					33.1
11	VA	5	62	9	122					29.6
12	VA	5	60	6	67					26.0
13	VA	7	94	11	142					29.5
14	NC	2	24	5	61					27.3
15	NC	2	25	4	55					30.0
Total		43	519	81	1043	10	127	16	249	29.1

* 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

Table 3. Number of primary and alternate stations occupied in each region.

Region	Primary Stations	Alternate Stations	Total	Region	Primary Stations	Alternate Stations	Total
RI Sound	10	7	17	**8**	8	1	9
BI Sound	7	2*	9	**9**	11	1	12
1	1	1	2	**10**	10	0	10
2	4	1	5	**11**	13	1	14
3	5	0	5	**12**	9	2*	11
4	5	0	5	**13**	15	3	18
5	5	0	5	**14**	7	0	7
6	4	1	5	**15**	5	1	6
7	10	0	10	**Total**	**129**	**21**	**150**

* One planned station in BI Sound was not sampled; an extra station was occupied in Region 12.

On the 17 full sampling days (i.e., no long steam times or port calls), an average of 7.9 stations per day were sampled. Counting all 24 days at sea, including transit days and partial sampling days, the number of stations averaged 6.25. Day-by-day vessel activities and work schedules are presented (Table 4).

Table 4. Summary of activities conducted during each day at sea during the fall 2007 NEAMAP cruise.

Hours Worked and Stations Sampled Each Day

Time of Day: 12:00 AM – 6:00 AM – 12:00 PM – 6:00 PM – 11:00 PM

Date	Activity	No. Station
24-Sep	Final Survey Preparations	0
25-Sep	Steaming Day - Hampton to Montauk	0
26-Sep	Steaming Day - Hampton to Montauk	0
27-Sep		7
28-Sep		7
29-Sep		7
30-Sep		7
1-Oct		6
2-Oct	Crew Change / Survey Demo. Montauk	2
3-Oct		7
4-Oct		8
5-Oct		9
6-Oct		10
7-Oct		10
8-Oct	Survey Demo. Cape May	2
9-Oct		9
10-Oct		9
11-Oct		7
12-Oct		9
13-Oct		6
14-Oct	No Fishing / Crew Change and Resupply in Hampton	0
15-Oct	No Fishing / Crew Change and Resupply in Hampton	0
16-Oct		1
17-Oct		7
18-Oct		7
19-Oct		8
20-Oct		4
21-Oct	Survey Finished	0

= Fishing hours
= Personnel hours

Catch Summary

A total of 1,101,152 specimens weighing 49,868kg were collected during the fall 2007 survey. A total of 73,473 individuals were measured (laying all individuals head-to-tail 11,465m, or 7.1miles, of fish were measured). Of those specimens taken for full workup, 5,150 otoliths (or other ageing structures) were taken and 3,905 full stomachs were preserved for later analysis. On average at each station, 7,132 (range 75 – 151,598) specimens were captured (Figure 4) weighing 332kg (range 7.4kg – 6,396kg) (Figure 5), 490 specimens were measured (range 57 – 1,394), and 34 specimens were processed for the full workup (range 4 – 77). At each station, an average of 20.4 species was captured (range 7 – 36) (Figure 6). The number of specimens processed for each species, separately for each priority category, is summarized in Table 5.

Species Data Summaries
Several graphical data summaries are shown for each species (Figures 7-173). Species are organized alphabetically.

For priority A species, most or all of the following figures are presented (at the time of report preparation 2,433 otoliths and 1,930 stomachs for priority A species have been analyzed):

- Distribution maps showing catch rates by number and biomass for all stations.
- Bar graphs showing the minimum trawlable number (MTN) and biomass (MTB) by state, annotated with estimates of the overall MTN and MTB and percent standard error for each.
- Length-frequency histograms annotated with the total number of specimens captured and measured and the number of otoliths and stomachs removed for processing.
- Length-frequency histograms by age.
- Histograms of sex ratio by state, and for species with adequate sample size, by size groups, annotated with the number of specimens examined.
- Logistic regressions for maturity, by sex, annotated with sizes at 50% and 99% maturity.
- von Bertalanffy growth regressions, by sex if appropriate.
- Age distribution graphs (ageing has been completed only for black sea bass, scup, summer flounder, weakfish, and striped bass (not shown)) shown with the total number of specimens by age if all specimens had been aged.
- Length-weight power regressions for sexes combined and separately.
- Diet compositions by weight and number, with prey types separated into broad taxonomic groups, annotated with the number of stomachs analyzed.

These data summaries are numbered as follows:

- Black seabass – Figures 33-42.
- Bluefish – Figures 43-49.
- Butterfish – Figures 59-64.
- Scup – Figures 96-105.
- Silver hake – Figures 106-111.
- Summer flounder – Figures 139-148.
- Weakfish – Figures 149-158.
- Winter flounder – Figures 159-168.

For priority B species, some or all of the following data summaries are presented:

- Distribution maps showing catch rates by number and biomass for all stations.
- Bar graphs showing the MTN and MTB by state, annotated with estimates of the overall MTN and MTB and percent standard error for each.
- Length-frequency histograms annotated with the total number of specimens captured and measured and the number of otoliths (or vertebrae for elasmobranchs) and stomachs removed for processing.
- Histograms of sex ratio by state, and for species with adequate sample size, by size groups, annotated with the number of specimens examined.
- Logistic regressions for maturity, by sex, annotated with sizes at 50% and 99% maturity.

- Length-weight power regressions for sexes combined and separately.

These data summaries are numbered as follows:

- Atlantic croaker – Figures 12-17.
- Atlantic menhaden – Figures 18-23.
- Bluntnose stingray – Figures 50-52.
- Bullnose ray – Figures 56-58.
- Clearnose skate – Figures 65-70.
- Cownose ray – Figures 71-73.
- Little skate – Figures 82-86.
- Smooth butterfly ray – Figures 115-117.
- Smooth dogfish – Figures 118-123.
- Spot – Figures 127-132.
- Winter skate – Figures 169-173.

No Priority C species were captured in sufficient numbers to allow meaningful data summaries to be presented.

Several other species were captured in significant numbers as well (labeled as Priority D in Table 5). Data summaries for these species that are shown are:

- Distribution maps showing catch rates by number and biomass for all stations.
- Bar graphs showing the MTN and MTB by state, annotated with estimates of the overall MTN and MTB and percent standard error for each.
- Length-frequency histograms annotated with the total number of specimens captured and measured.

These data summaries are numbered as follows:

- Atlantic spadefish – Figures 24-26.
- Atlantic thread herring – Figures 27-29.
- Bay anchovy – Figures 30-32.
- Kingfish spp. – Figures 79-81.
- Northern searobin – Figures 90-92.
- Pinfish – Figures 93-95.
- Silver perch – Figures 112-114.
- Spanish mackerel – Figures 124-126.
- Striped anchovy – Figures 133-135.
- Striped searobin – Figures 136-138.

Finally, several invertebrate species (or species groups) and selected sharks were captured in sufficient numbers to be of note (described as Priority D species in Table 5). Data summaries for these species that are shown are:

- Distribution maps showing catch rates by number and biomass for all stations.
- Bar graphs showing the MTN and MTB by state, annotated with estimates of the overall MTN and MTB and percent standard error for each.

- Length-frequency histograms annotated with the total number of specimens captured and measured.
- Histograms of sex ratio by state, annotated with the number of specimens examined (horseshoe crab only).
- Length-weight power regressions for sexes combined and separately (horseshoe crab only).

These data summaries are numbered as follows:

- American lobster – Figures 7-11.
- Brown shrimp – Figures 53-55.
- Horseshoe crab – Figures 74-78.
- Loligo squid – Figures 87-89.

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Table 5. Number of specimens captured and measured and number of otoliths (or other hard parts) and stomachs sampled, by species priority level.

Priority A Species					
Species	**Total Number Caught**	**Total Species Weight (kg)**	**Number Measured**	**Number of Otoliths**	**Number of Stomachs**
black seabass	401	85.3	401	219	210
bluefish	4,635	394.5	2,613	588	485
butterfish	148,182	1,904.9	6,015	538	11
scup	276,234	3,928.7	13,718	808	797
silver hake (whiting)	346	24.8	346	59	59
striped bass	17	66.3	17	16	16
summer flounder	960	625.5	926	716	448
weakfish	60,990	4,168.1	5,747	572	471
winter flounder	391	98.7	391	118	114
Priority B Species					
Species	**Total Number Caught**	**Total Species Weight (kg)**	**Number Measured**	**Number of Otoliths**	**Number of Stomachs**
American shad	9	0.8	9	9	9
Atlantic croaker	58,763	7,616.5	2,843	211	193
Atlantic menhaden	740	30.2	288	78	78
Atlantic torpedo	8	92.3	8	7	3
bluntnose stingray	349	1,178.9	307		
bullnose ray	731	1,155.0	631		
clearnose skate	1,499	1,847.7	1,355	340	324
cownose ray	451	3,976.6	150		
Leucoraja spp.	20	5.7	20		
little skate	5,288	3,026.2	2,659	194	187
monkfish	6	31.2	6	6	6
roughtail stingray	92	510.1	92	1	1
skate spp.	60	37.0	60		
smooth butterfly ray	292	557.1	292		
smooth dogfish	1,690	1,555.6	765	202	200
southern stingray	18	139.0	18		
spiny butterfly ray	133	1,366.7	133		
spiny dogfish	17	51.3	17	13	12
spot	44,437	3,942.0	2,507	160	9
winter skate	951	925.3	735	171	160
yellowtail flounder	1	0.1	1	1	1
Priority C Species					
Species	**Total Number Caught**	**Total Species Weight (kg)**	**Number Measured**	**Number of Otoliths**	**Number of Stomachs**
alewife	56	3.1	56	24	24
Atlantic herring	198	5.4	198	20	20
Atlantic mackerel	3	0.3	3	3	1
black drum	35	5.8	35	33	25
blueback herring	50	1.6	50	18	18
red drum	2	14.9	2	1	1
tautog	4	3.7	4	4	4

continued

Table 5. cont..

Priority D Species					
Species	Total Number Caught	Total Species Weight(kg)	Number Measured	Number of Otoliths	Number of Stomachs
African pompano	2	0.2	2		
Atlantic bumper	2	0.0	2		
Atlantic cutlassfish	212	2.1	117		
Atlantic moonfish	2,803	15.1	1,196		
Atlantic pomfret	2	0.2	2		
Atlantic spadefish	673	31.0	478		
Atlantic sturgeon	2	29.4	2		
Atlantic thread herring	3,345	167.7	554		
Atlantic threadfin	3	0.3	3		
banded drum	655	50.7	210		
bay anchovy	119,741	203.4	3,961		
Berycidae	5	13.7	5		
bigeye	11	1.7	11		
bigeye scad	75	2.4	75		
blackcheek tonguefish	3	0.2	3		
blue runner	175	9.9	160		
bluespotted cornetfish	1	0.0	1		
cobia	4	33.1	4		
conger eel	1	0.7	1		
crevalle jack	31	1.1	31		
dwarf goatfish	13	0.2	8		
Etropus sp.	24	0.3	24		
Florida pompano	43	7.6	43		
flying gurnard	1	0.0	1		
fourbeard rockling	1	0.1	1		
fourspot flounder	73	15.7	73		
fringed flounder	27	0.4	27		
gray triggerfish	23	9.2	23		
Gulf Stream flounder	91	1.9	91		
harvestfish	102	10.0	57		
hickory shad	7	2.4	7		
hogchoker	130	14.3	129		
inshore lizardfish	514	56.9	514		
jellyfish spp		818.3			
king mackerel	5	22.1	5		
kingfish spp	9,124	1,398.8	1,707		
lane snapper	4	0.1	4		
lined seahorse	2	0.0	2		
longspine snipefish	1	0.2	1		
lookdown	5	0.2	5		

continued

Table 5. cont.

Priority D Species (continued)					
Species	Total Number Caught	Total Species Weight (kg)	Number Measured	Number of Otoliths	Number of Stomachs
mackerel scad	38	0.4	38		
mantis shrimp	14	0.4	14		
northern pipefish	1	0.0	1		
northern puffer	93	5.8	93		
northern searobin	881	104.2	782		
northern sennet	222	19.7	76		
northern stargazer	12	21.1	12		
orange filefish	1	0.1	1		
pigfish	287	18.7	269		
pinfish	2,744	107.3	331		
planehead filefish	1	0.0	1		
red goatfish	1	0.0	1		
red hake	74	8.4	74		
rock crab	117	12.6	117		
rough scad	140	2.9	70		
round herring	452	9.1	447		
round scad	258	1.9	243		
sea raven	4	3.8	4		
sharksucker	3	0.2	3		
sheepshead	6	21.5	6		
short bigeye	3	0.1	3		
silver anchovy	42	0.5	42		
silver perch	1,398	39.0	141		
smallmouth flounder	32	0.5	32		
Spanish mackerel	161	42.5	161		
Spanish sardine	276	5.2	114		
species unidentified	40	22.8	40		
spotfin mojarra	87	1.3	82		
spotted hake	207	25.7	207		
striped anchovy	224,369	2,519.3	4,990		
striped burrfish	25	11.2	23		
striped searobin	760	171.5	546		
threadfin shad	2	0.2	2		
triggerfish spp.	1	0.1	1		
windowpane	744	114.0	694		

continued

Table 5. cont.

Priority E Species					
Species	Total Number Caught	Total Species Weight (kg)	Number Measured	Number of Otoliths	Number of Stomachs
American lobster	262	59.0	262		
Atlantic angel shark	3	12.8	3		
Atlantic sharpnose shark	68	257.4	68	10	8
blue crab - juvenile female	1	0.0	1		
blue crab - male	4	0.1	4		
blue crab, adult female	12	1.6	12		
brown shrimp	898	21.6	459		
dusky shark	4	18.1	4	1	1
horseshoe crab	795	1,447.9	342		
jonah crab	2	0.2	2		
Loligo squid	119,501	2,277.5	9,614		
sandbar shark	15	100.1	15	9	9
sea scallop	32	4.3	32		
squid spp	11	1.1	11		
thresher shark	5	73.6	5		
white shrimp	48	1.8	20		
Total	**1,101,152**	**49,868**	**73,473**	**5,150**	**3,905**

Figure 1. Chronological summary of average net performance parameters for each tow. Accepted ranges for each parameter are given by the dotted lines.

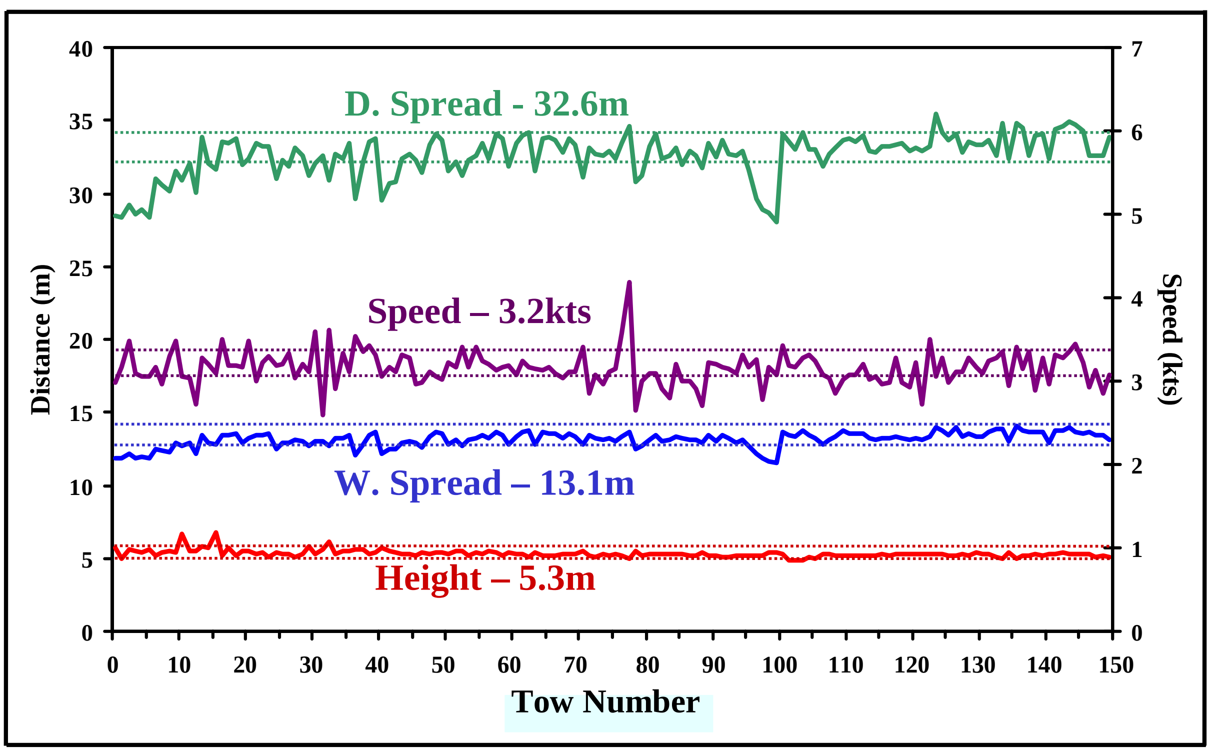


Figure 2. Thyboron Type IV 66” trawl doors frontside (A) and backside (B) with mounting bracket for Netmind sensor.

A.

B.

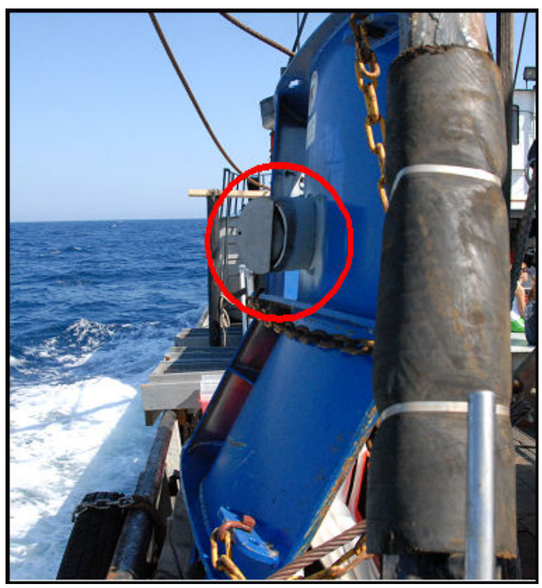


Figure 3. Comparison of stations selected (red) to locations sampled (black) in Rhode Island to New York (A), New Jersey to Maryland (B), and Virginia to North Carolina (C).

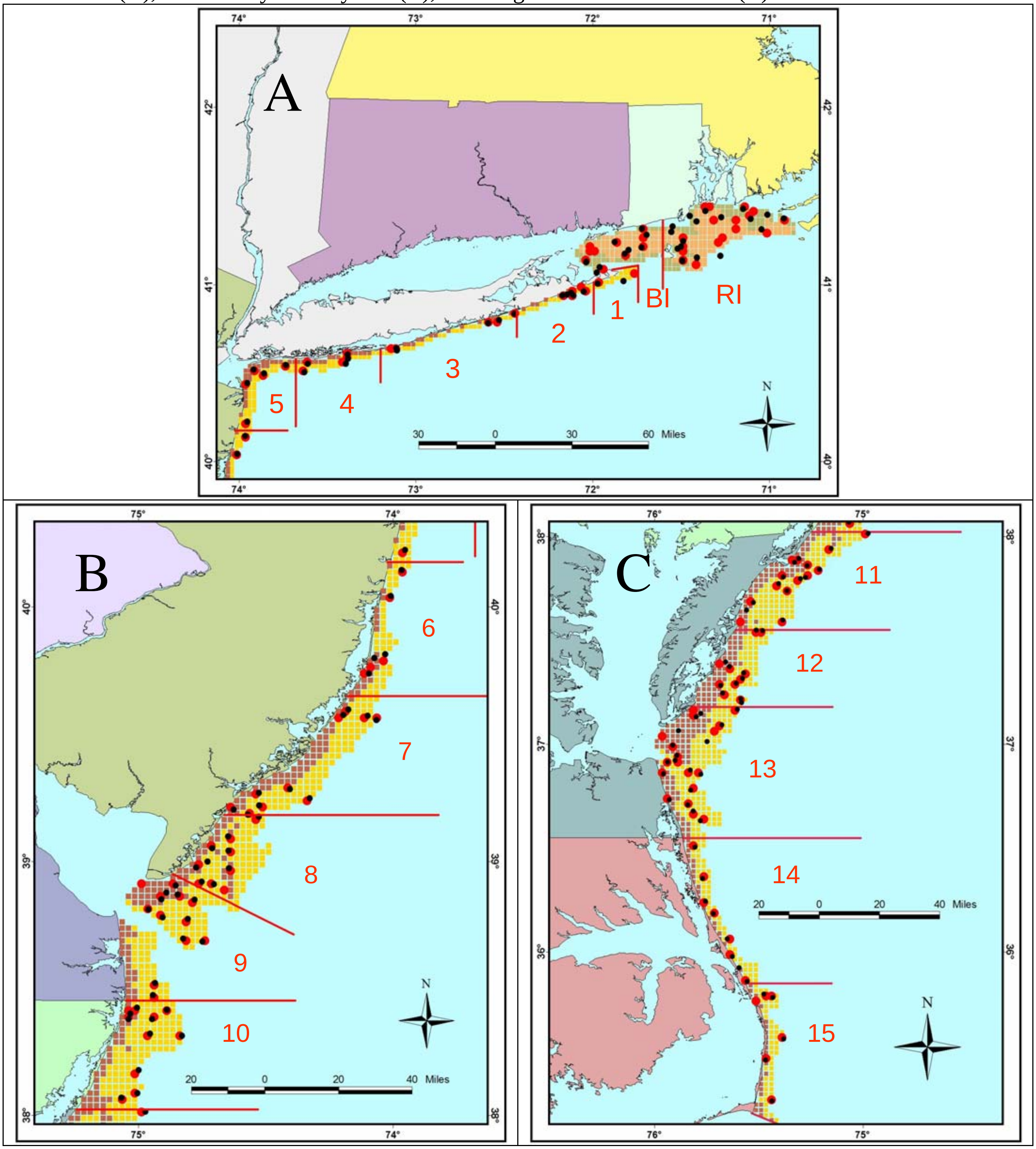


Figure 4. Frequency histogram of number of species captured at each station.

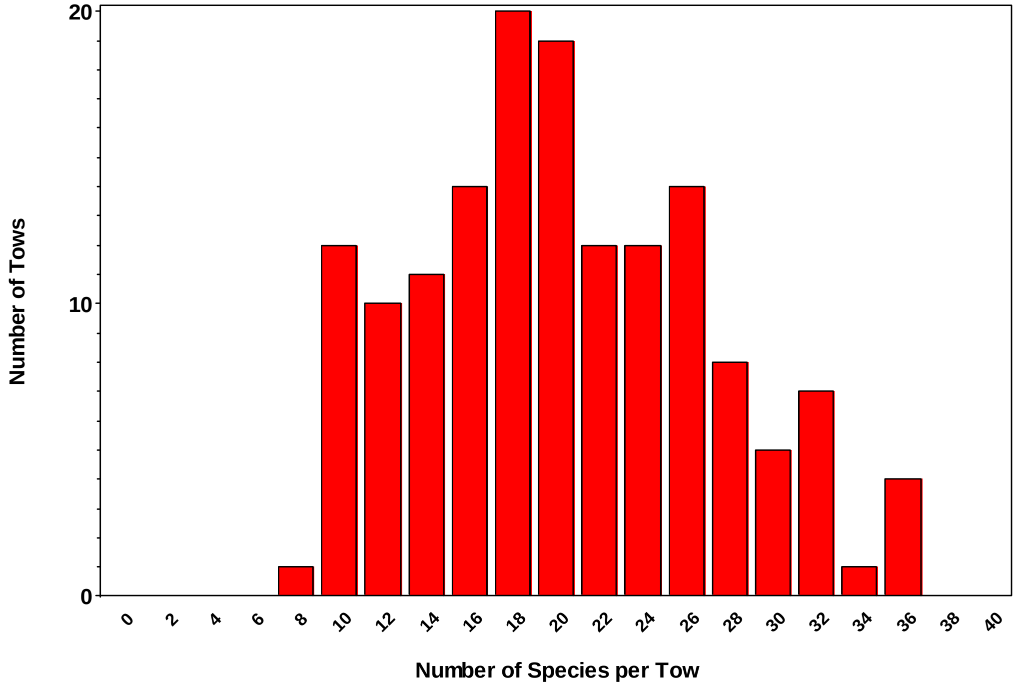


Figure 5. Frequency histogram of number of specimens captured at each station (note irregularly incremented values at the high end of the x-axis).

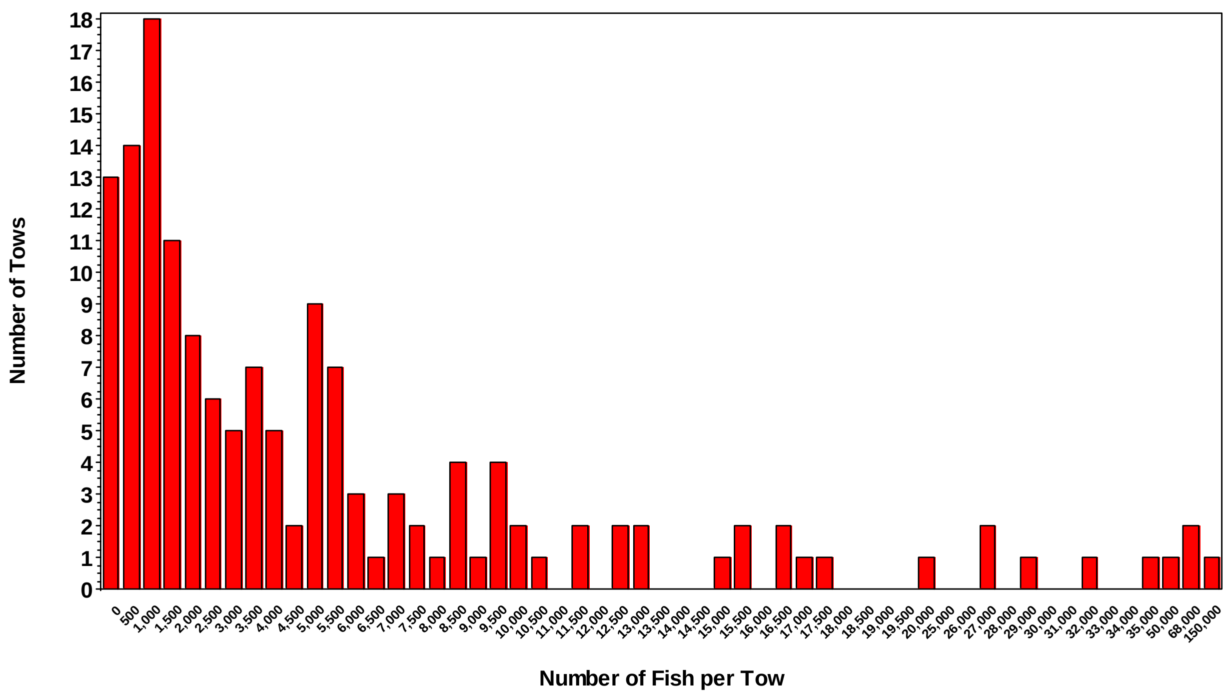
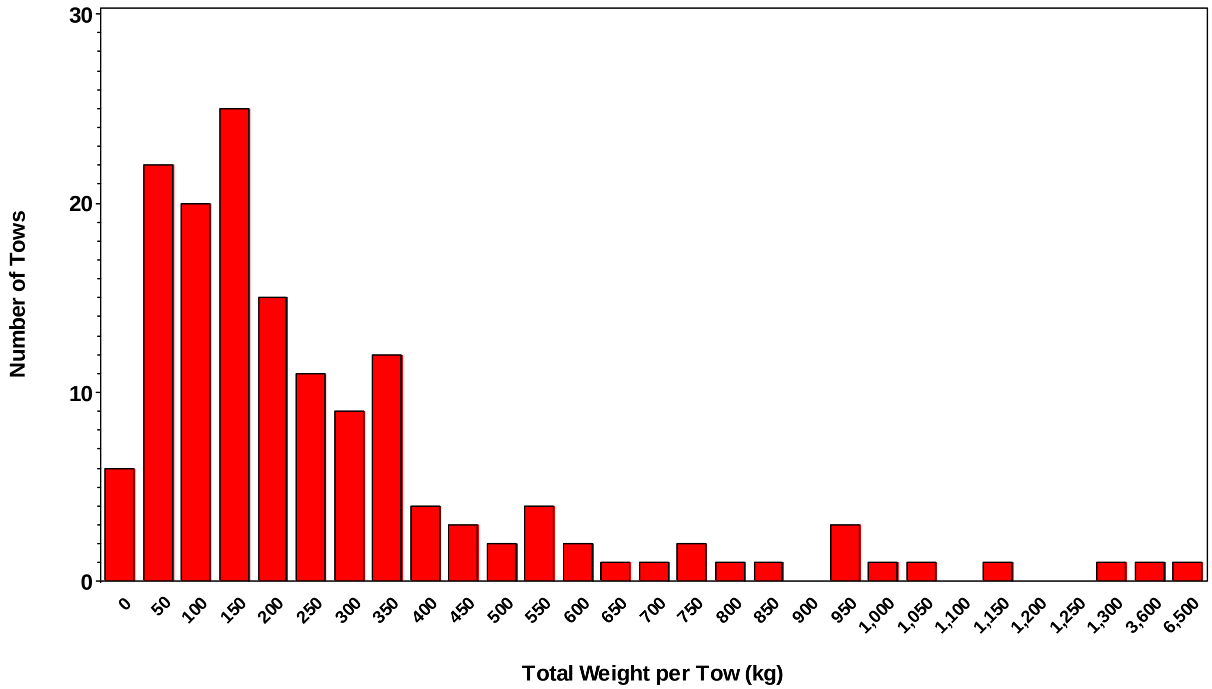
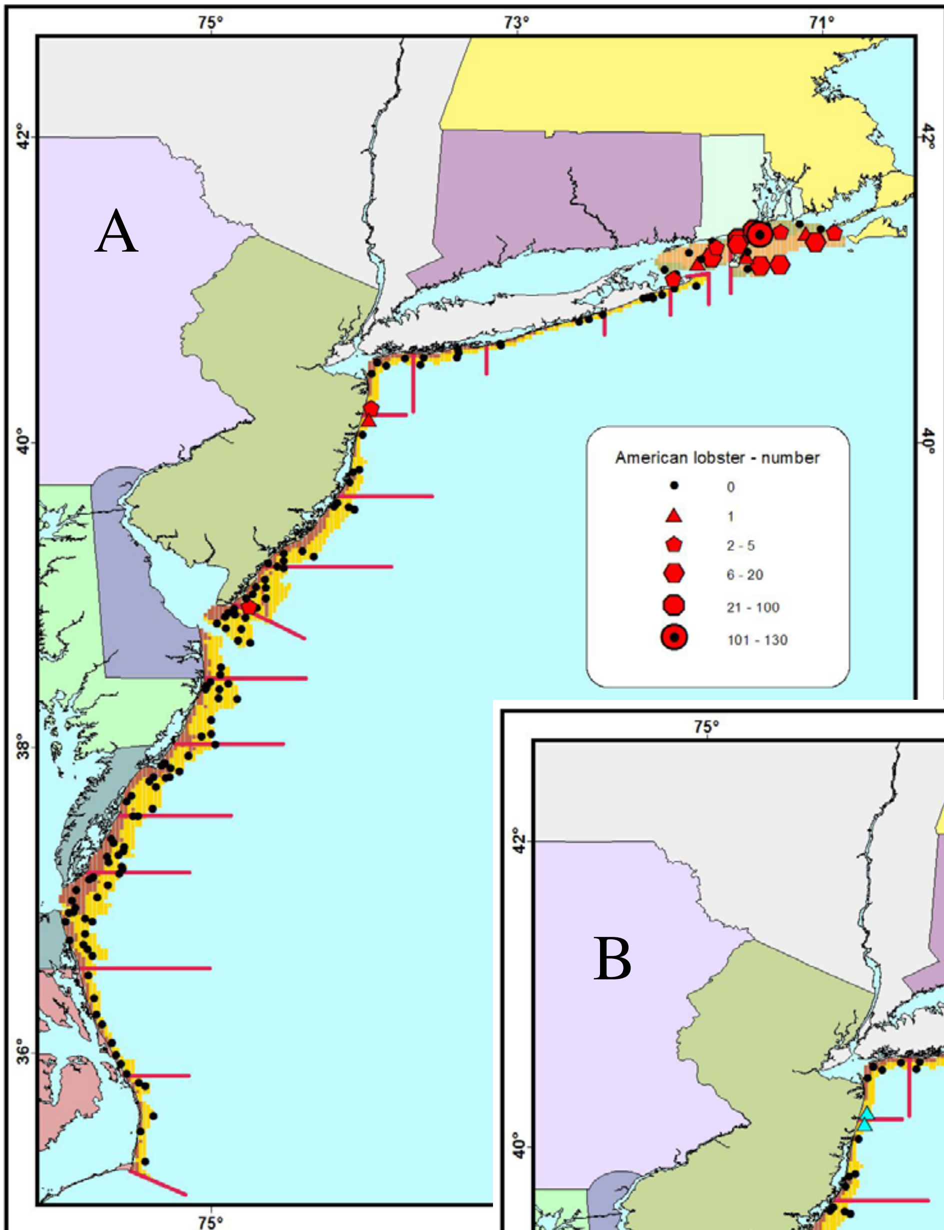


Figure 6. Frequency histogram of biomass of all specimens captured at each station (note irregularly incremented values at the high end of the x-axis).



American Lobster (Priority E)



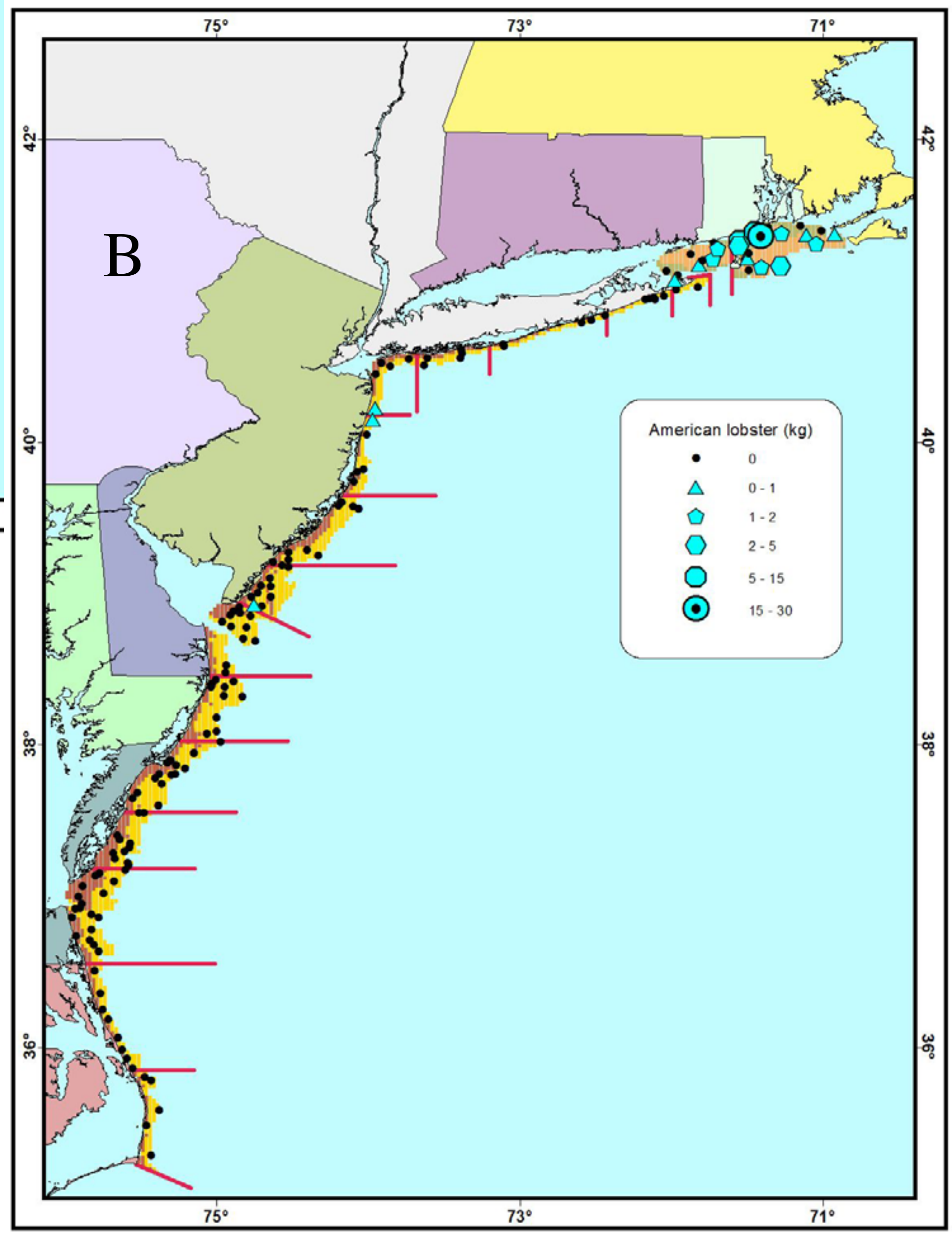


Figure 7. Number (A) and biomass (B) of specimens captured at each station for American lobster.

Figure 8. Minimum trawlable number and biomass by state for American lobster.

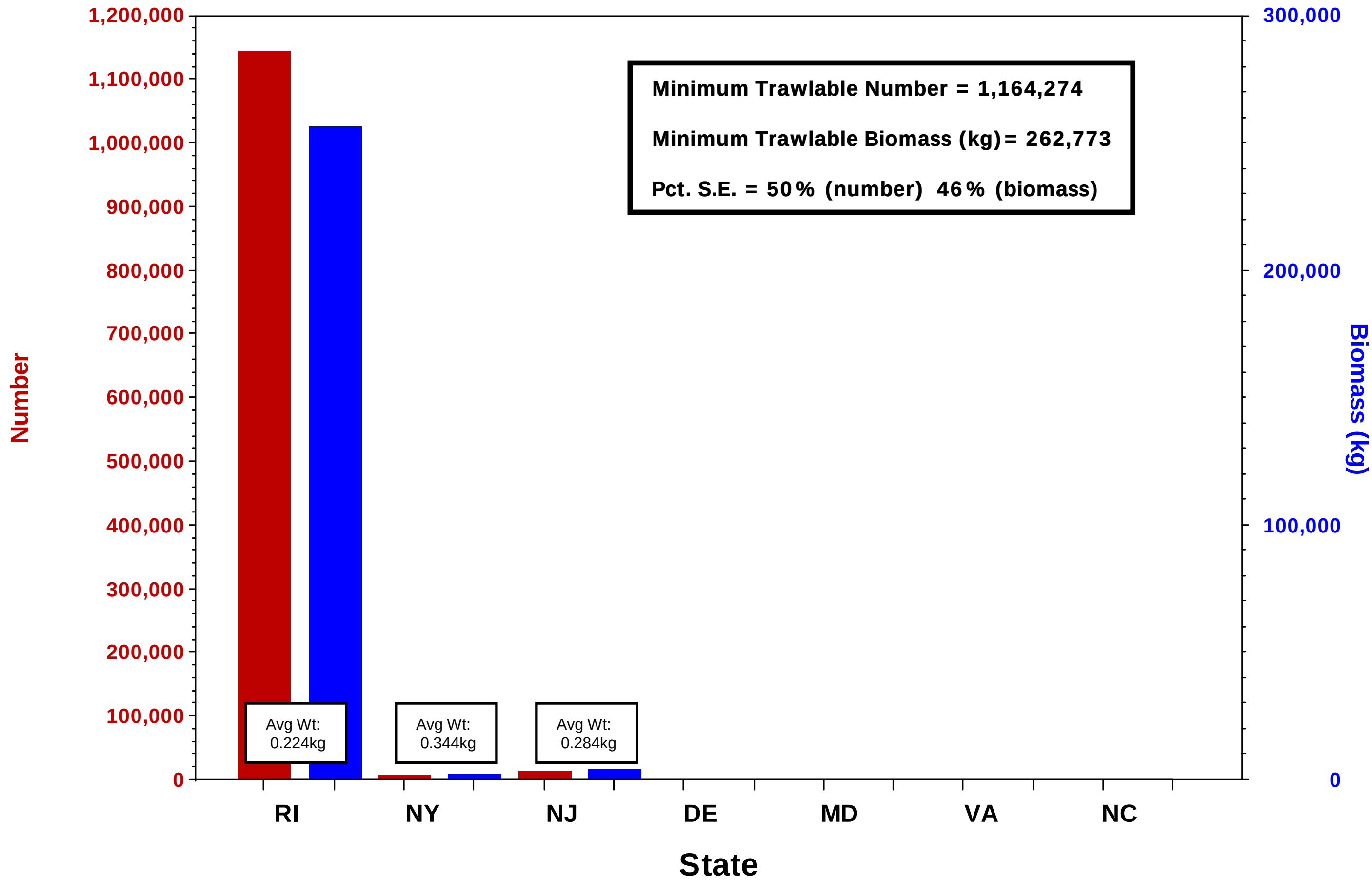


Figure 9. Length frequency histogram for American lobster.

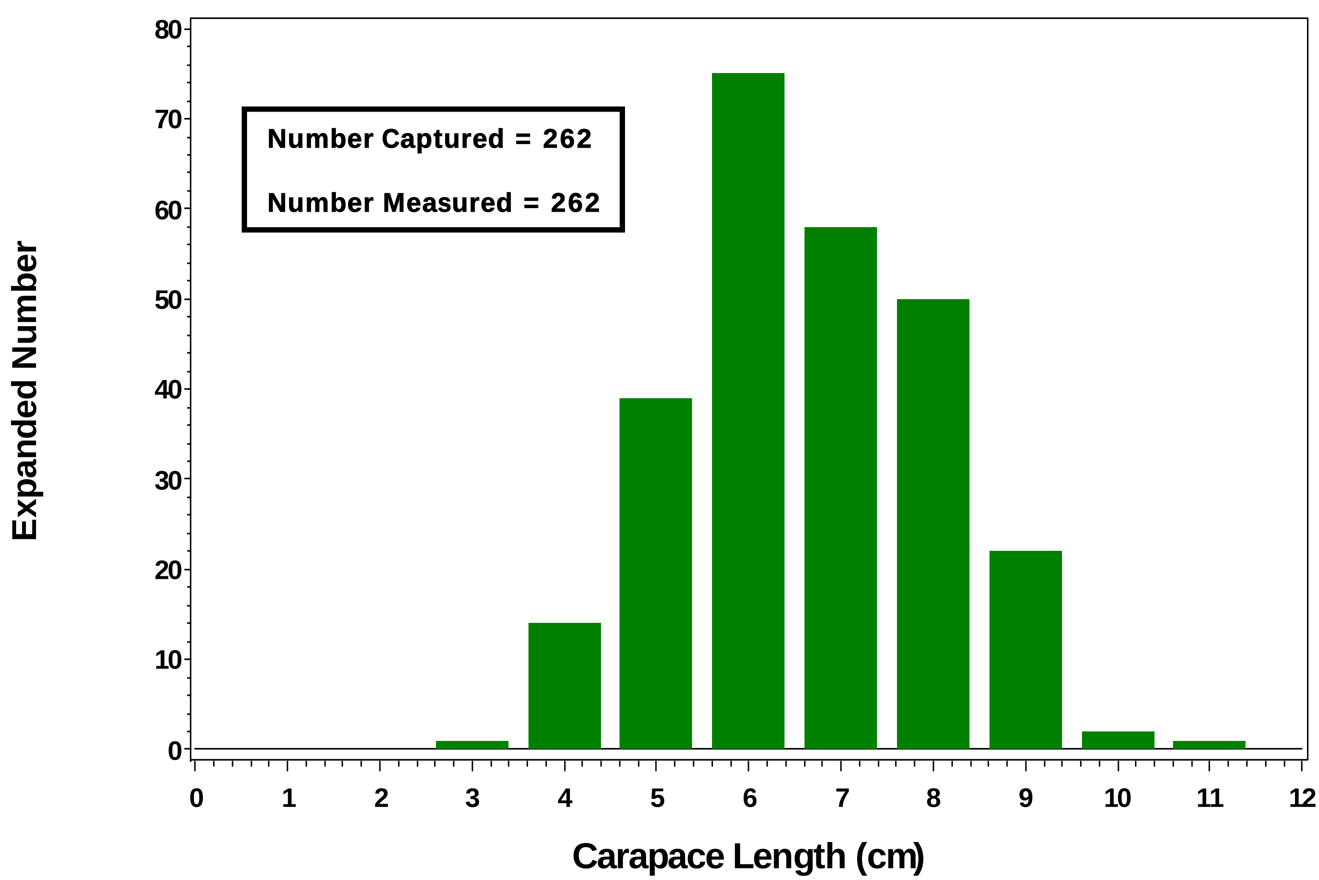


Figure 10. Sex ratios for American lobster, by state.

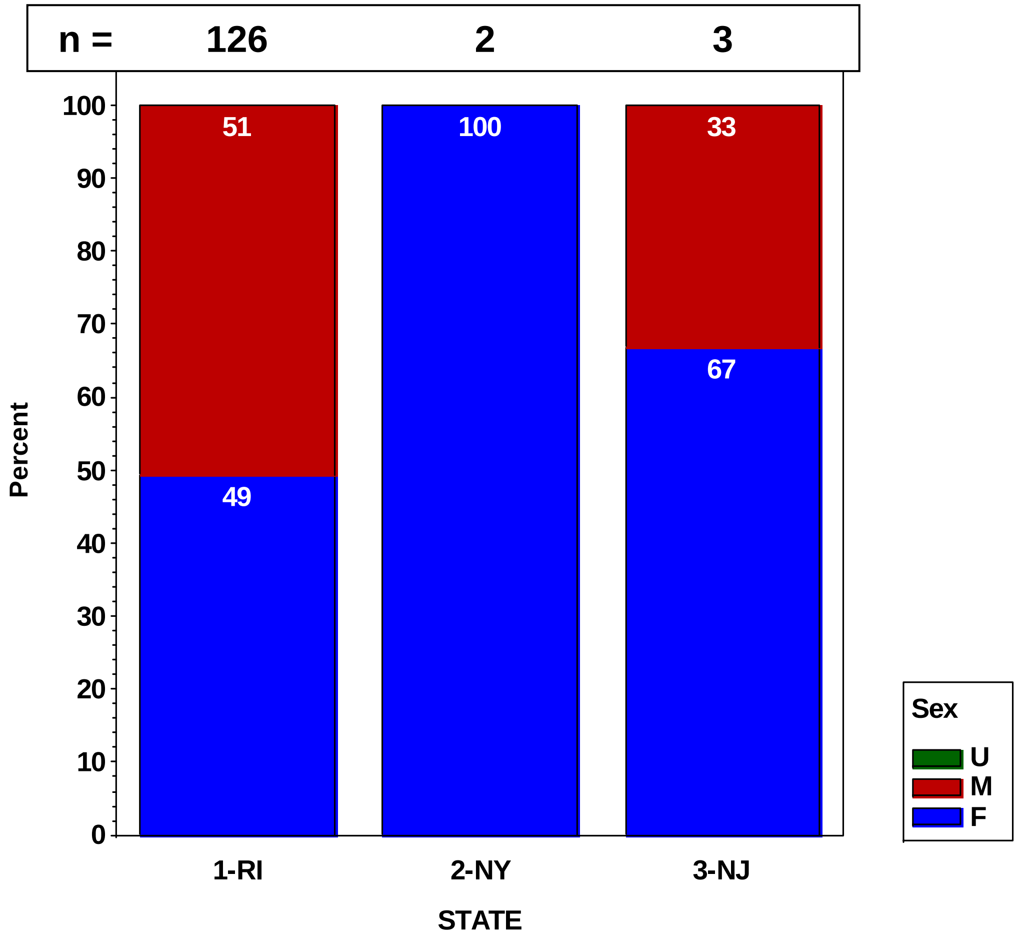
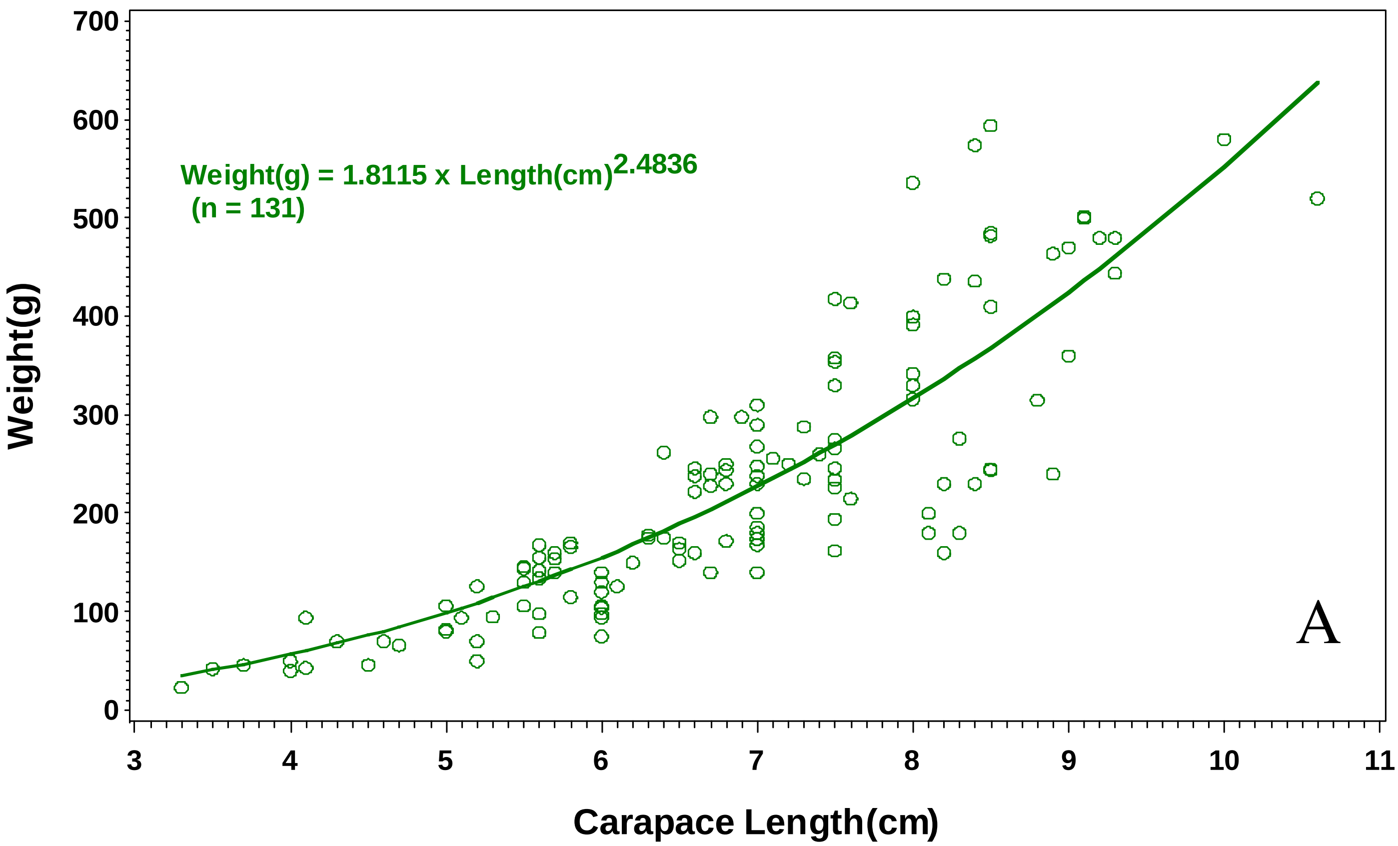
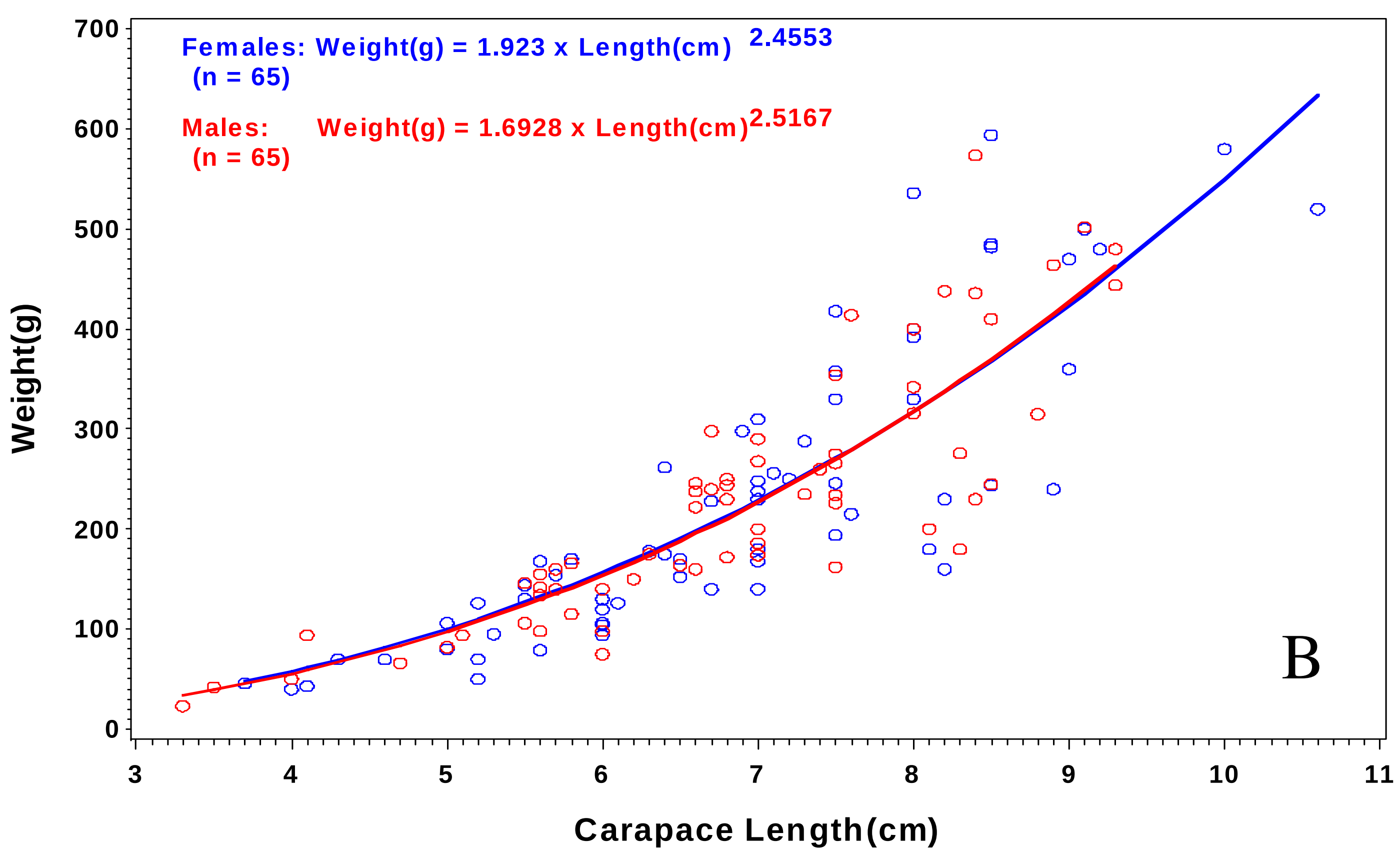
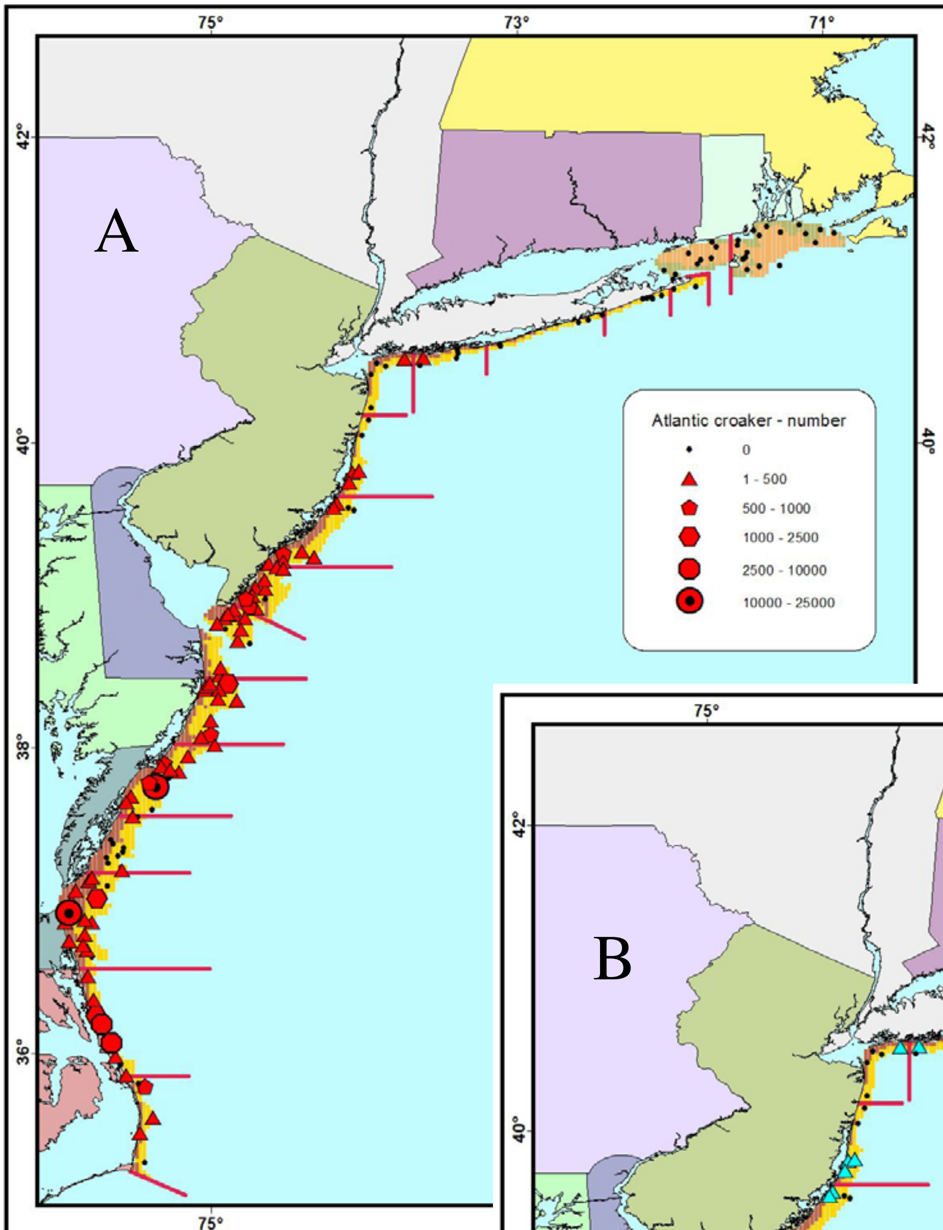


Figure 11. Length-weight regression for American lobster, sexes combined (A) and by sex (B).





Atlantic Croaker (Priority B)



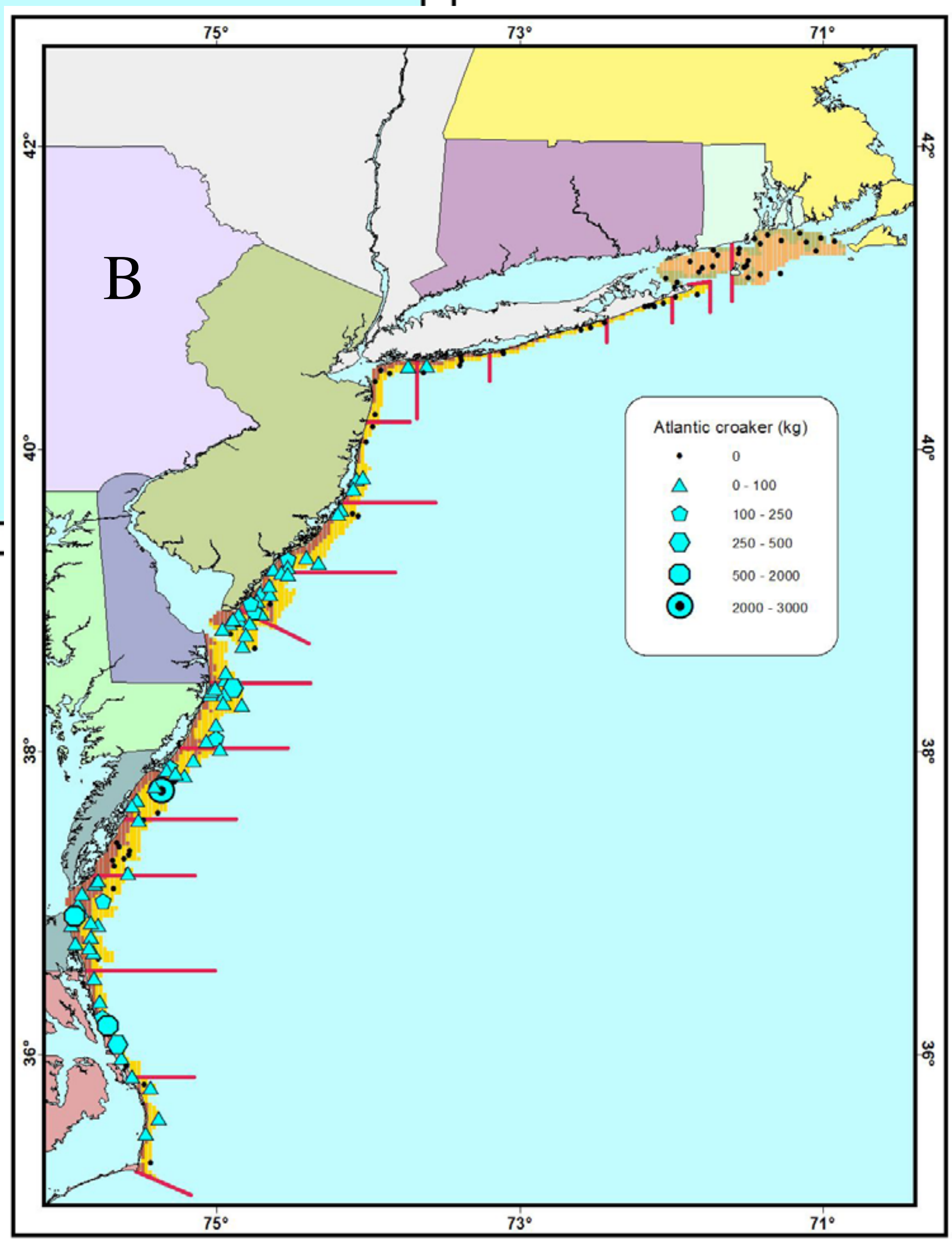


Figure 12. Number (A) and biomass (B) of specimens captured at each station for Atlantic croaker.

Figure 13. Minimum trawlable number and biomass by state for Atlantic croaker.

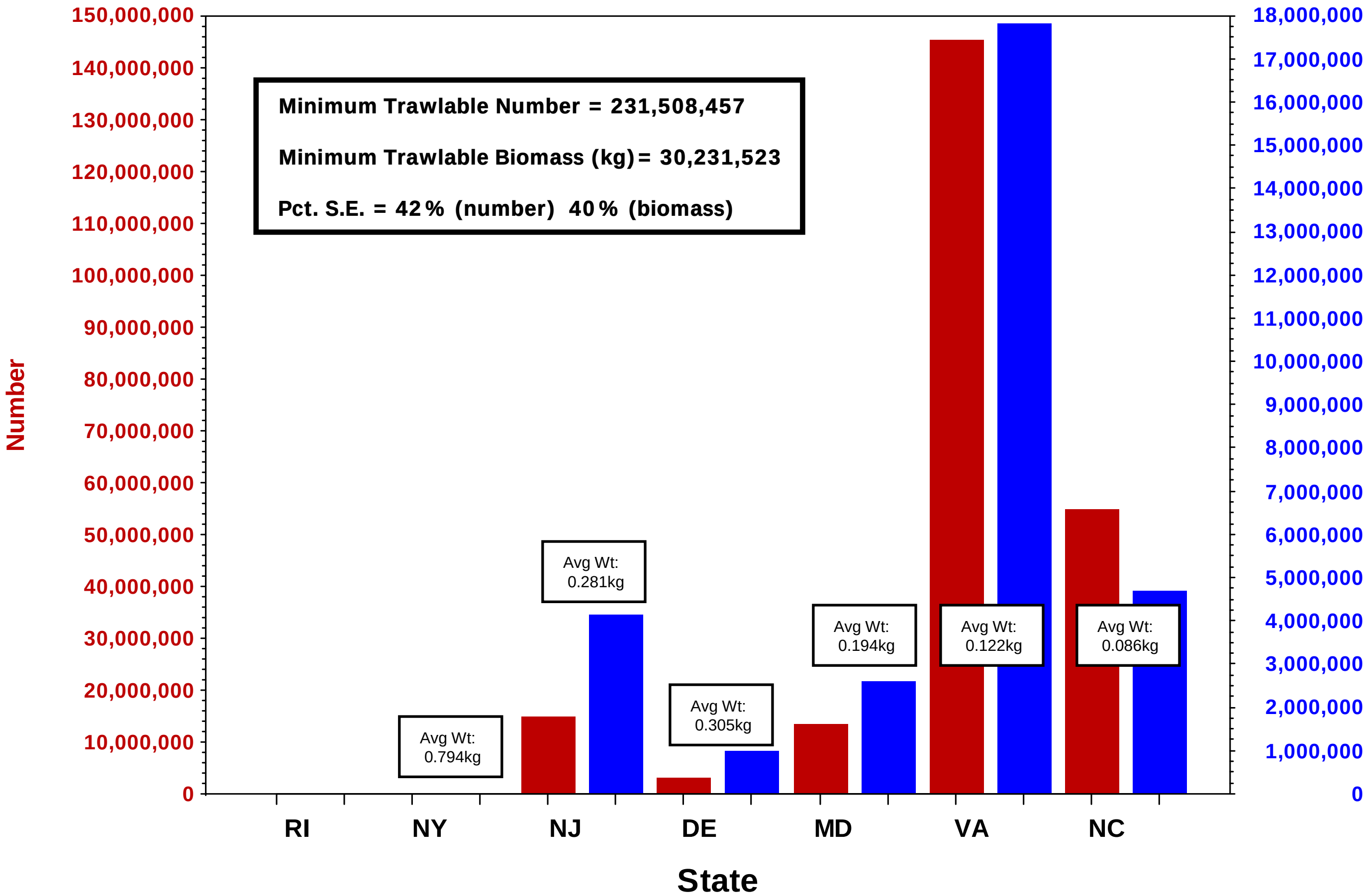


Figure 14. Length frequency histogram for Atlantic croaker.

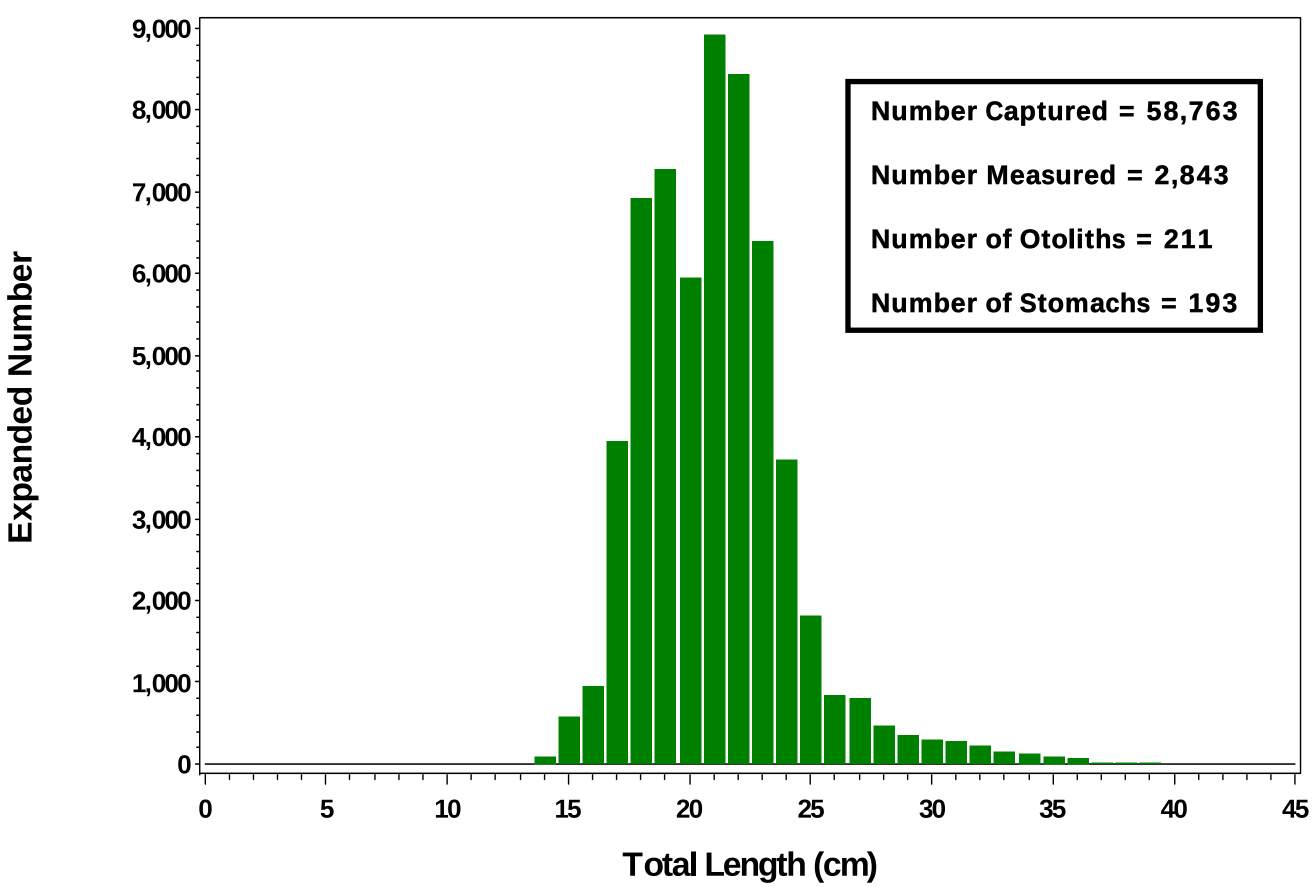


Figure 15. Sex ratios for Atlantic croaker by state (A) and length group (B).

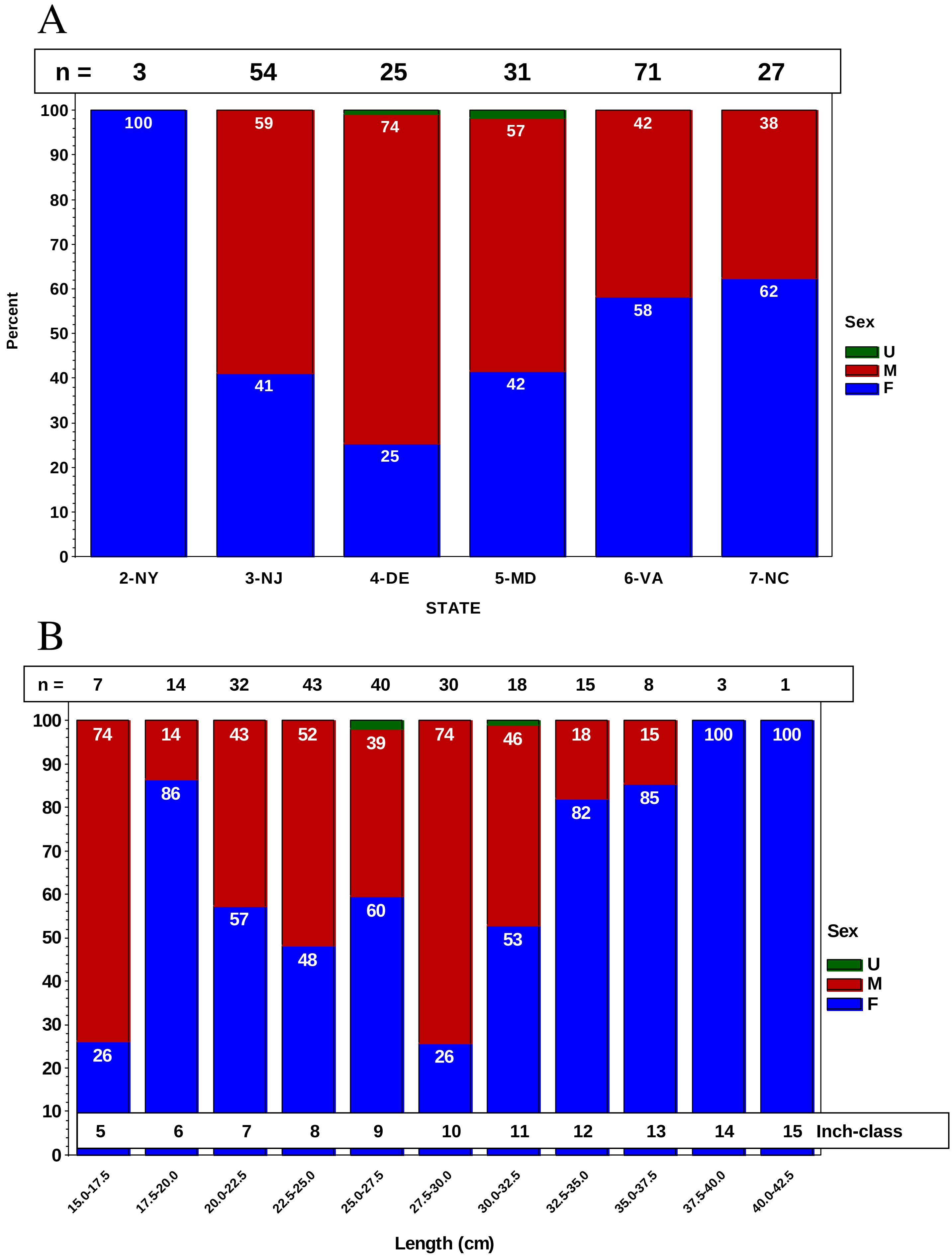


Figure 16. Maturity logistic regression for Atlantic croaker, by sex.

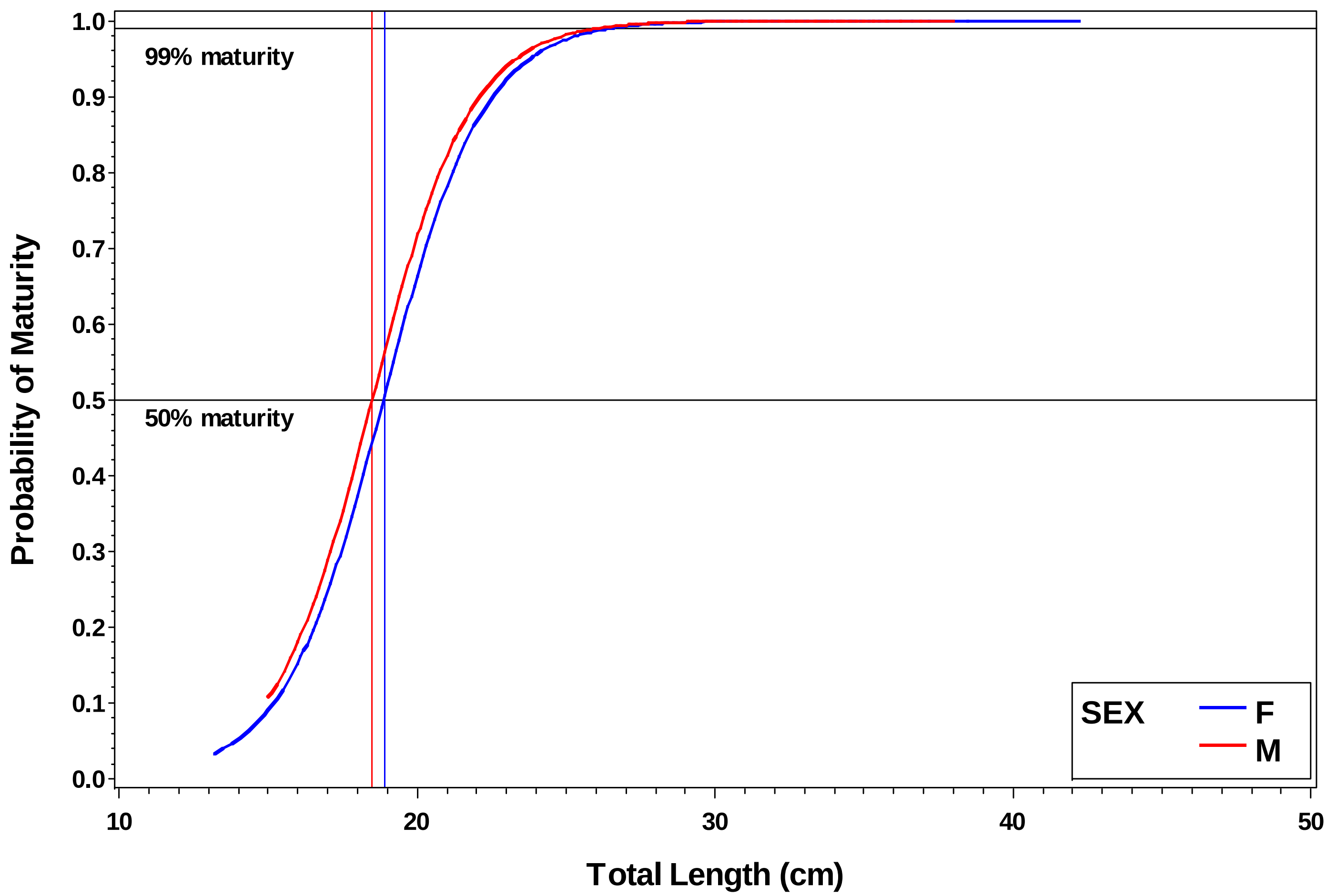
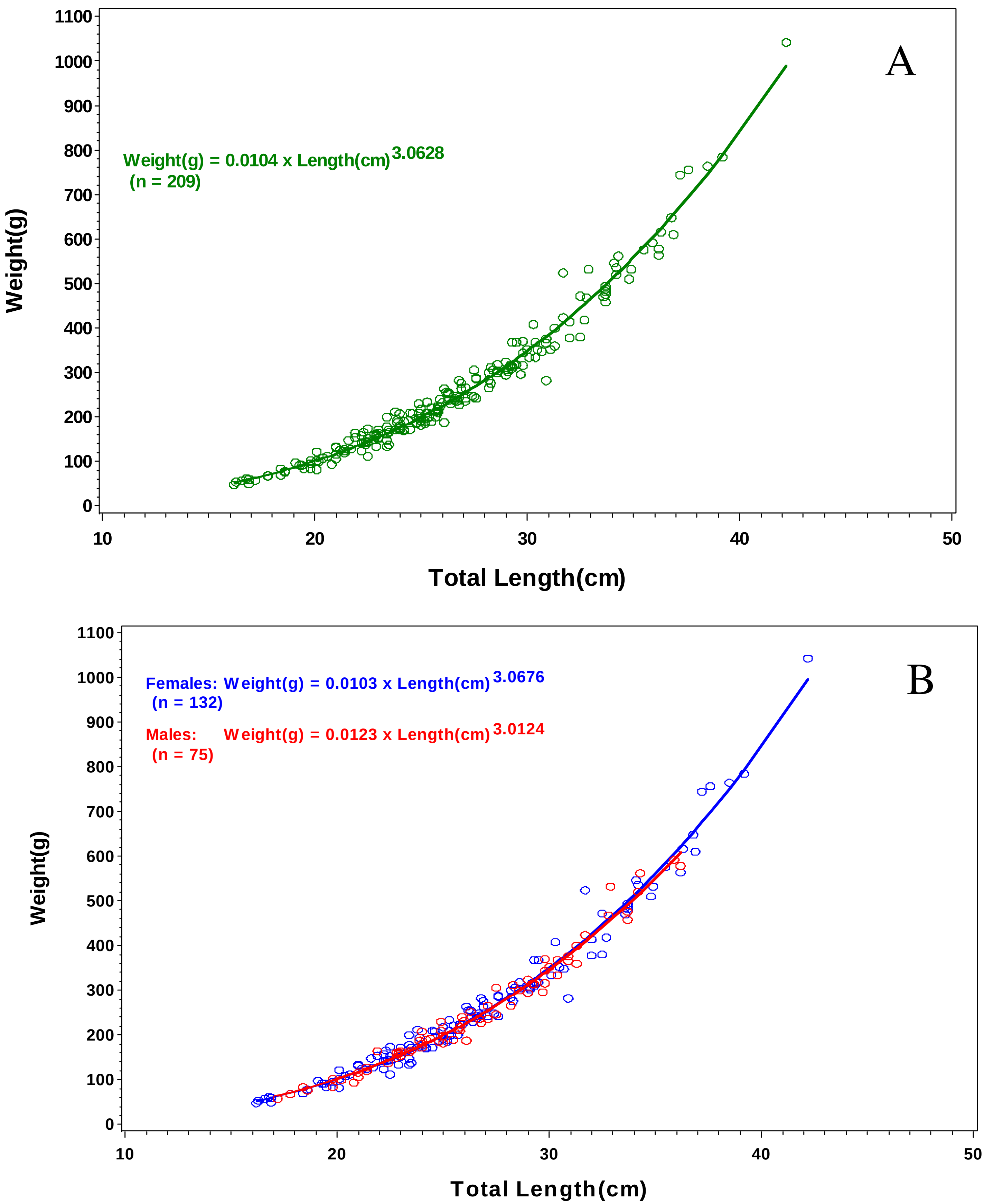


Figure 17. Length-weight regression for Atlantic croaker, sexes combined (A) and by sex (B).



Atlantic Menhaden (Priority B)

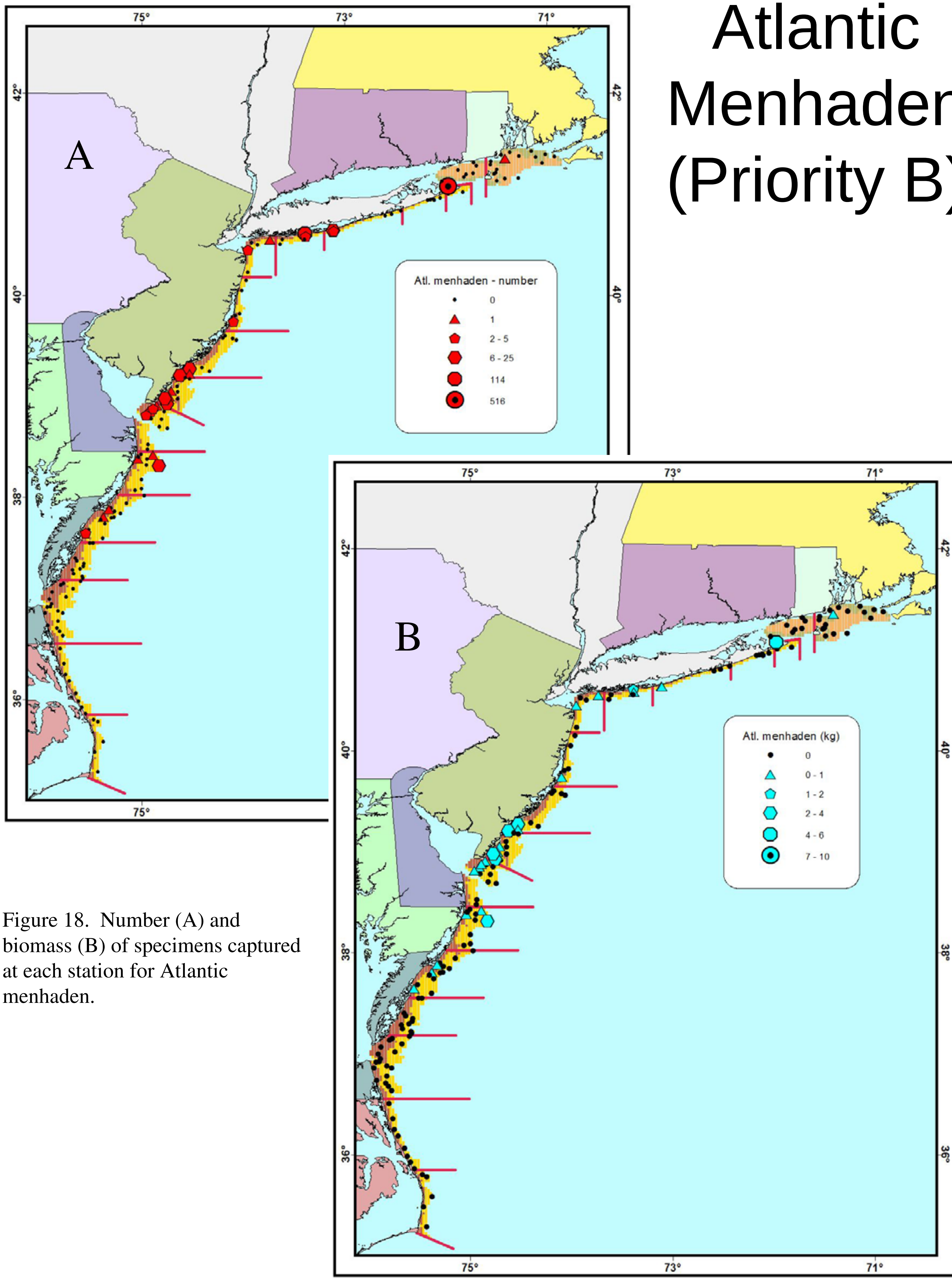


Figure 18. Number (A) and biomass (B) of specimens captured at each station for Atlantic menhaden.

Figure 19. Minimum trawlable number and biomass by state for Atlantic menhaden.

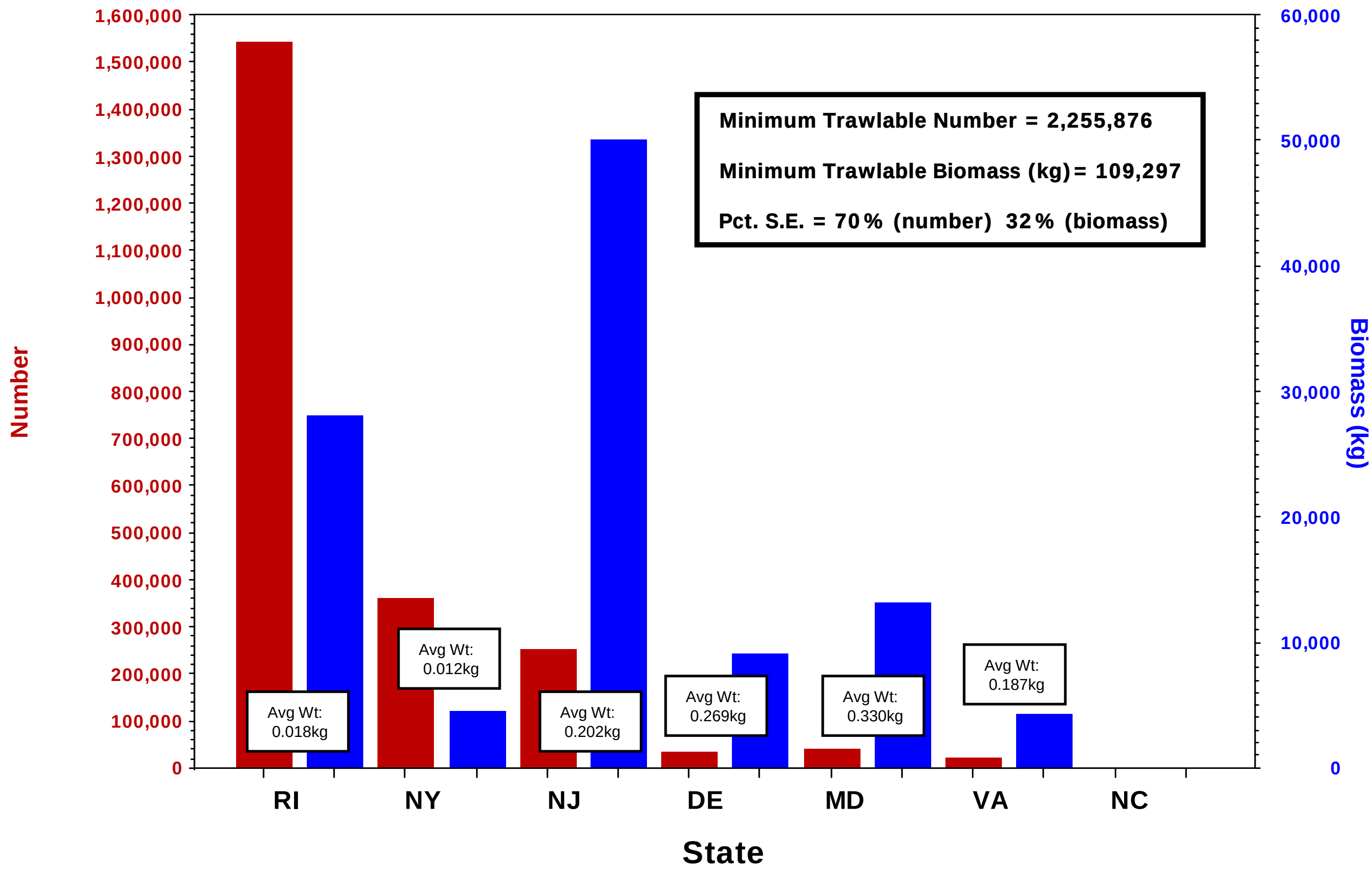


Figure 20. Length frequency histogram for Atlantic menhaden.

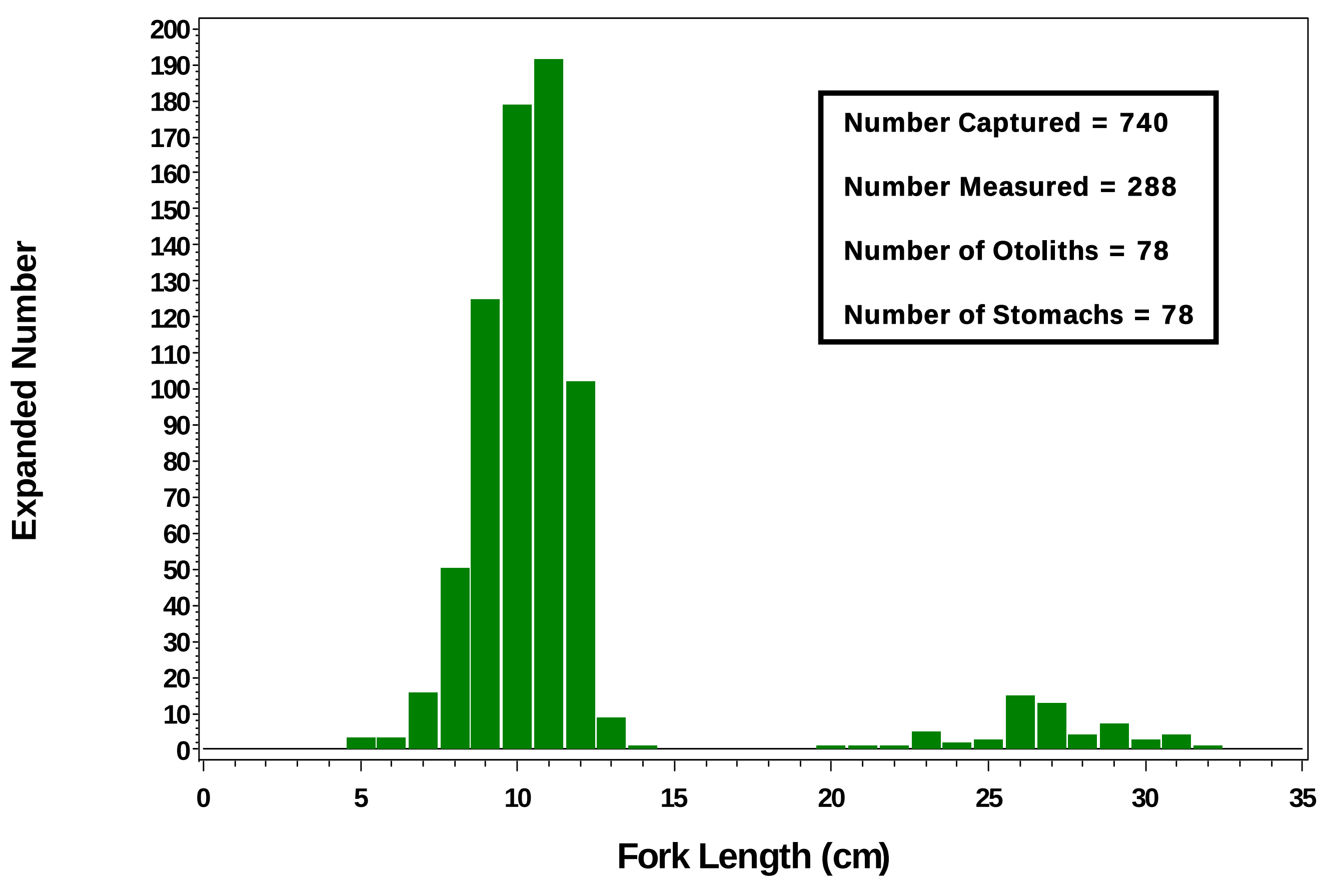
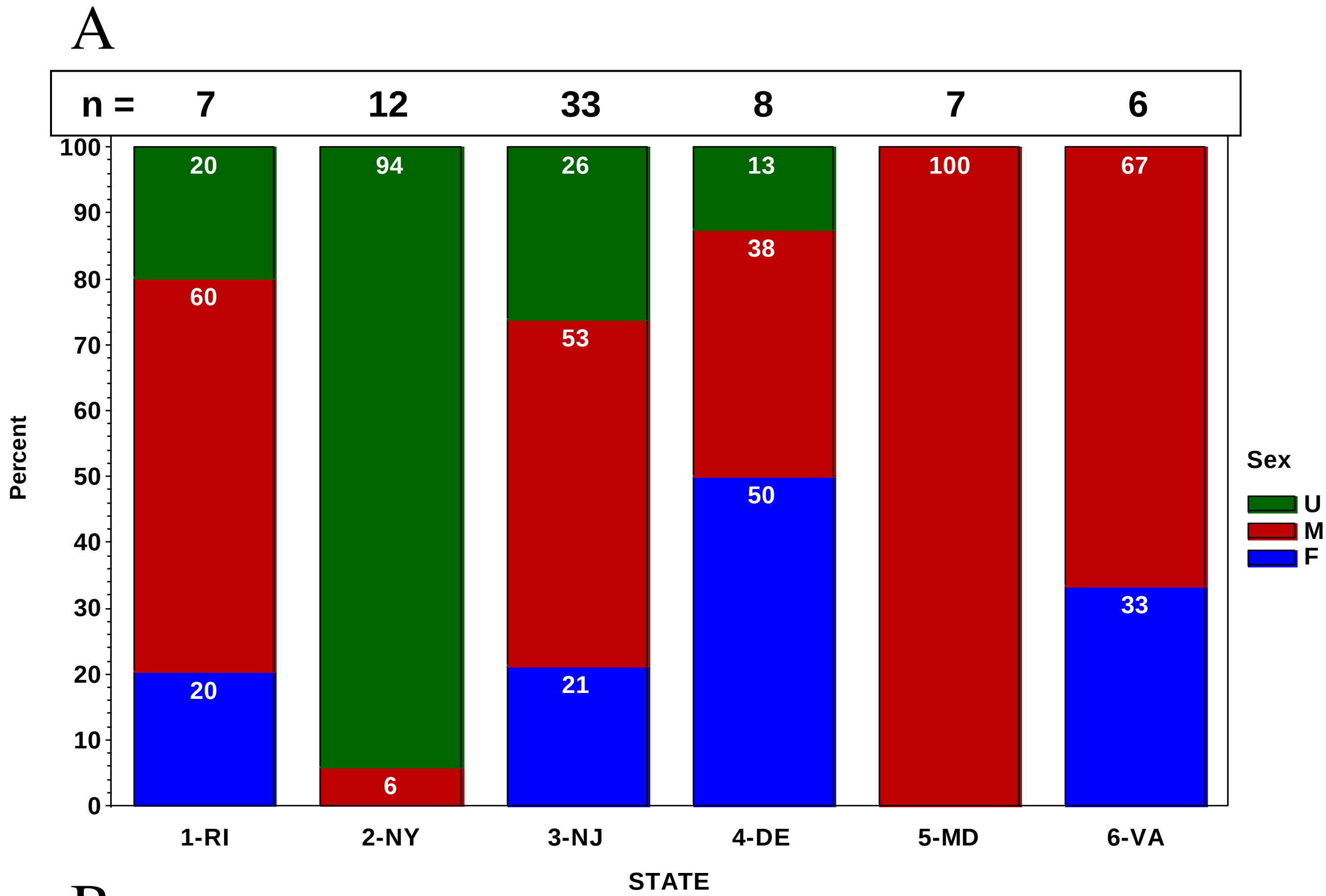


Figure 21. Sex ratios for Atlantic menhaden by state (A) and length group (B).

A



B

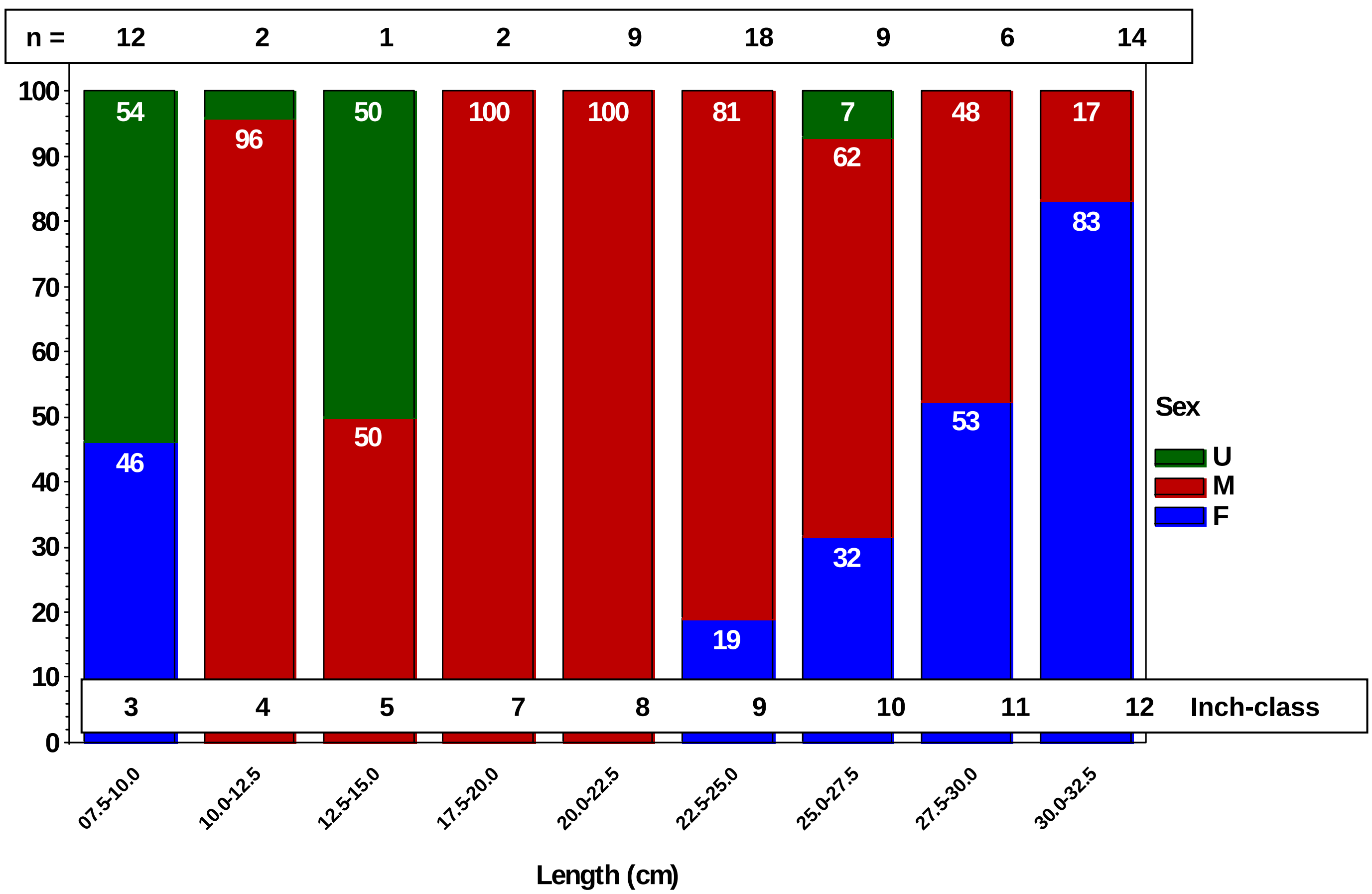


Figure 22. Maturity logistic regression for Atlantic menhaden, by sex.

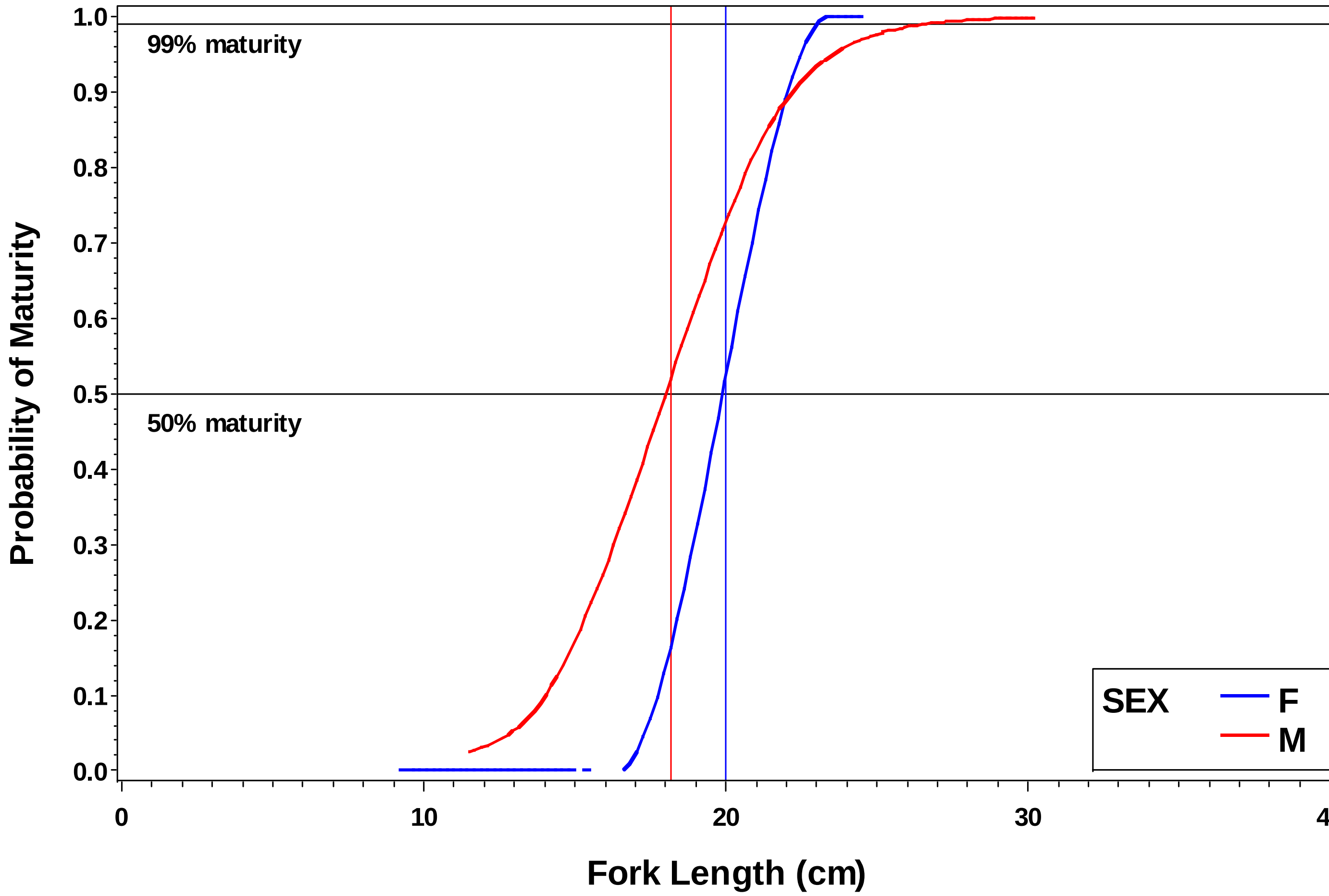
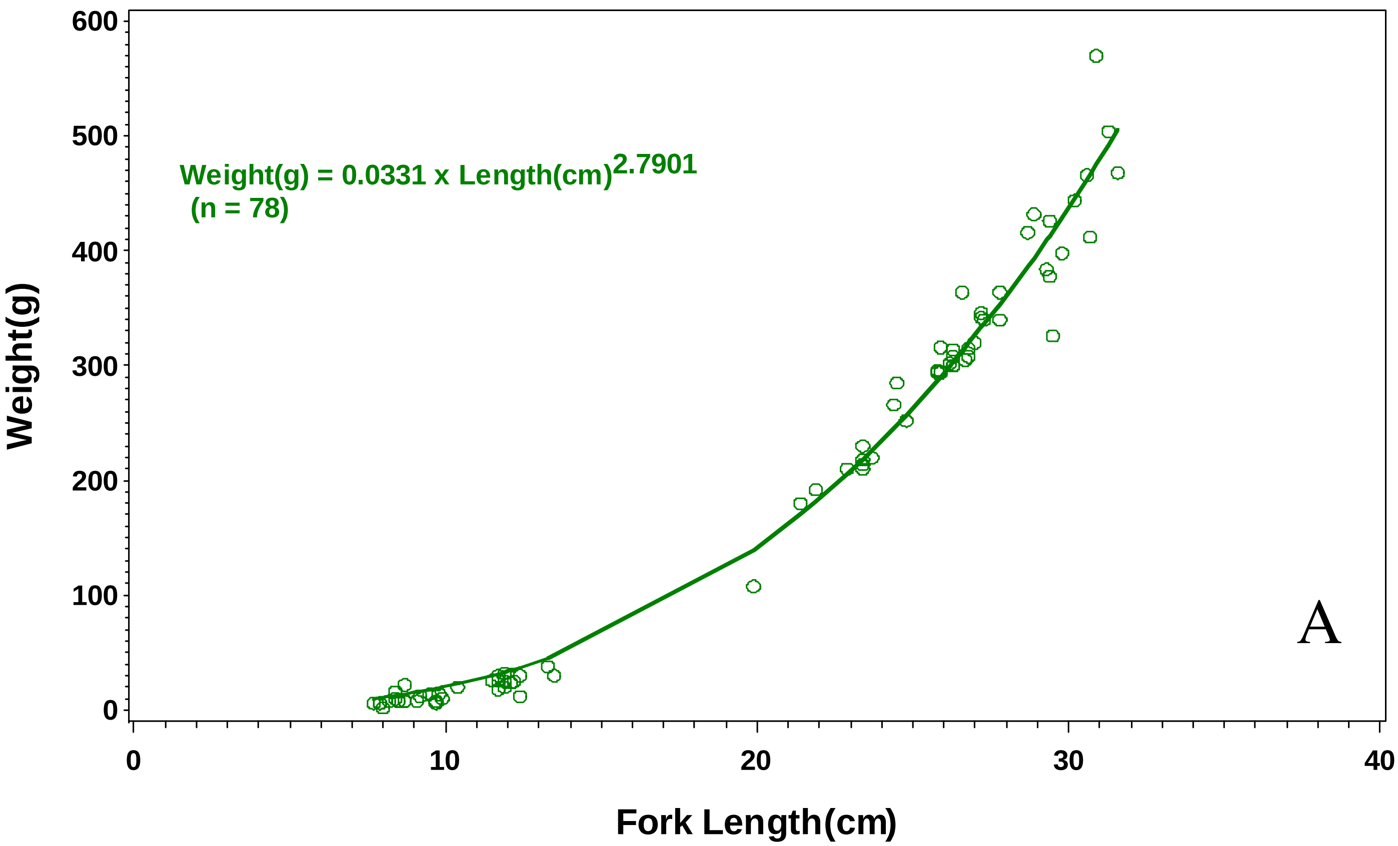
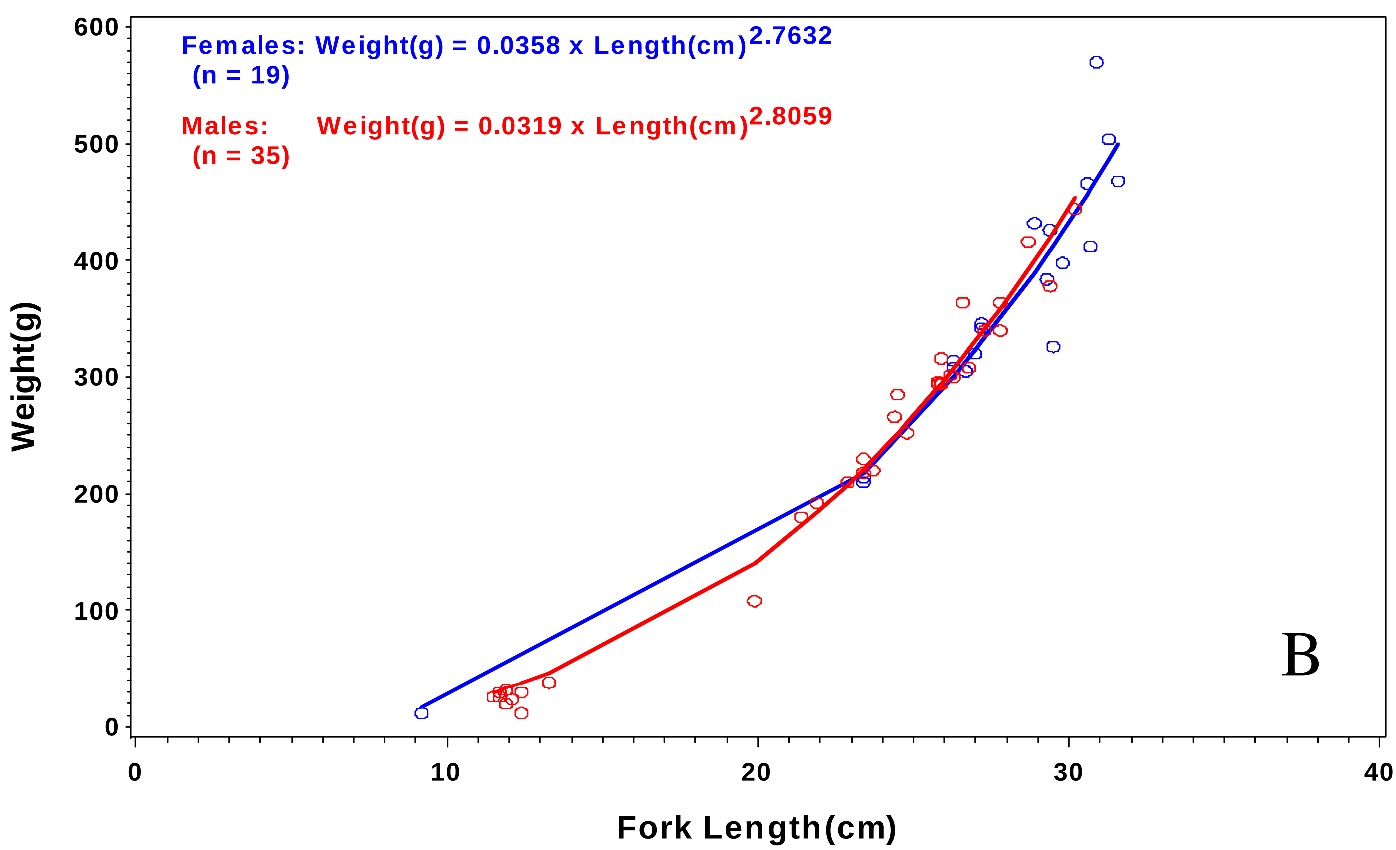
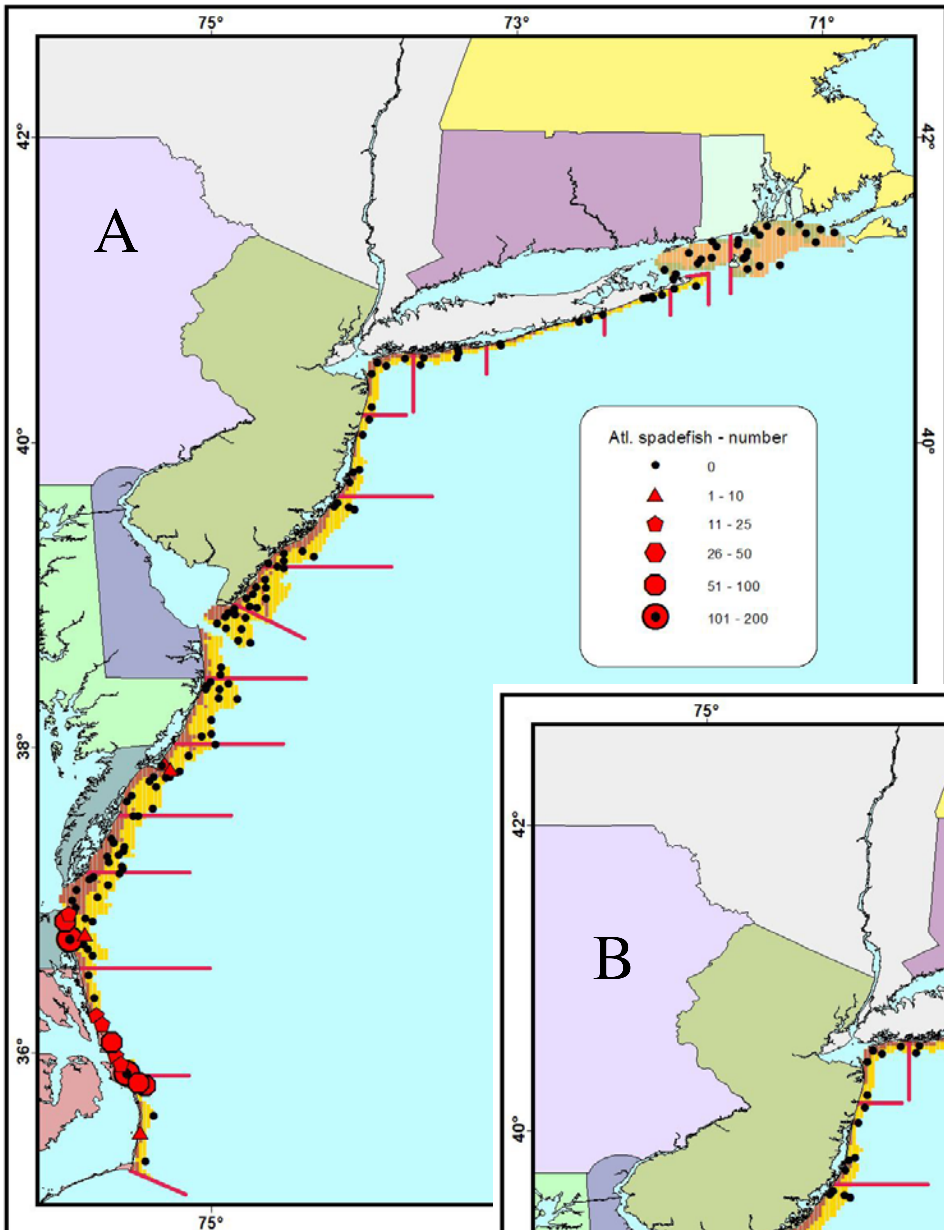


Figure 23. Length-weight regression for Atlantic menhaden, sexes combined (A) and by sex (B).





Atlantic Spadefish (Priority D)



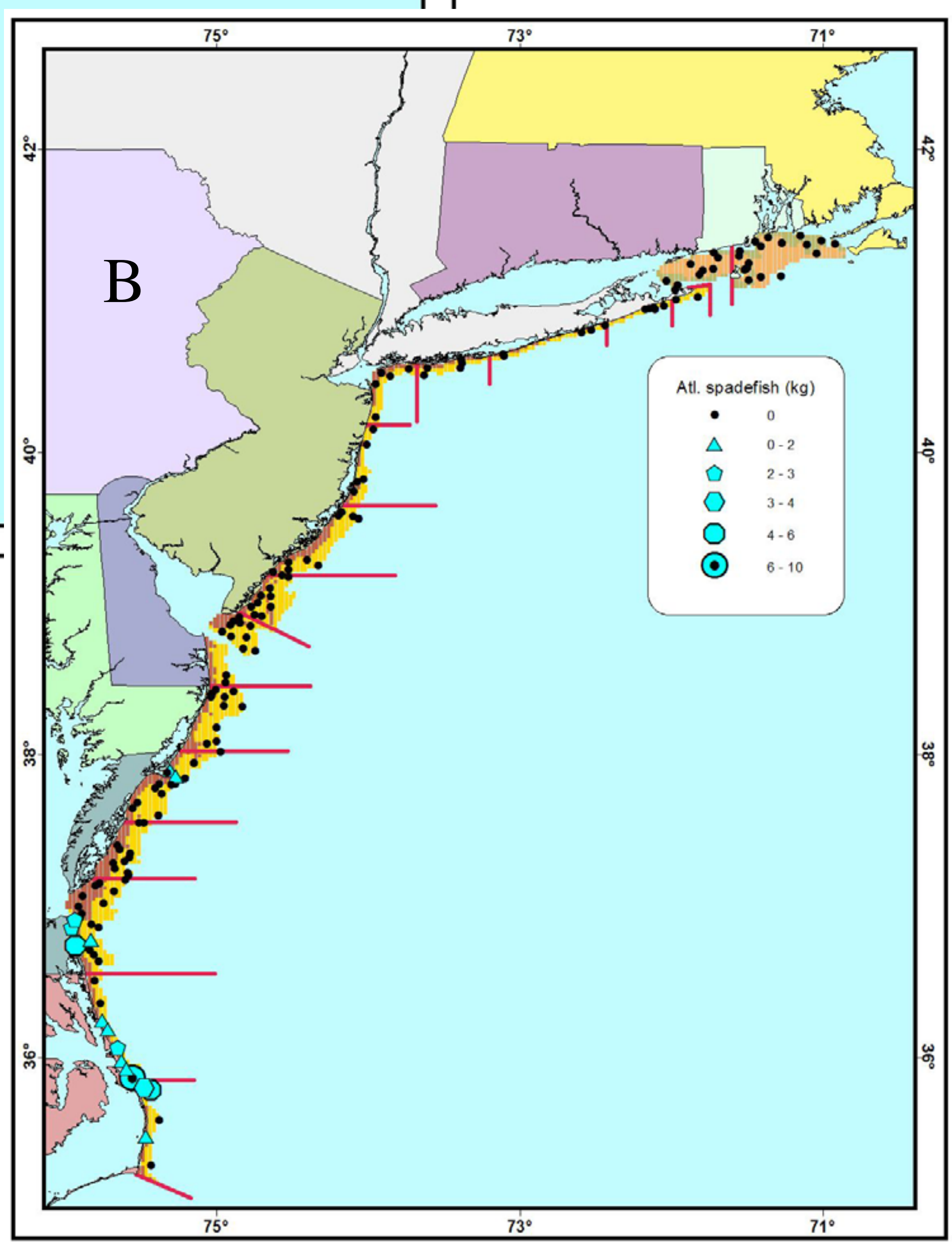


Figure 24. Number (A) and biomass (B) of specimens captured at each station for Atlantic spadefish.

Figure 25. Minimum trawlable number and biomass by state for Atlantic spadefish.

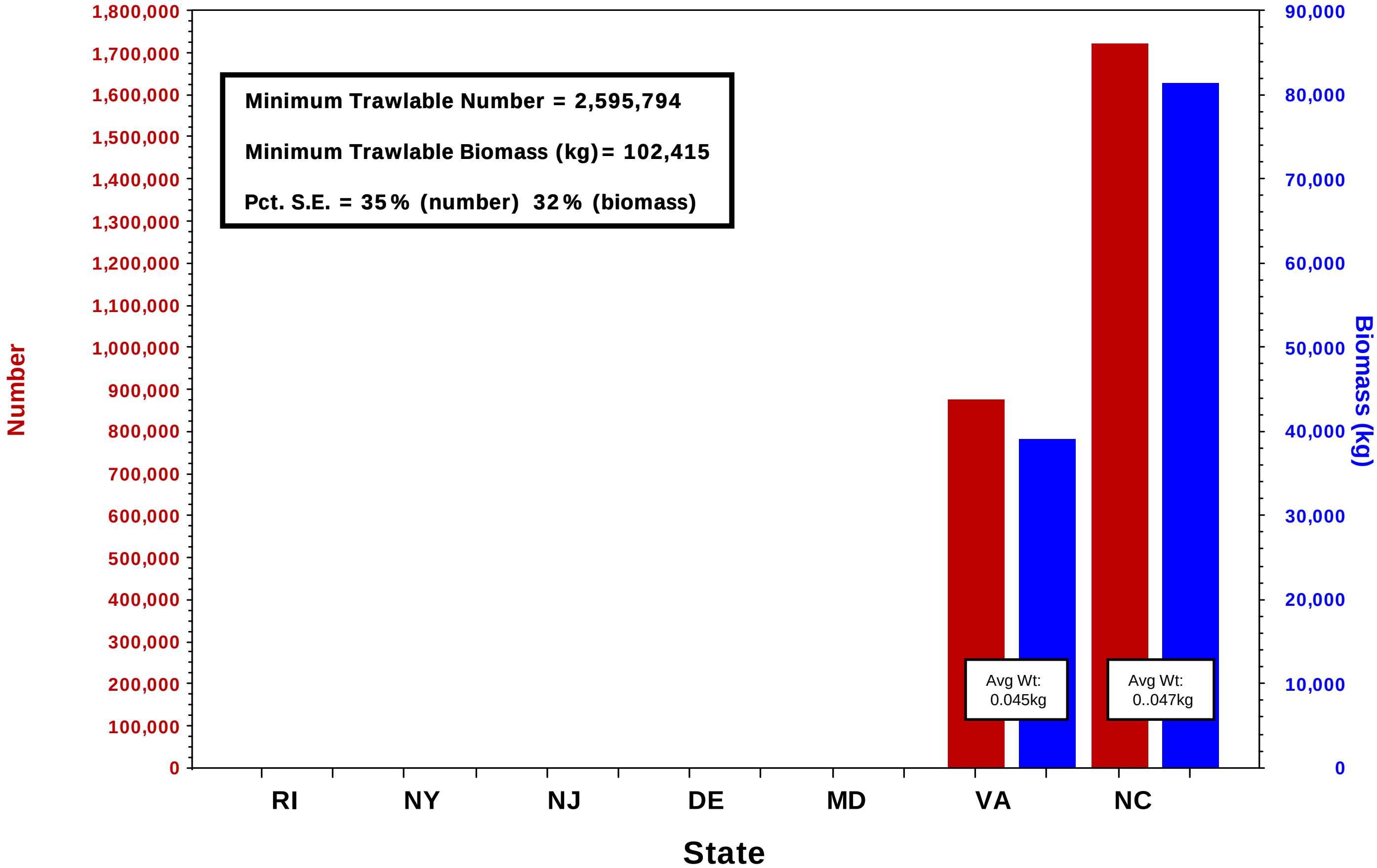
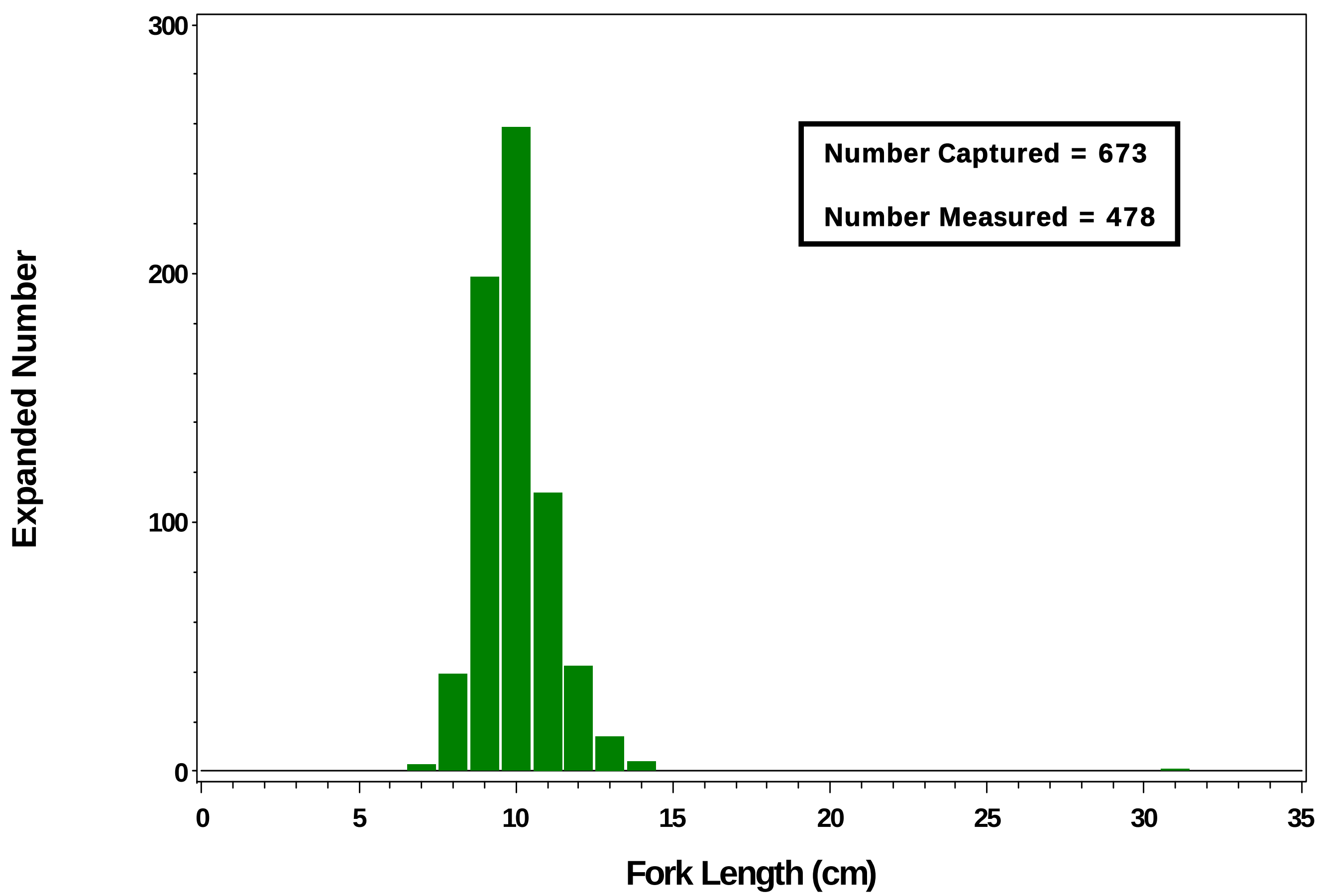


Figure 26. Length frequency histogram for Atlantic spadefish.



Atlantic Thread Herring (Priority D)

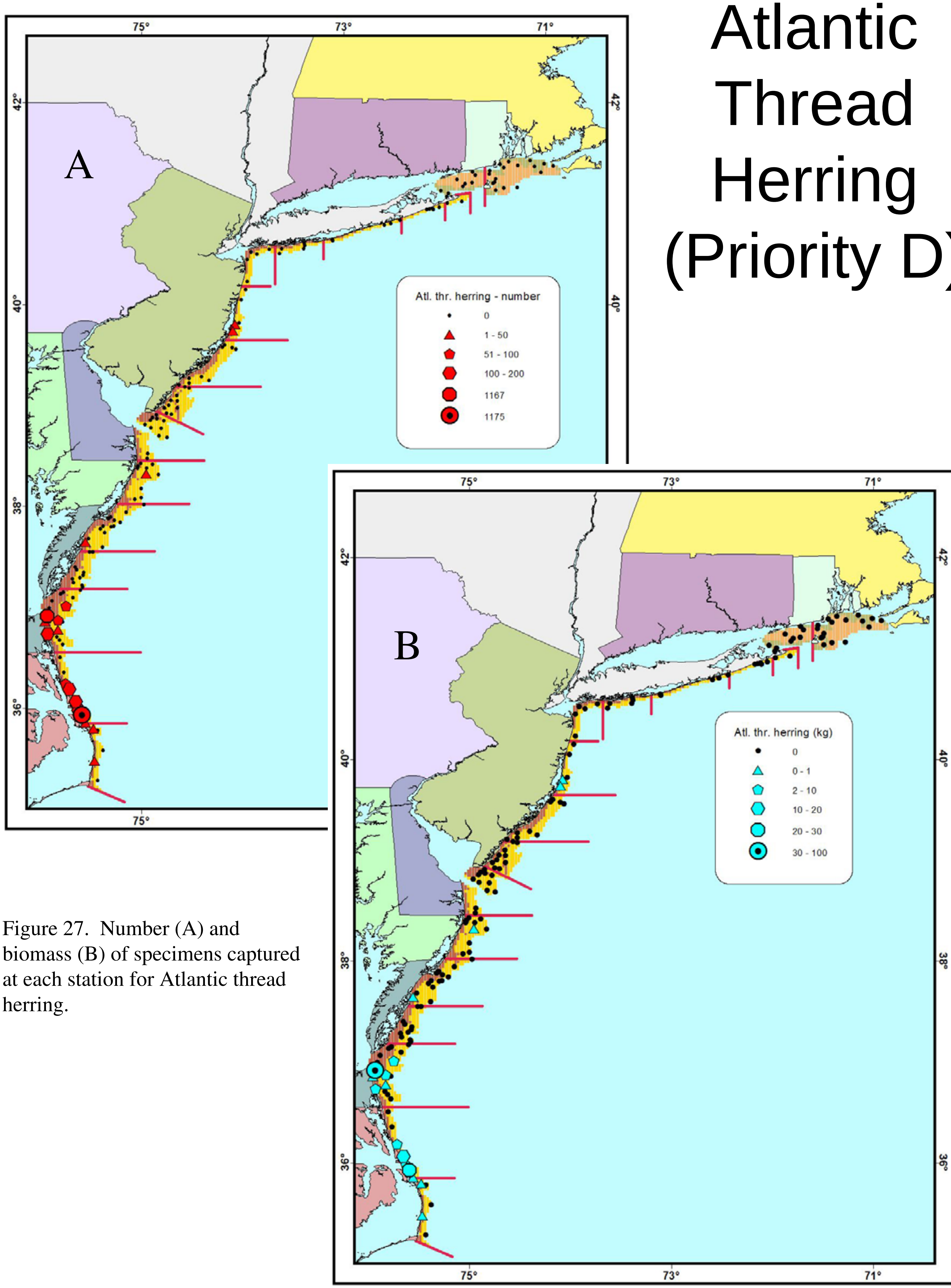


Figure 27. Number (A) and biomass (B) of specimens captured at each station for Atlantic thread herring.

Figure 28. Minimum trawlable number and biomass by state for Atlantic thread herring.

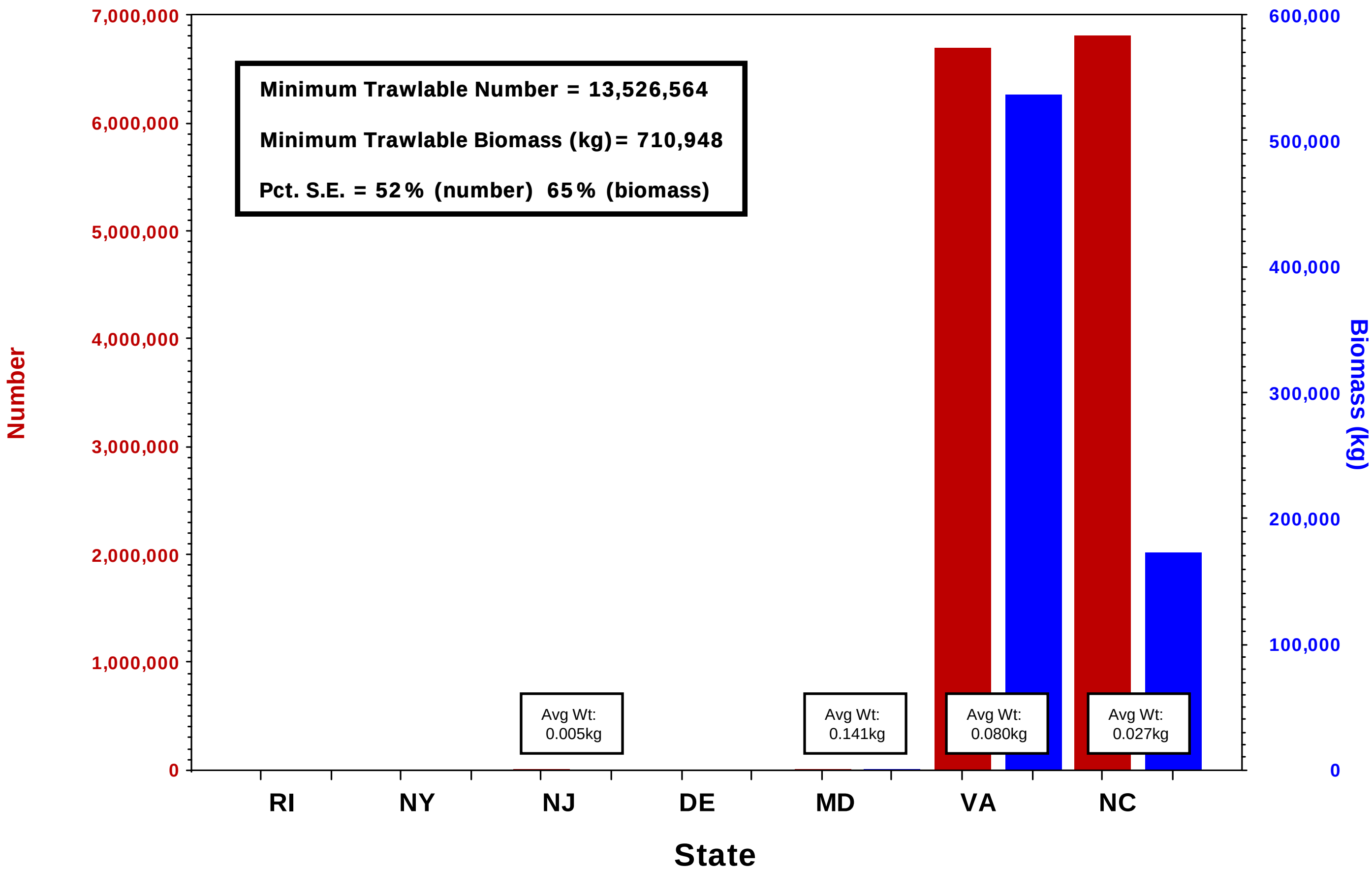
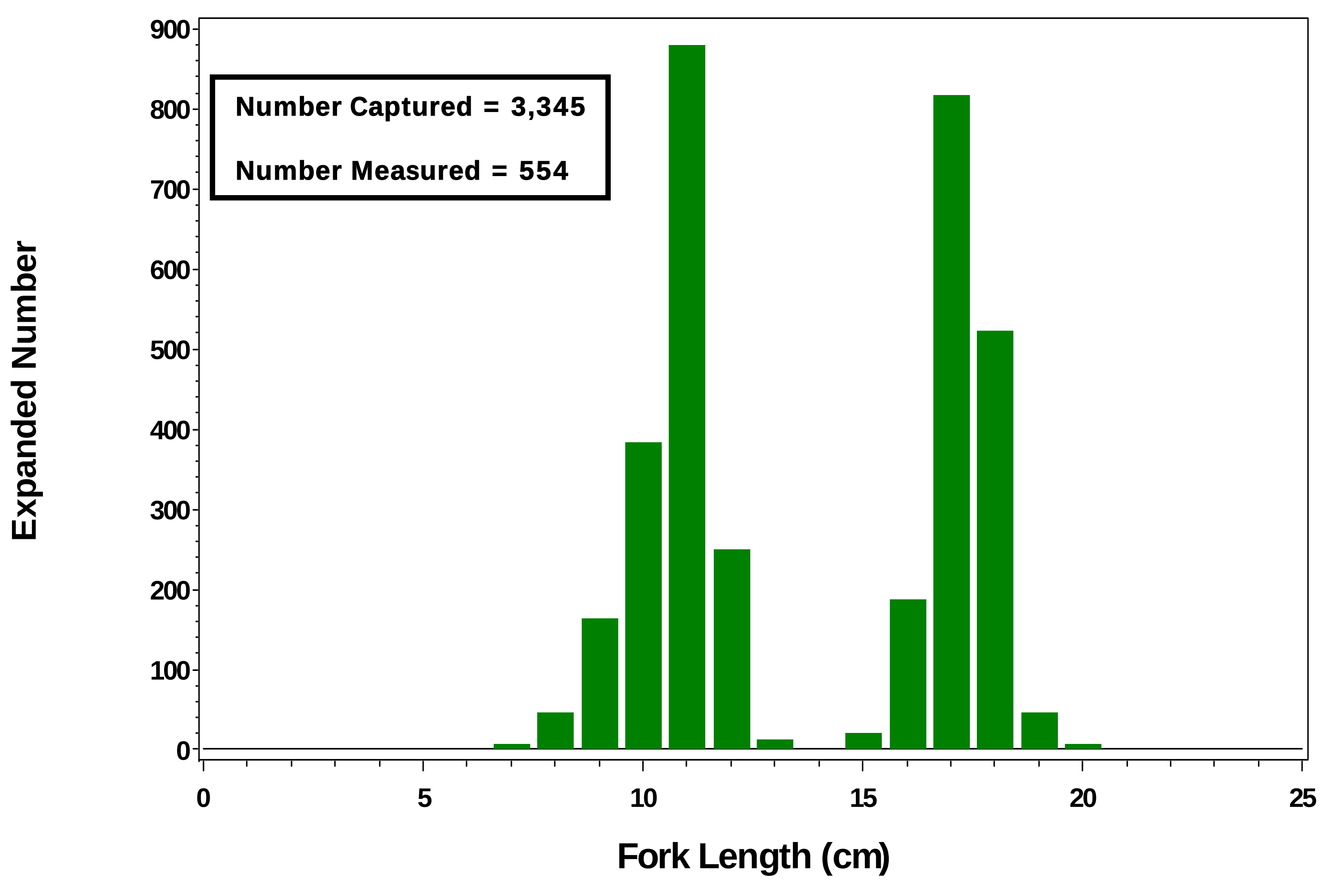
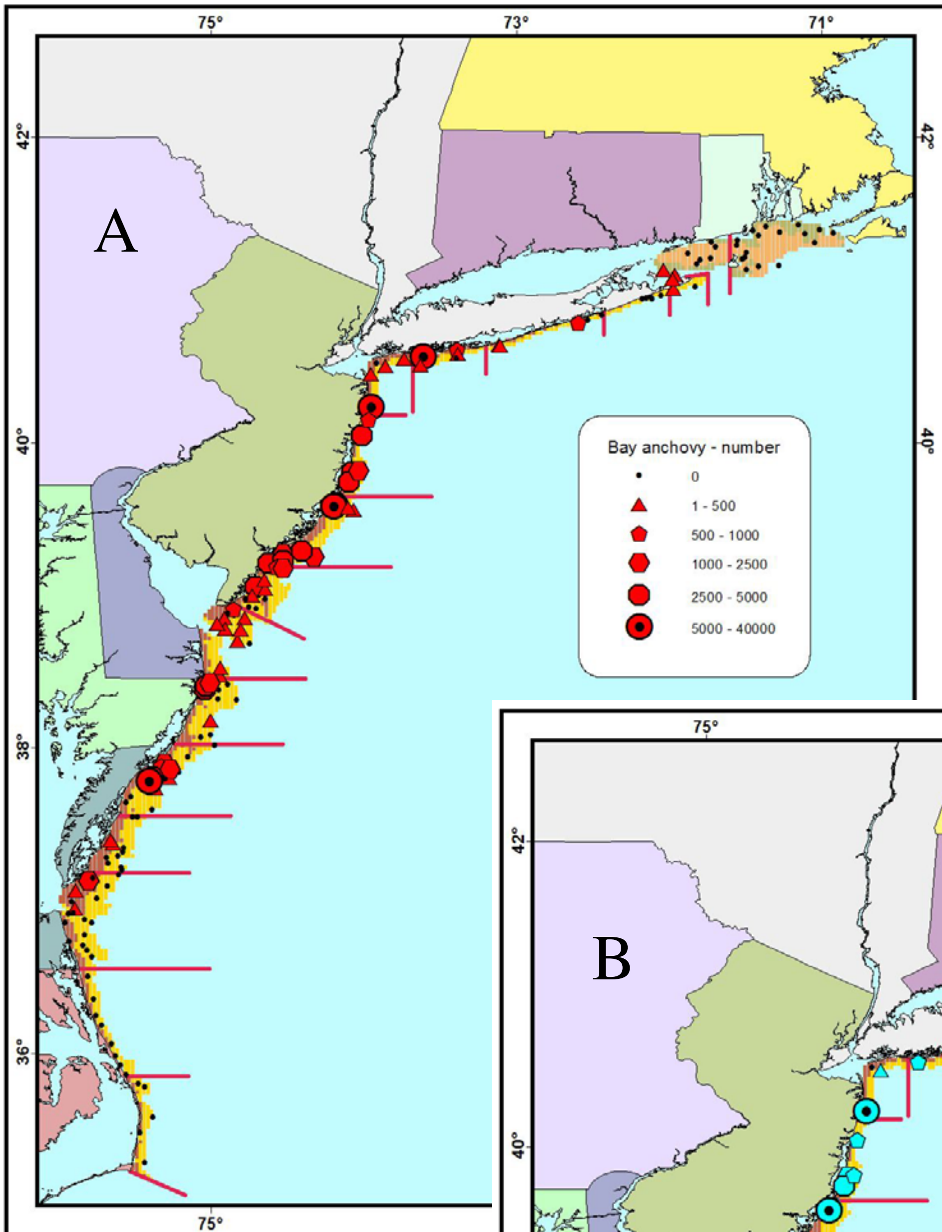


Figure 29. Length frequency histogram for Atlantic thread herring.



Bay Anchovy (Priority D)



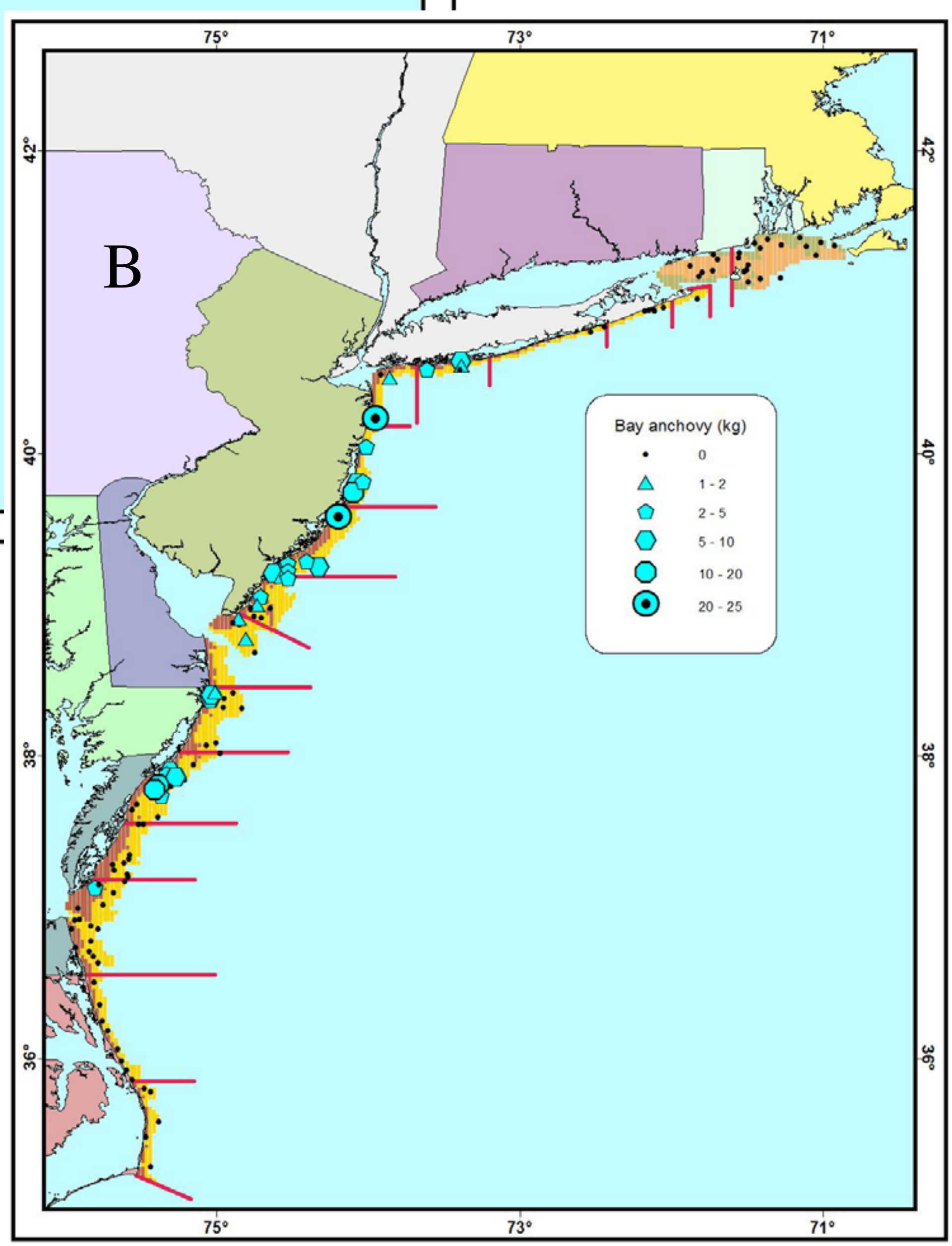


Figure 30. Number (A) and biomass (B) of specimens captured at each station for bay anchovy.

Figure 31. Minimum trawlable number and biomass by state for bay anchovy.

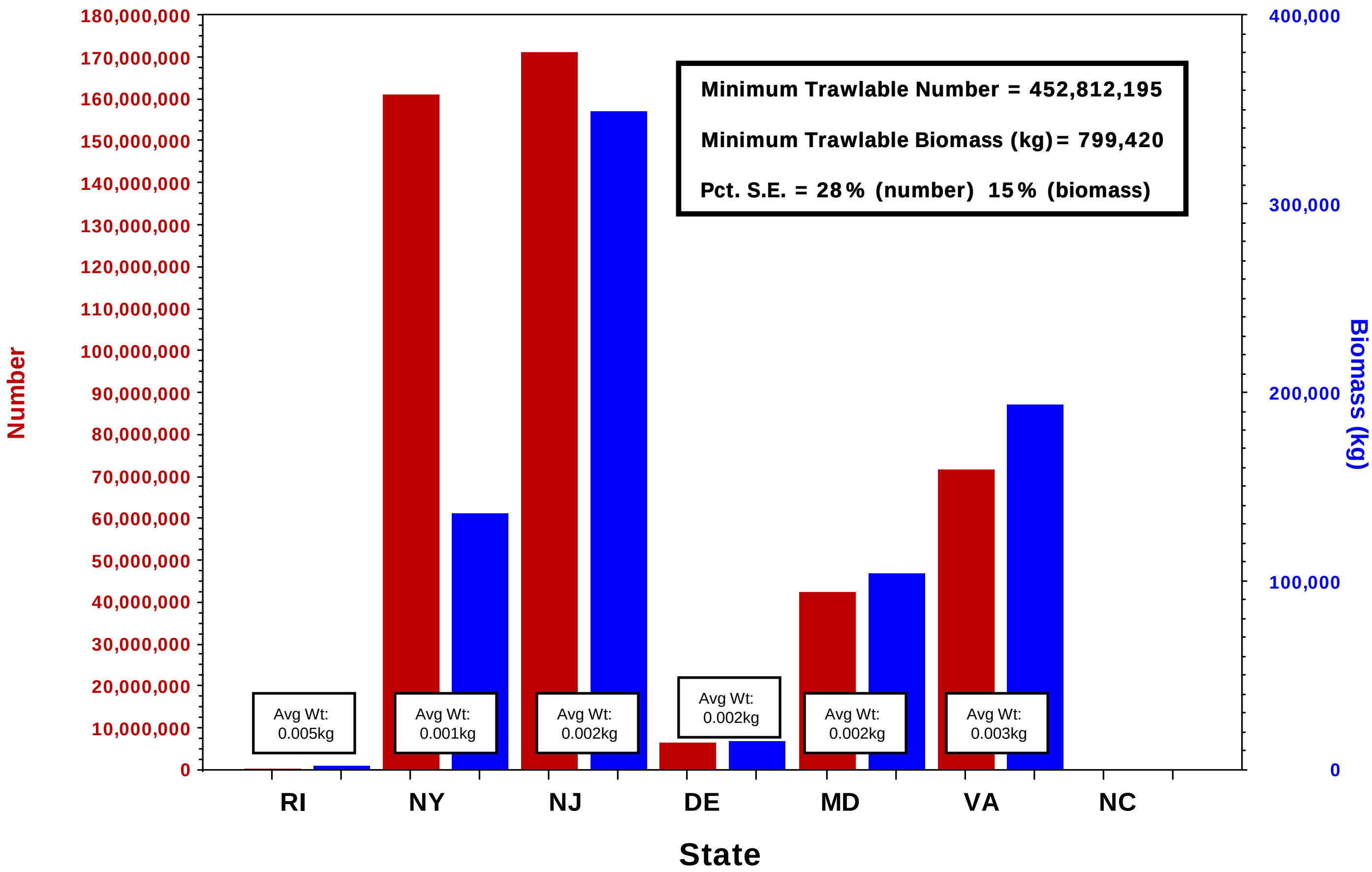
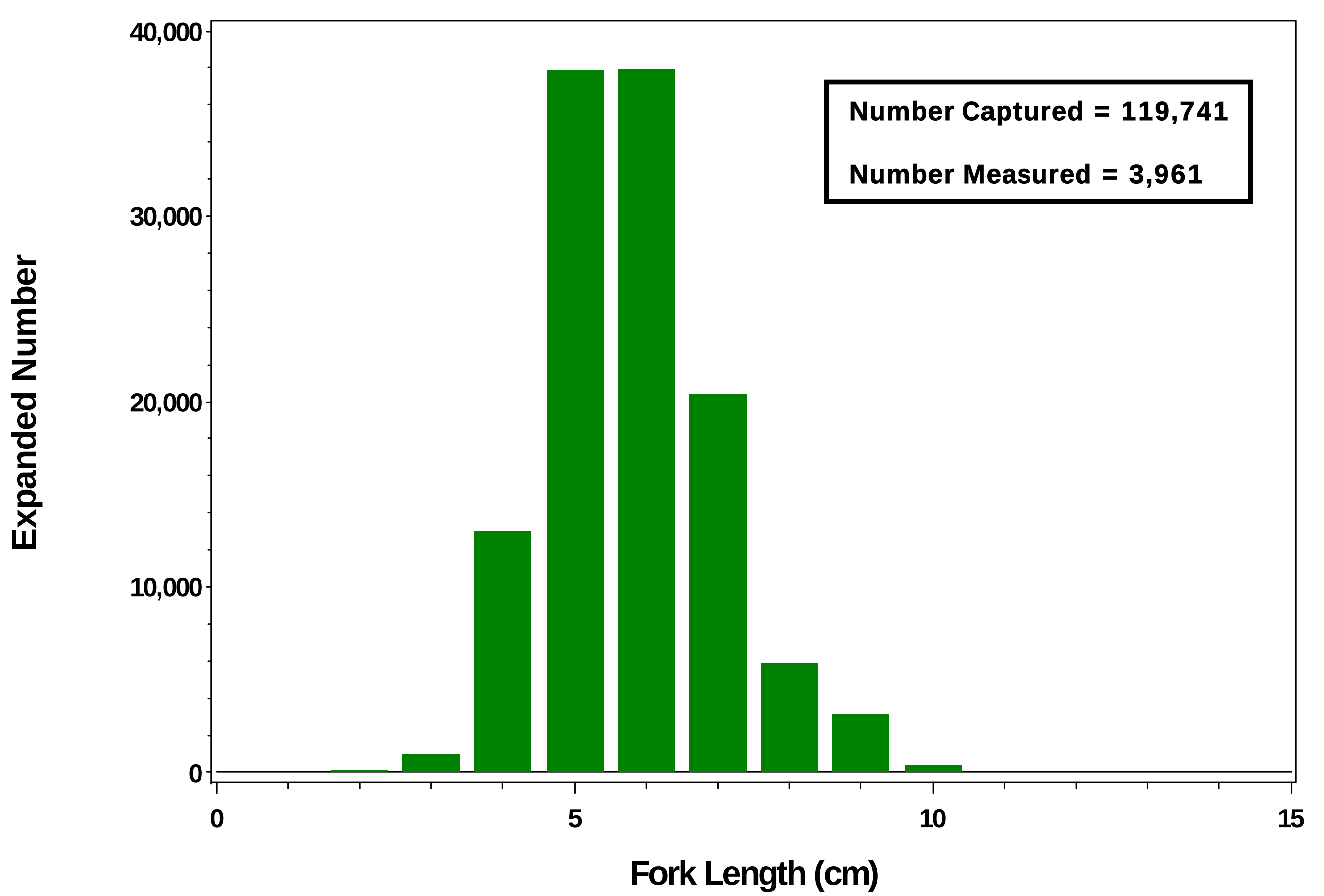
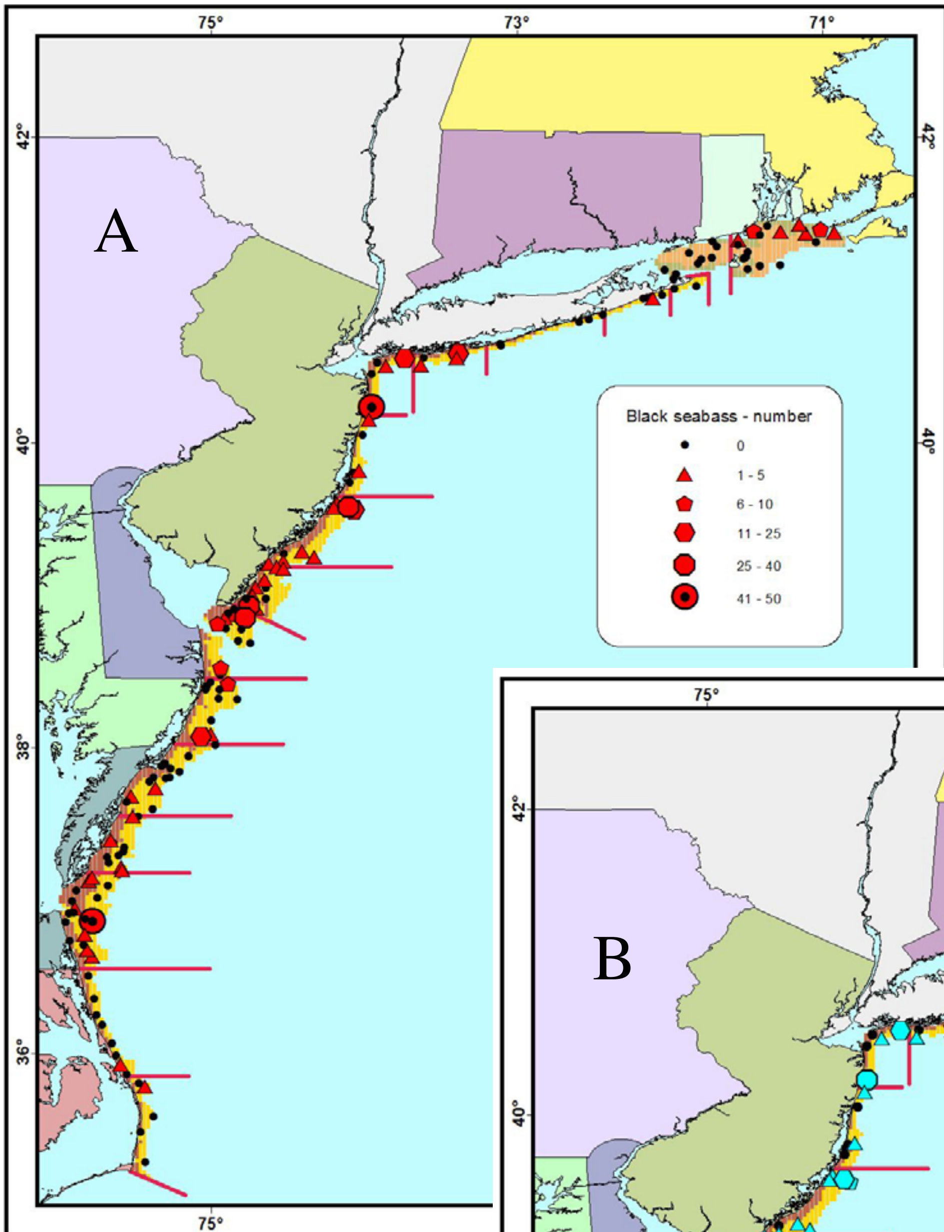


Figure 32. Length frequency histogram for bay anchovy.



Black Sea Bass (Priority A)



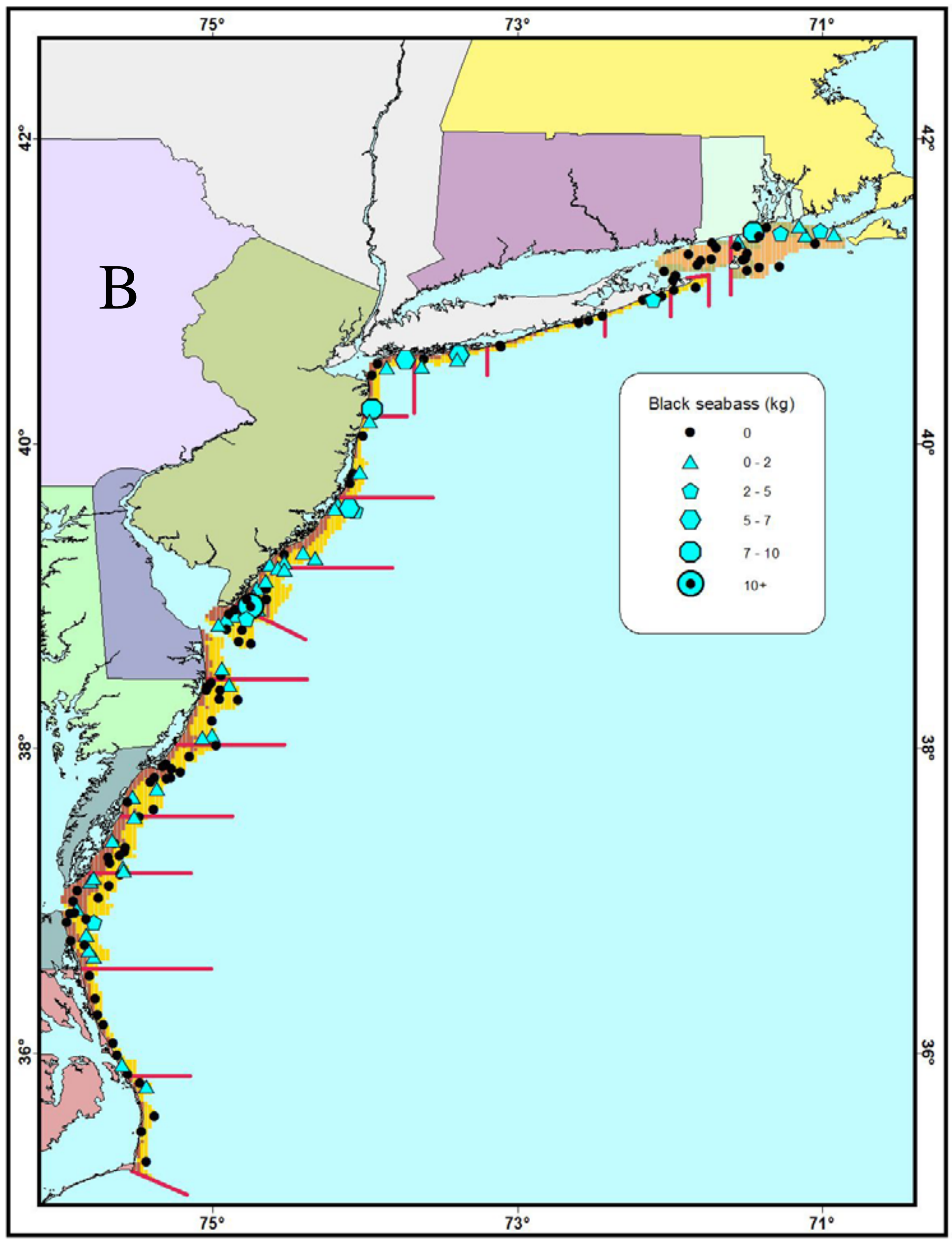


Figure 33. Number (A) and biomass (B) of specimens captured at each station for black sea bass.

Figure 34. Minimum trawlable number and biomass by state for black sea bass.

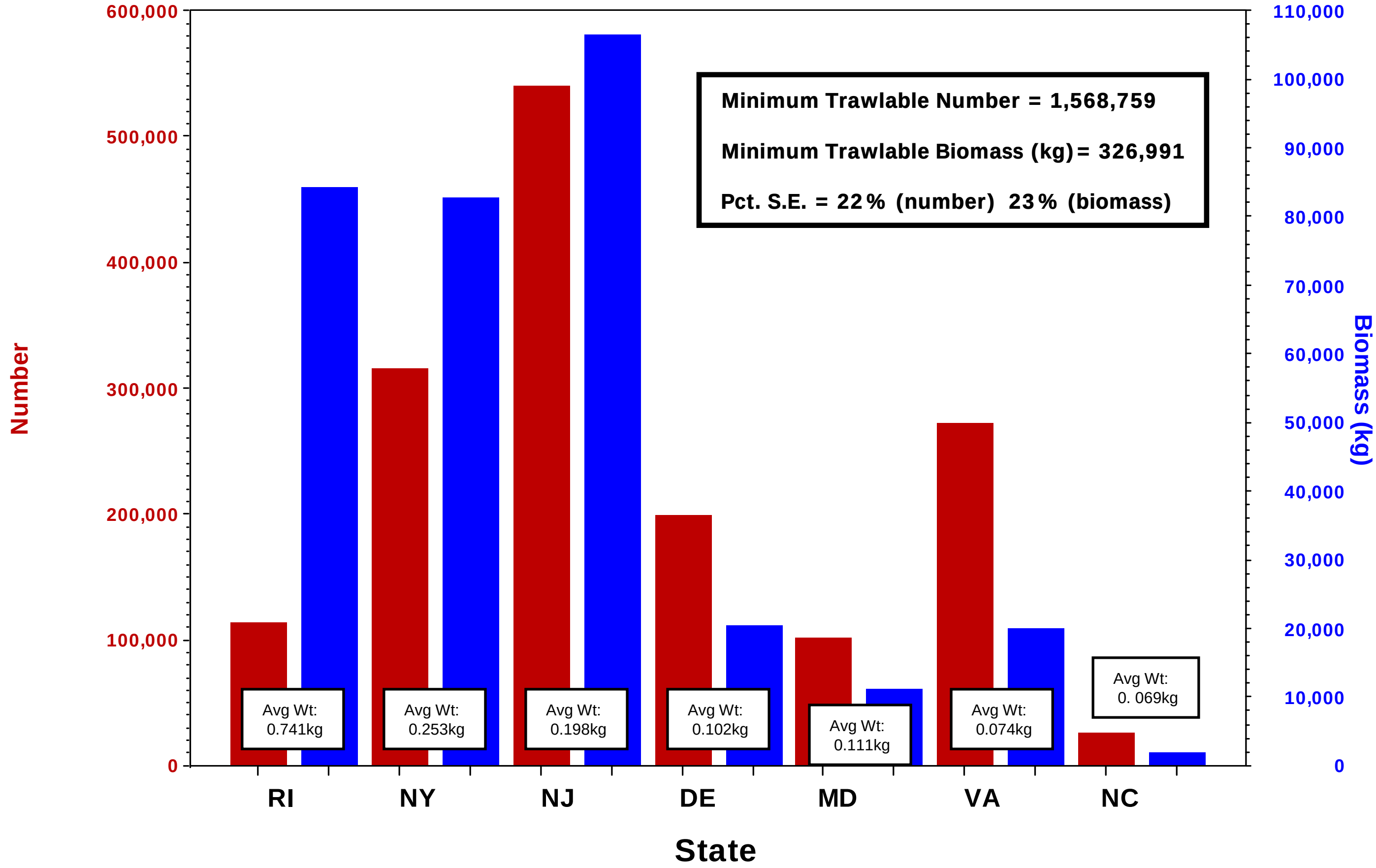


Figure 35. Length frequency histogram for black sea bass.

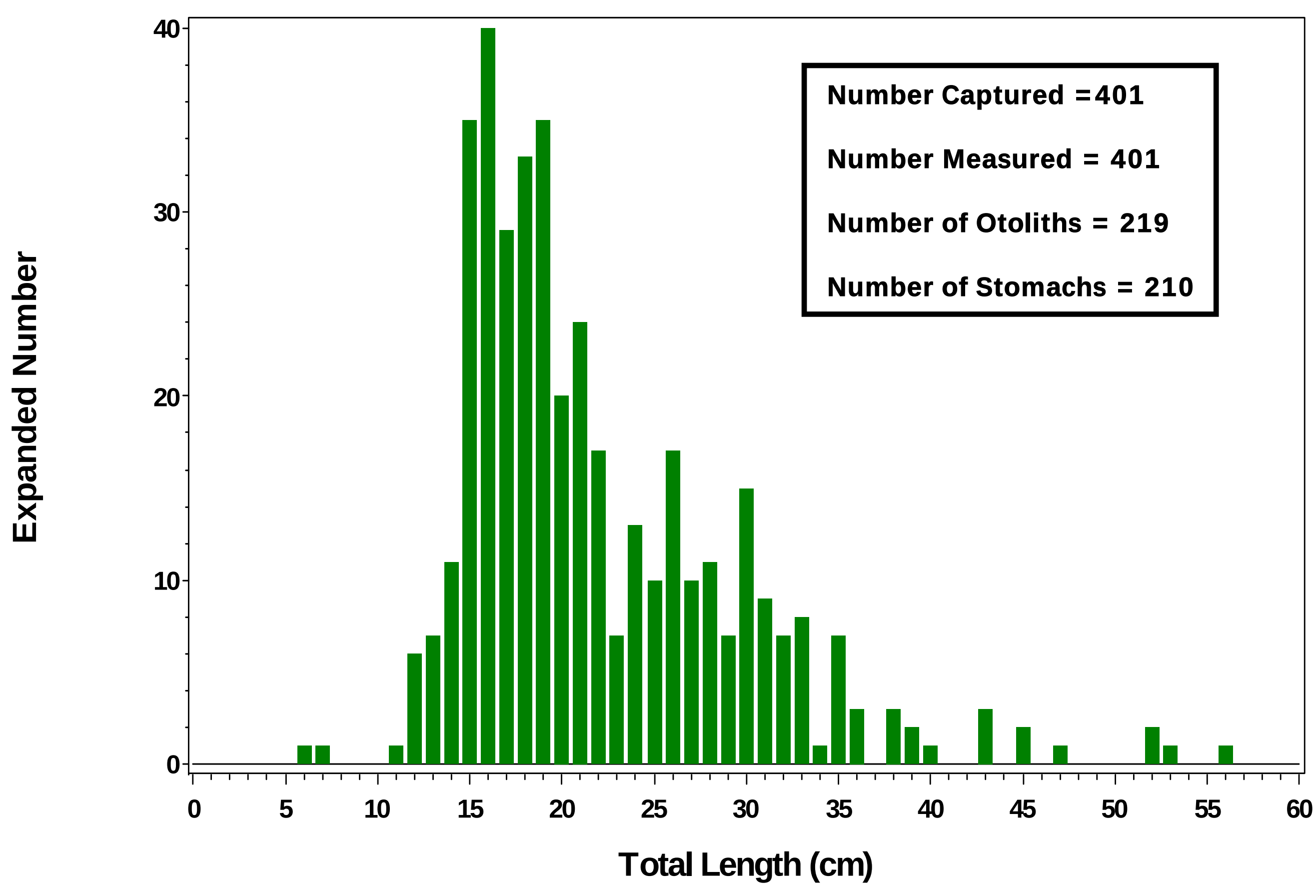


Figure 36. Sex ratios for black sea bass, by state (A) and length group (B).

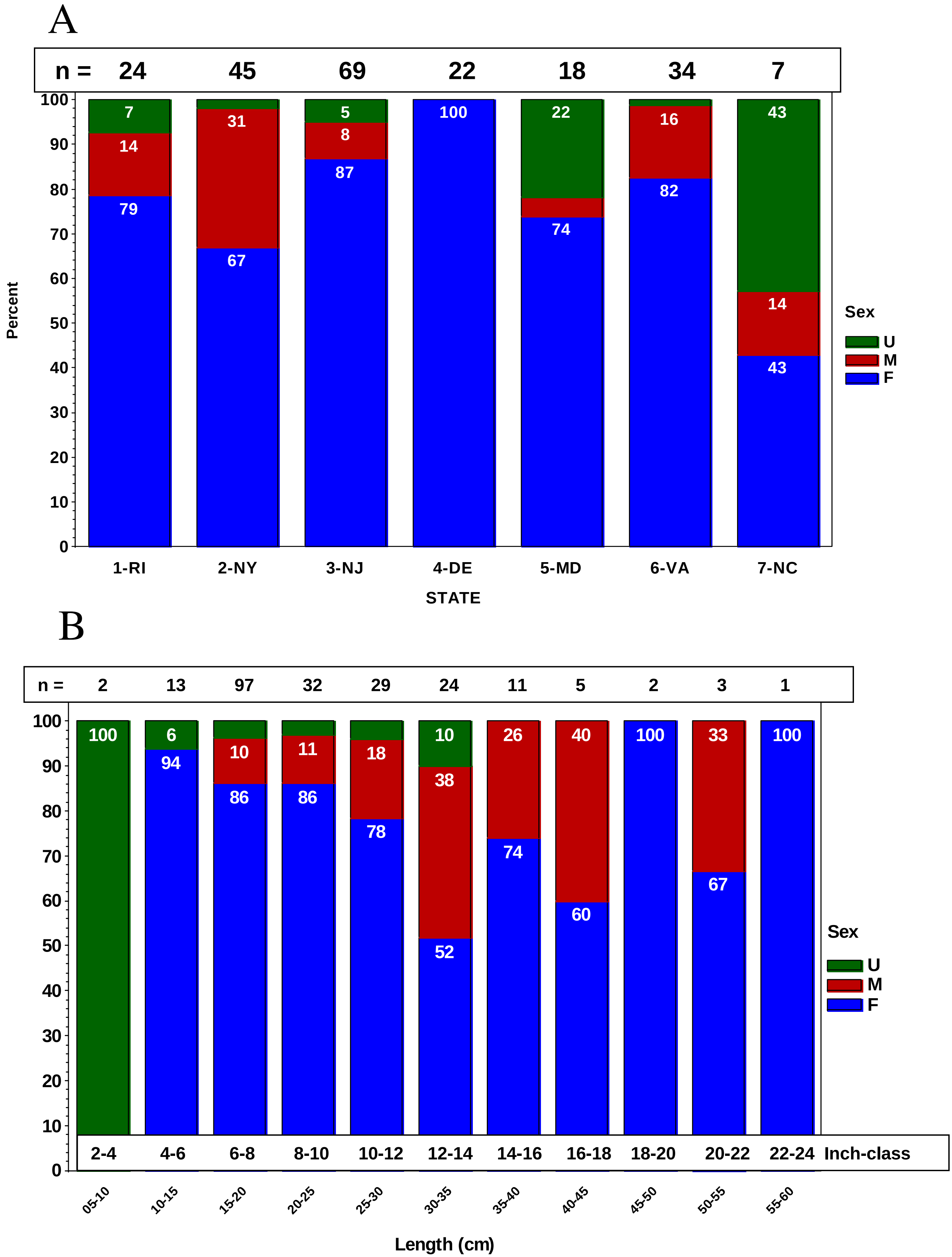


Figure 37. Maturity logistic regression for black sea bass, by sex.

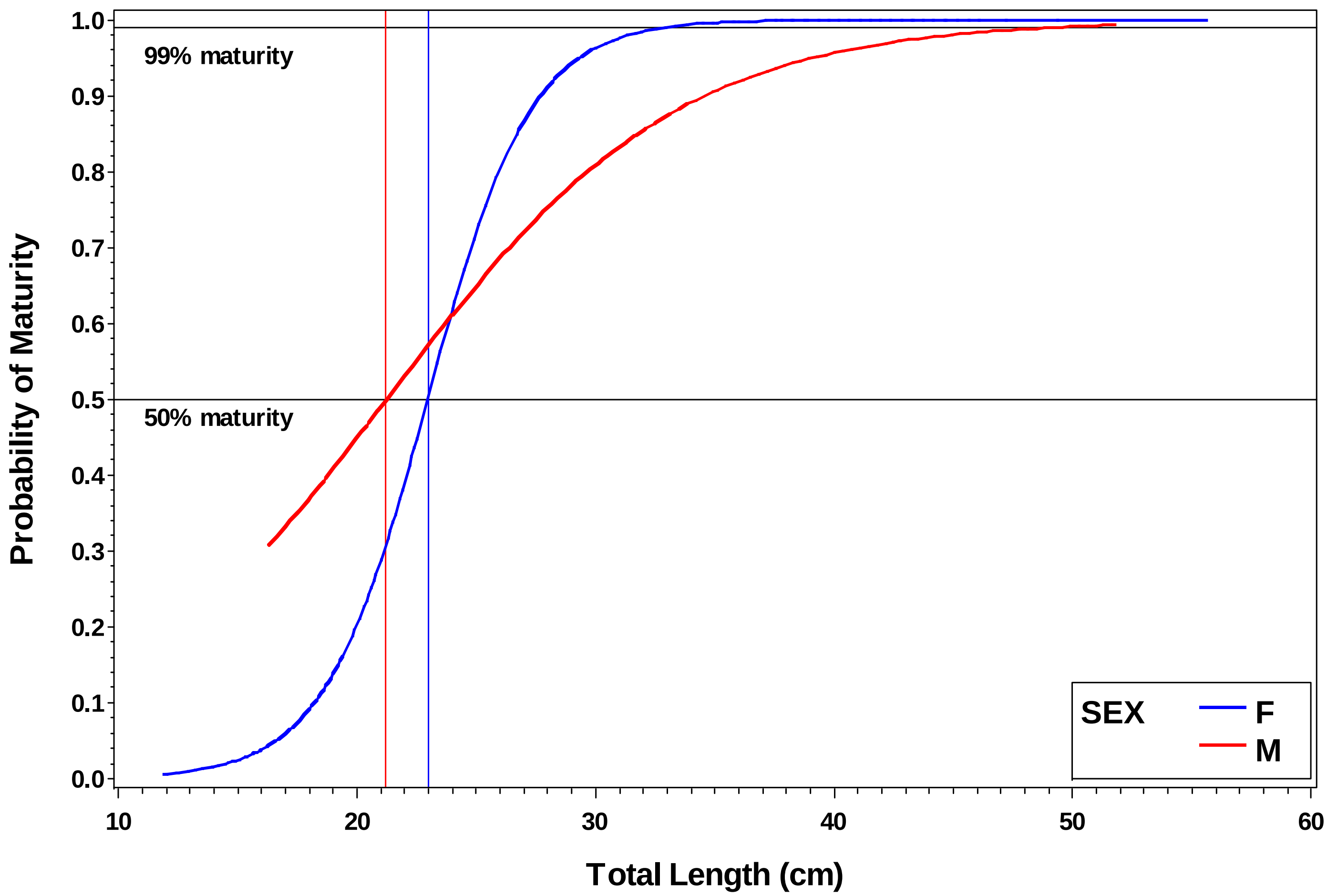


Figure 38. Expanded age frequency histogram for black sea bass.

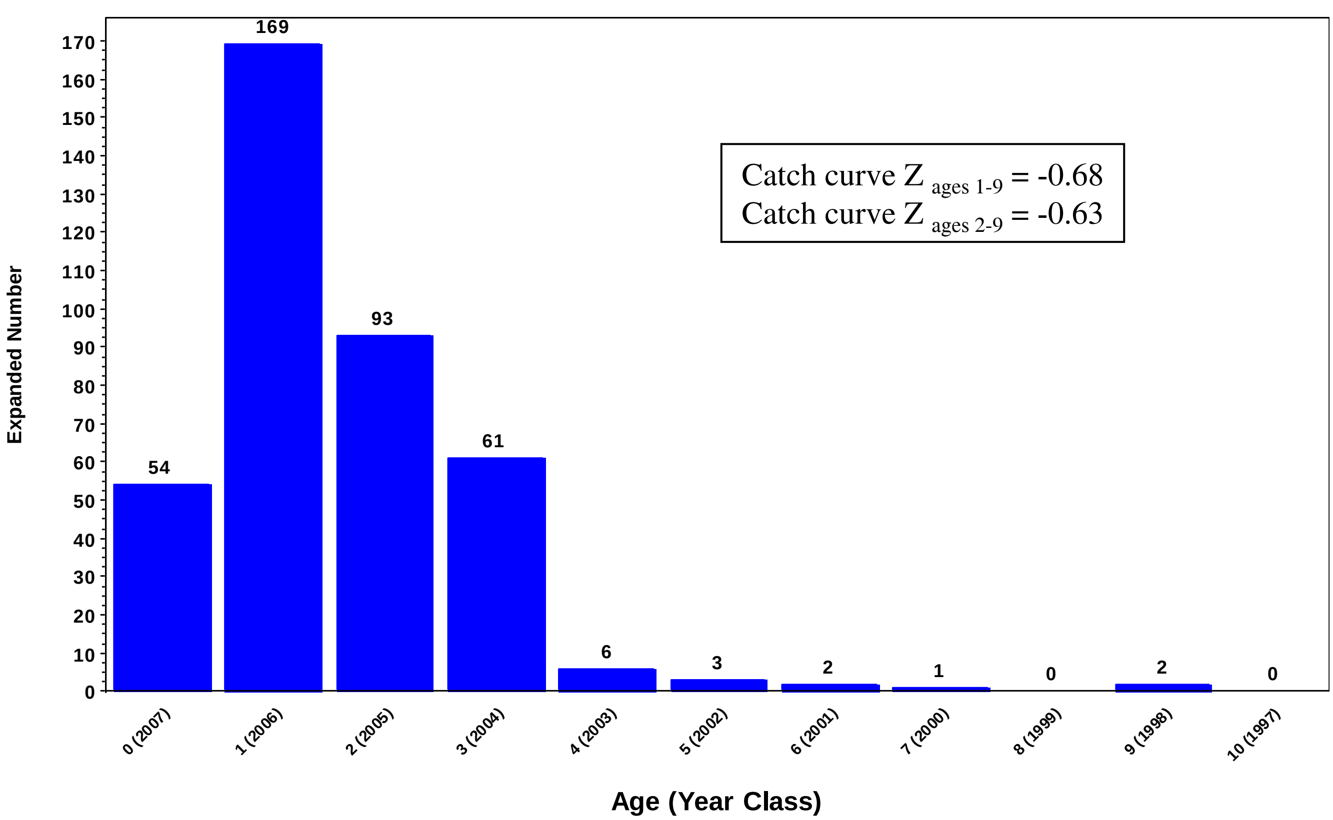


Figure 39. Age-specific length-frequency histograms for black sea bass for ages 0 through 3, and 5.

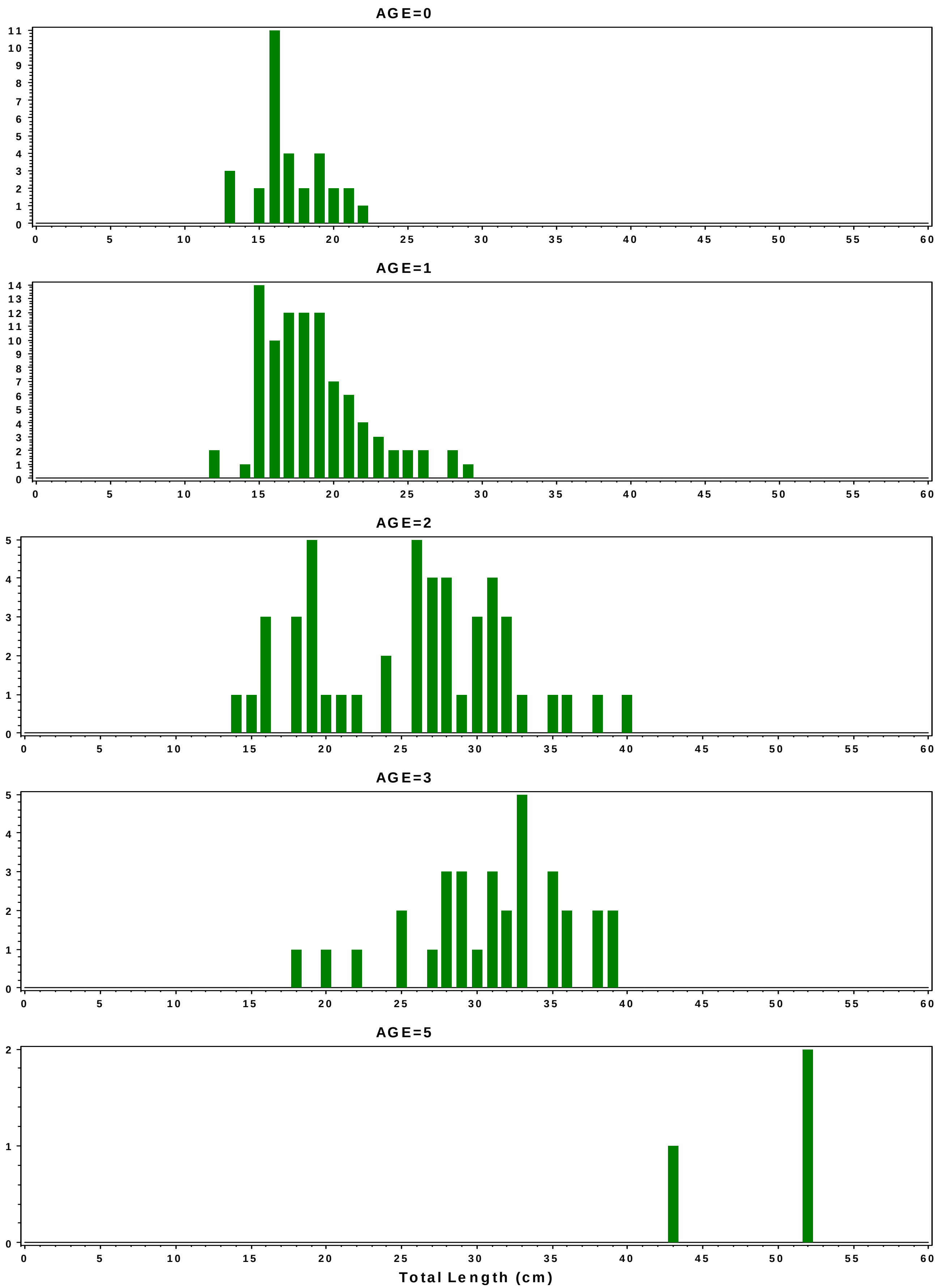


Figure 40. von Bertalanffy growth curves for black sea bass, by sex.

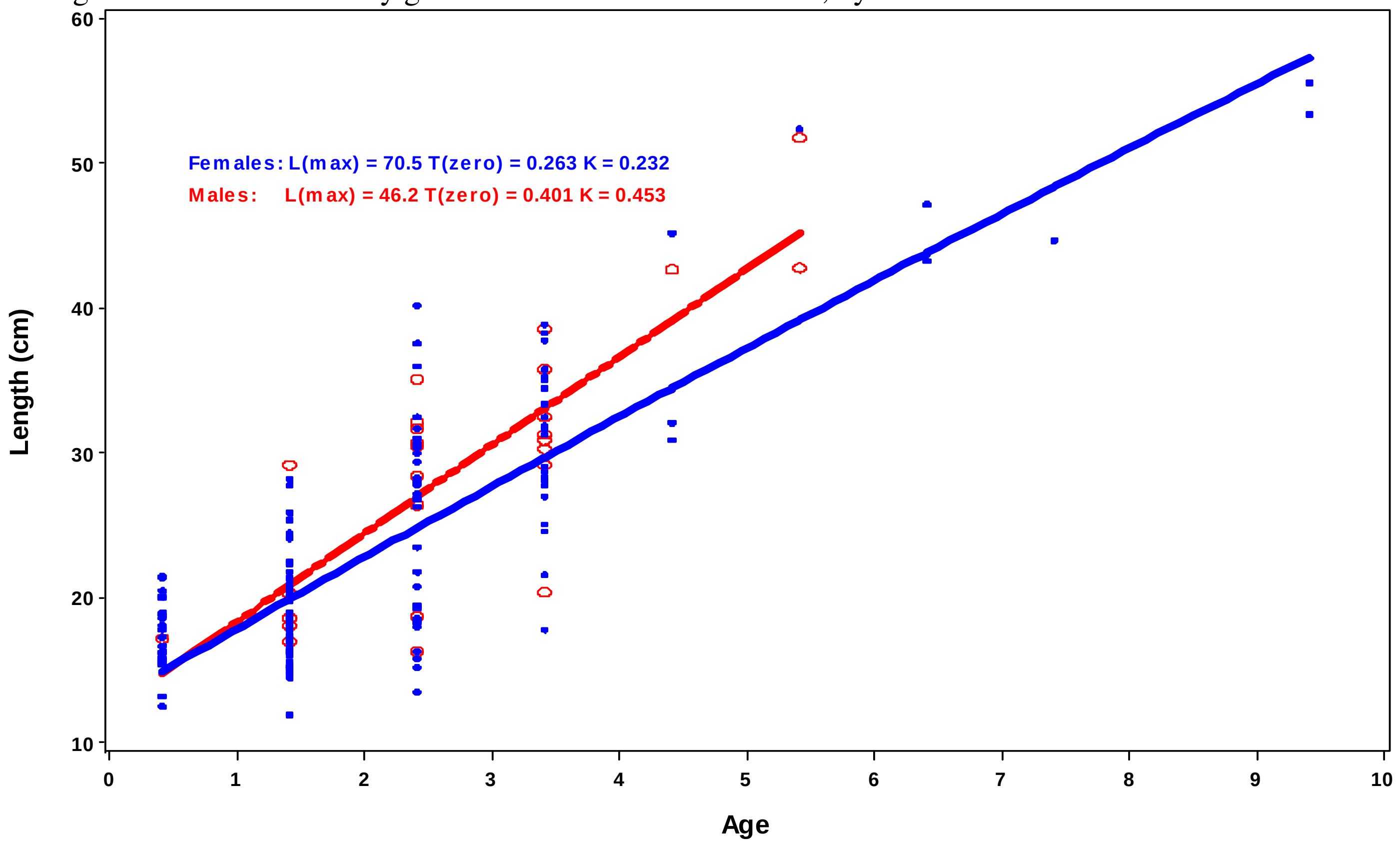
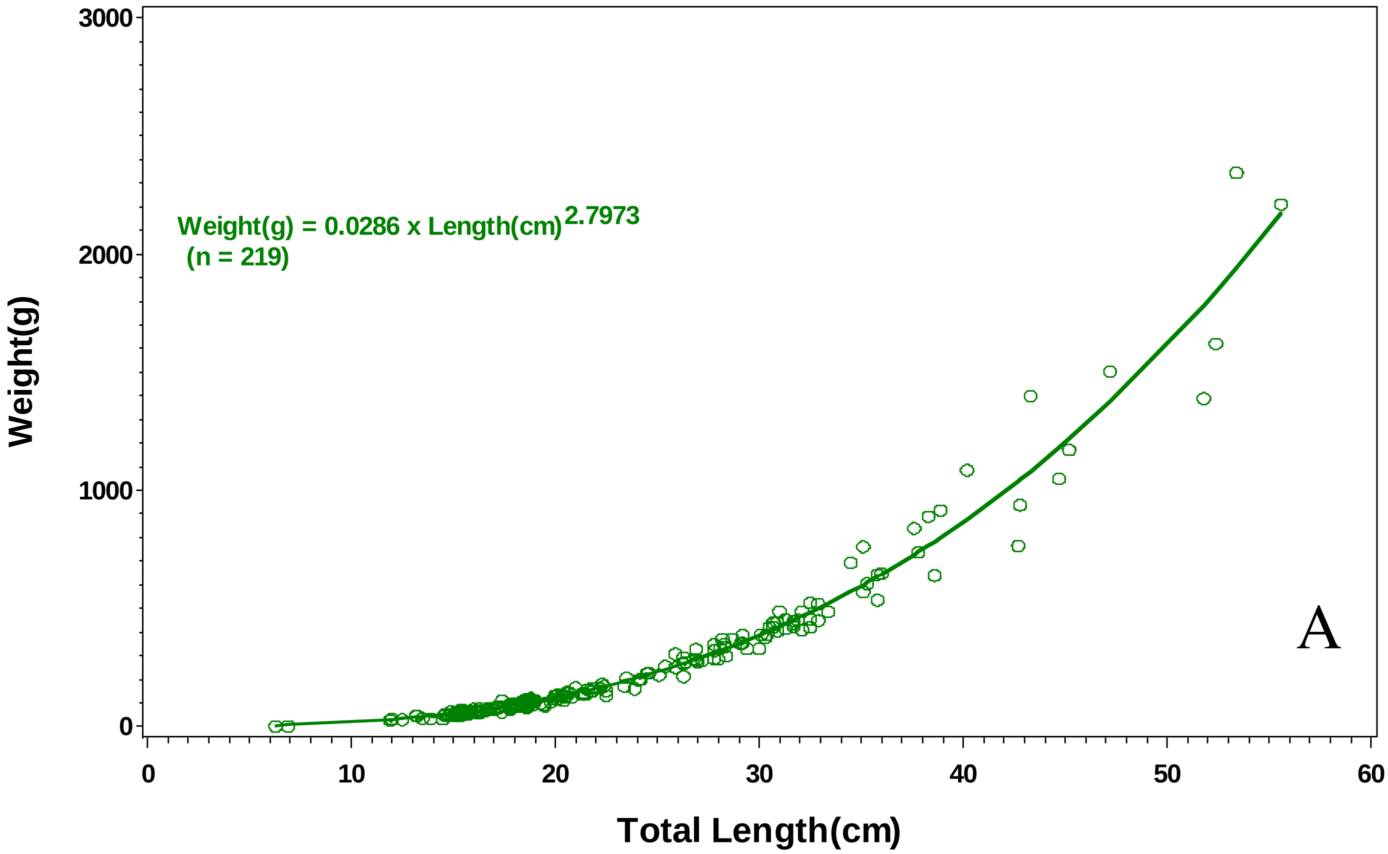


Figure 41. Length-weight regression for black sea bass, sexes combined (A) and by sex (B)..



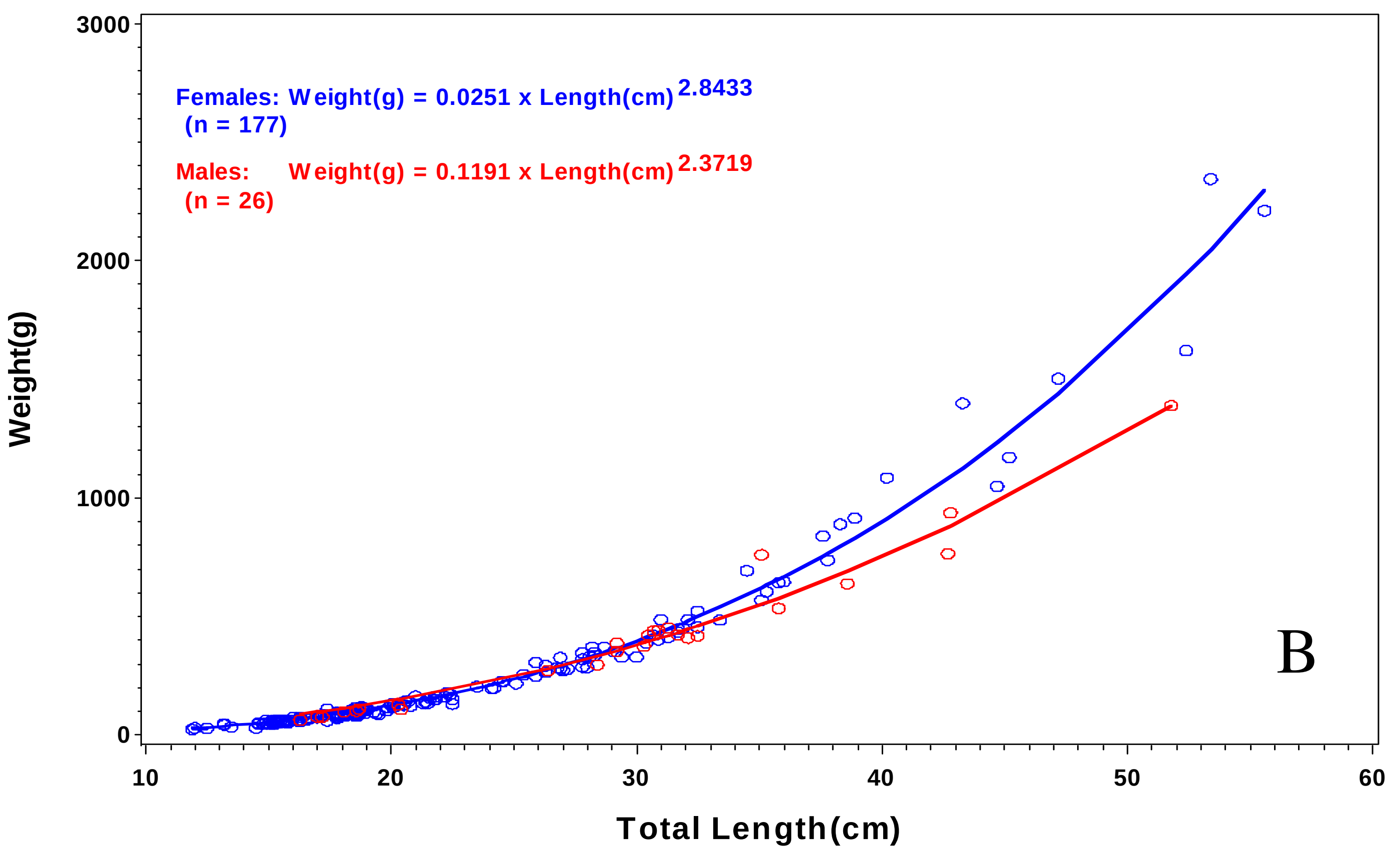
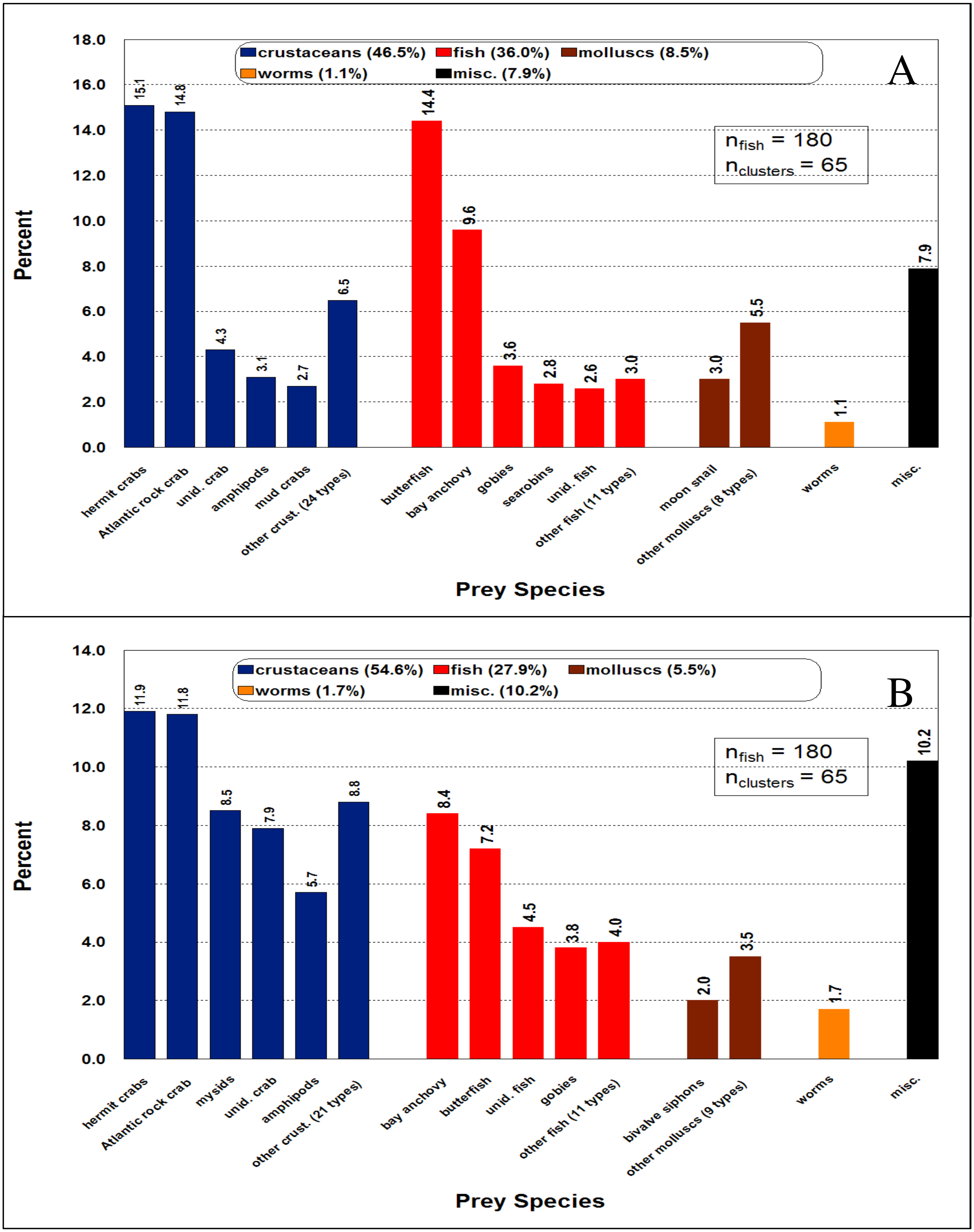
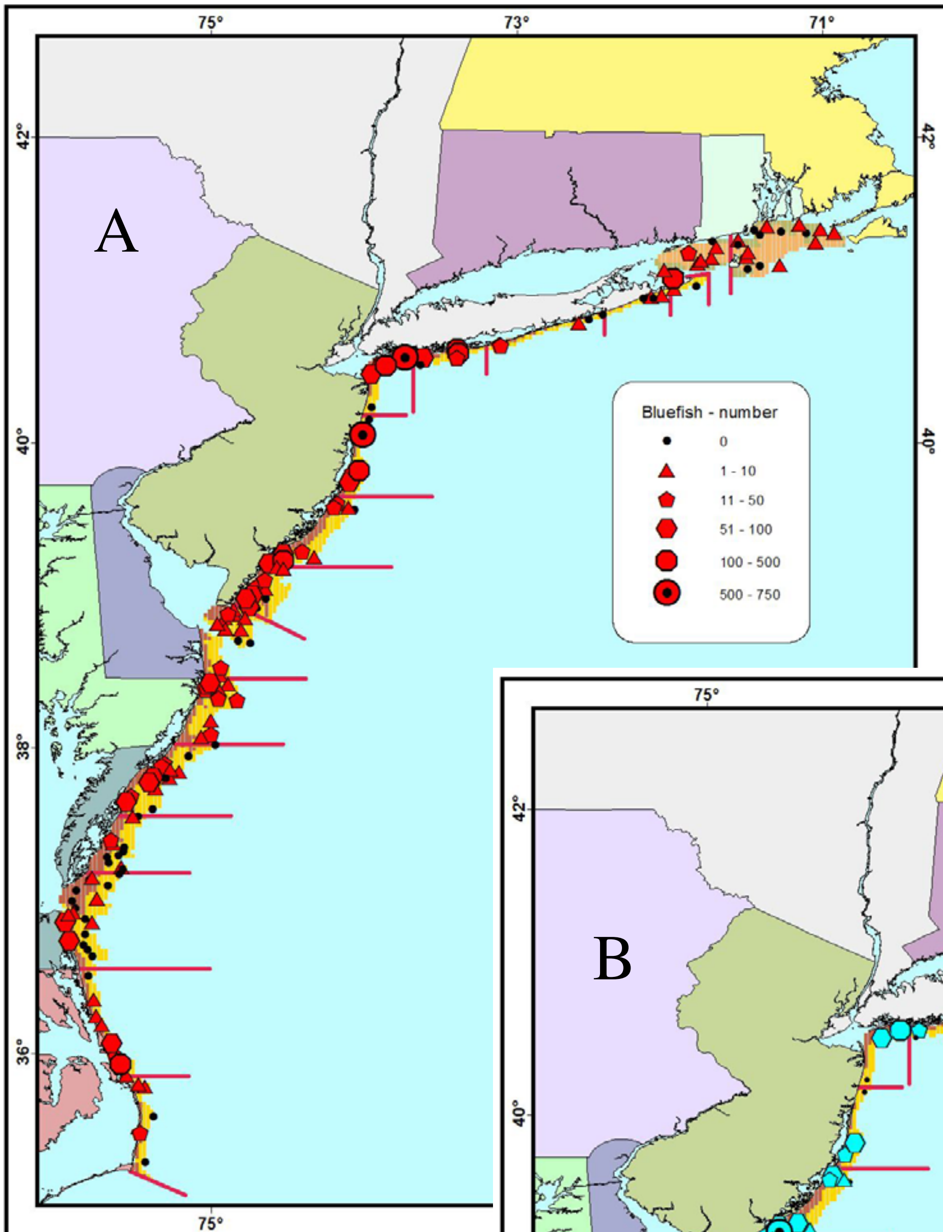


Figure 42. Diets of black sea bass by percent weight (A) and percent number (B).



Bluefish (Priority A)



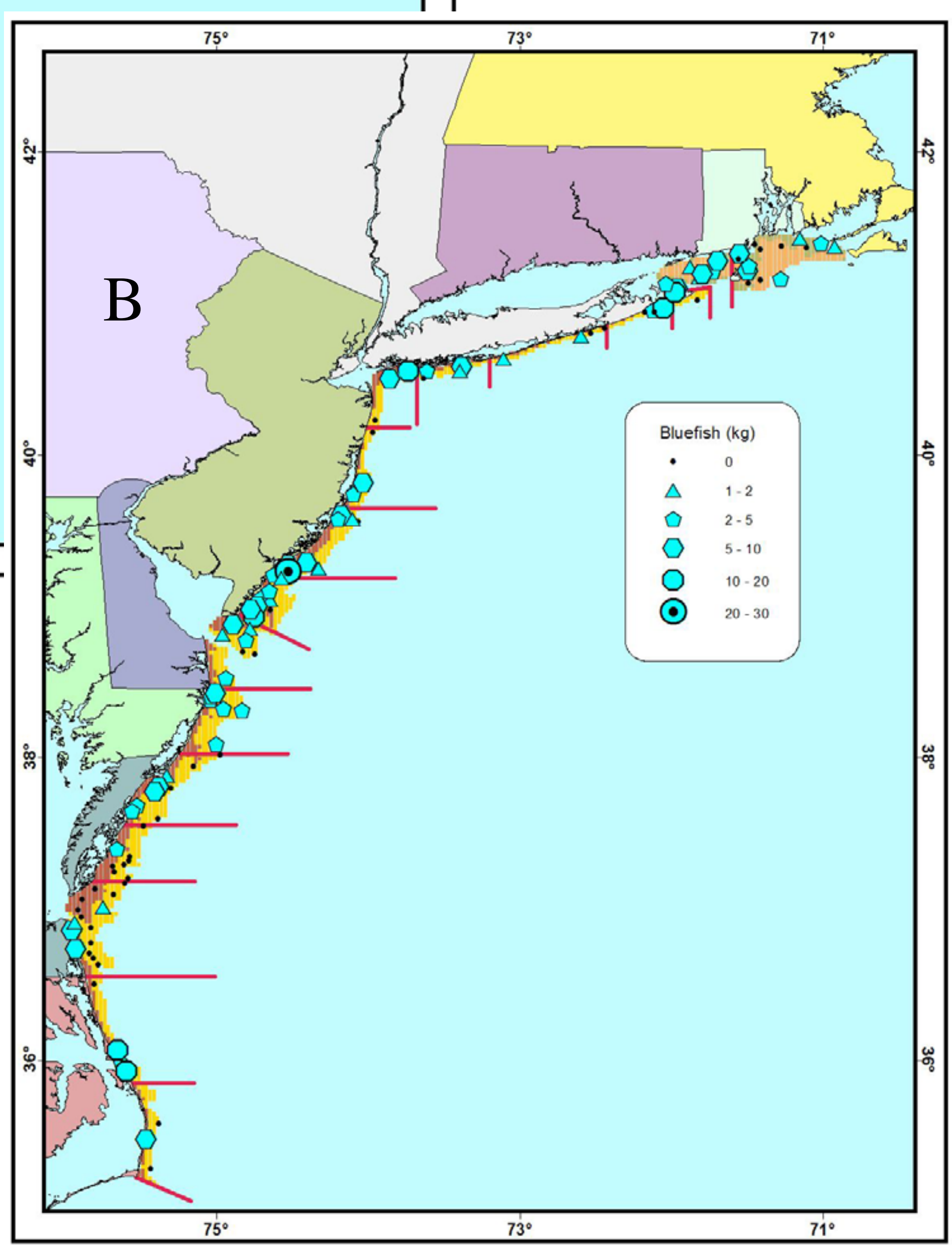


Figure 43. Number (A) and biomass (B) of specimens captured at each station for bluefish.

Figure 44. Minimum trawlable number and biomass by state for bluefish.

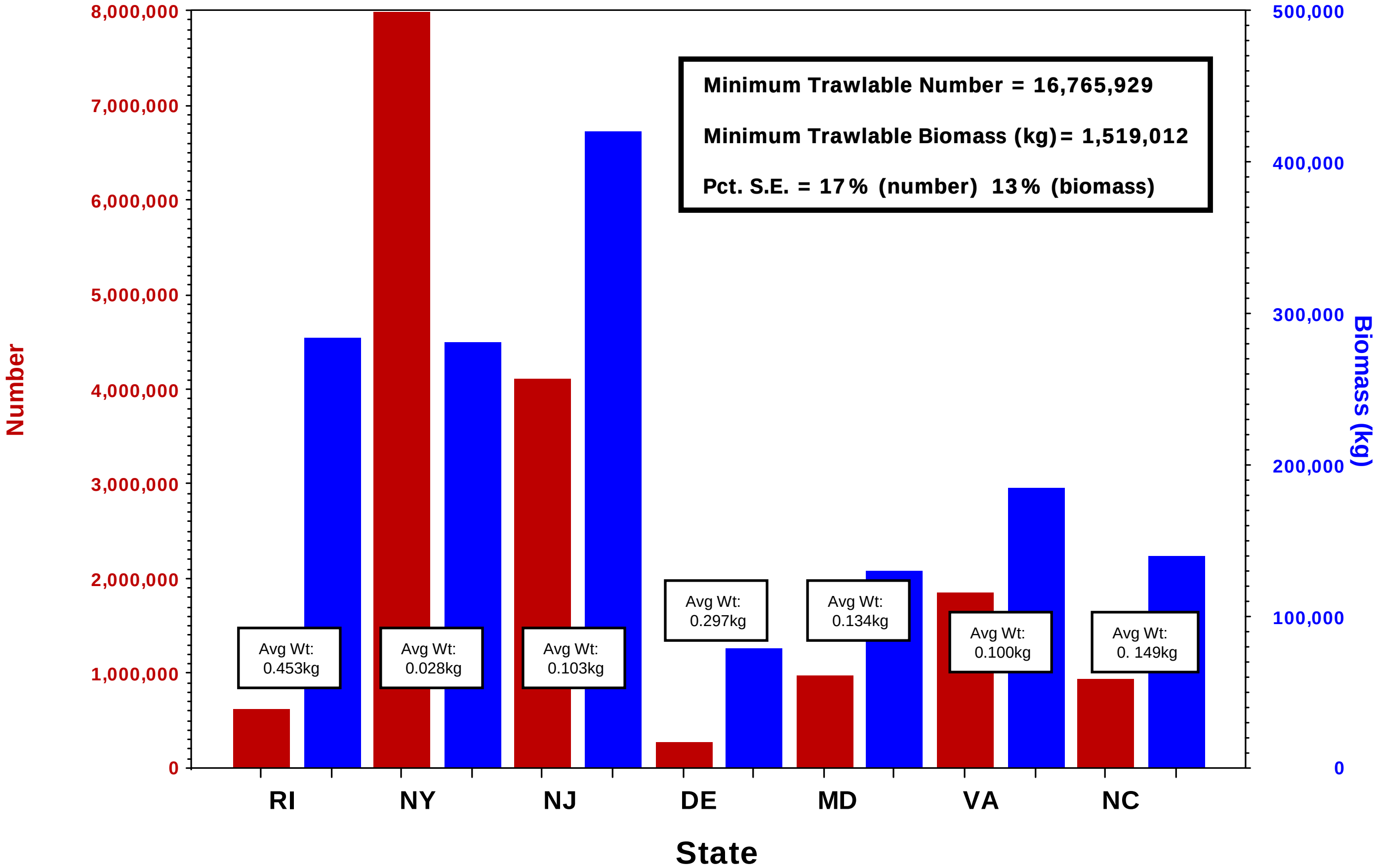


Figure 45. Length frequency histogram for bluefish.

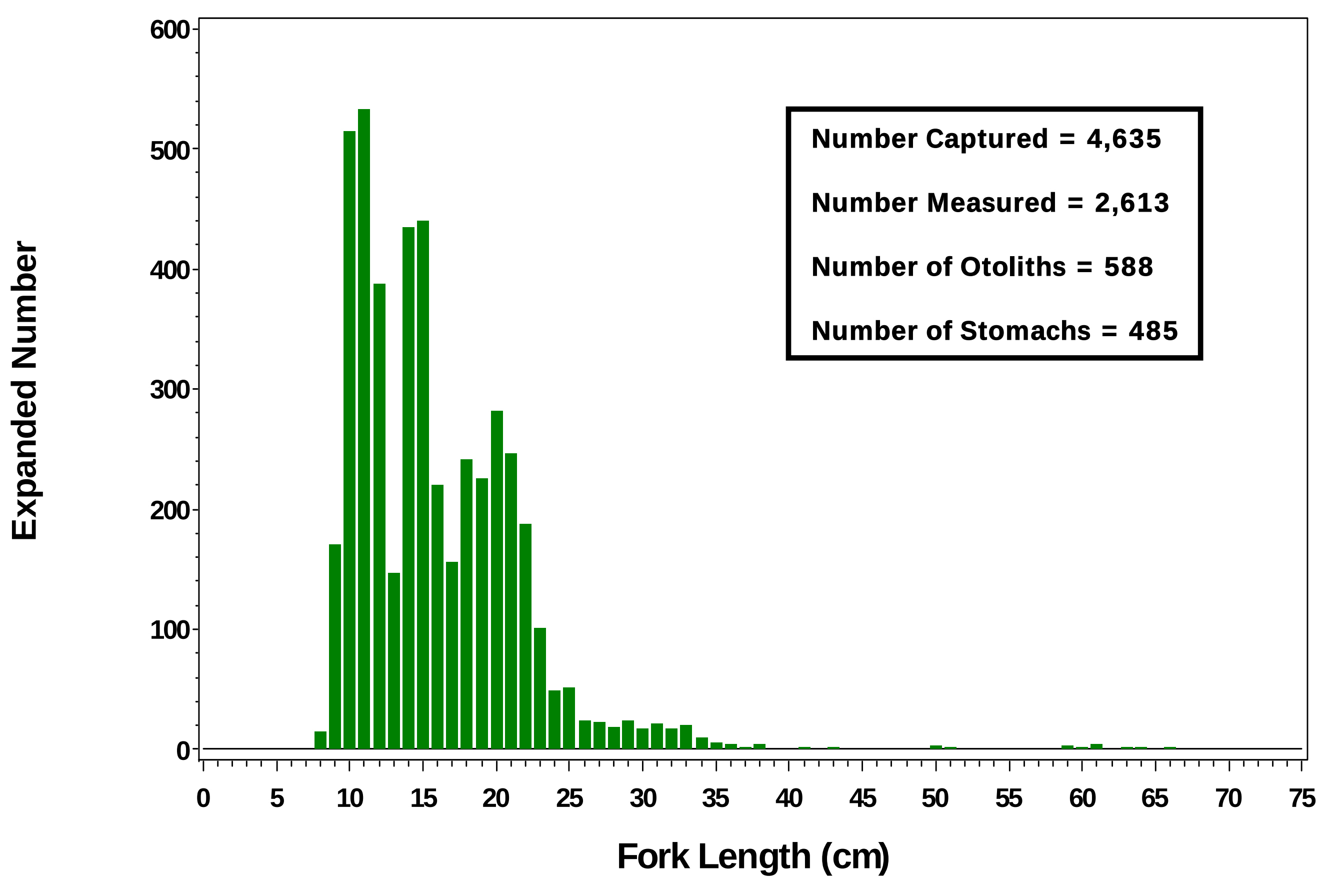
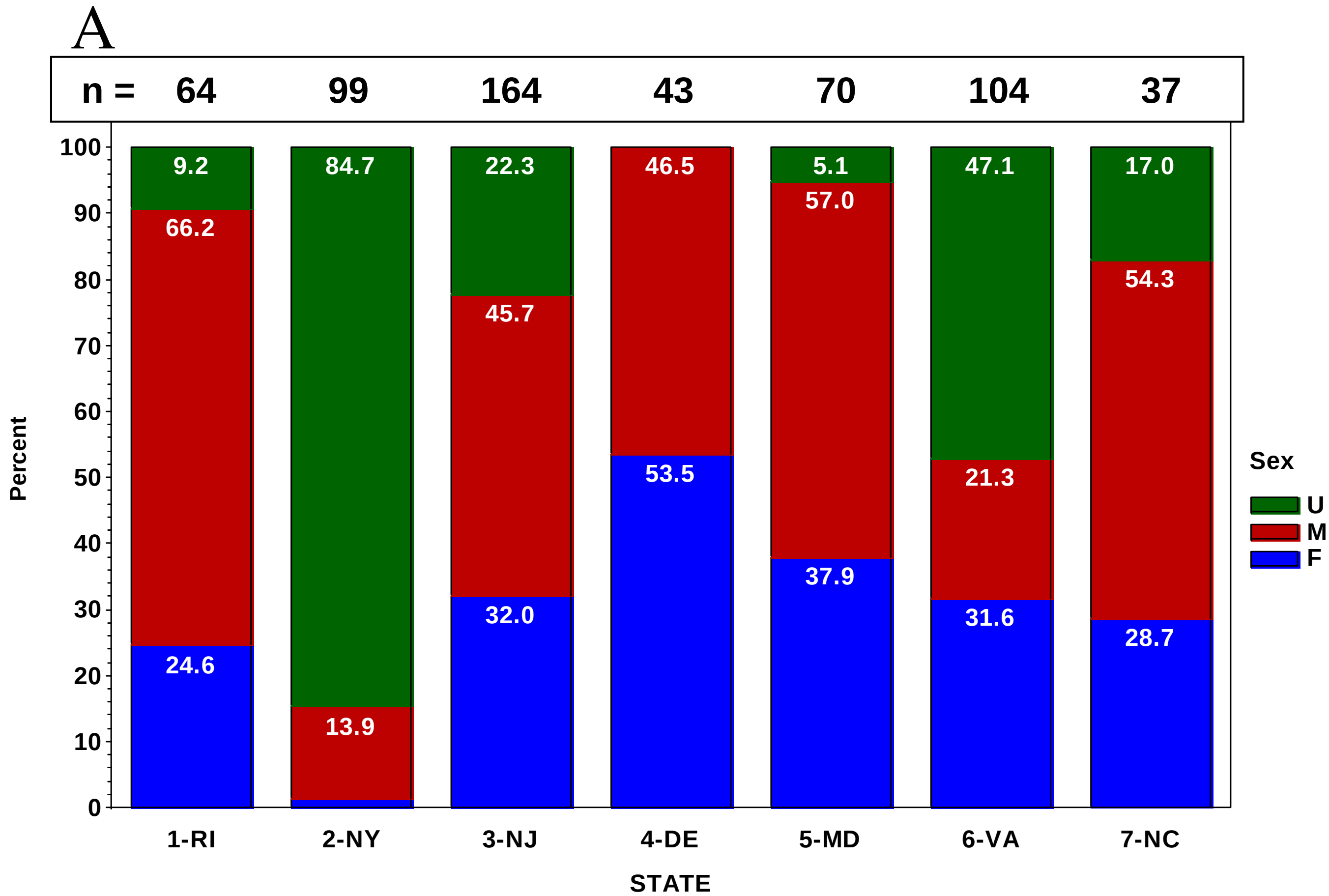


Figure 46. Sex ratios for bluefish, by state (A) and length group (B).



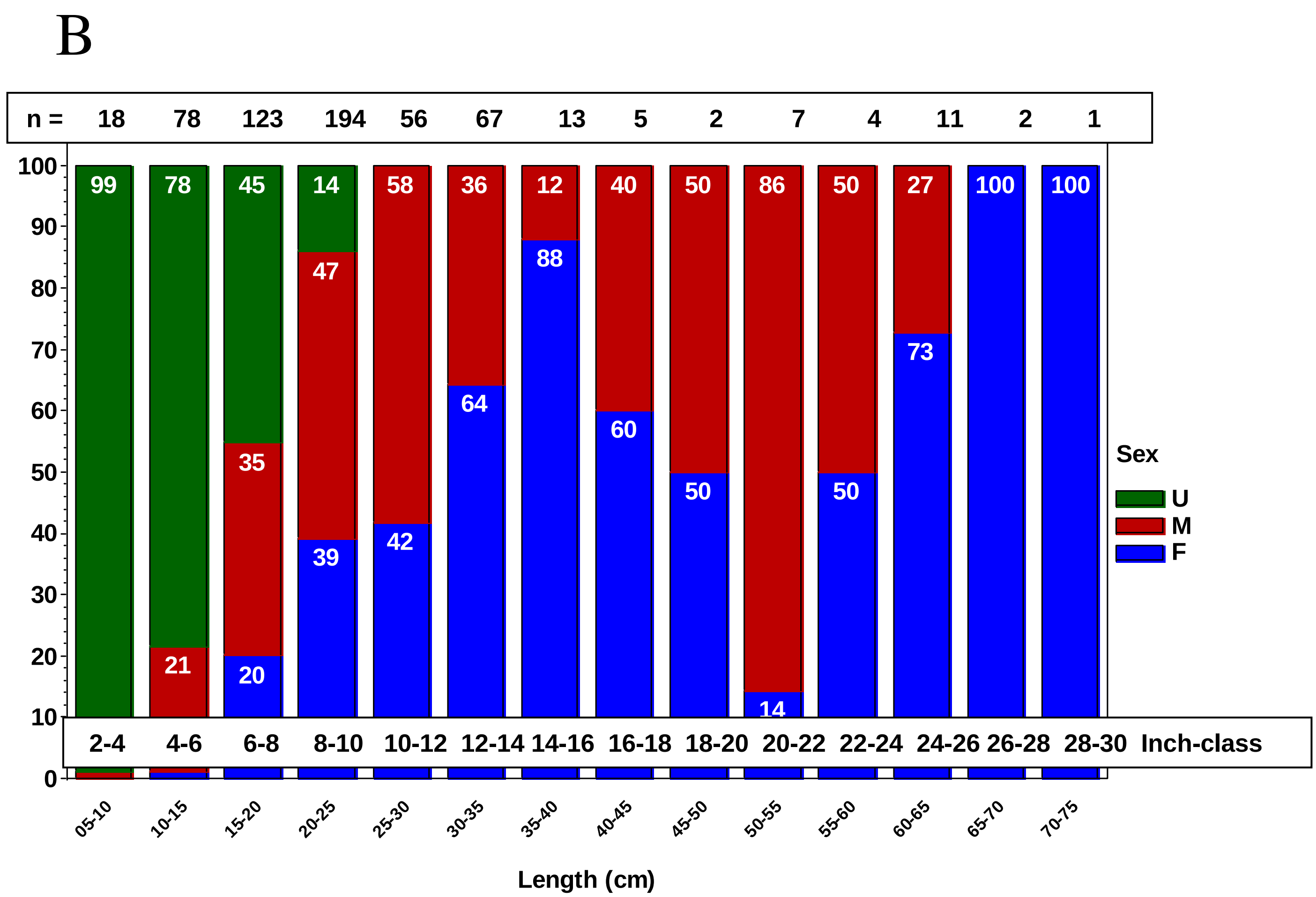


Figure 47. Maturity logistic regression for bluefish, by sex.

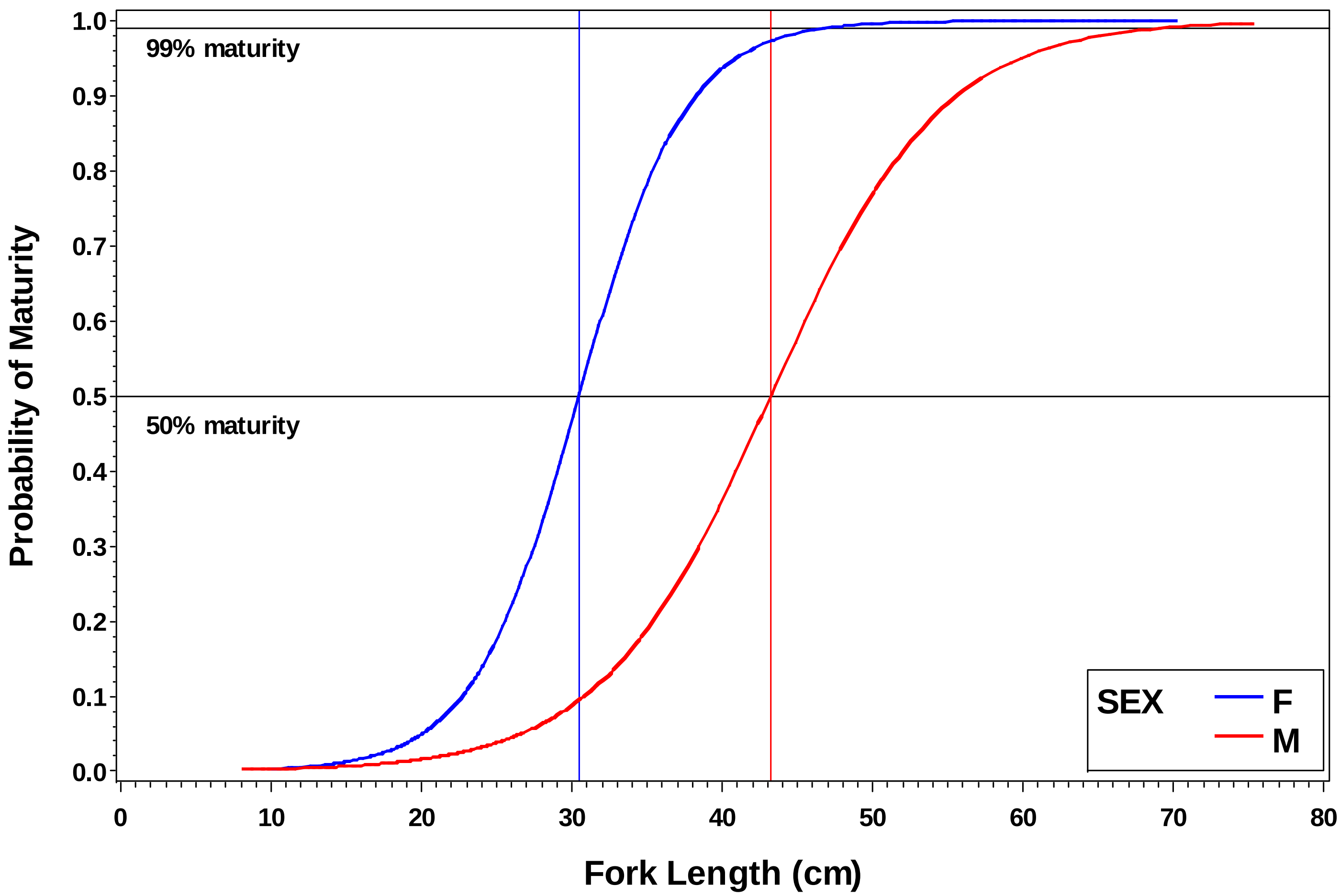
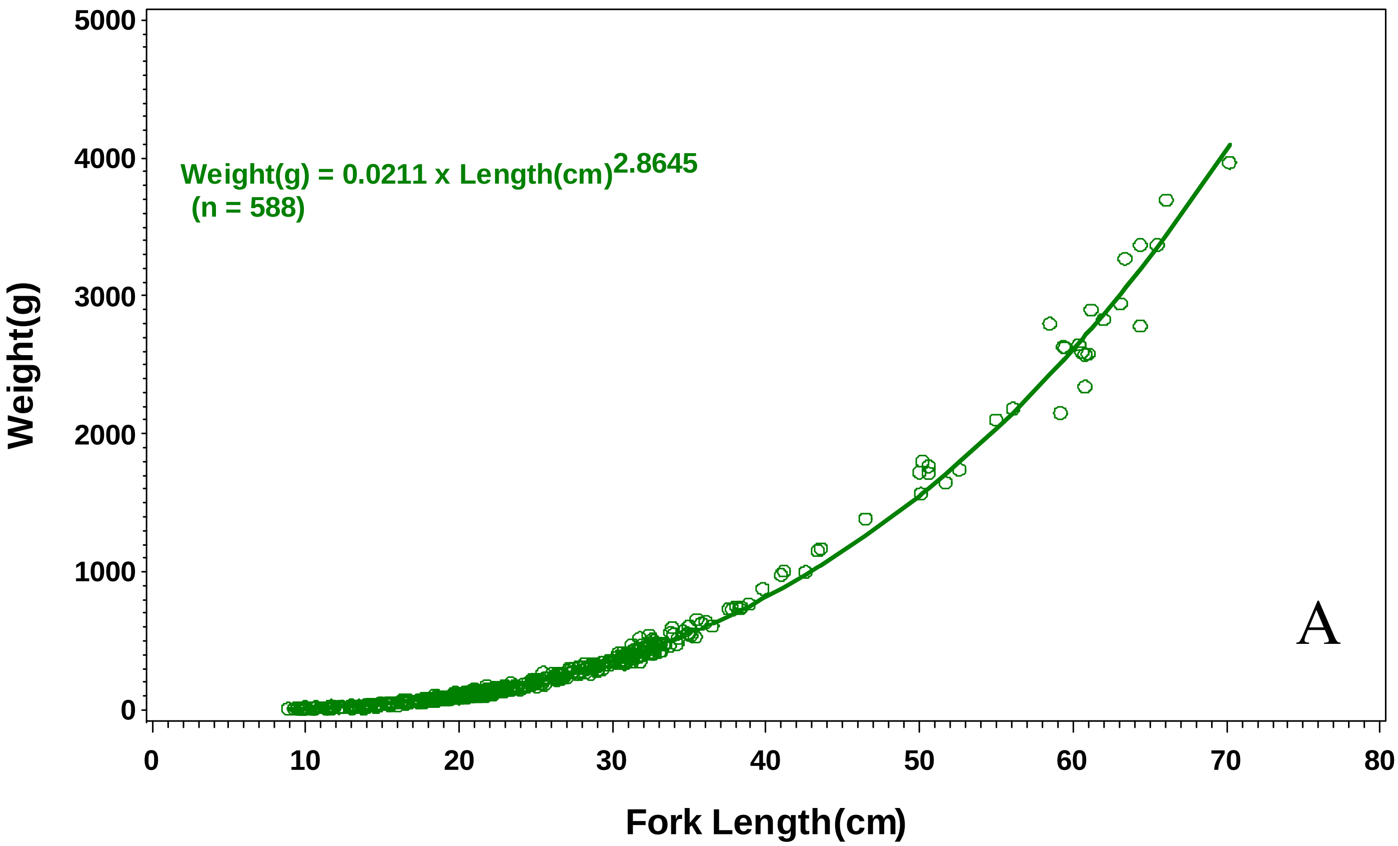


Figure 48. Length-weight regression for bluefish, sexes combined (A) and by sex (B)..



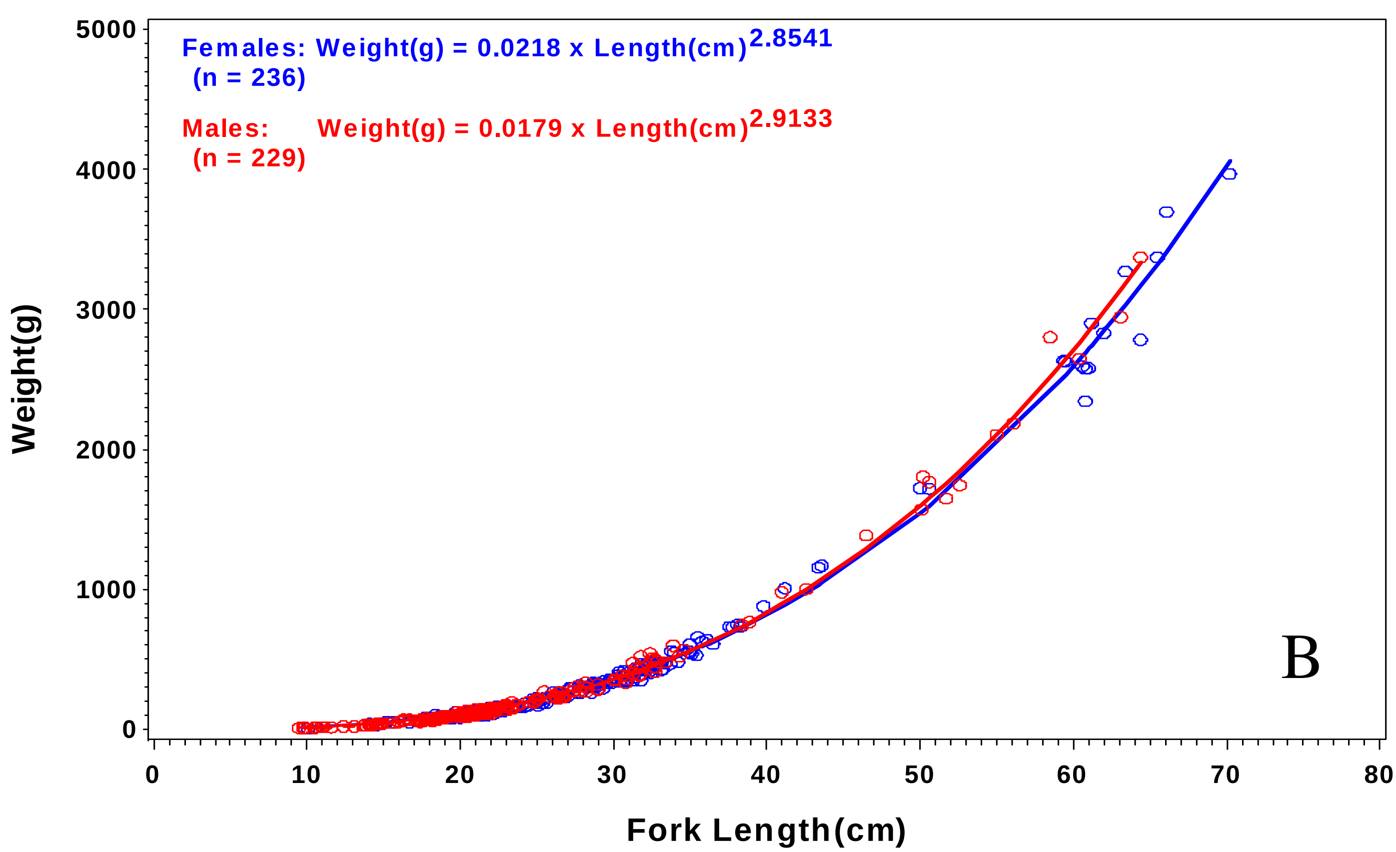
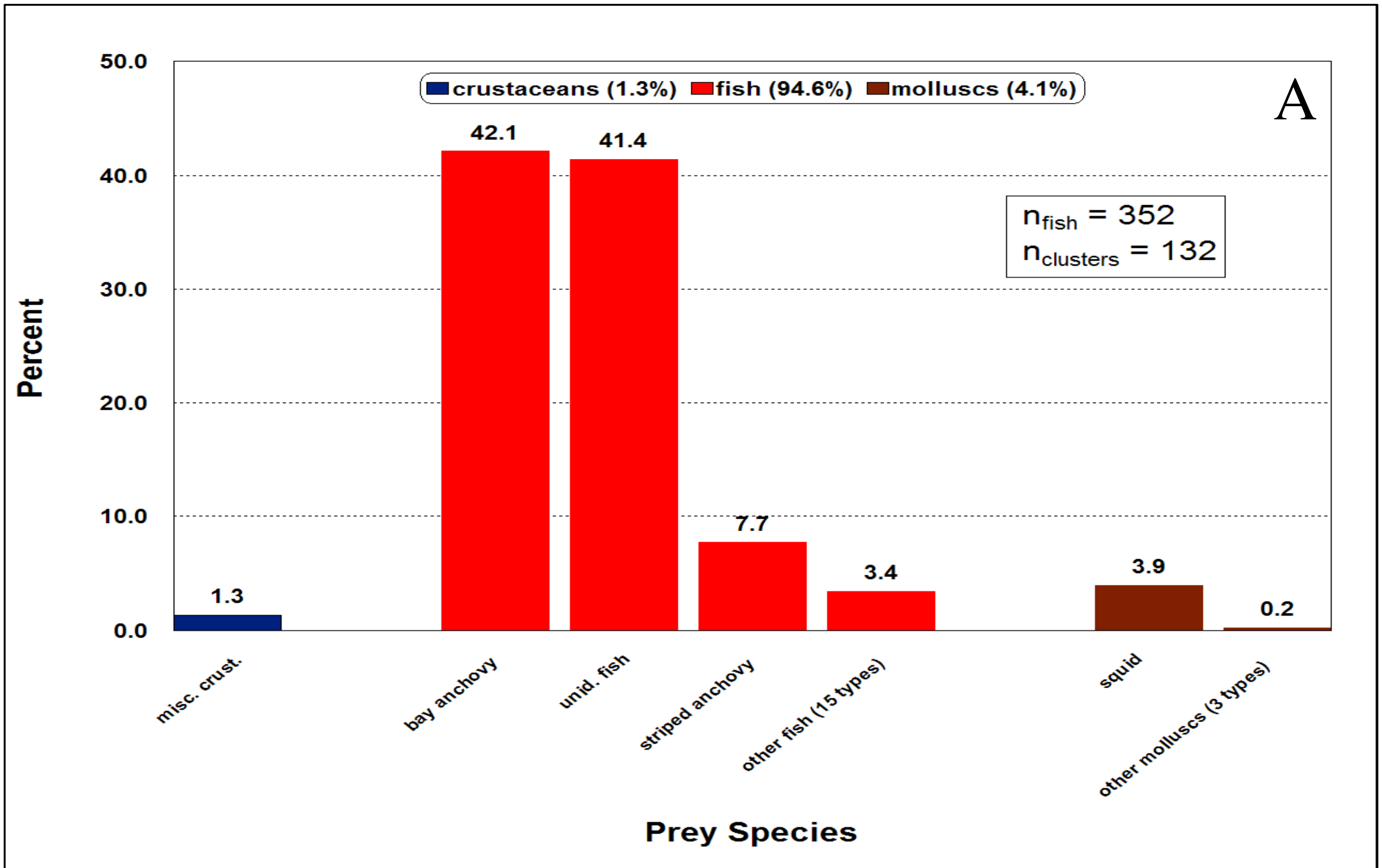
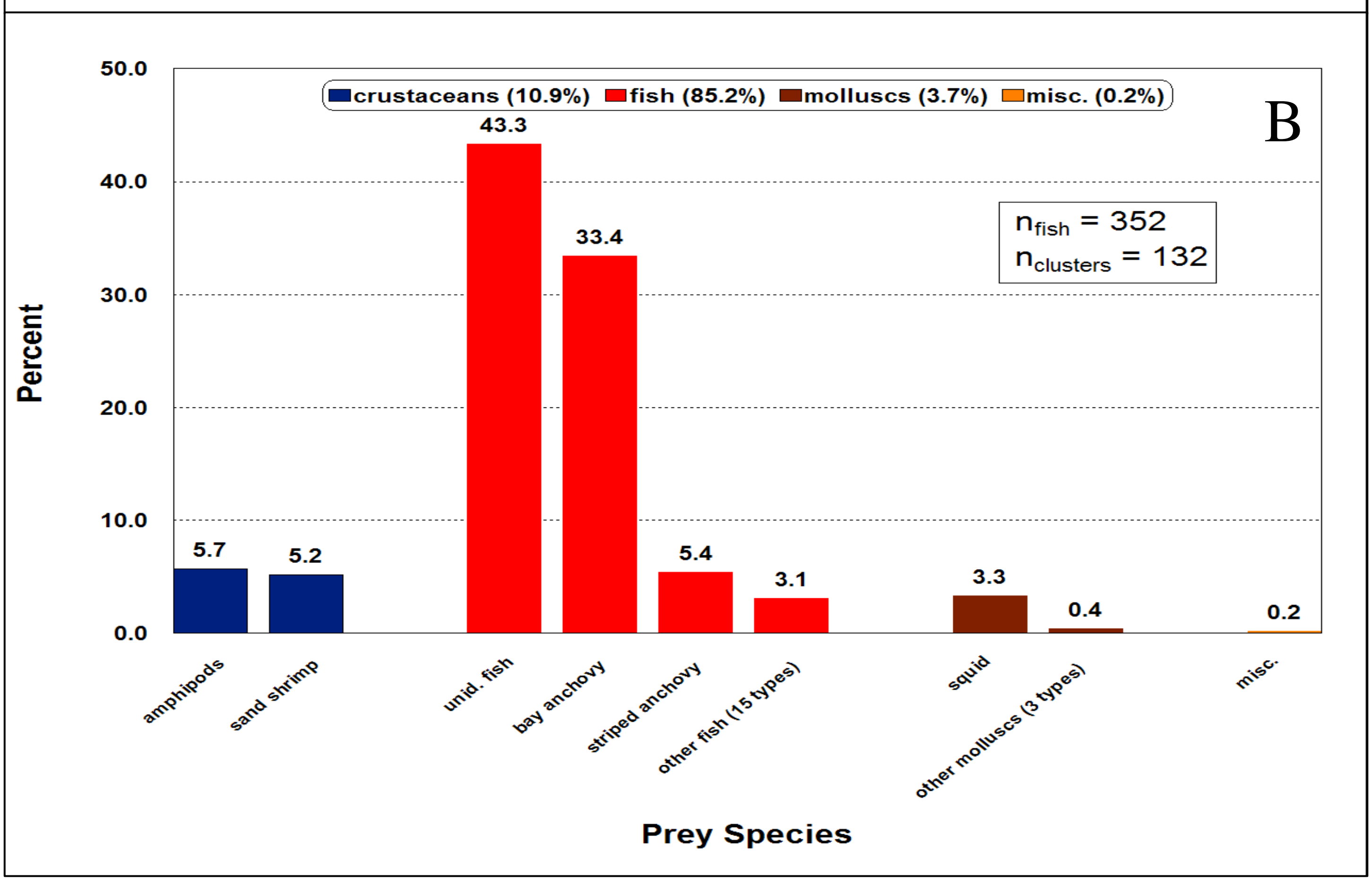
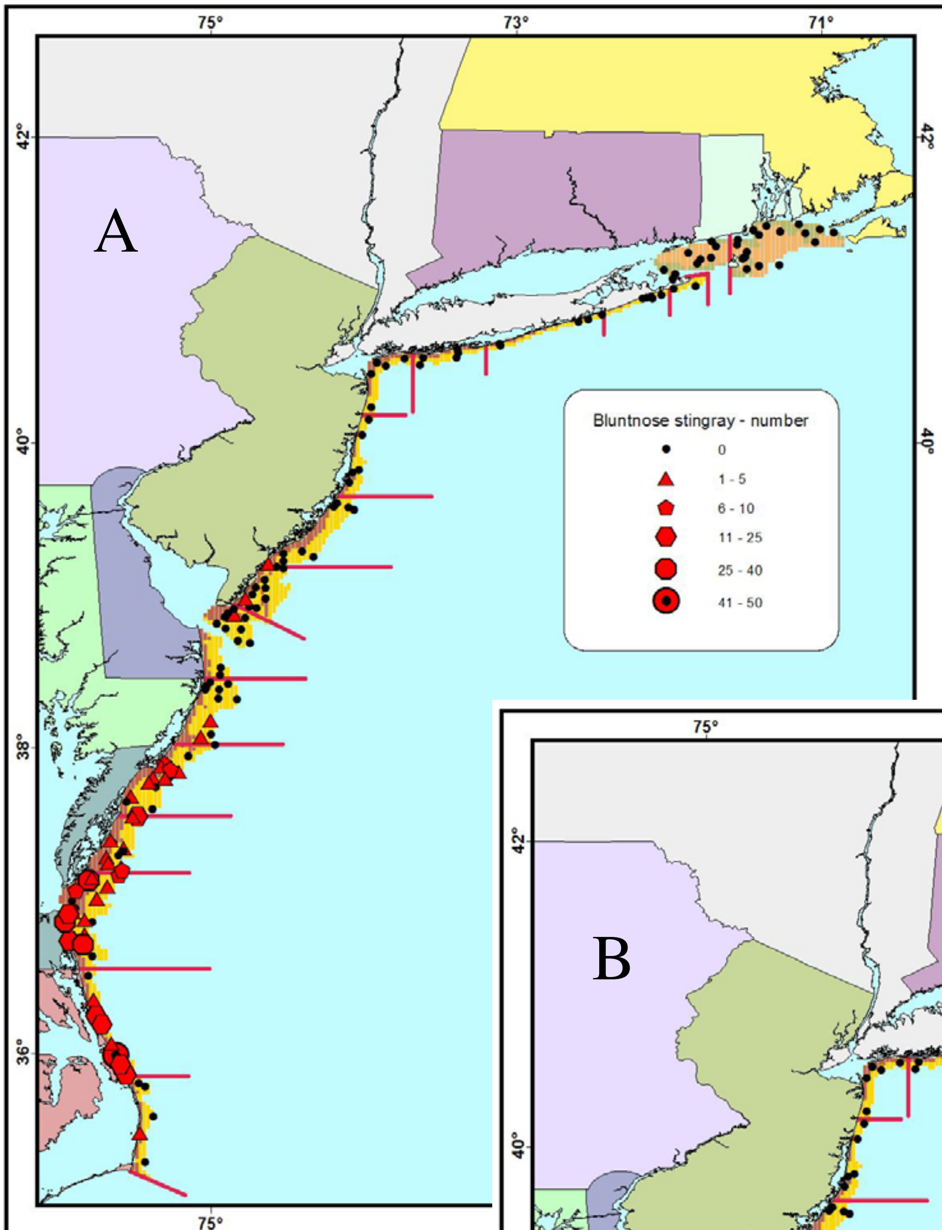


Figure 49. Diets of bluefish by percent weight (A) and percent number (B).





Bluntnose Stingray (Priority B)



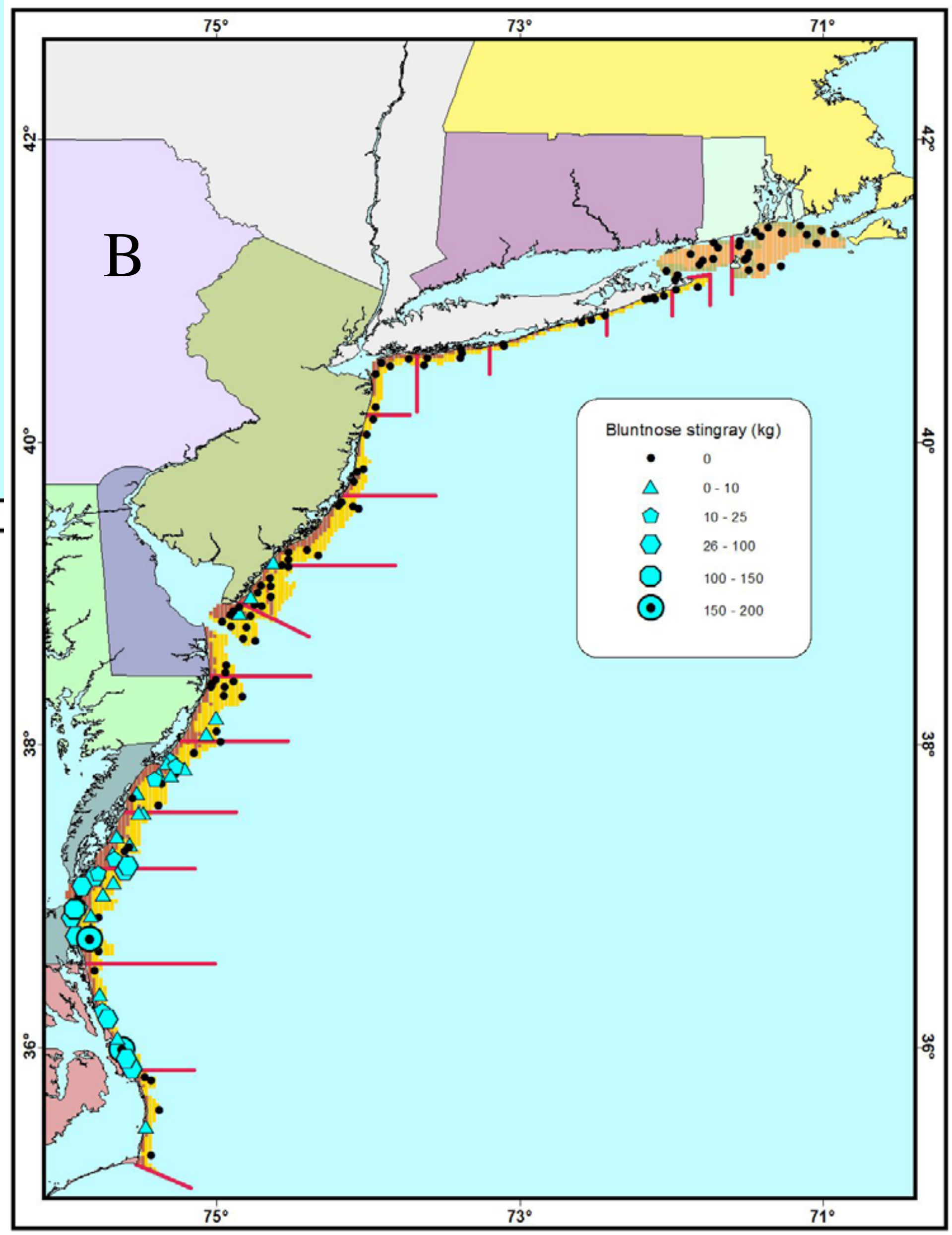


Figure 50. Number (A) and biomass (B) of specimens captured at each station for bluntnose stingray.

Figure 51. Minimum trawlable number and biomass by state for bluntnose stingray.

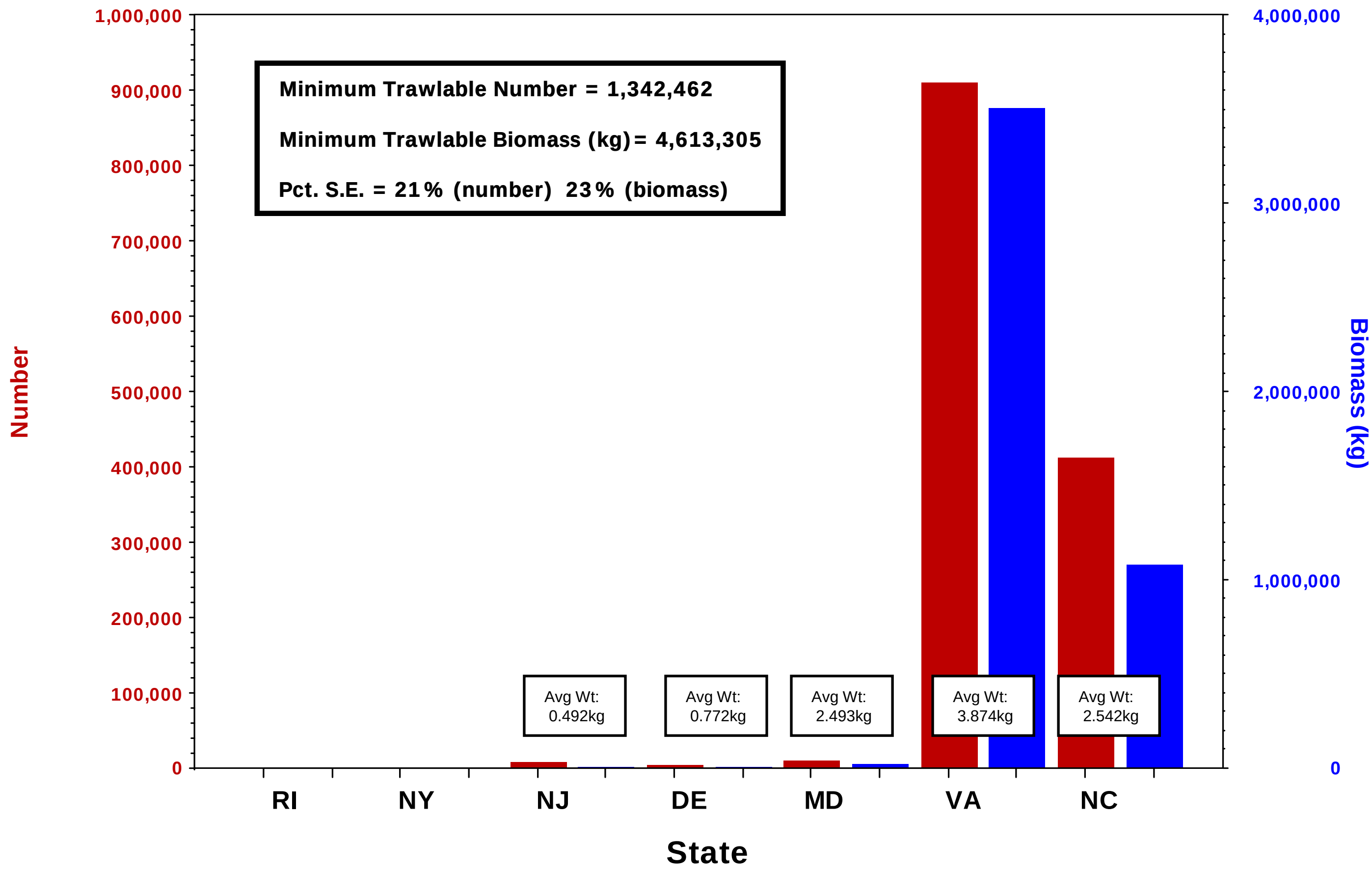
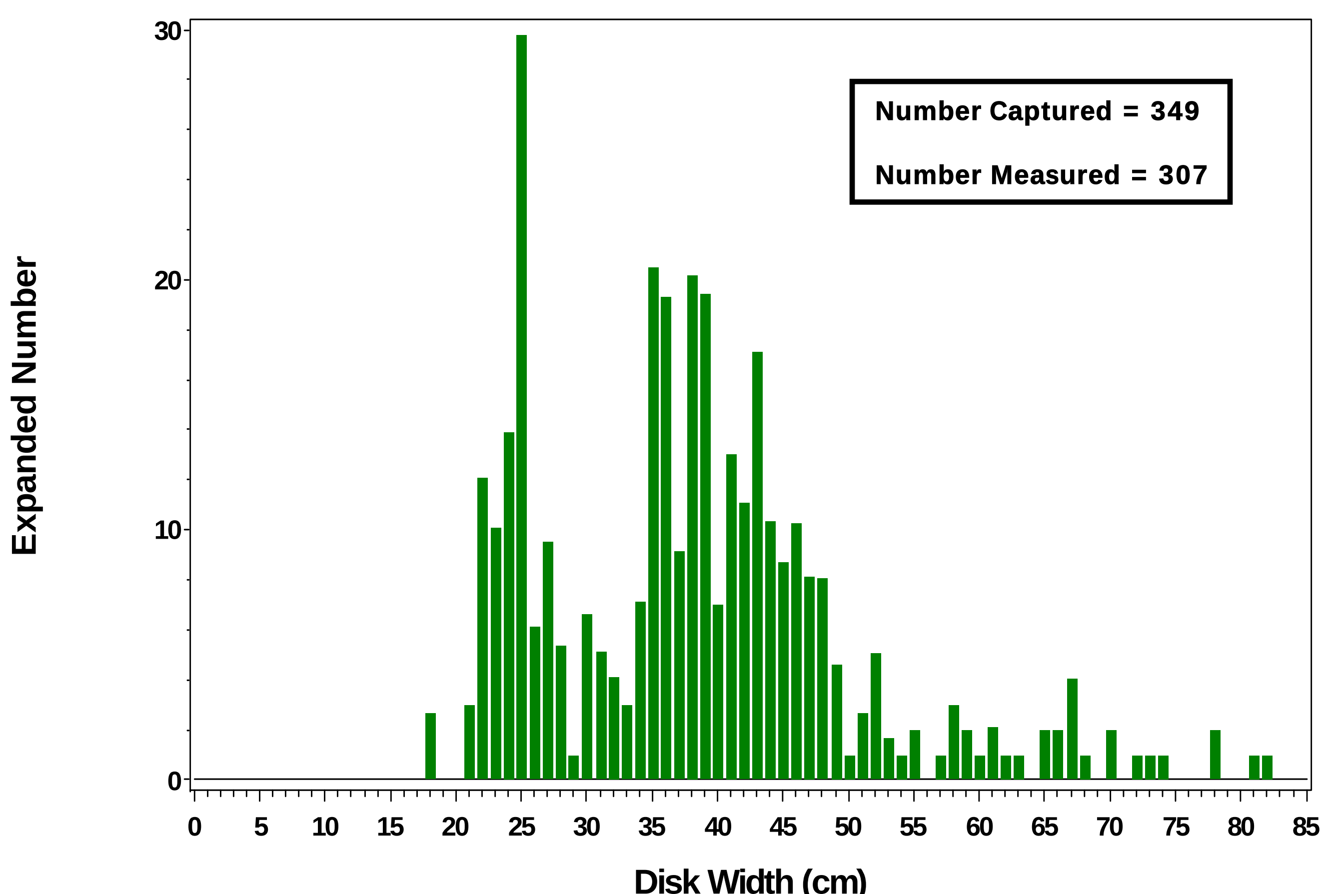
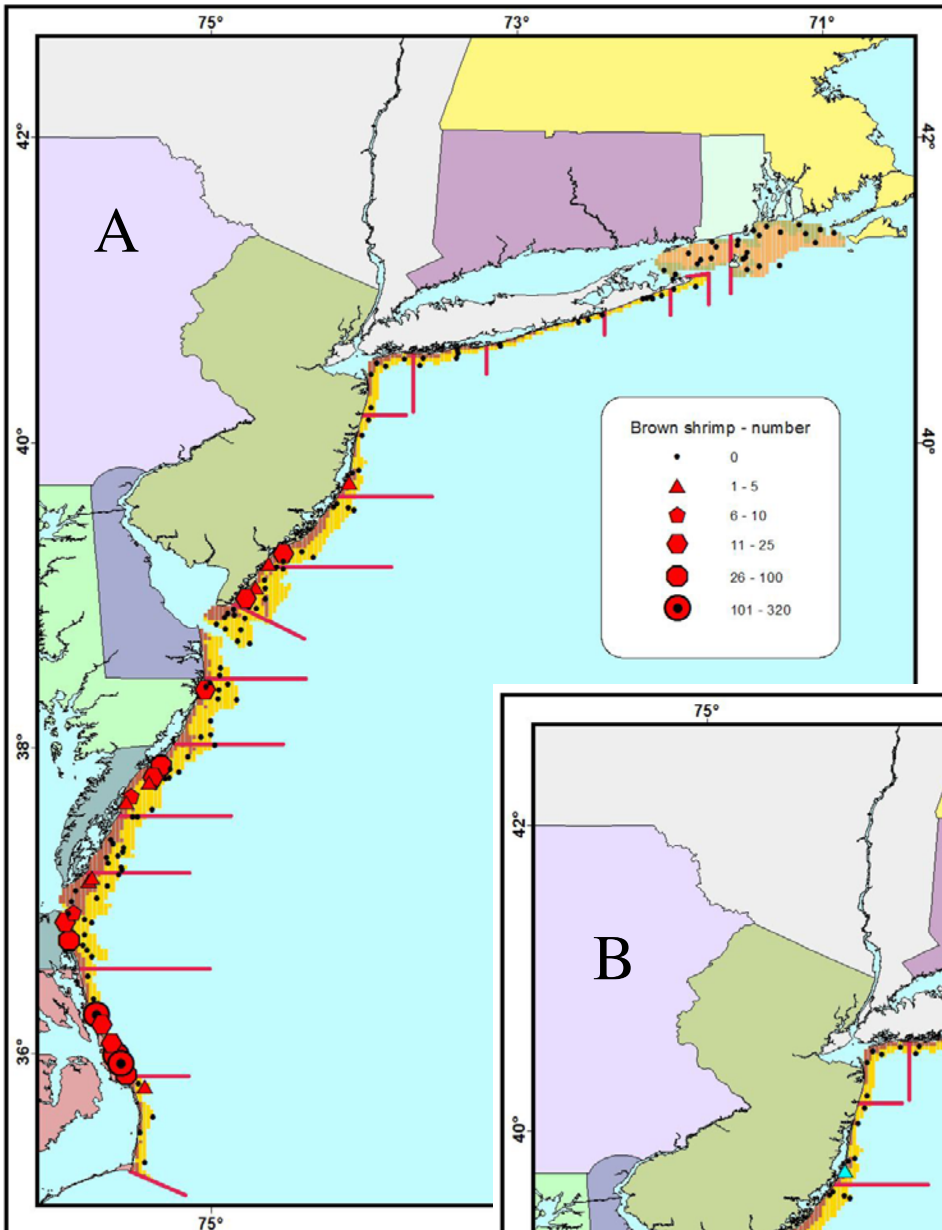


Figure 52. Width frequency histogram for bluntnose stingray.



Brown Shrimp (Priority E)



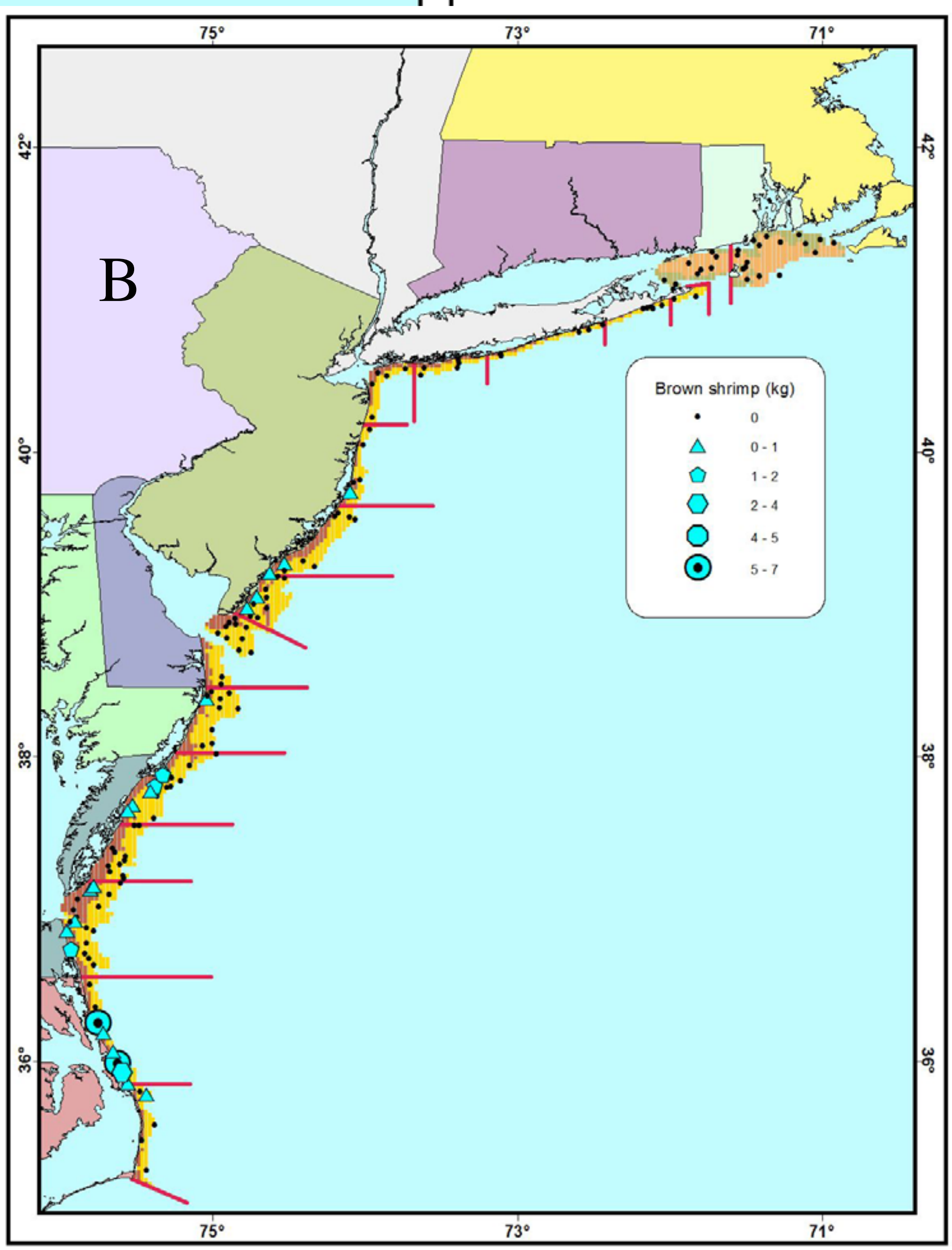


Figure 53. Number (A) and biomass (B) of specimens captured at each station for brown shrimp.

Figure 54. Minimum trawlable number and biomass by state for brown shrimp.

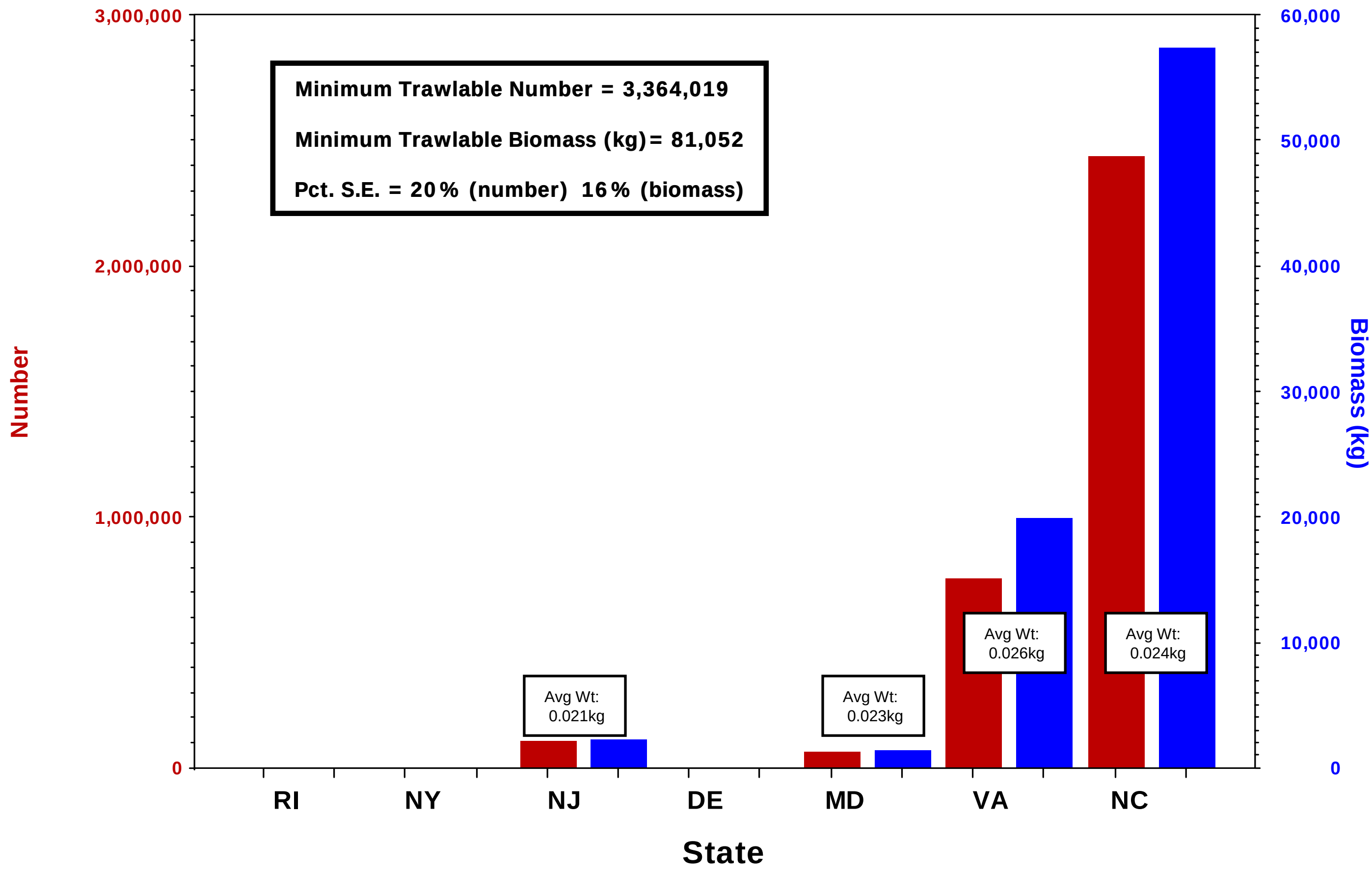
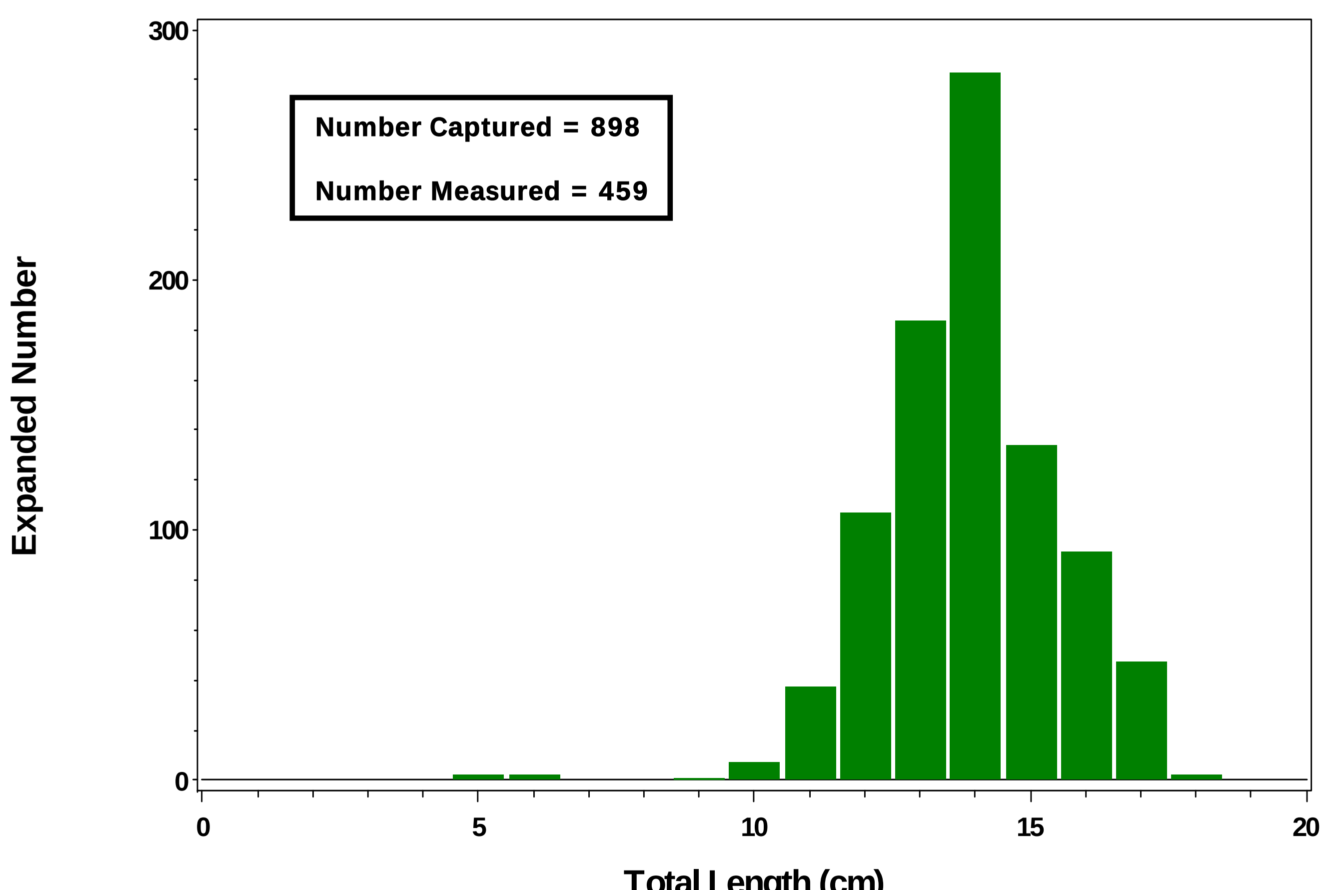


Figure 55. Length frequency histogram for brown shrimp.



Bullnose Stingray (Priority B)

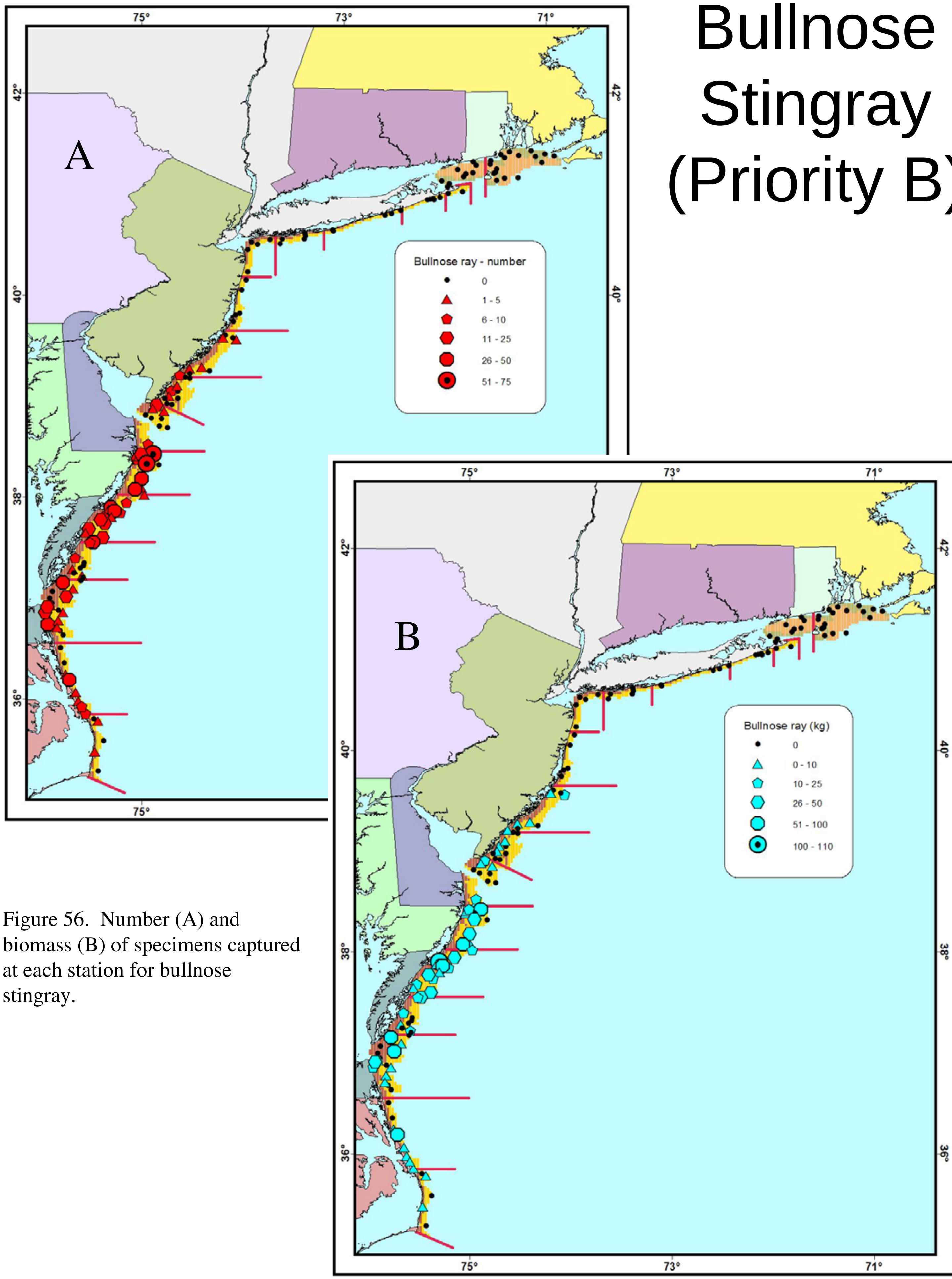


Figure 56. Number (A) and biomass (B) of specimens captured at each station for bullnose stingray.

Figure 57. Minimum trawlable number and biomass by state for bullnose stingray.

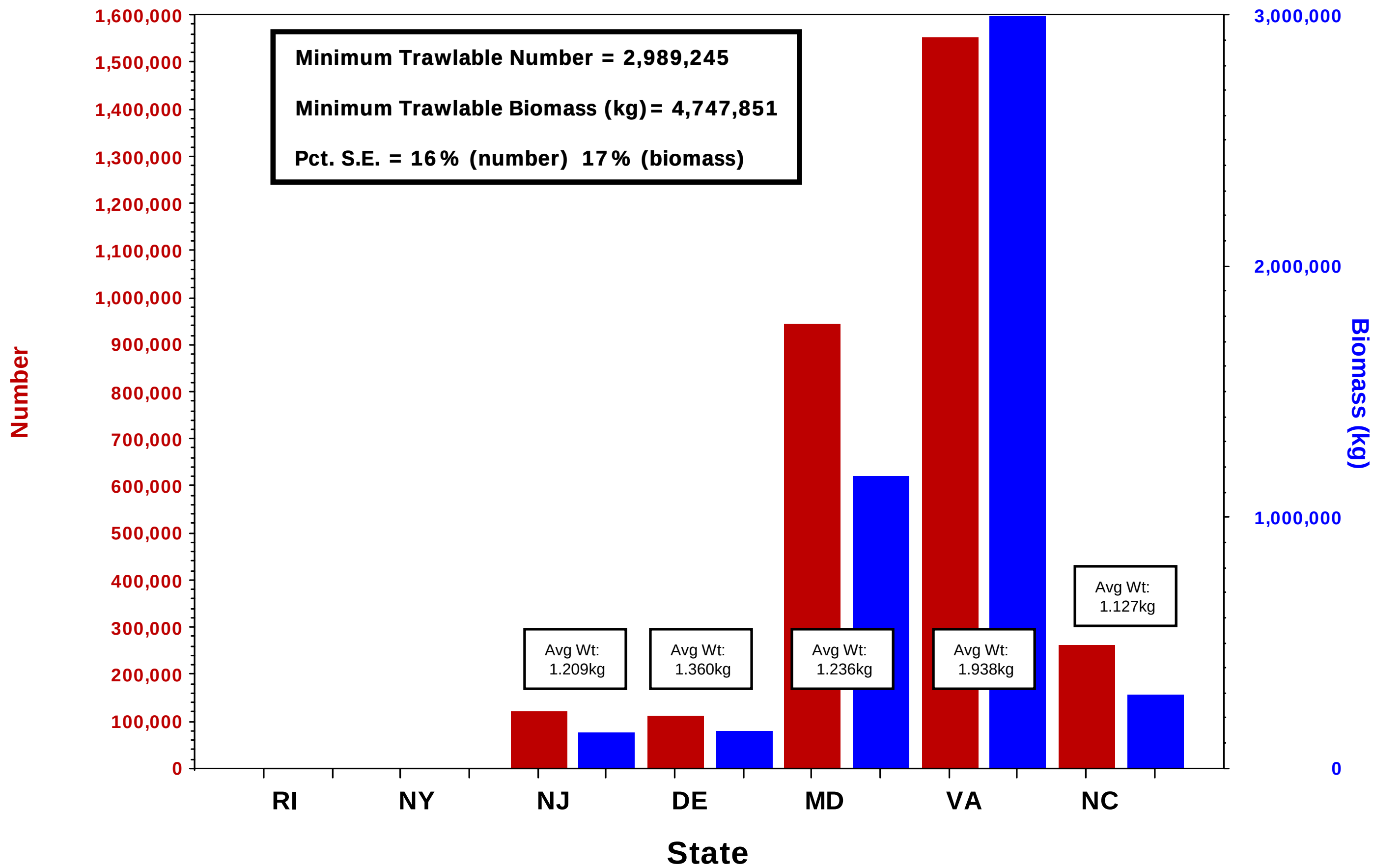
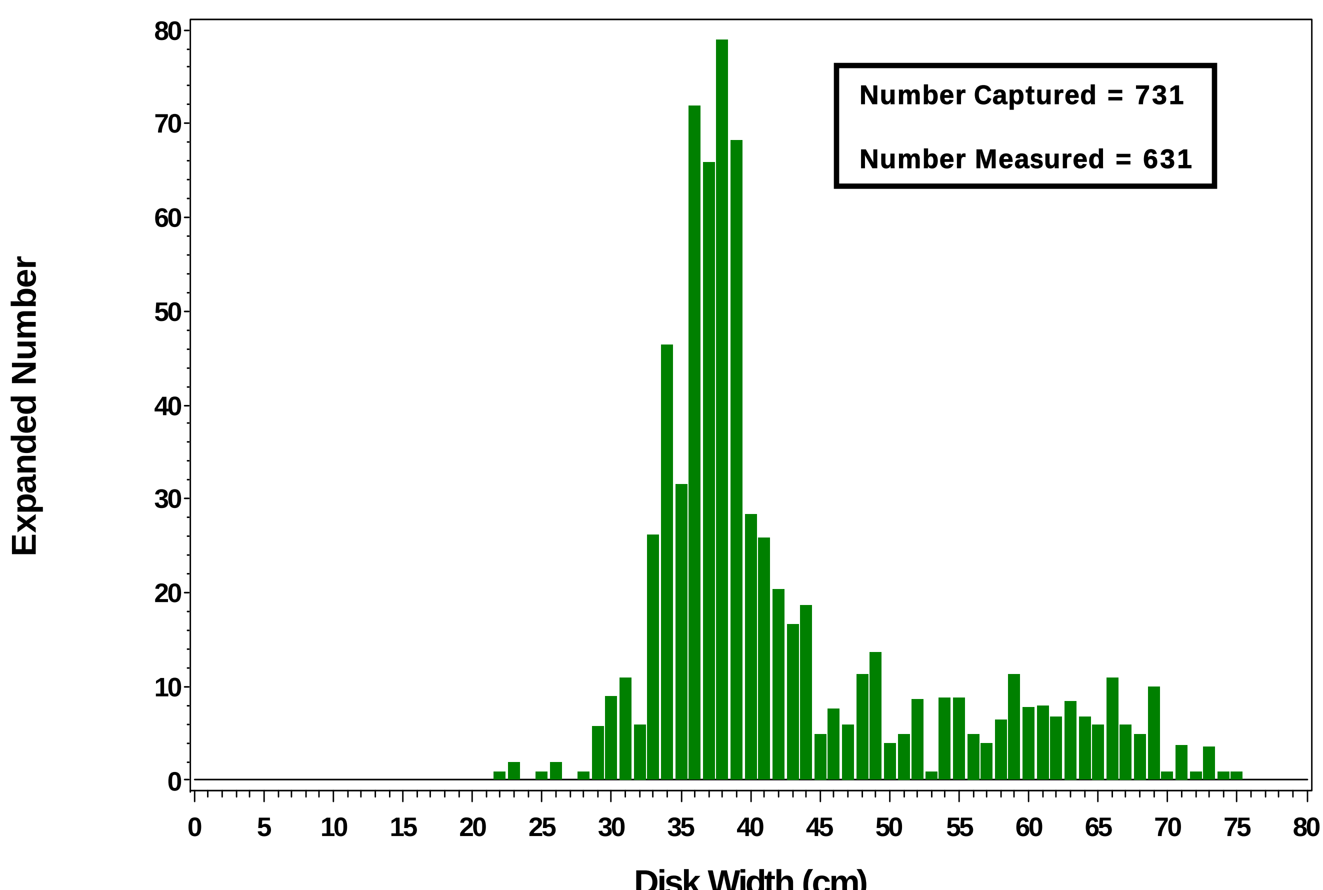
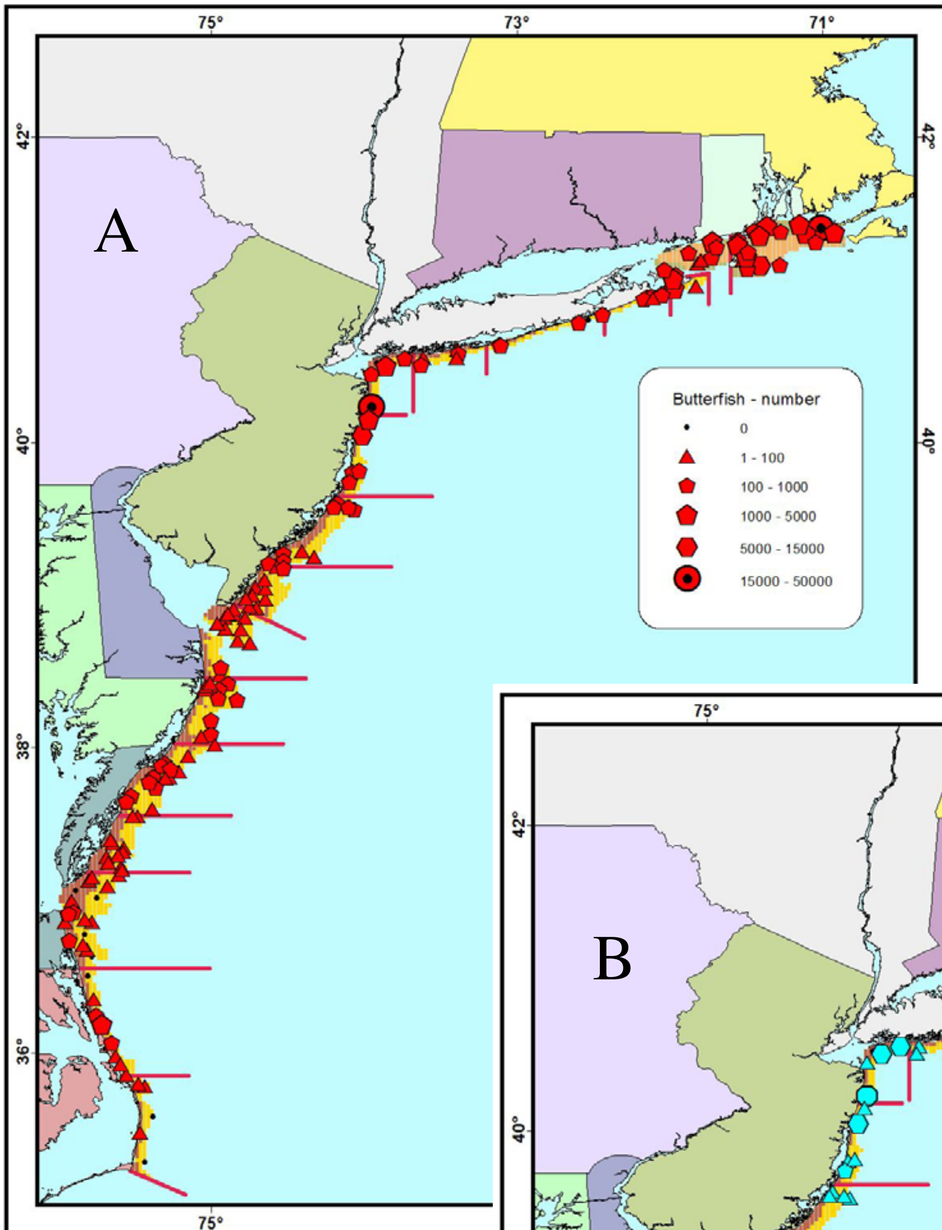


Figure 58. Width frequency histogram for bullnose stingray.



Butterfish (Priority A)



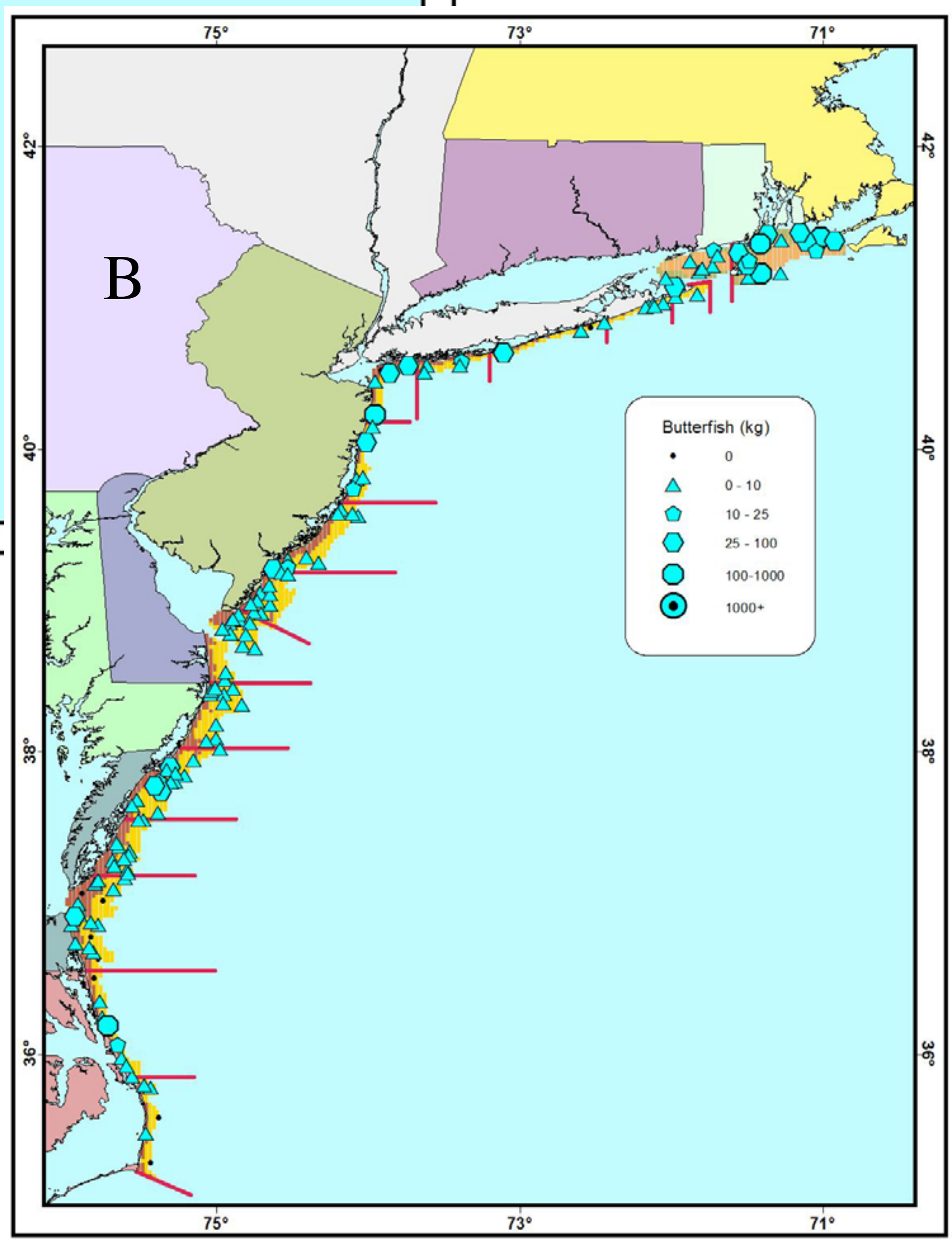


Figure 59. Number (A) and biomass (B) of specimens captured at each station for butterfish.

Figure 60. Minimum trawlable number and biomass by state for butterfish.

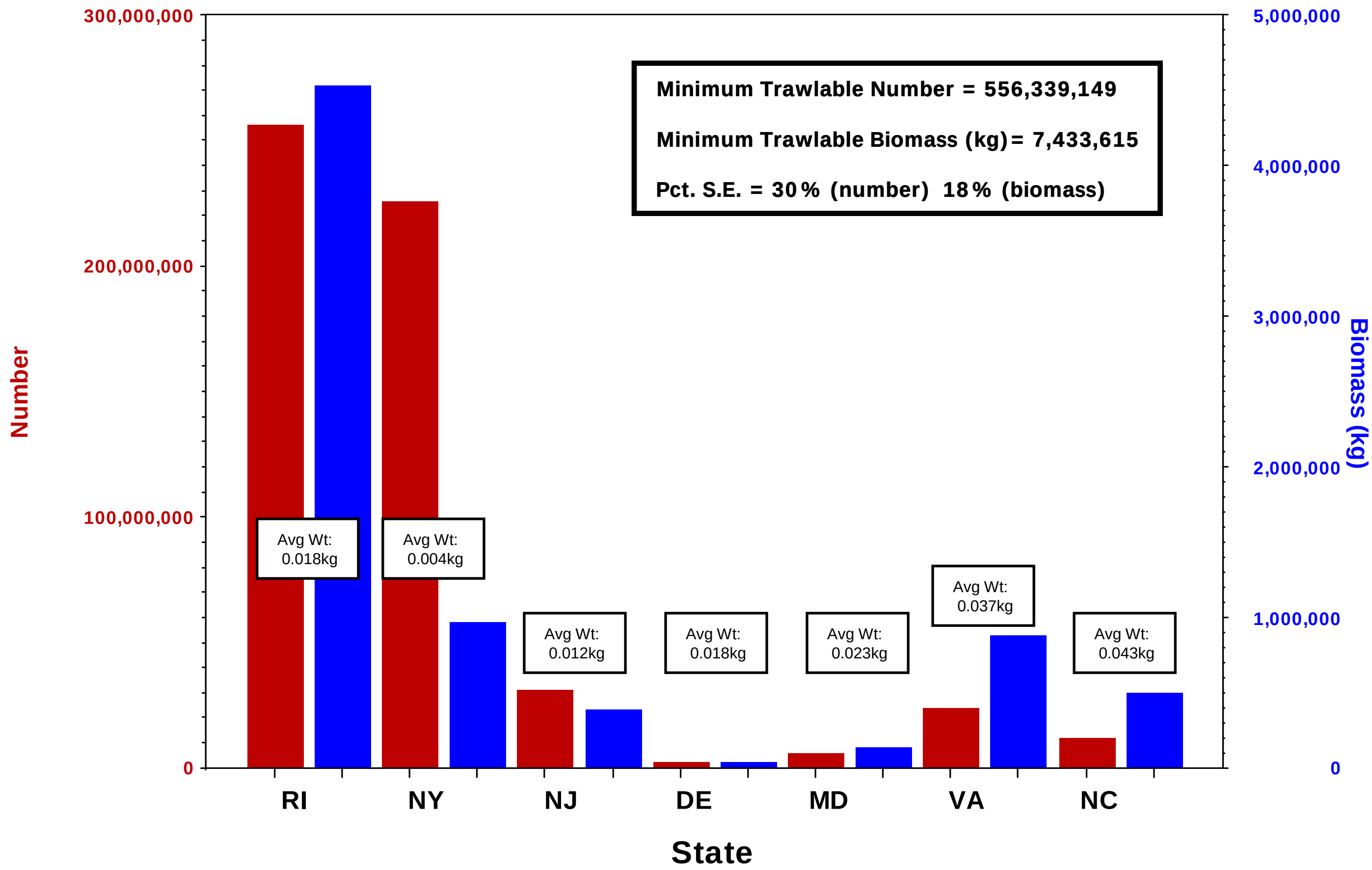


Figure 61. Length frequency histogram for butterfish.

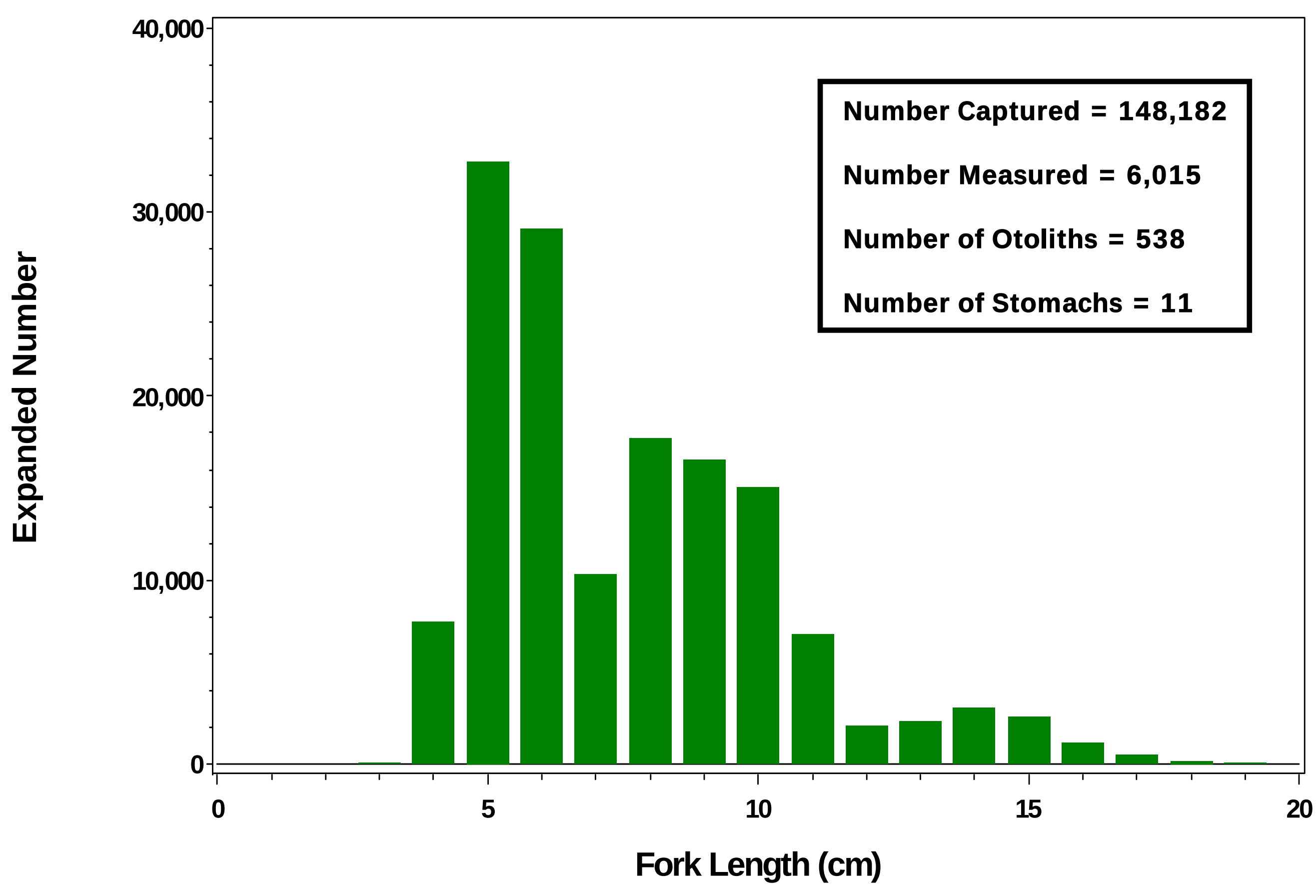


Figure 62. Sex ratios for butterfish, by state (A) and length group (B).

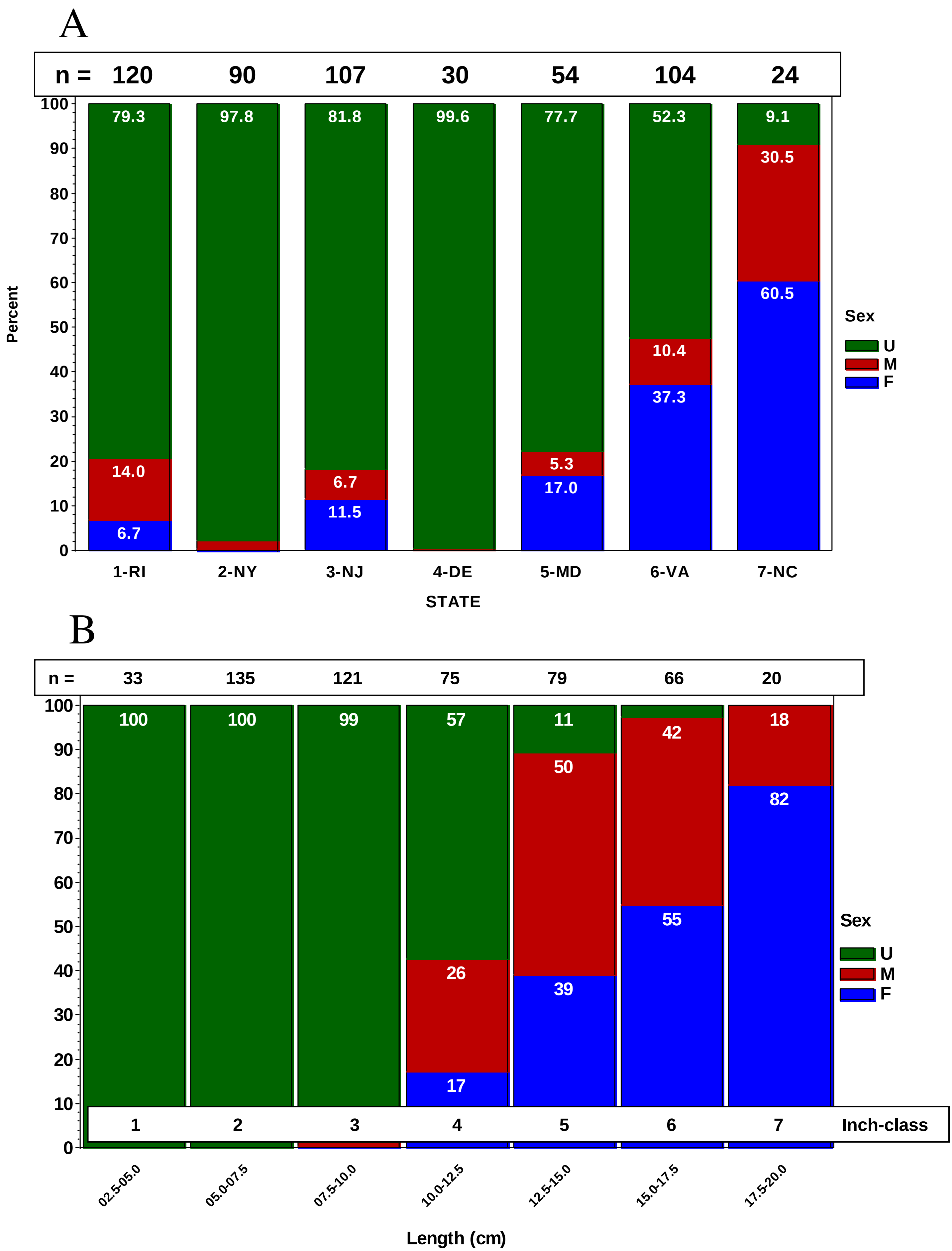


Figure 63. Maturity logistic regression for butterfish, by sex.

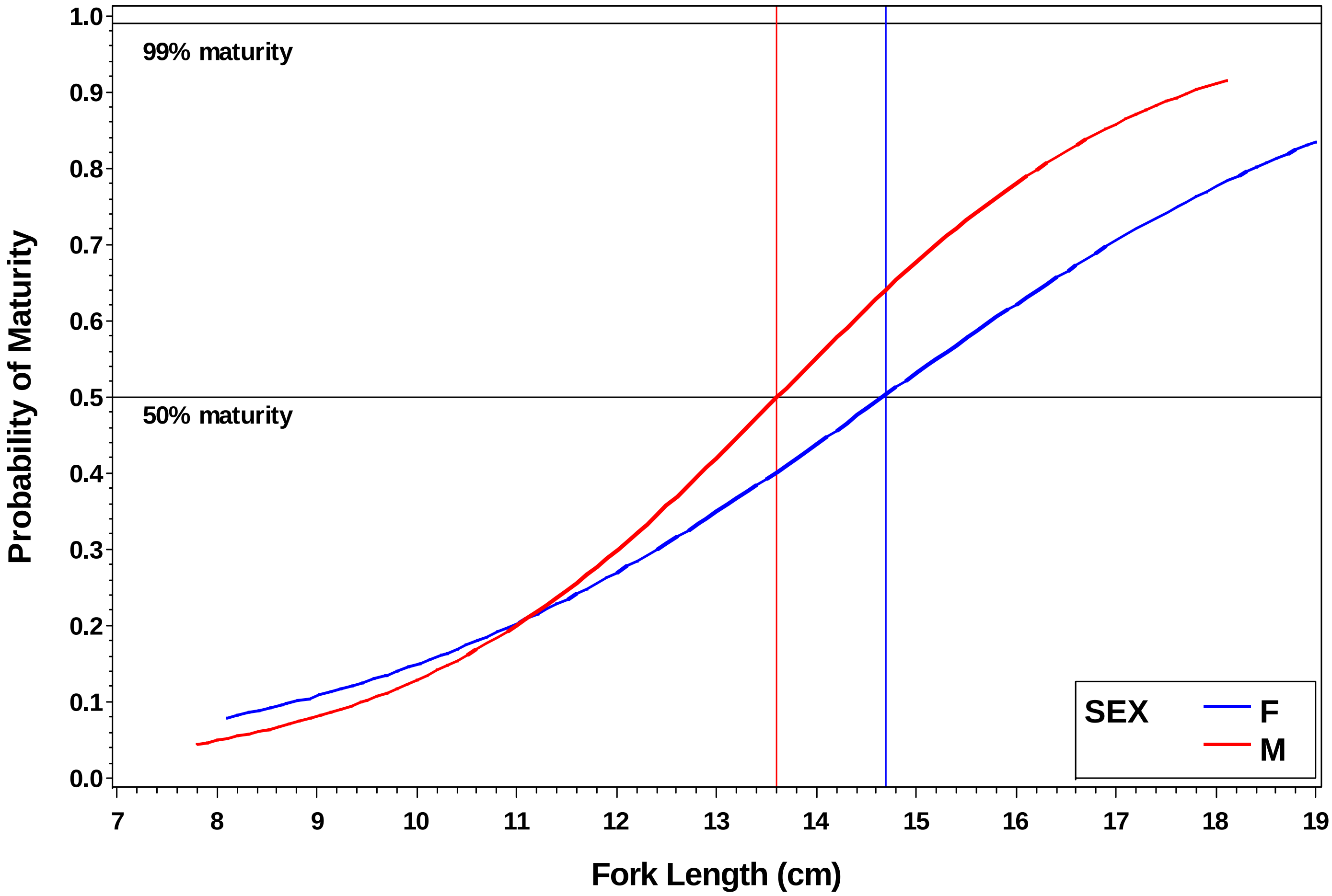
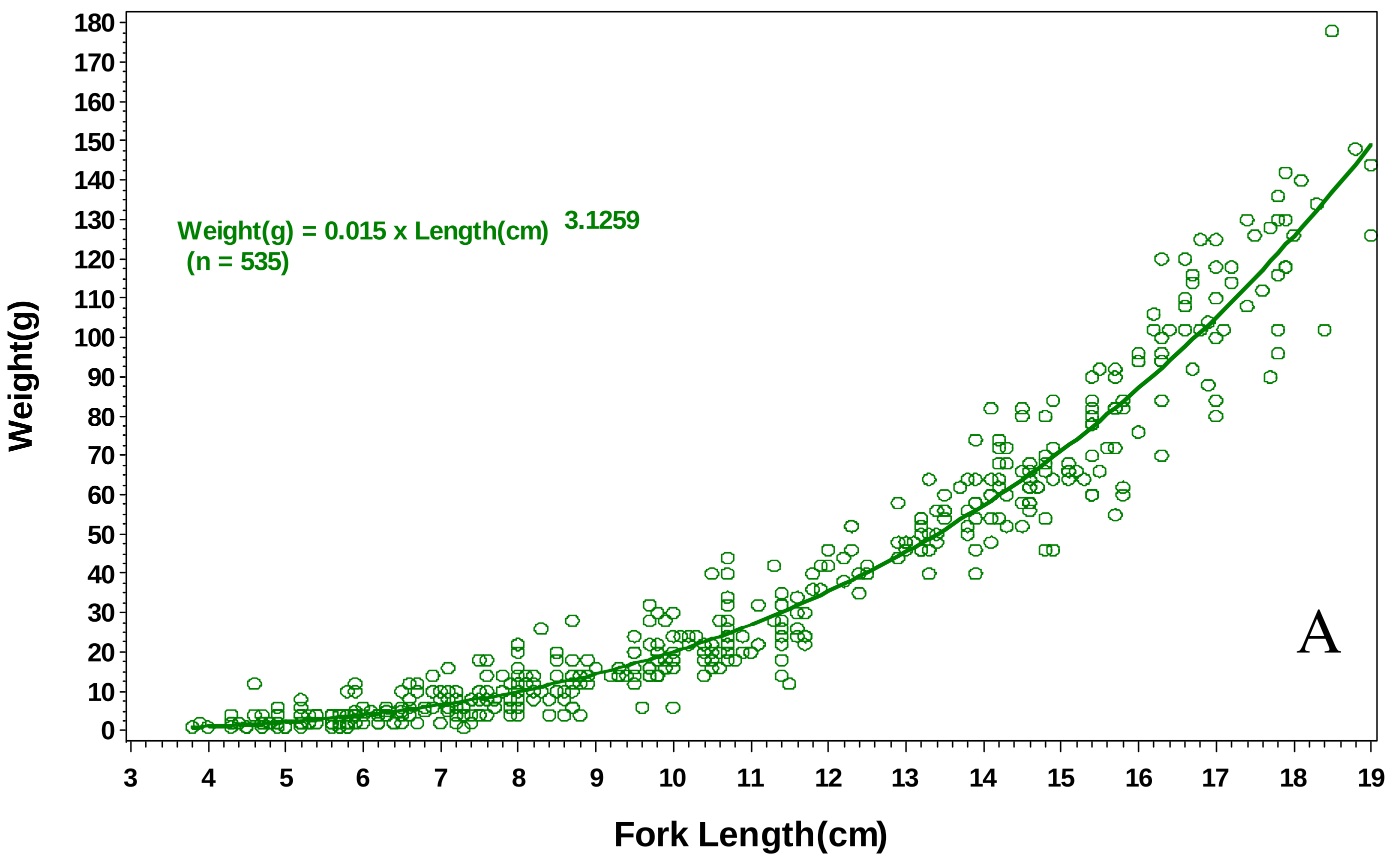
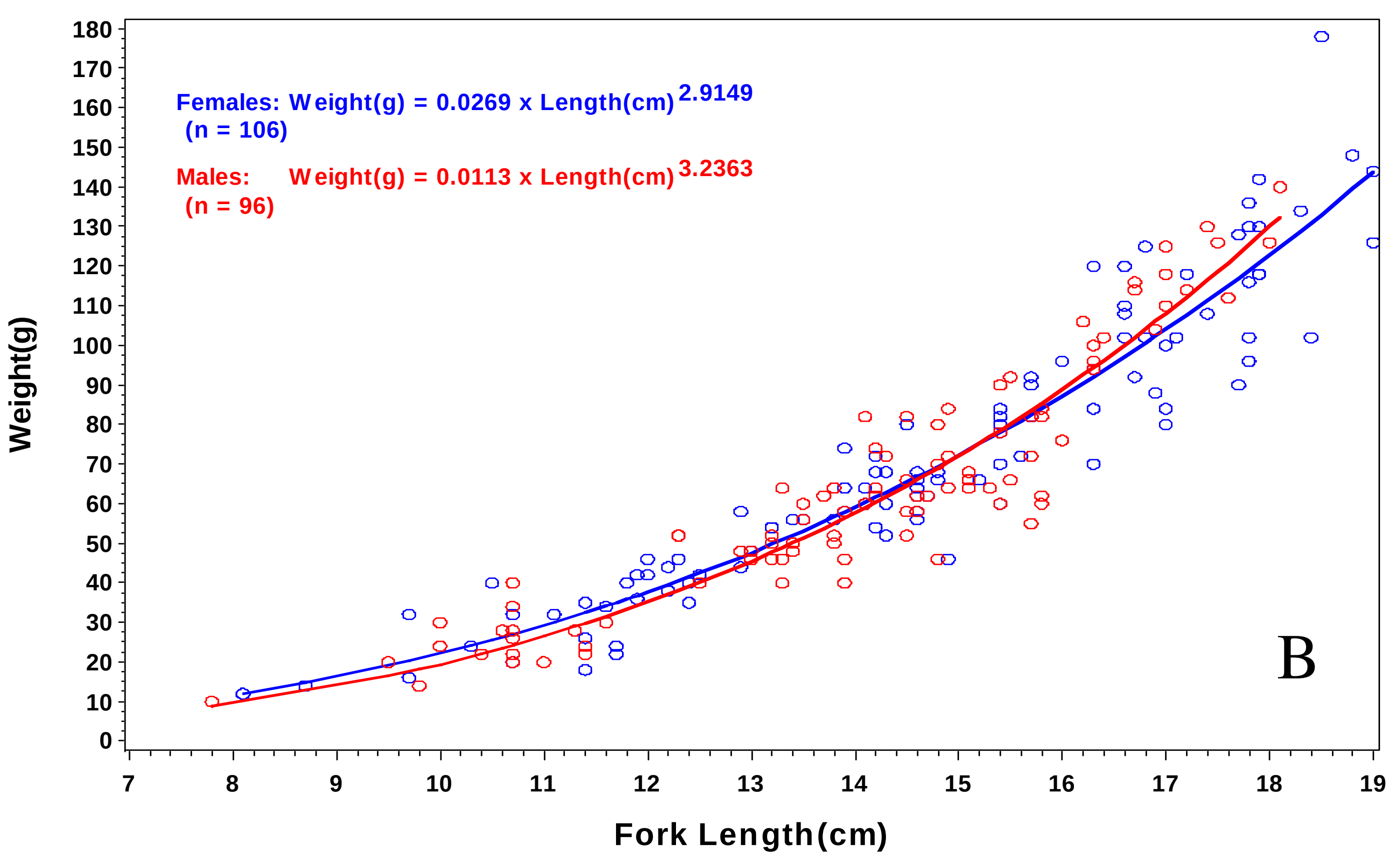
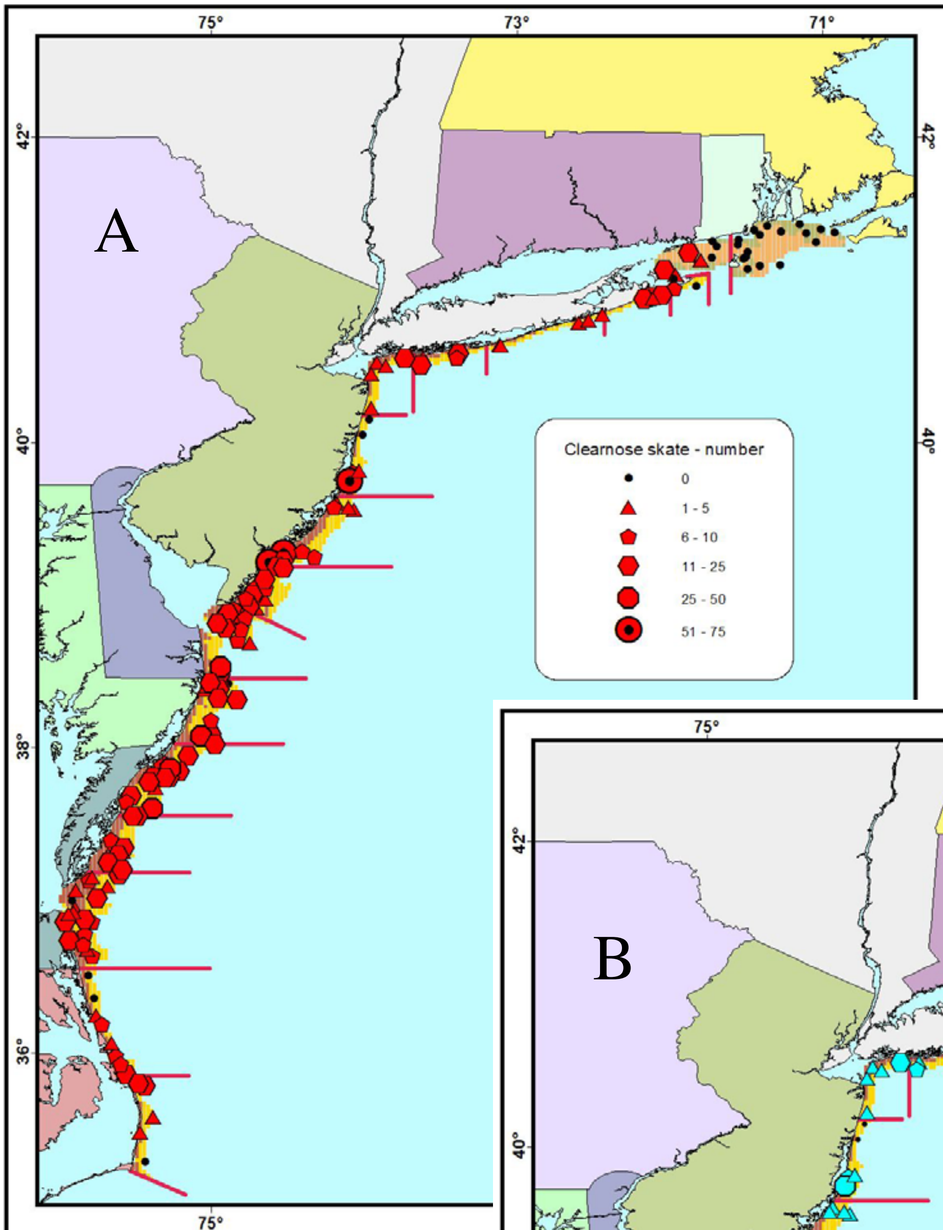


Figure 64. Length-weight regression for butterfish, sexes combined (A) and by sex (B).





Clearnose Skate (Priority B)



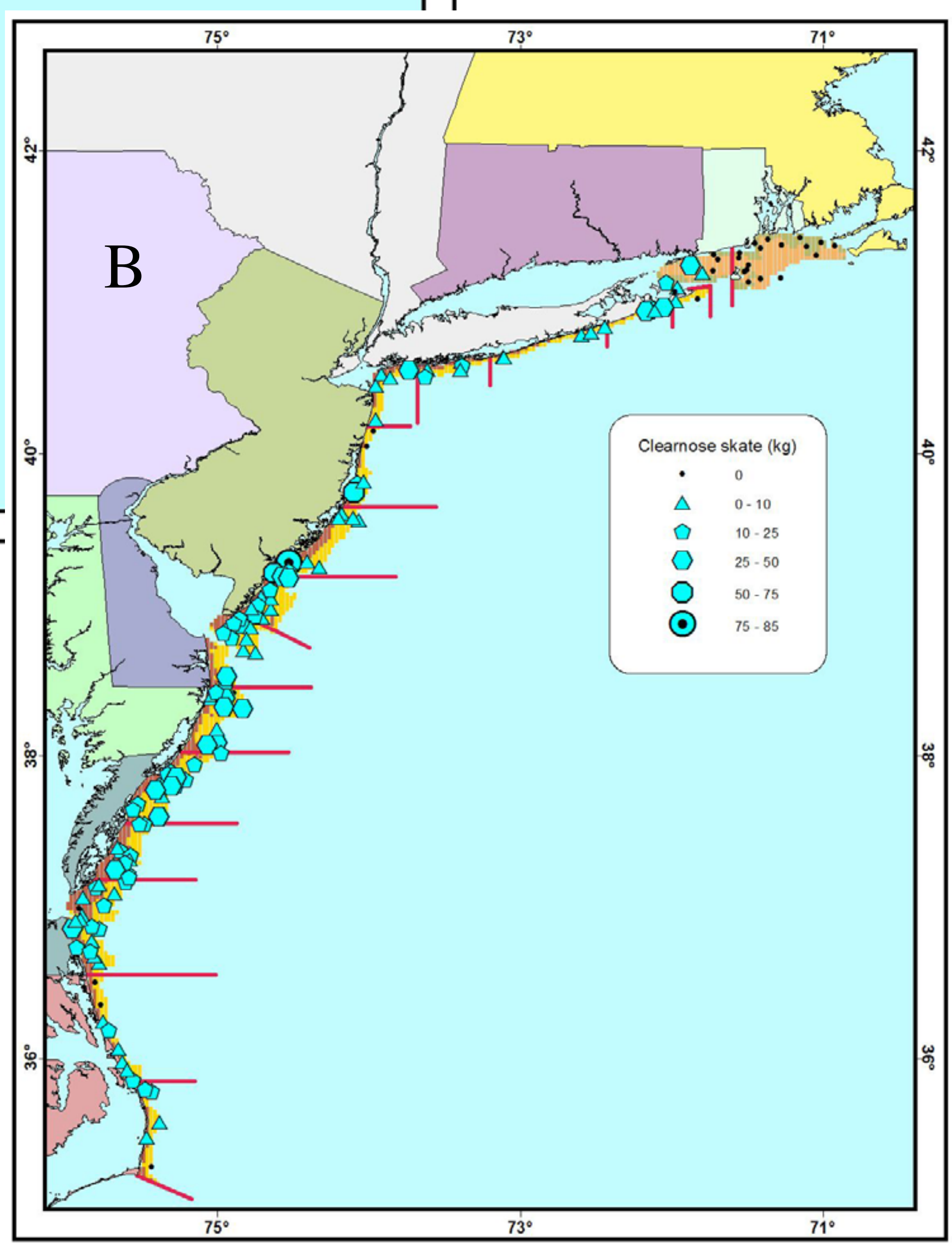


Figure 65. Number (A) and biomass (B) of specimens captured at each station for clearnose skate.

Figure 66. Minimum trawlable number and biomass by state for clearnose skate.

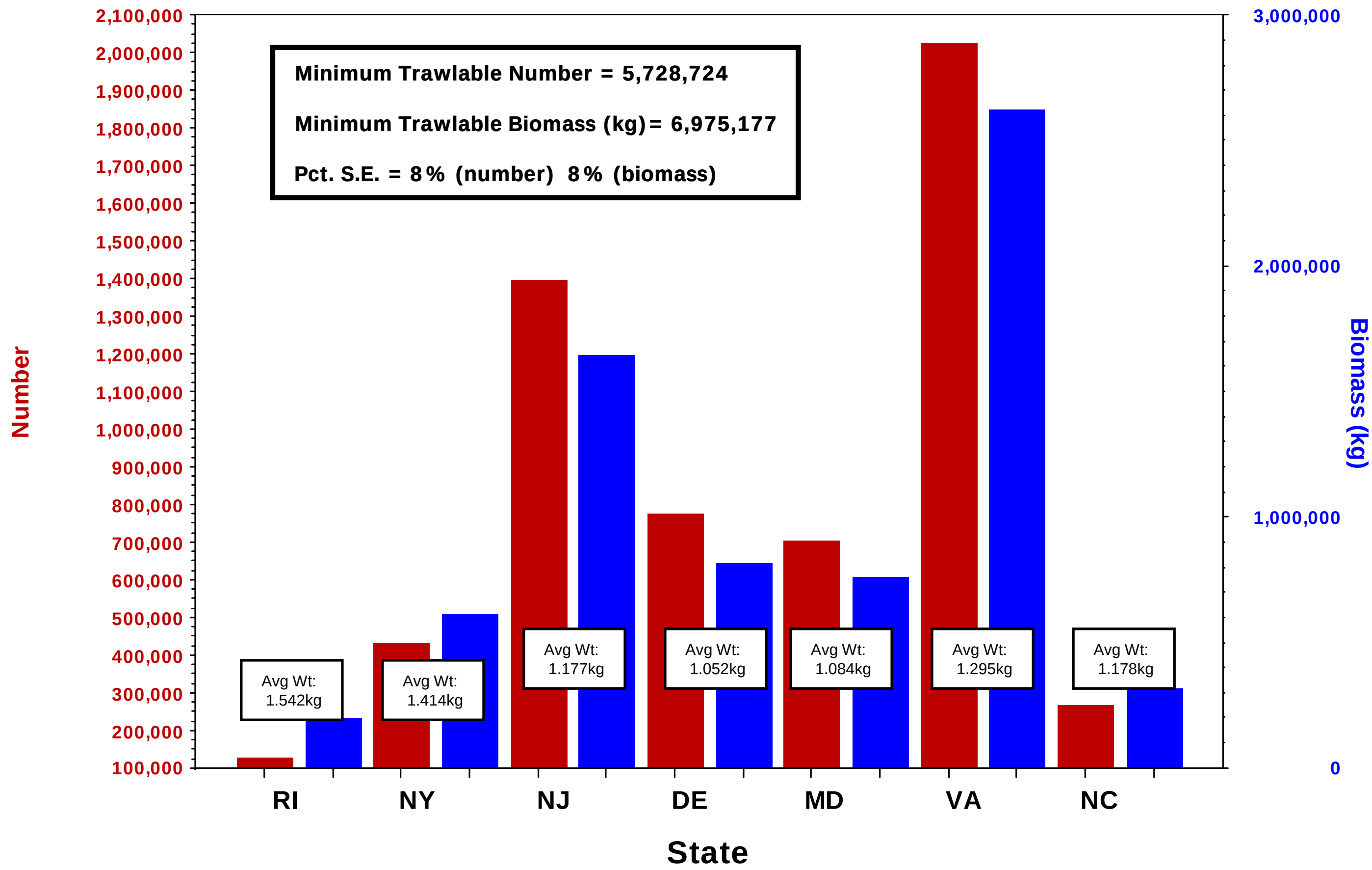


Figure 67. Width frequency histogram for clearnose skate.

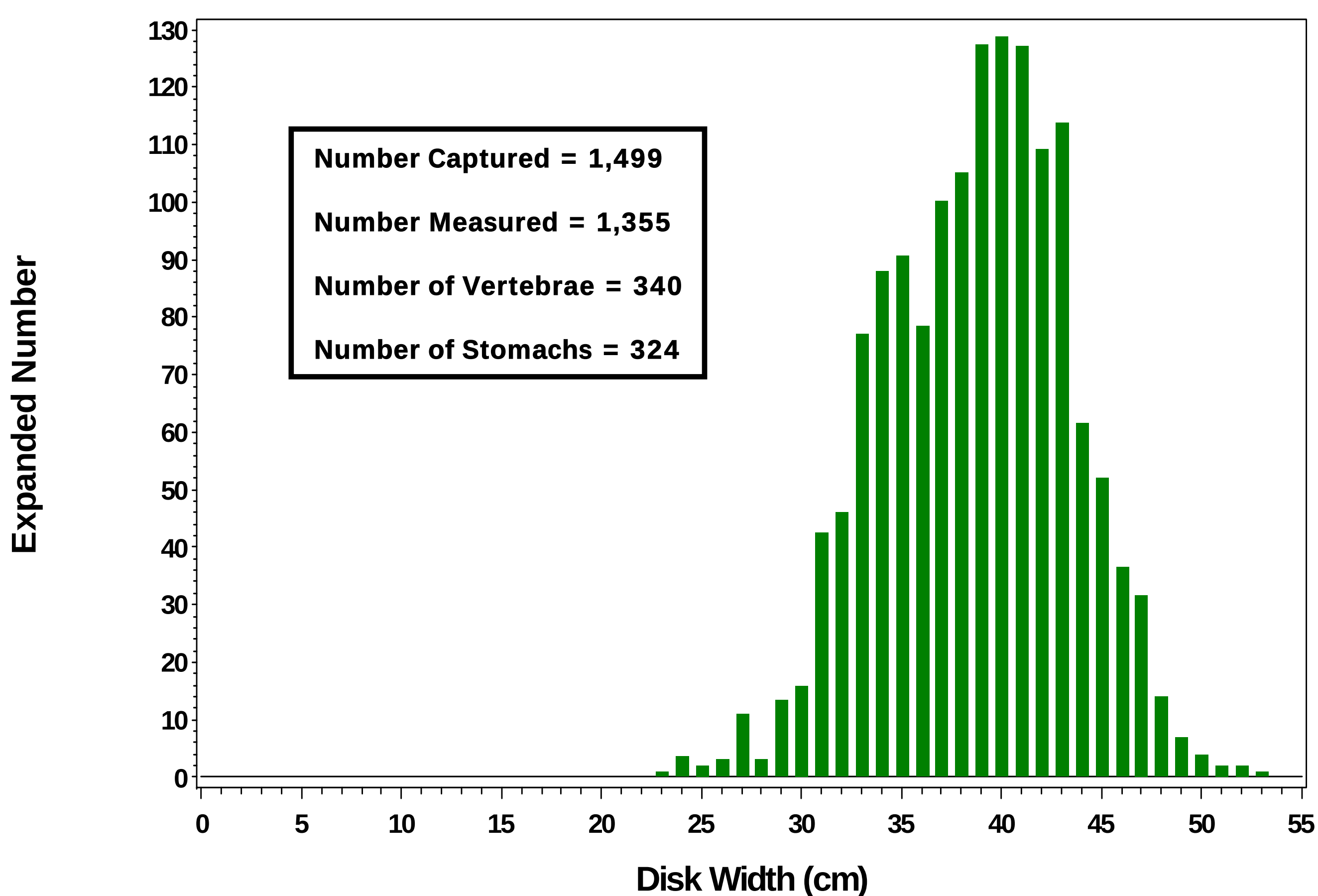


Figure 68. Sex ratios for clearnose skate, by state (A) and width group (B).

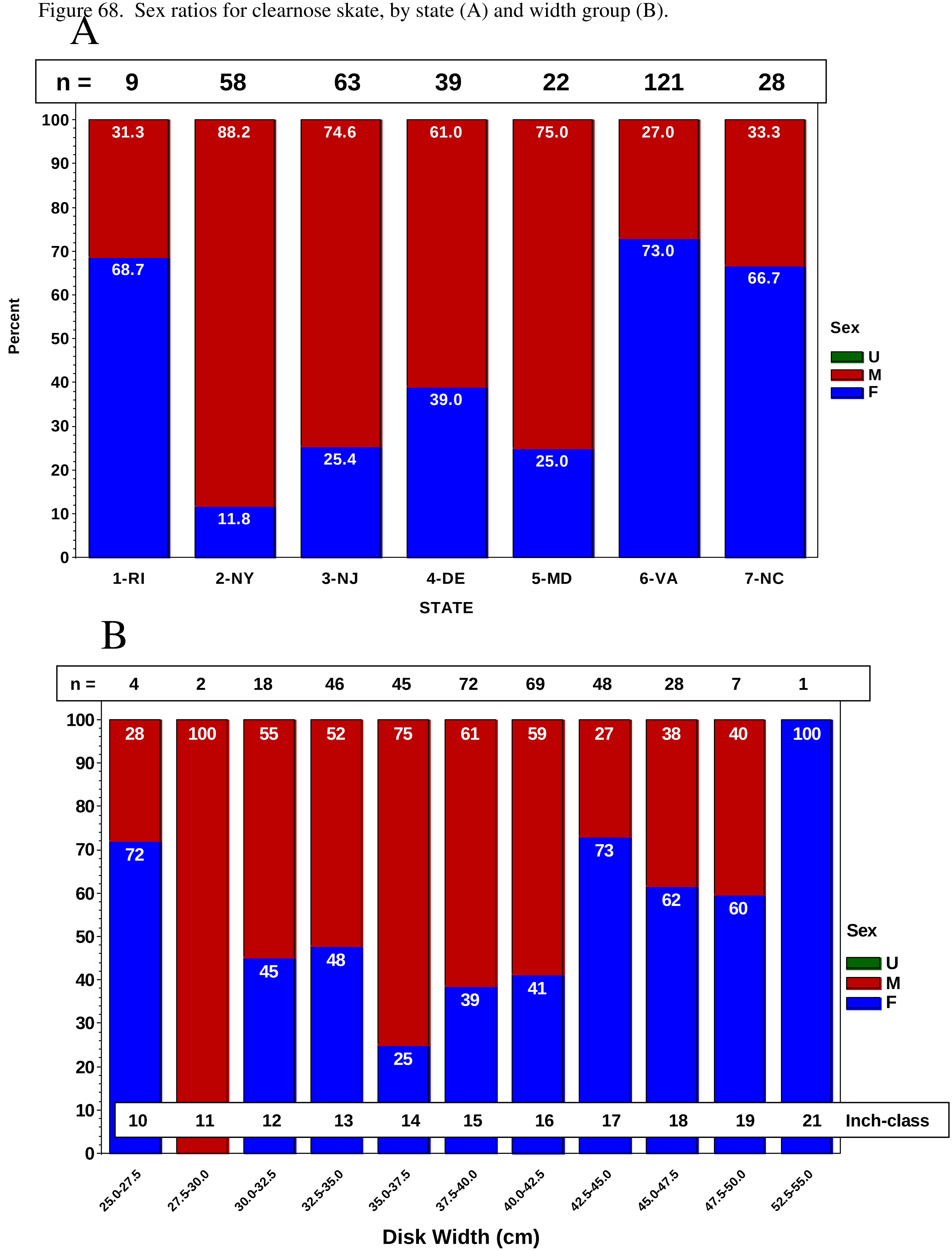


Figure 69. Maturity logistic regression for clearnose skate, by sex.

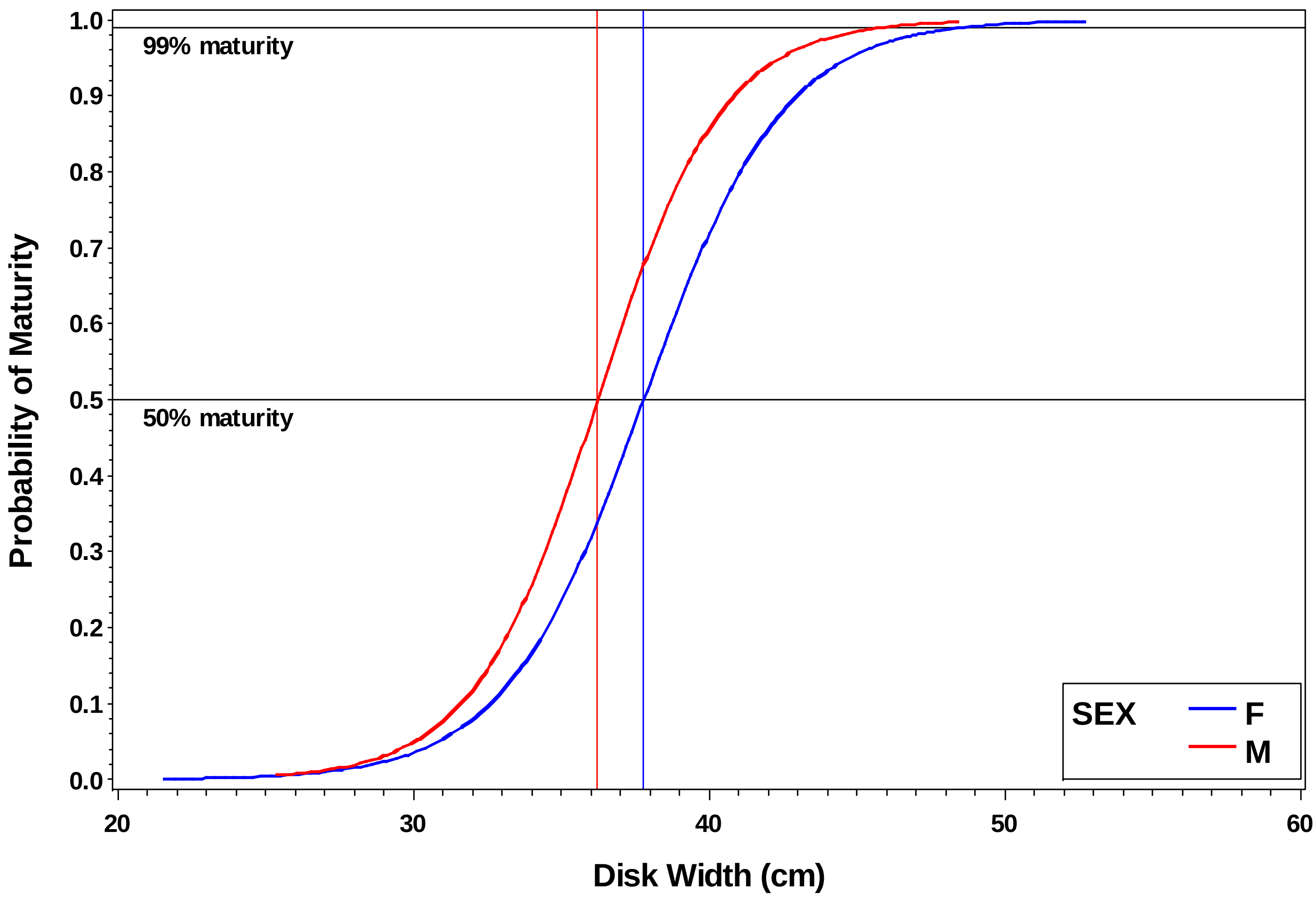
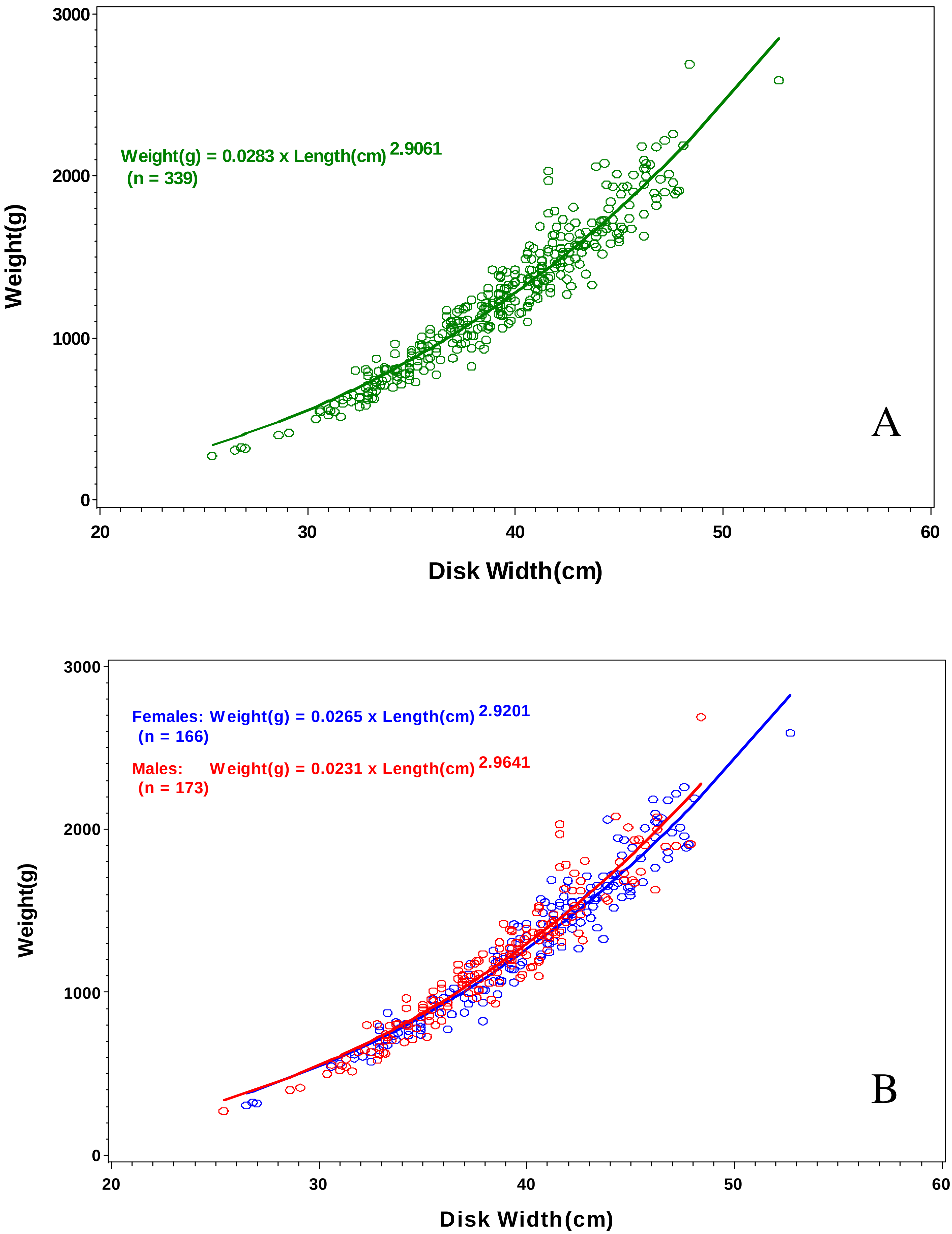
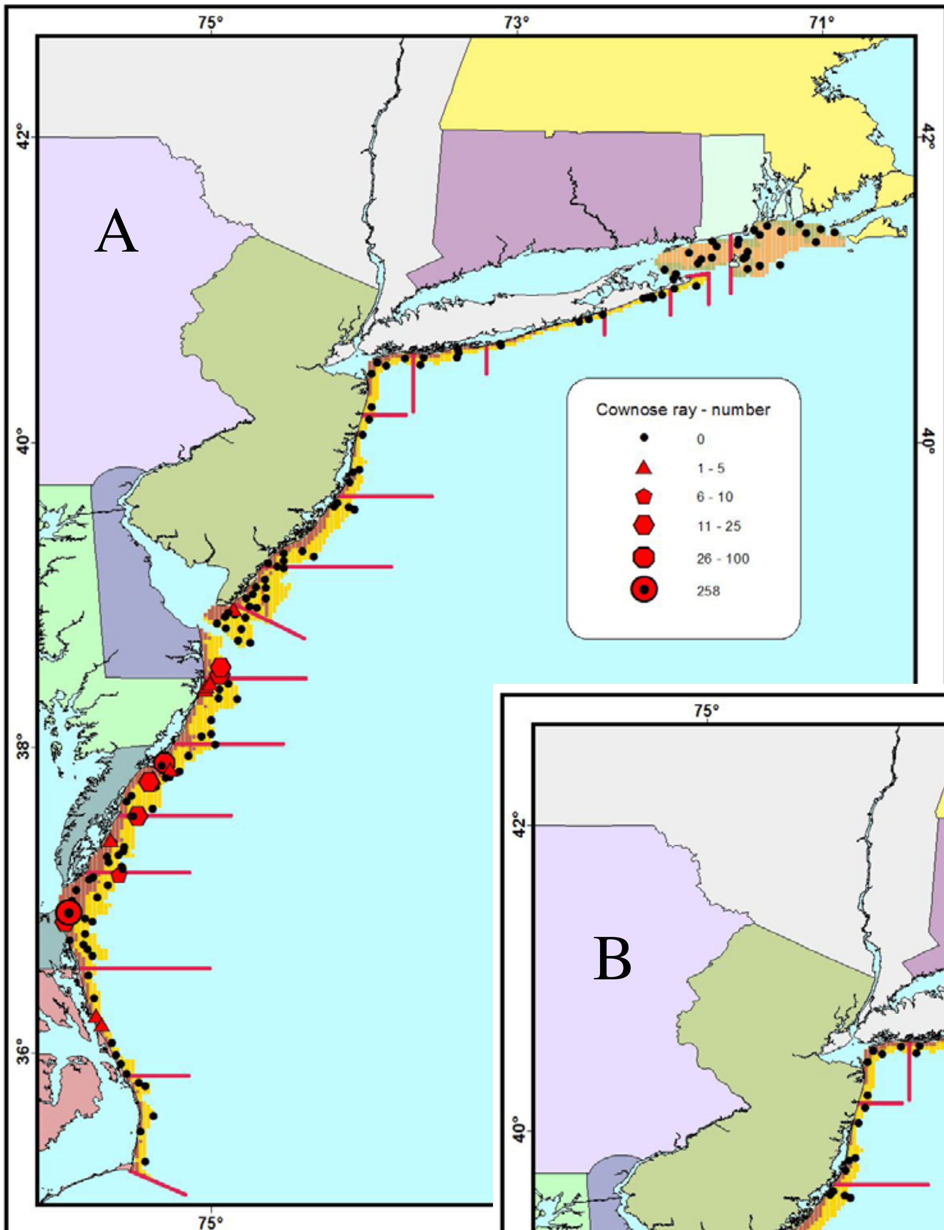


Figure 70. Width-weight regression for clearnose skate, sexes combined (A) and by sex (B).



Cownose Ray (Priority B)



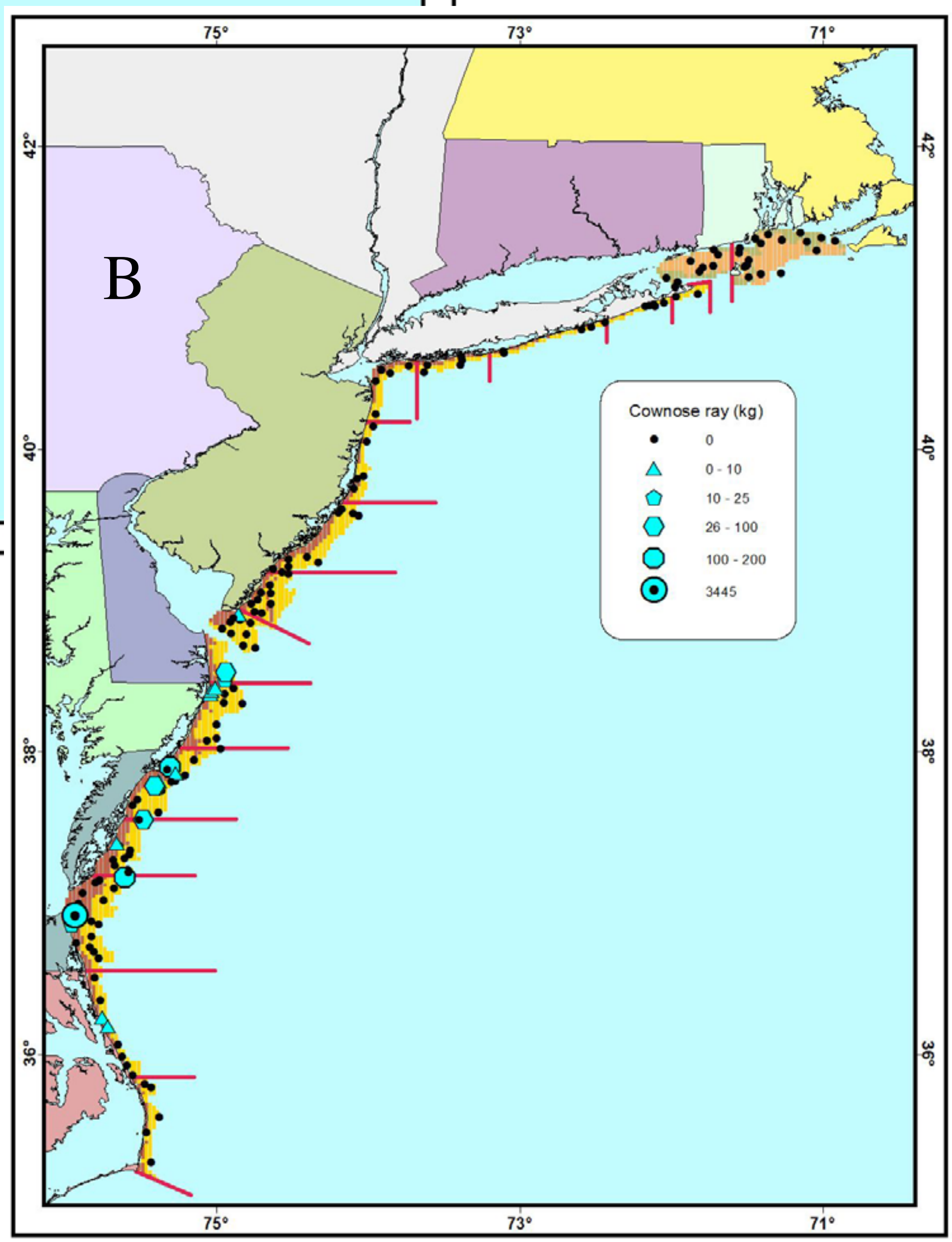


Figure 71. Number (A) and biomass (B) of specimens captured at each station for cownose ray.

Figure 72. Minimum trawlable number and biomass by state for cownose ray.

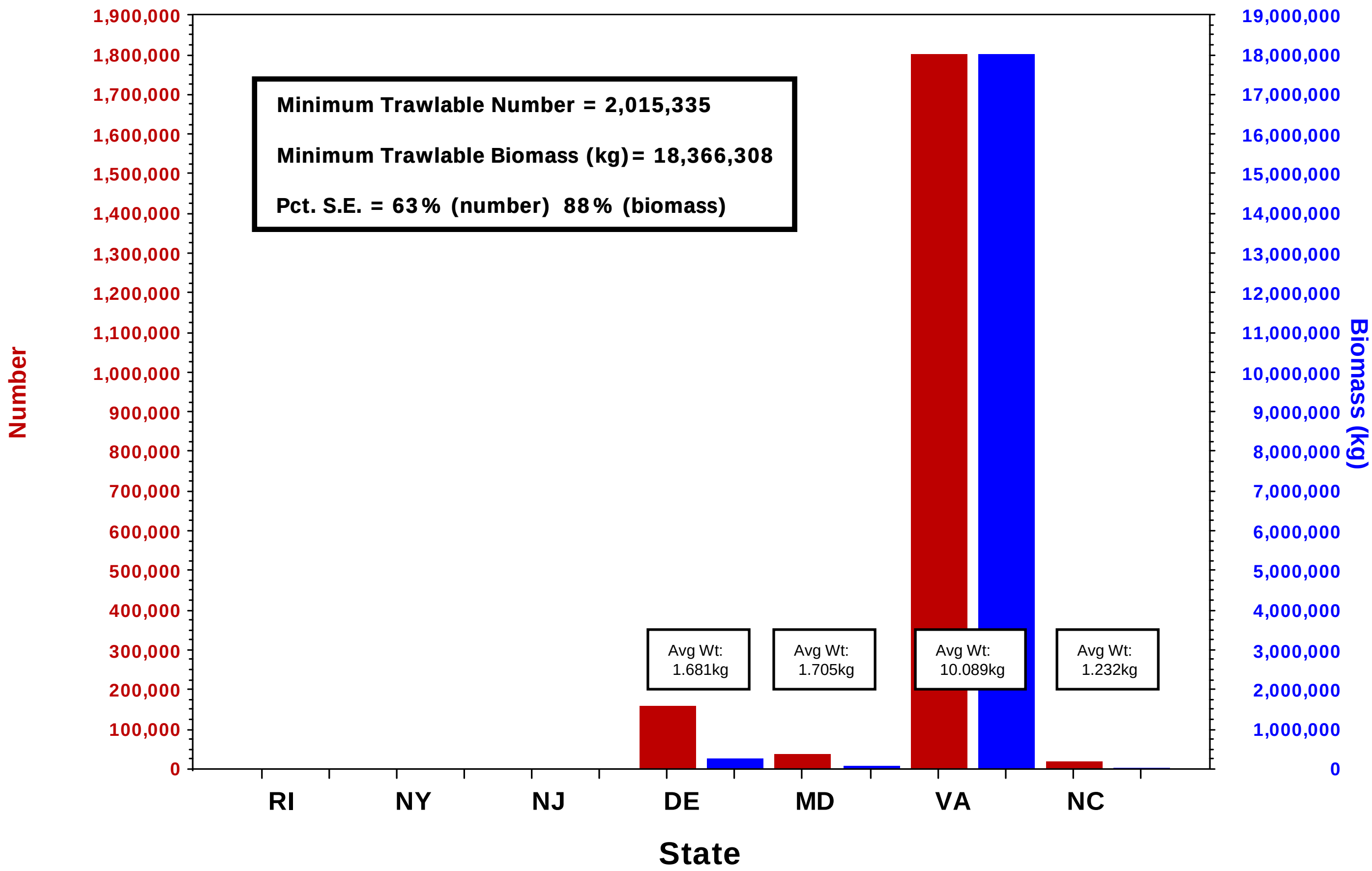
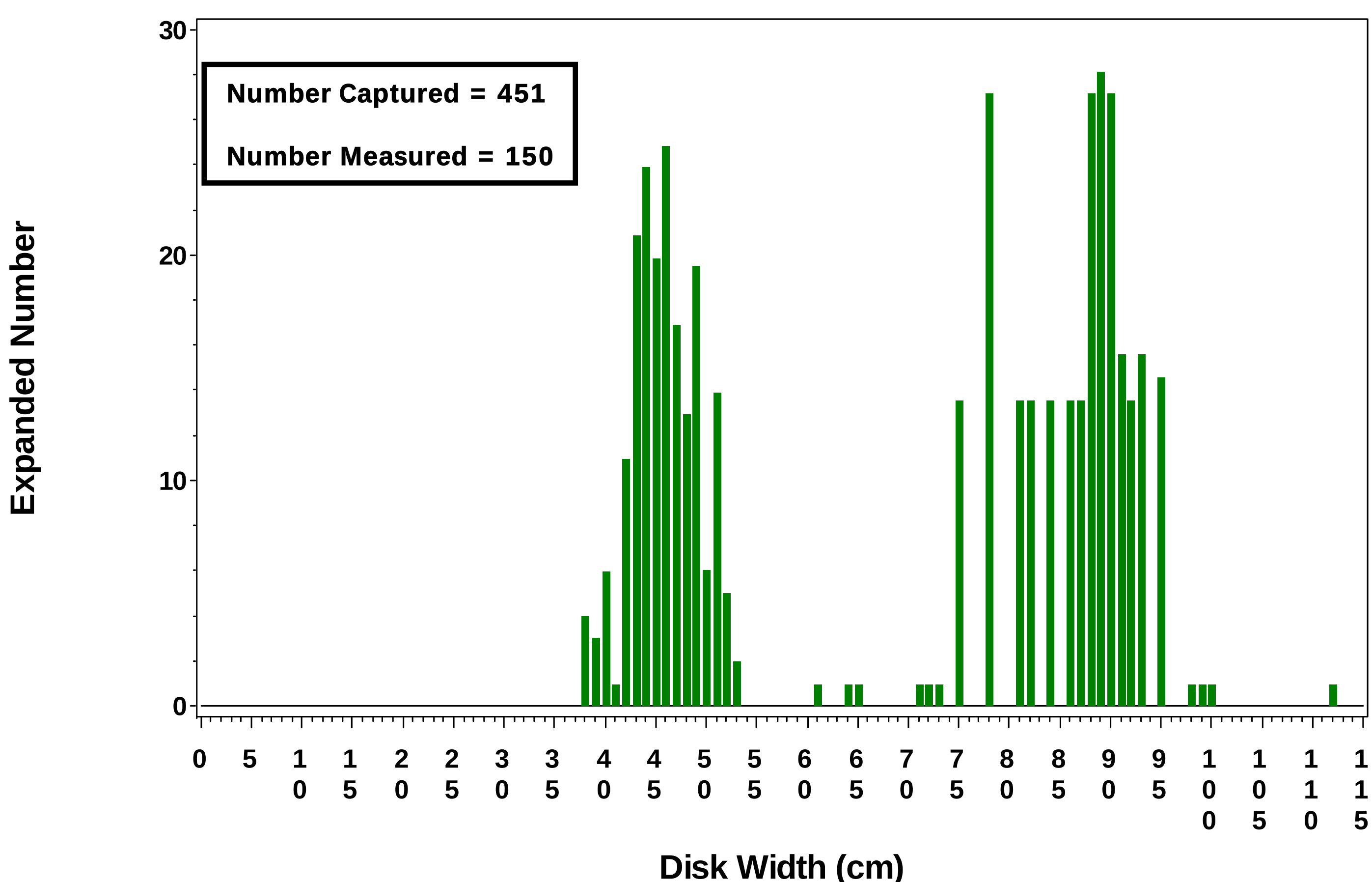
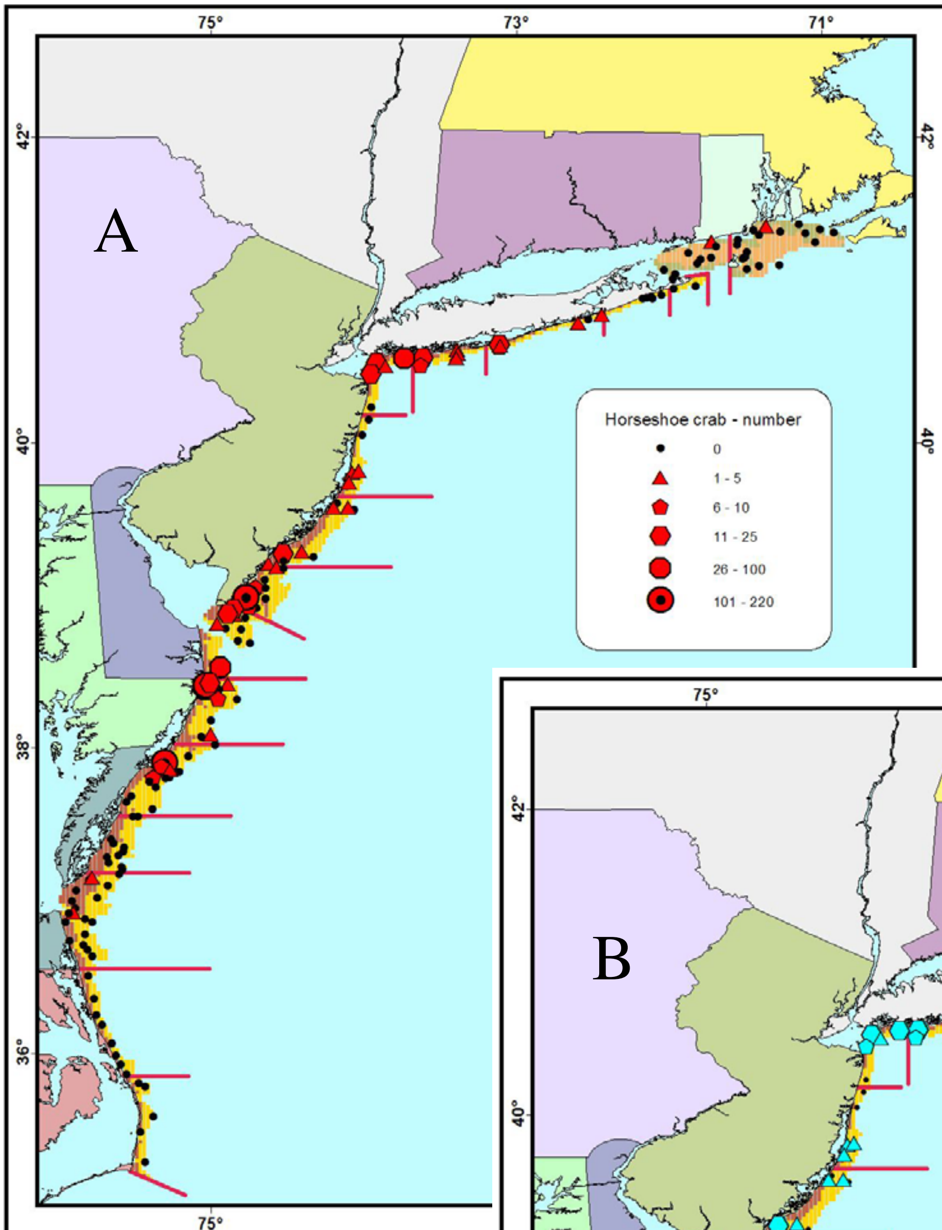


Figure 73. Width frequency histogram for cownose ray.



Horseshoe Crab (Priority E)



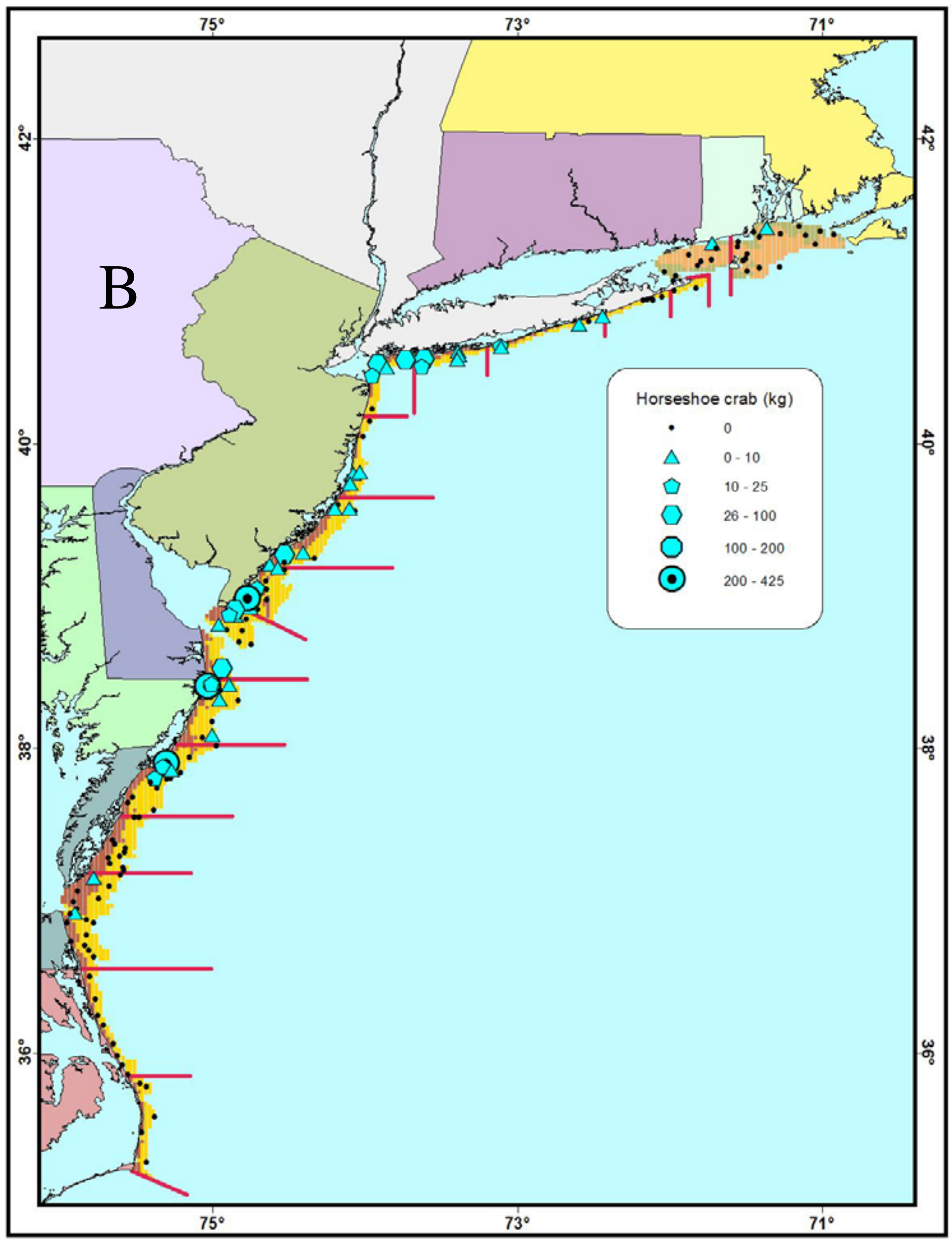


Figure 74. Number (A) and biomass (B) of specimens captured at each station for horseshoe crab.

Figure 75. Minimum trawlable number and biomass by state for horseshoe crab.

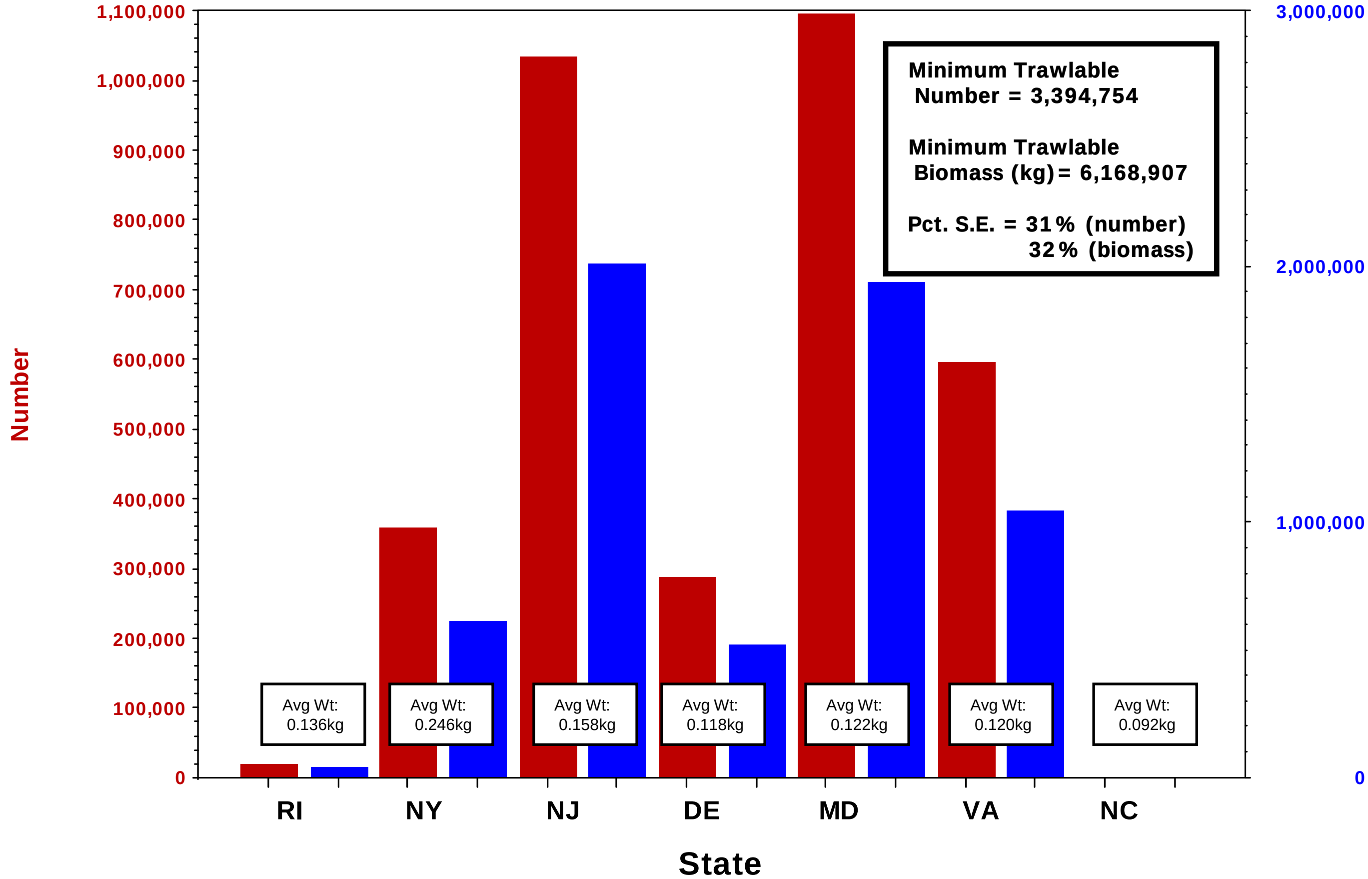


Figure 76. Width frequency histogram for horseshoe crab.

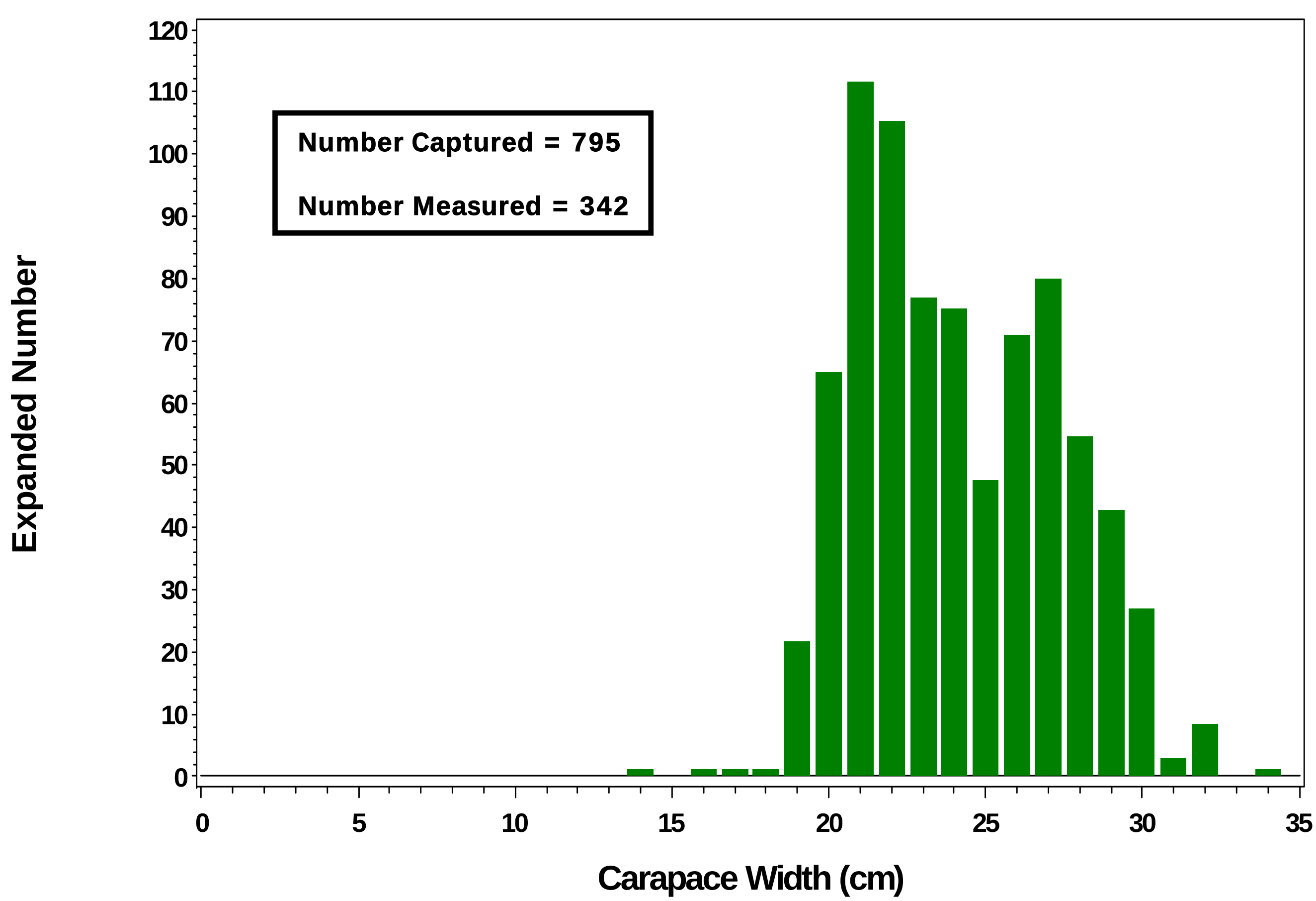


Figure 77. Sex ratios for horseshoe crab, by state (A) and width group (B).

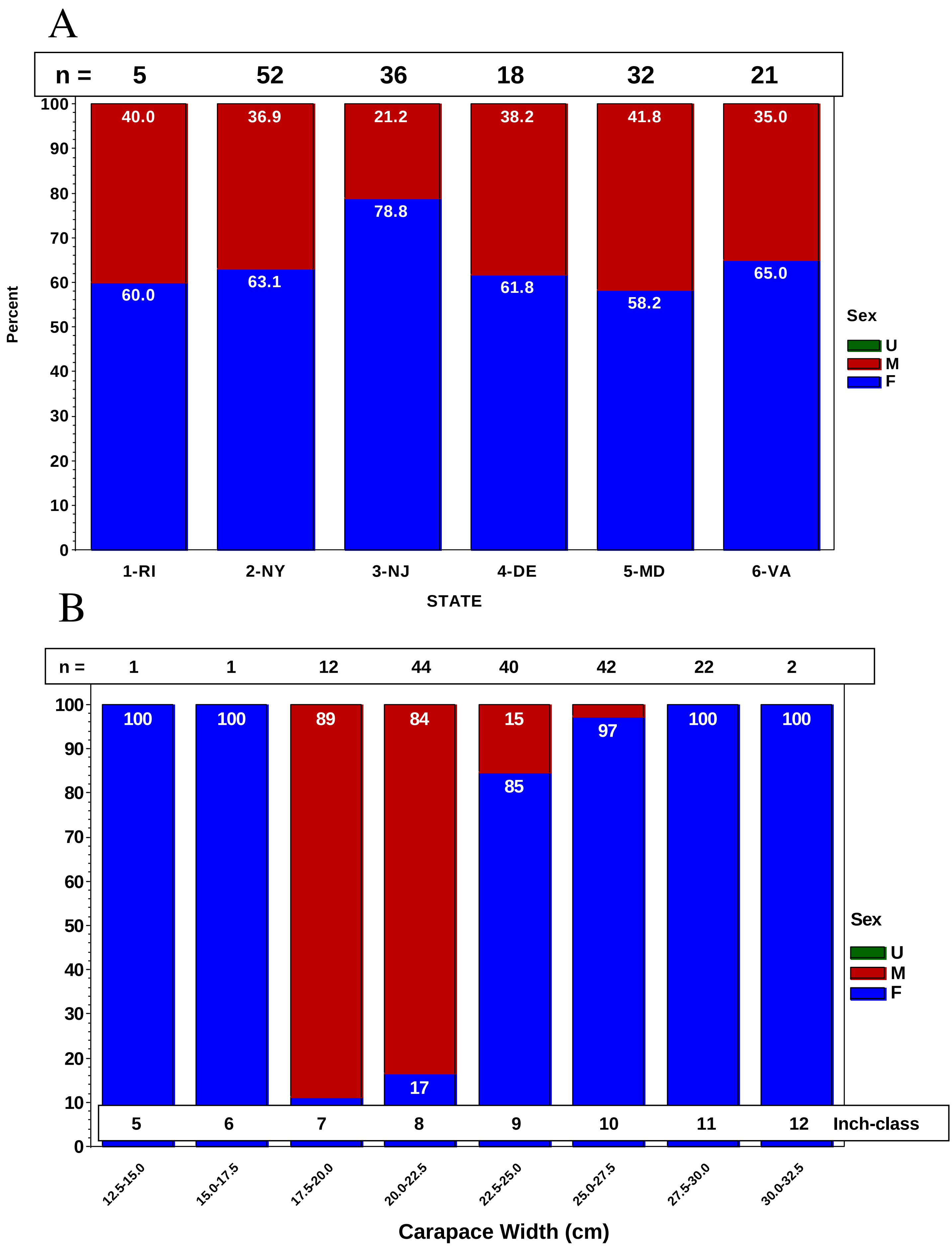
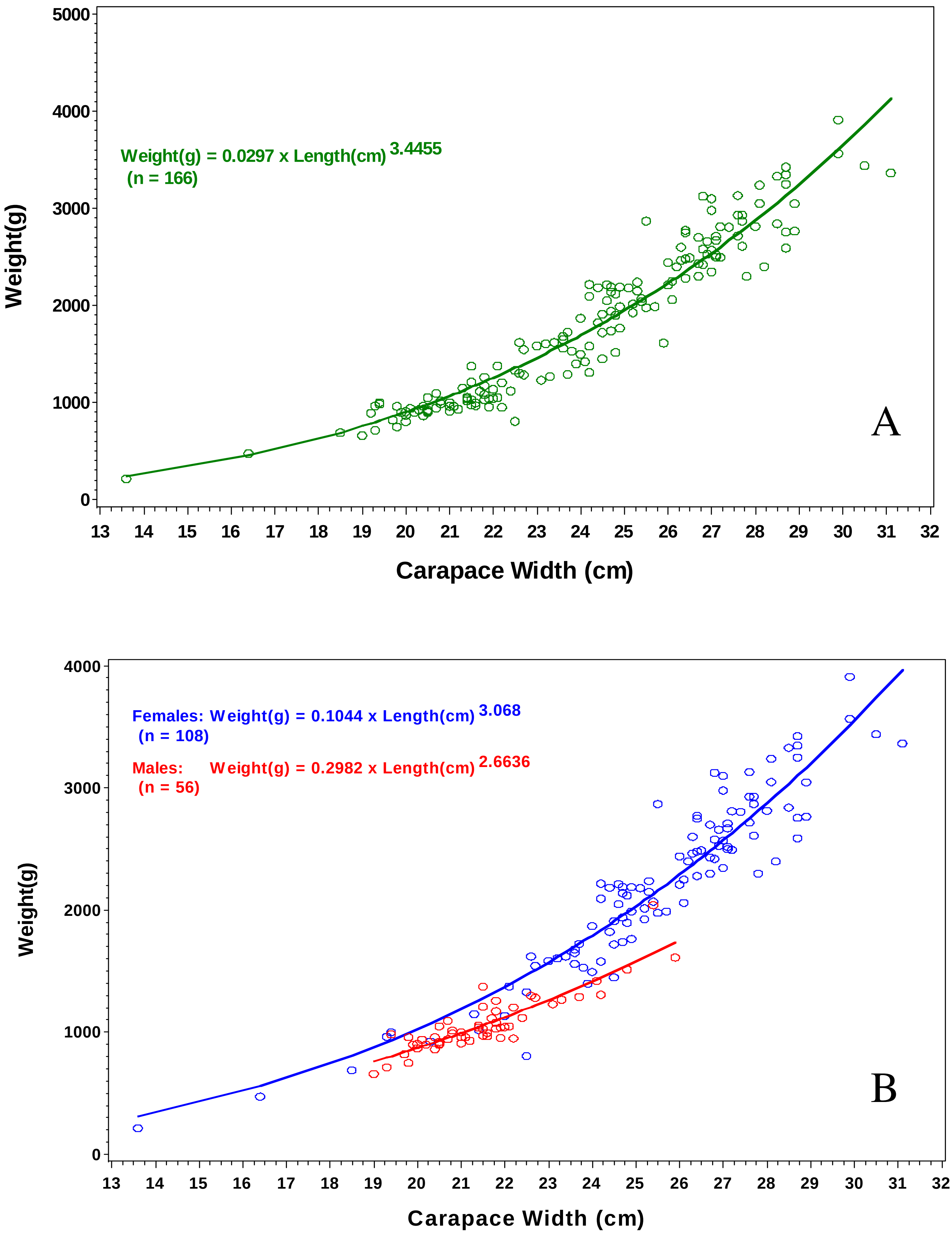
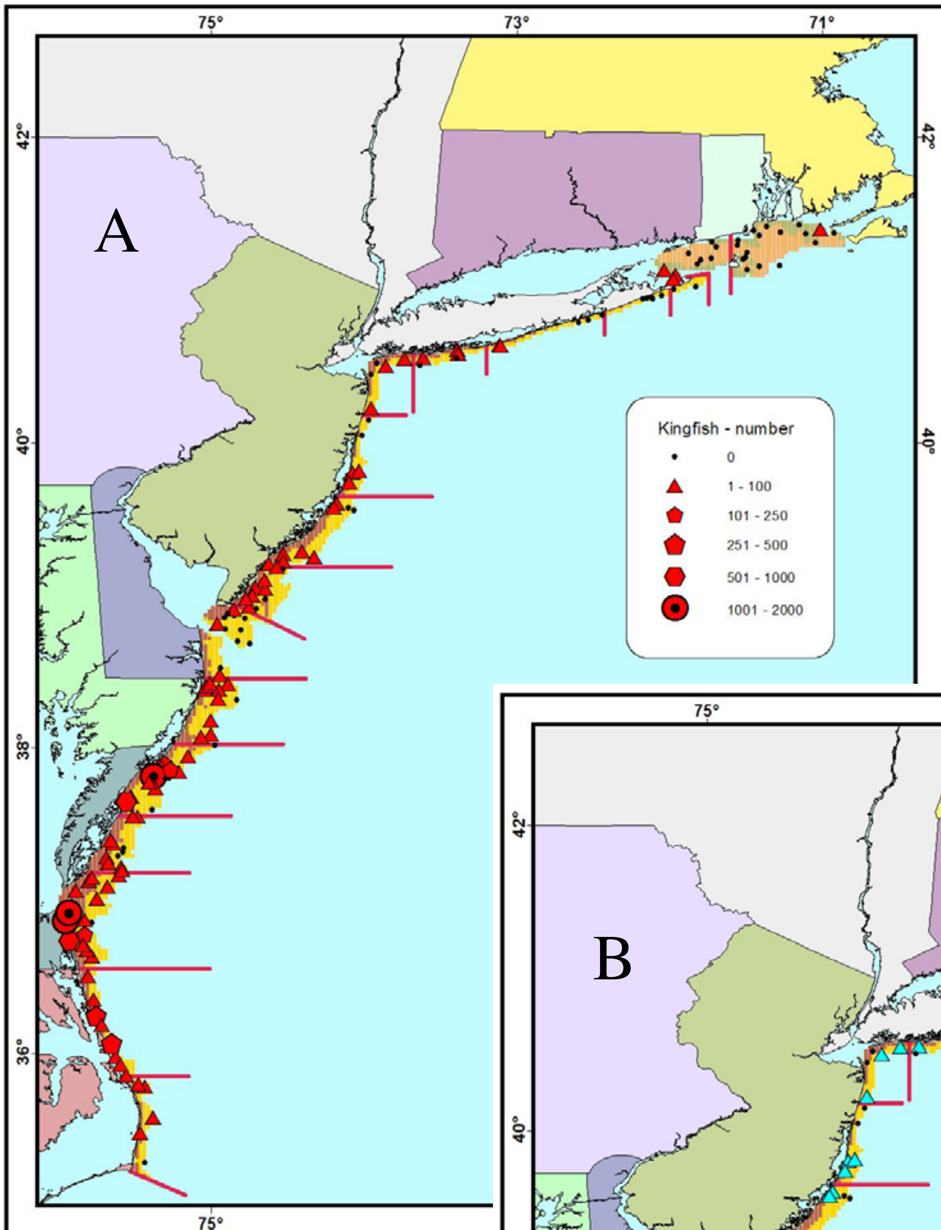


Figure 78. Width-weight regression for horseshoe crab, sexes combined (A), and by sex (B).



Kingfish spp. (Priority D)



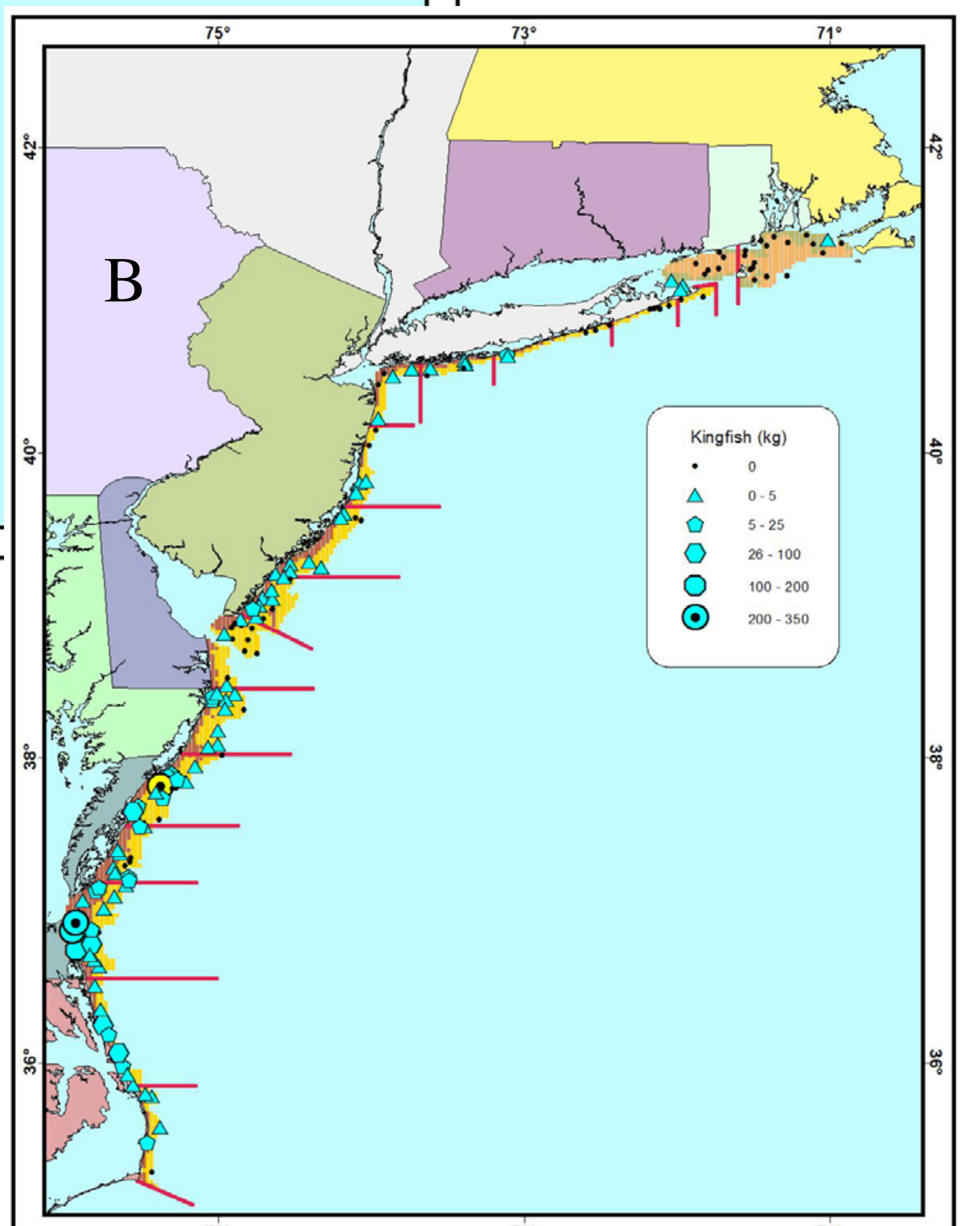


Figure 79. Number (A) and biomass (B) of specimens captured at each station for kingfish (spp).

Figure 80. Minimum trawlable number and biomass by state for kingfish (spp).

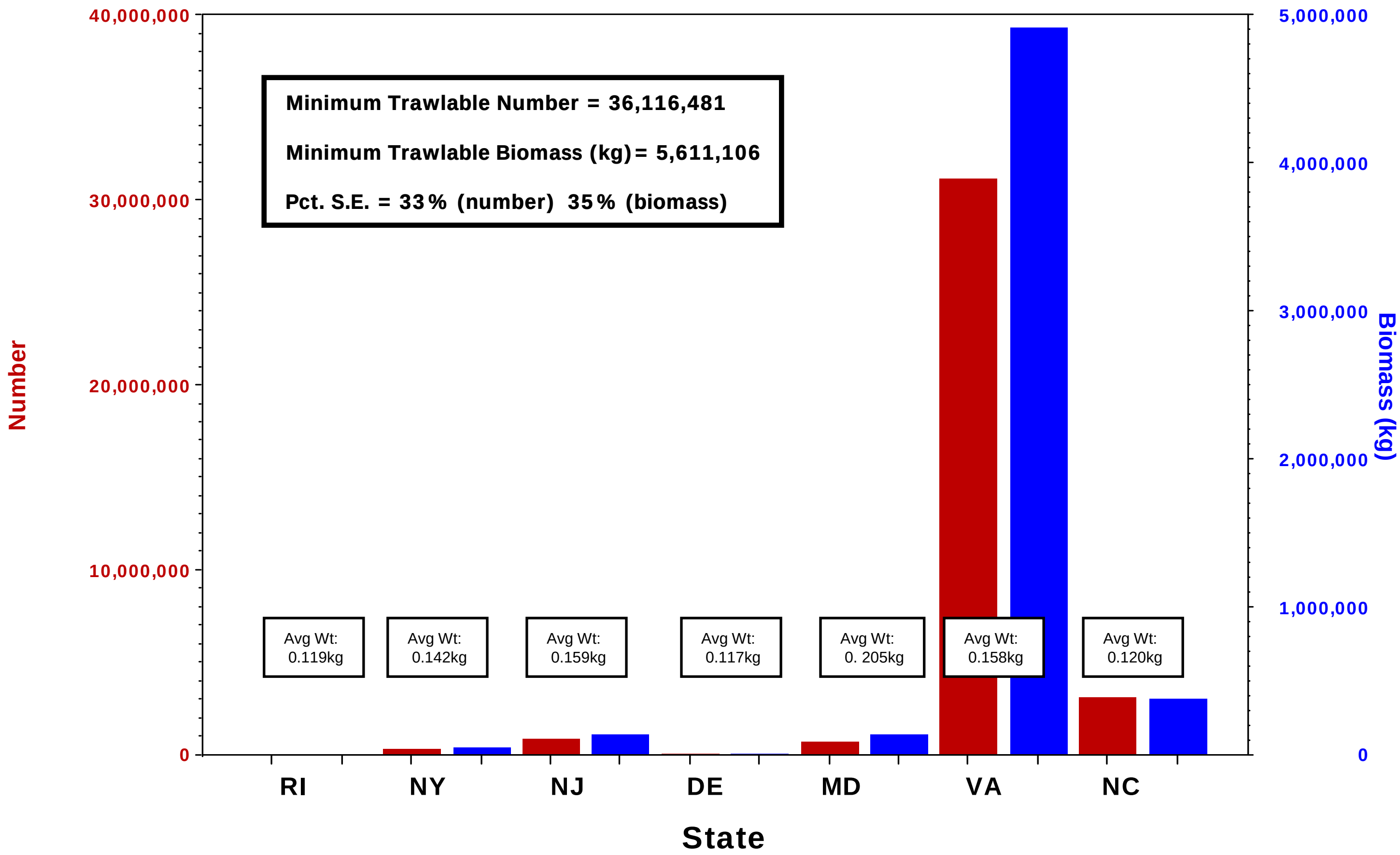
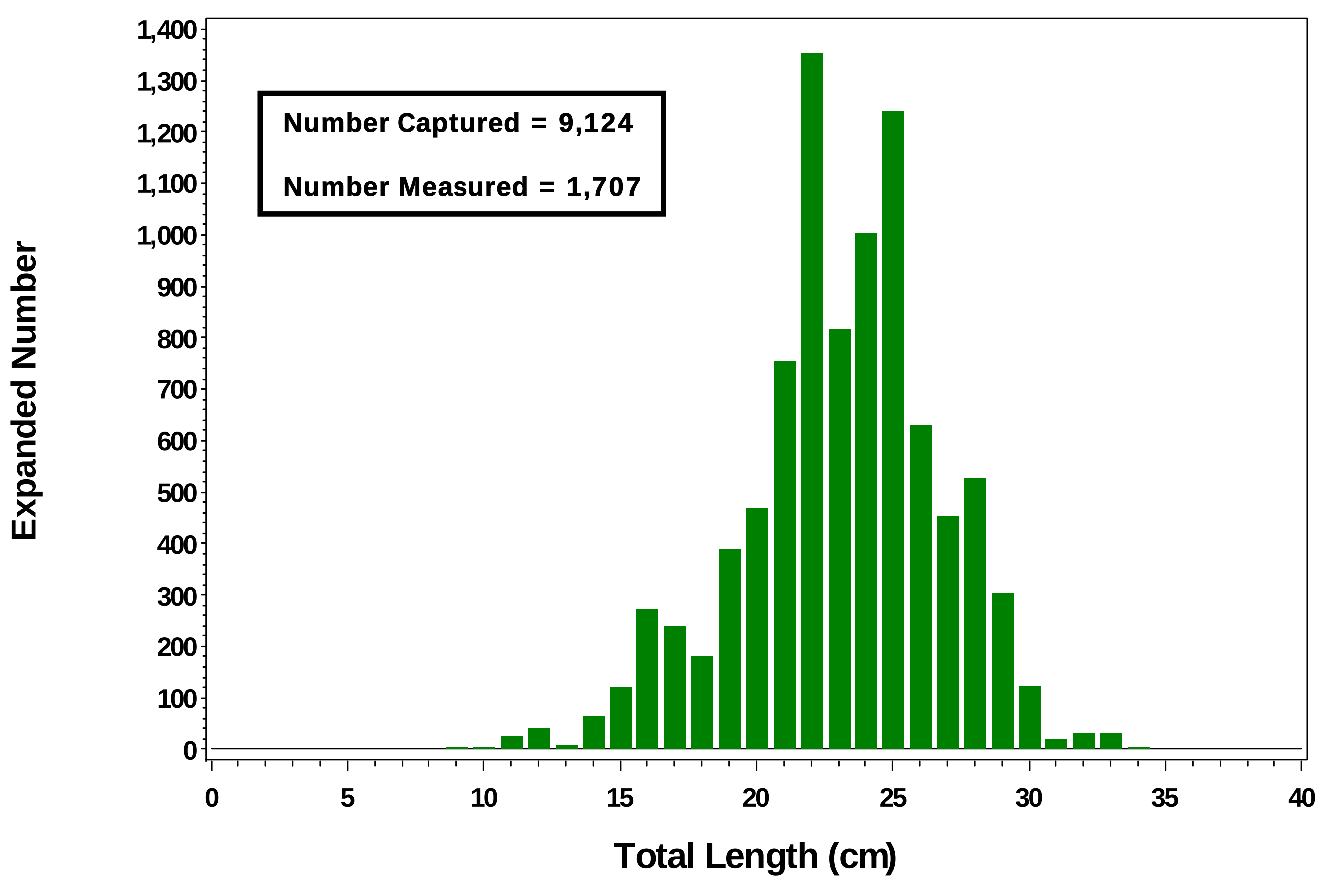
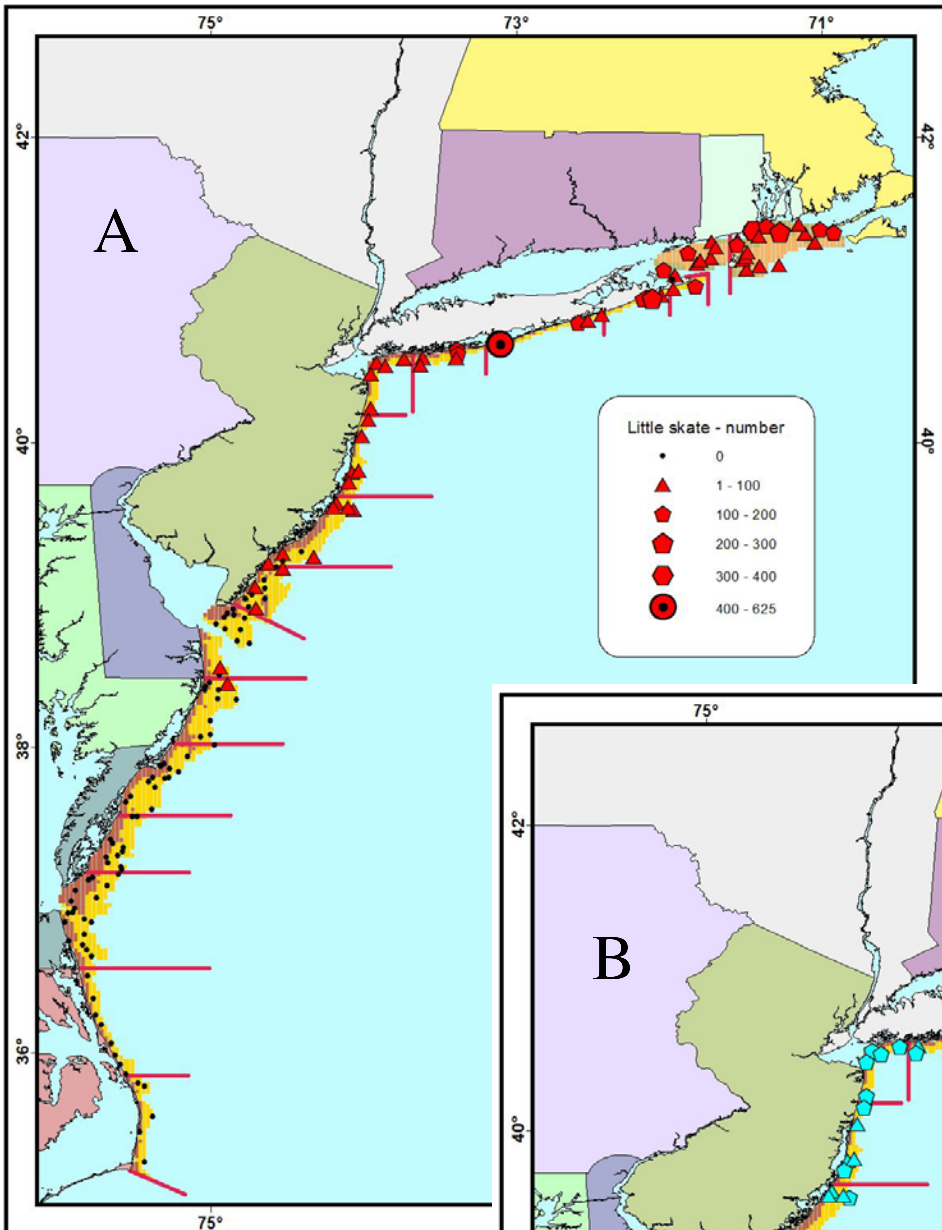


Figure 81. Length frequency histogram for kingfish (spp).



Little Skate (Priority B)



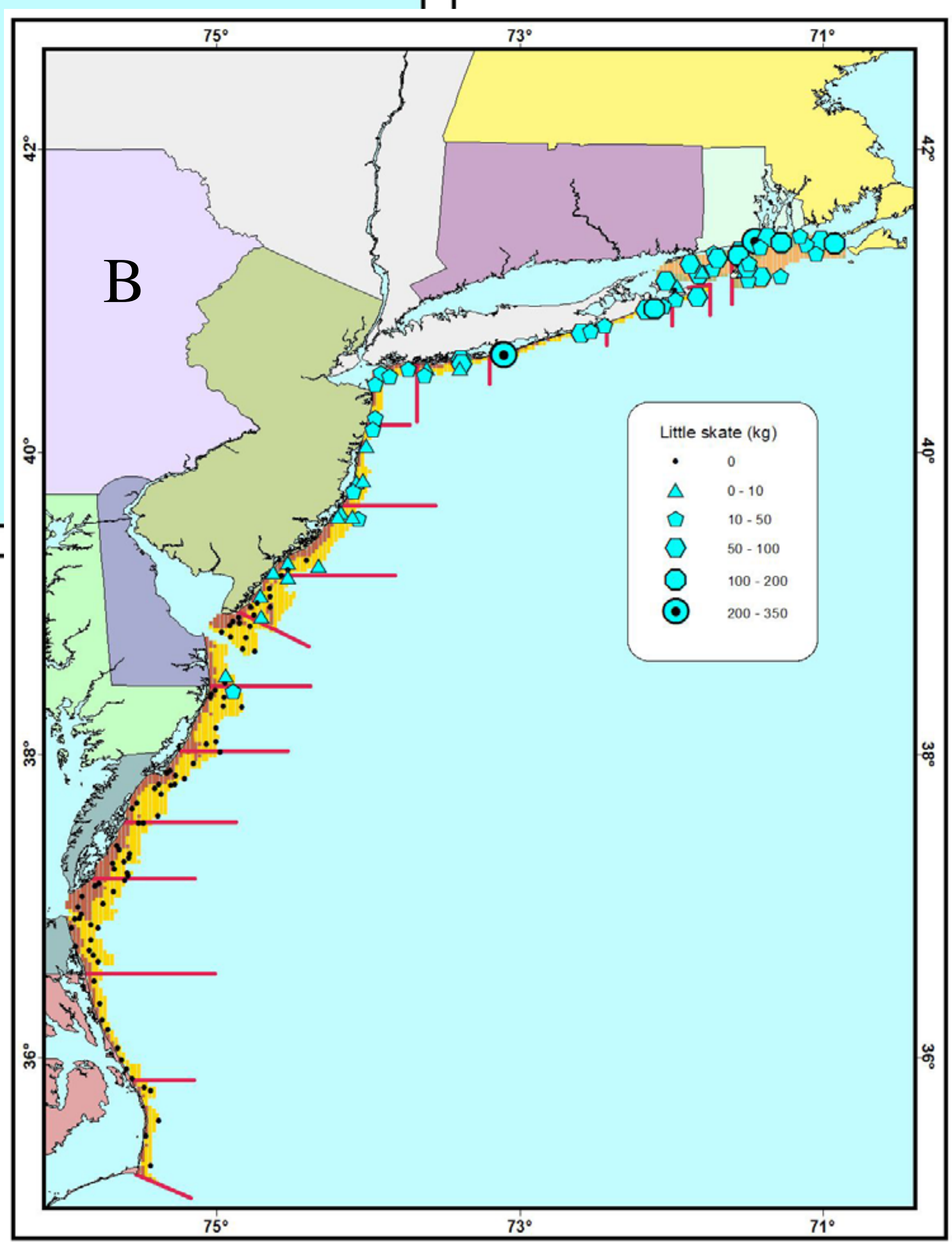


Figure 82. Number (A) and biomass (B) of specimens captured at each station for little skate.

Figure 83. Minimum trawlable number and biomass by state for little skate.

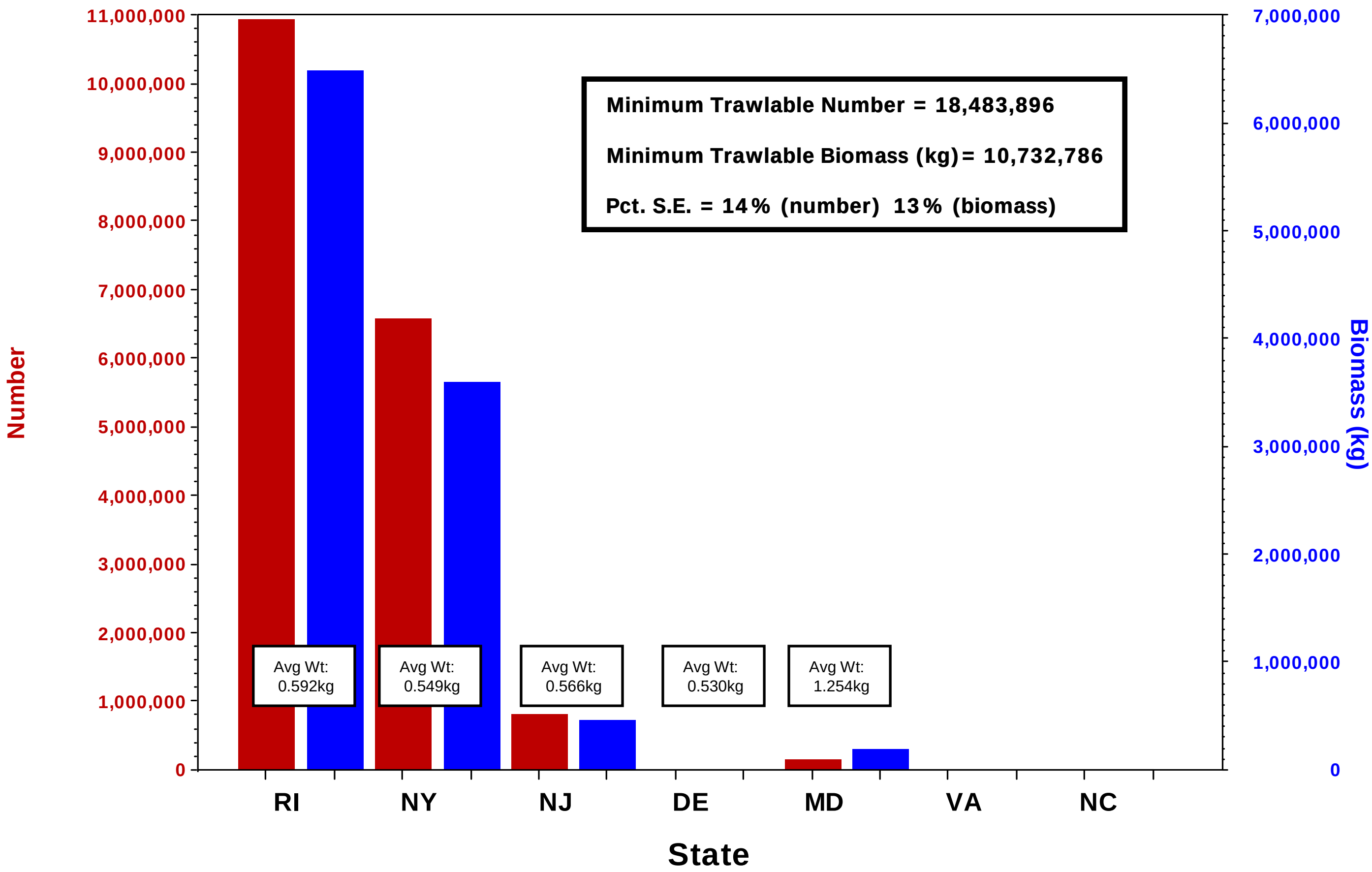


Figure 84. Width frequency histogram for little skate.

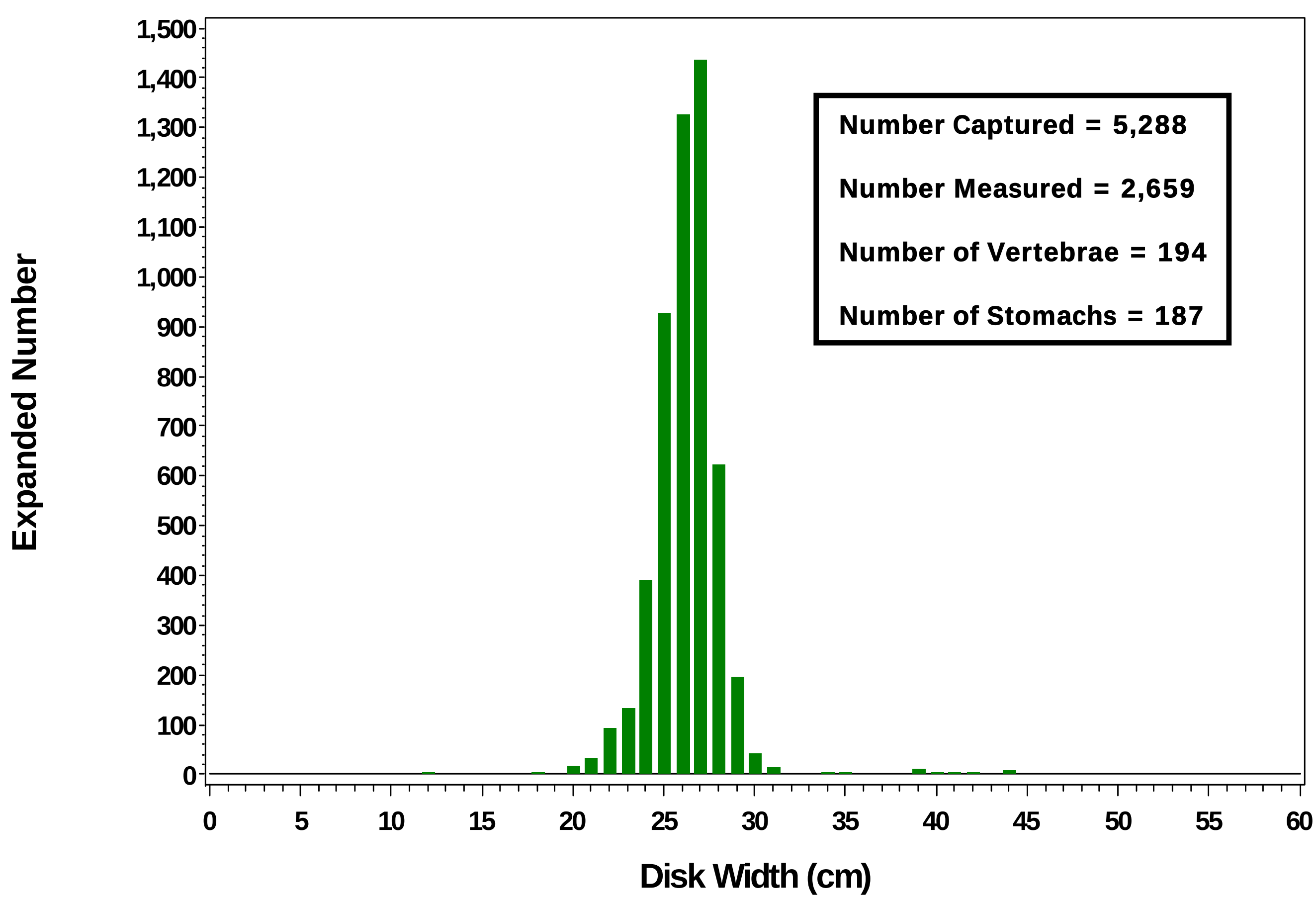
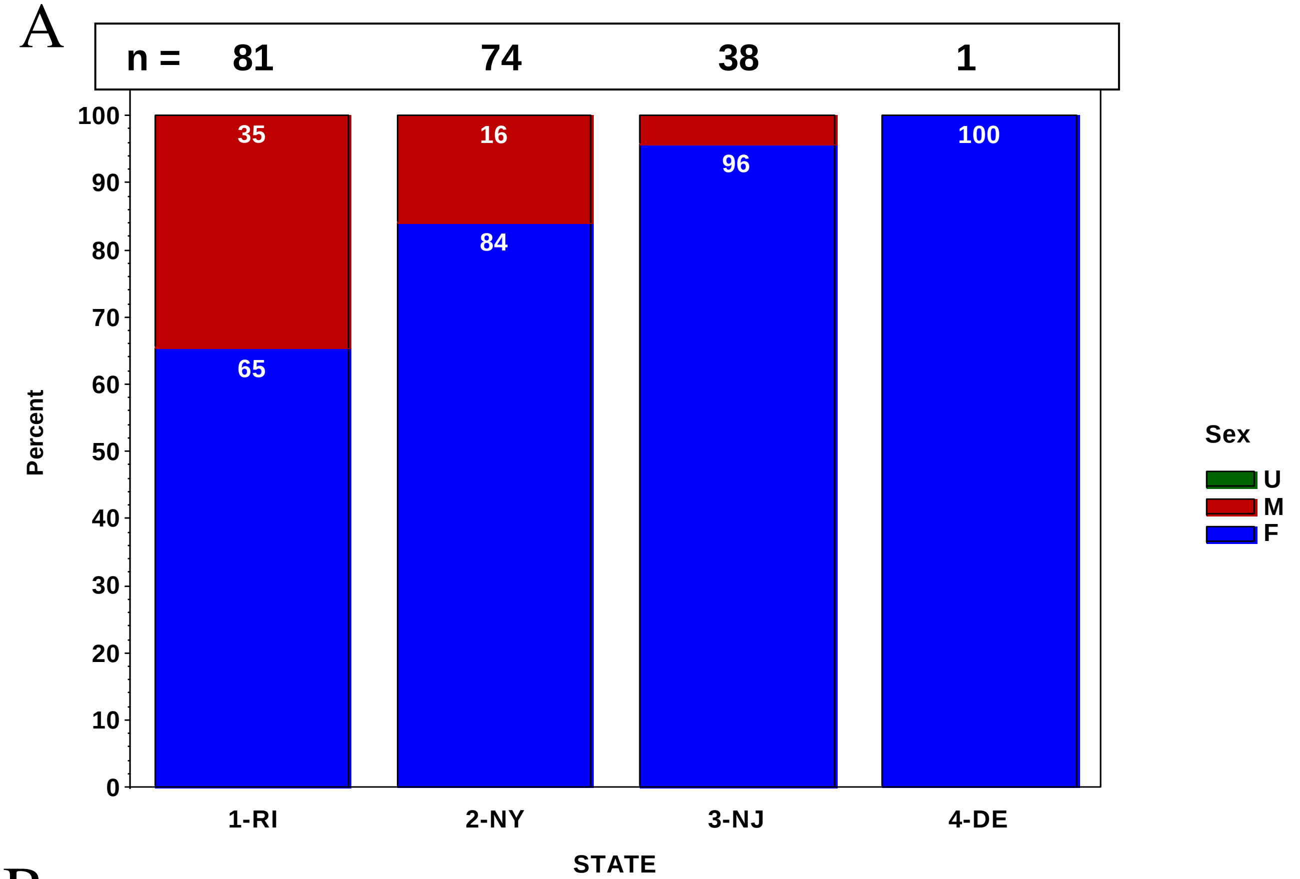


Figure 85. Sex ratios for little skate, by state (A) and width group (B).

A



B

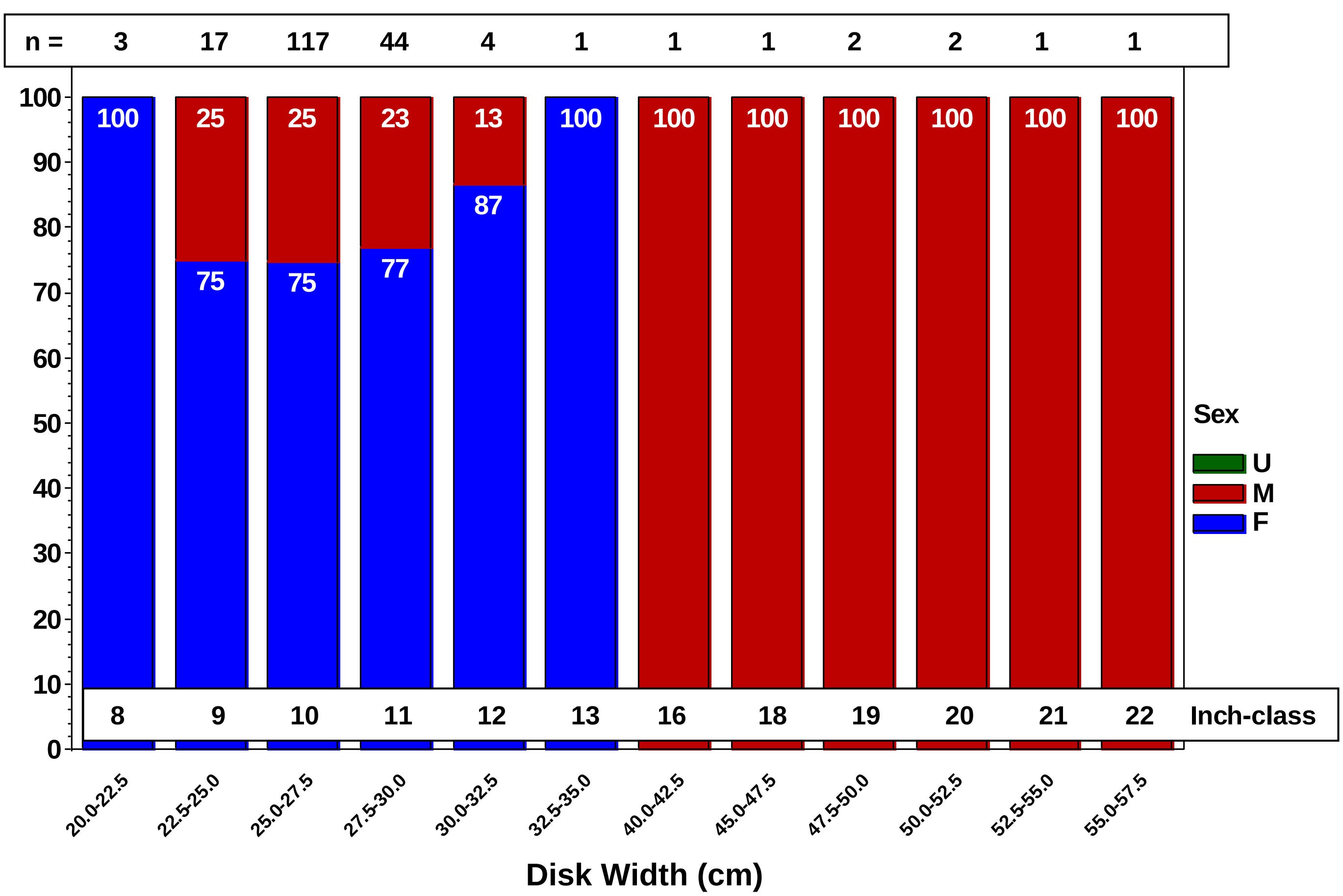
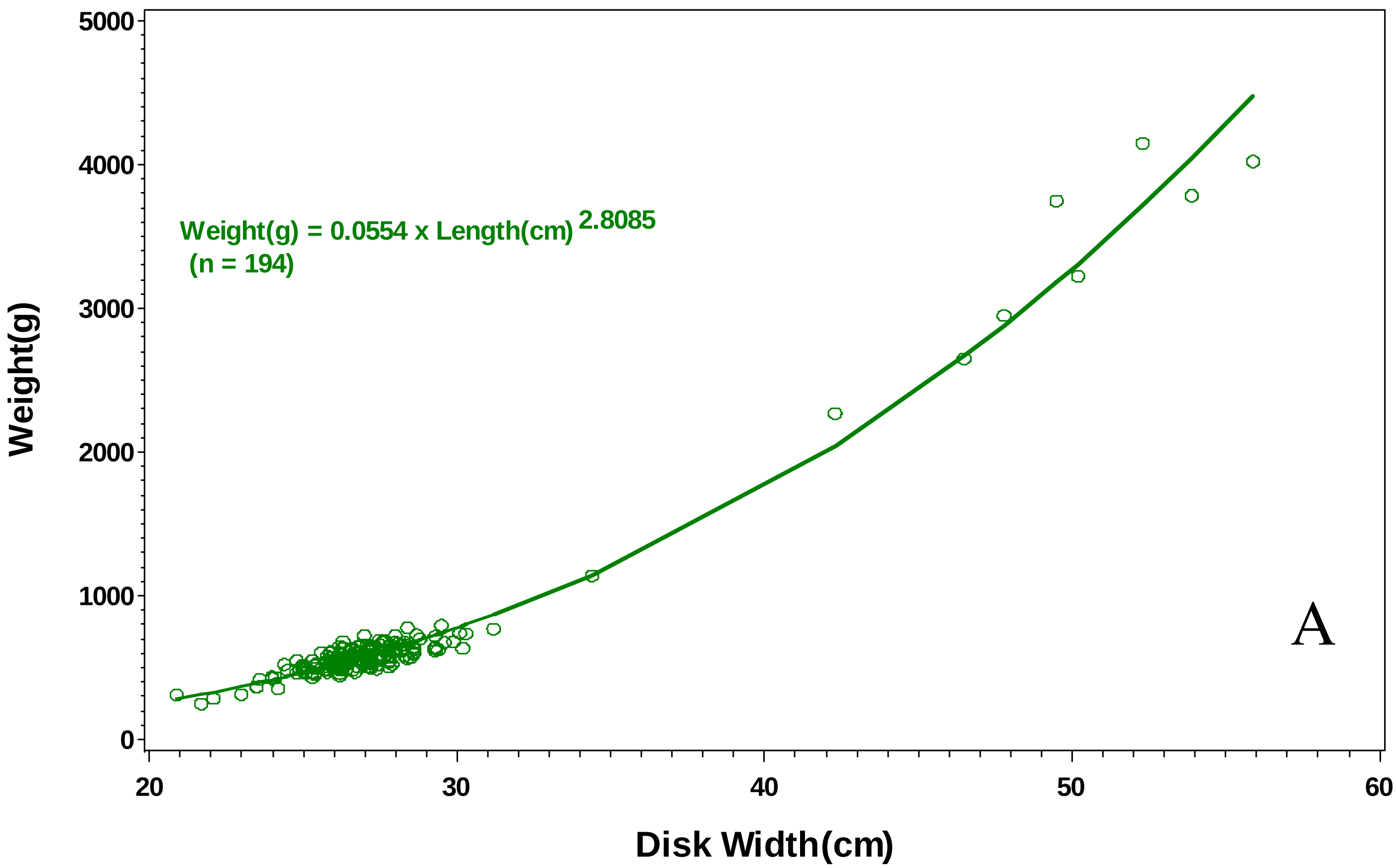
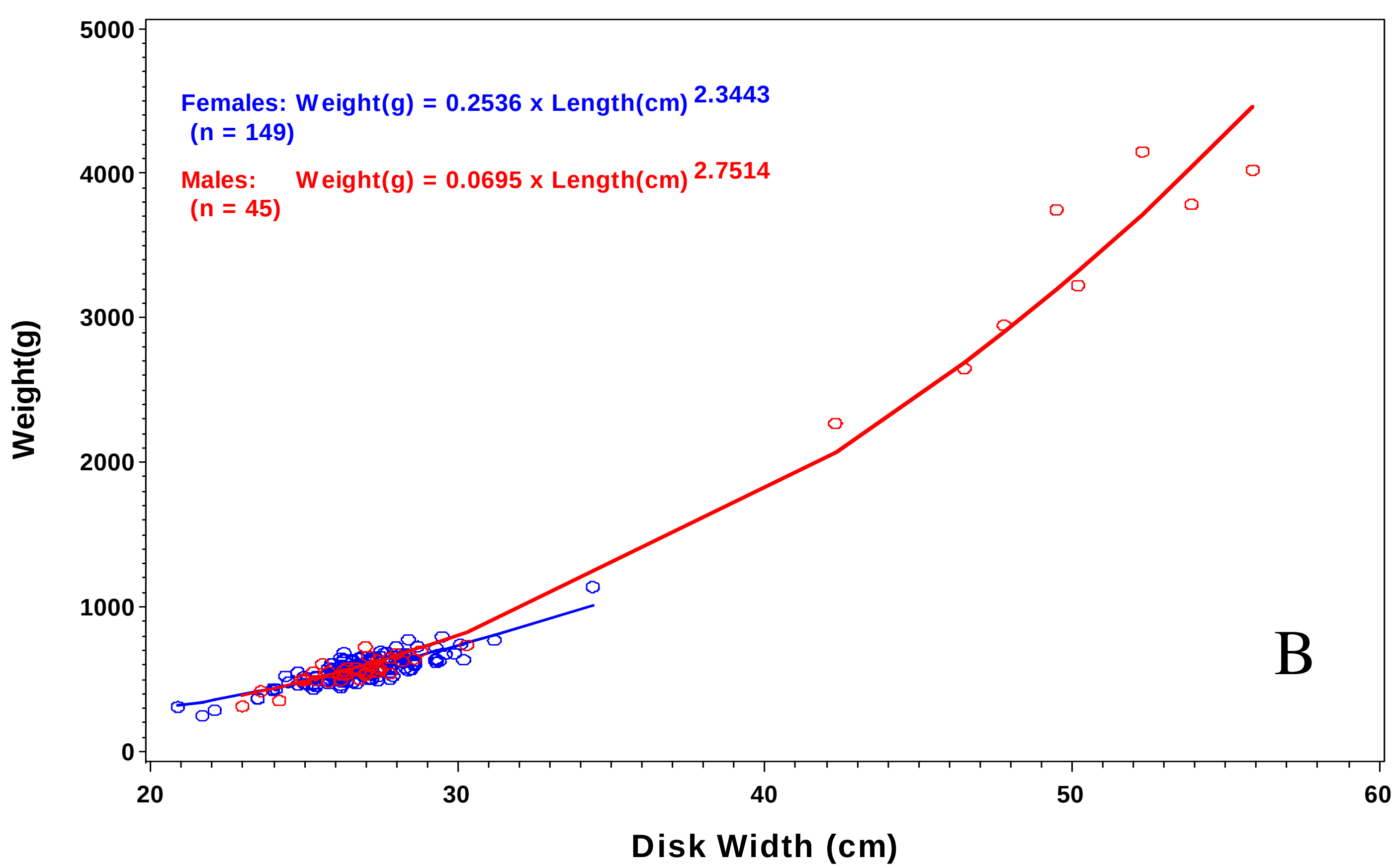
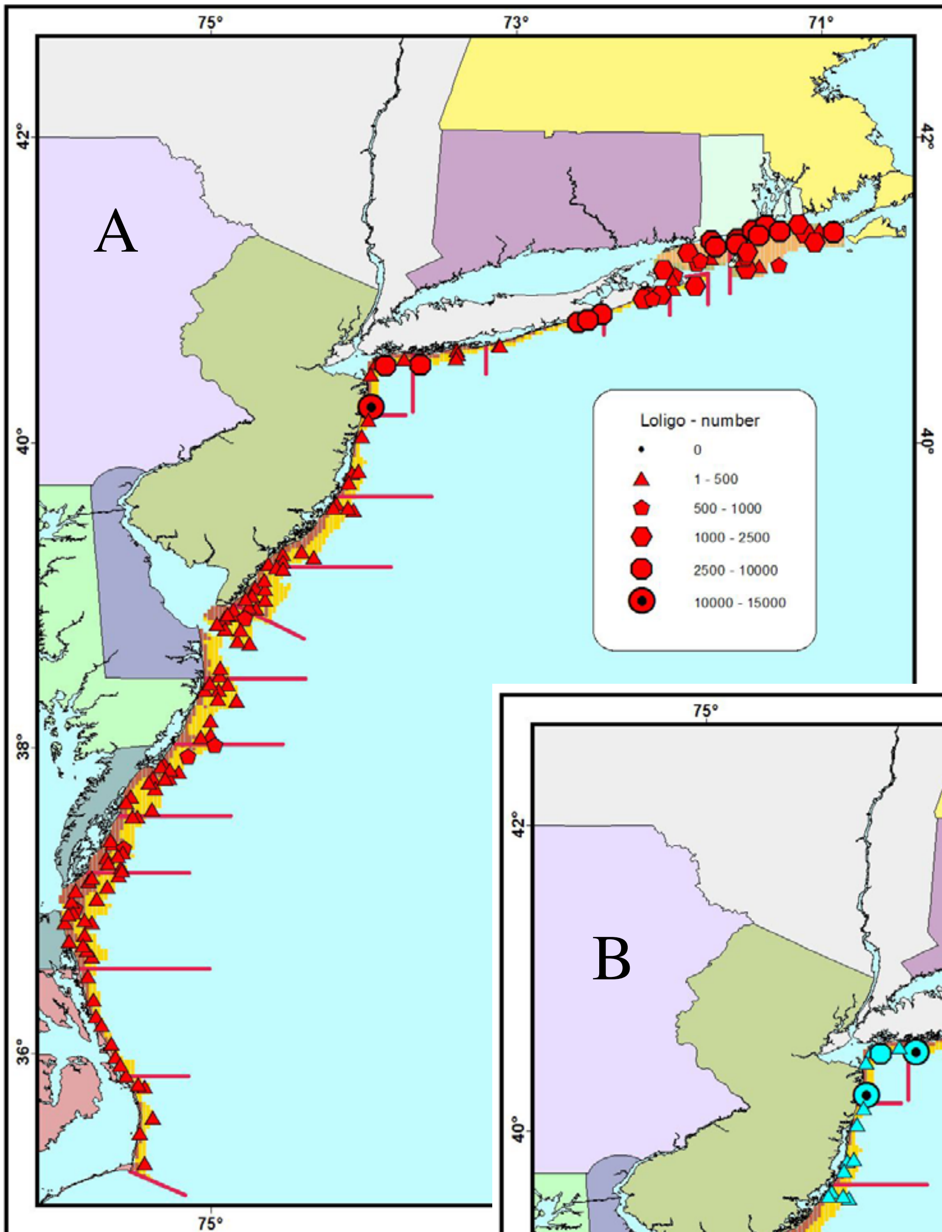


Figure 86. Width-weight regression for little skate, sexes combined (A) and by sex (B).





Loligo Squid (Priority E)



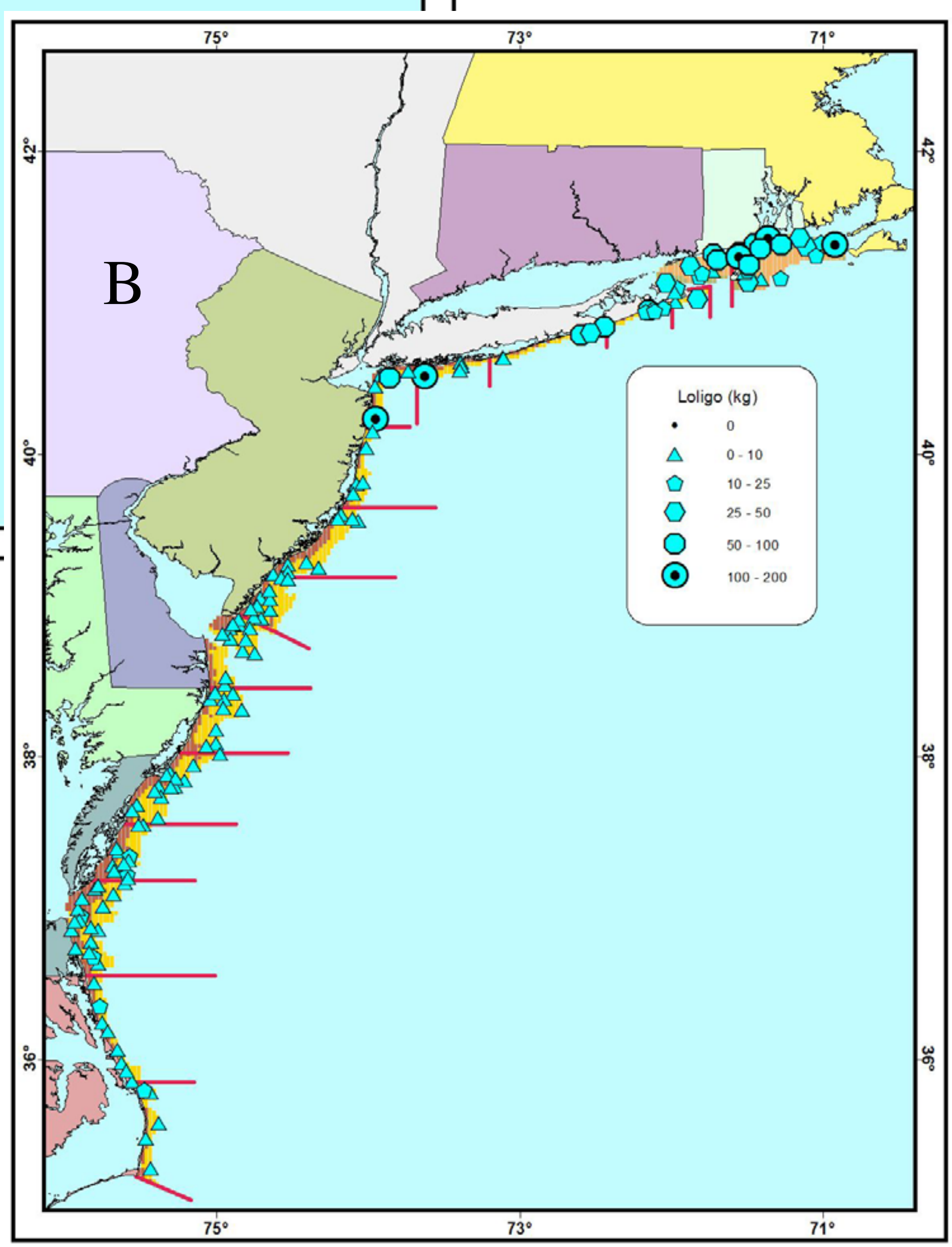


Figure 87. Number (A) and biomass (B) of specimens captured at each station for Loligo squid.

Figure 88. Minimum trawlable number and biomass by state for Loligo squid.

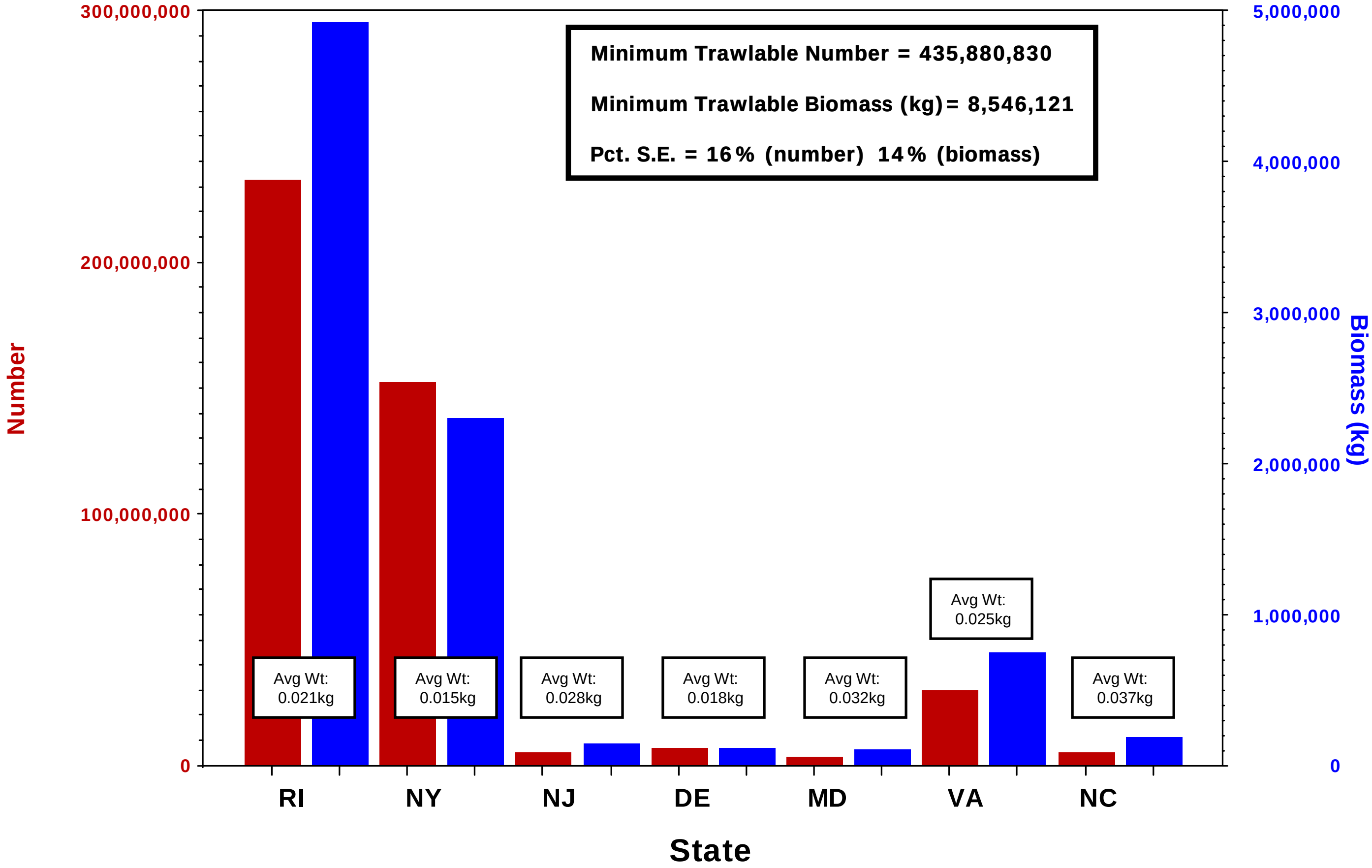
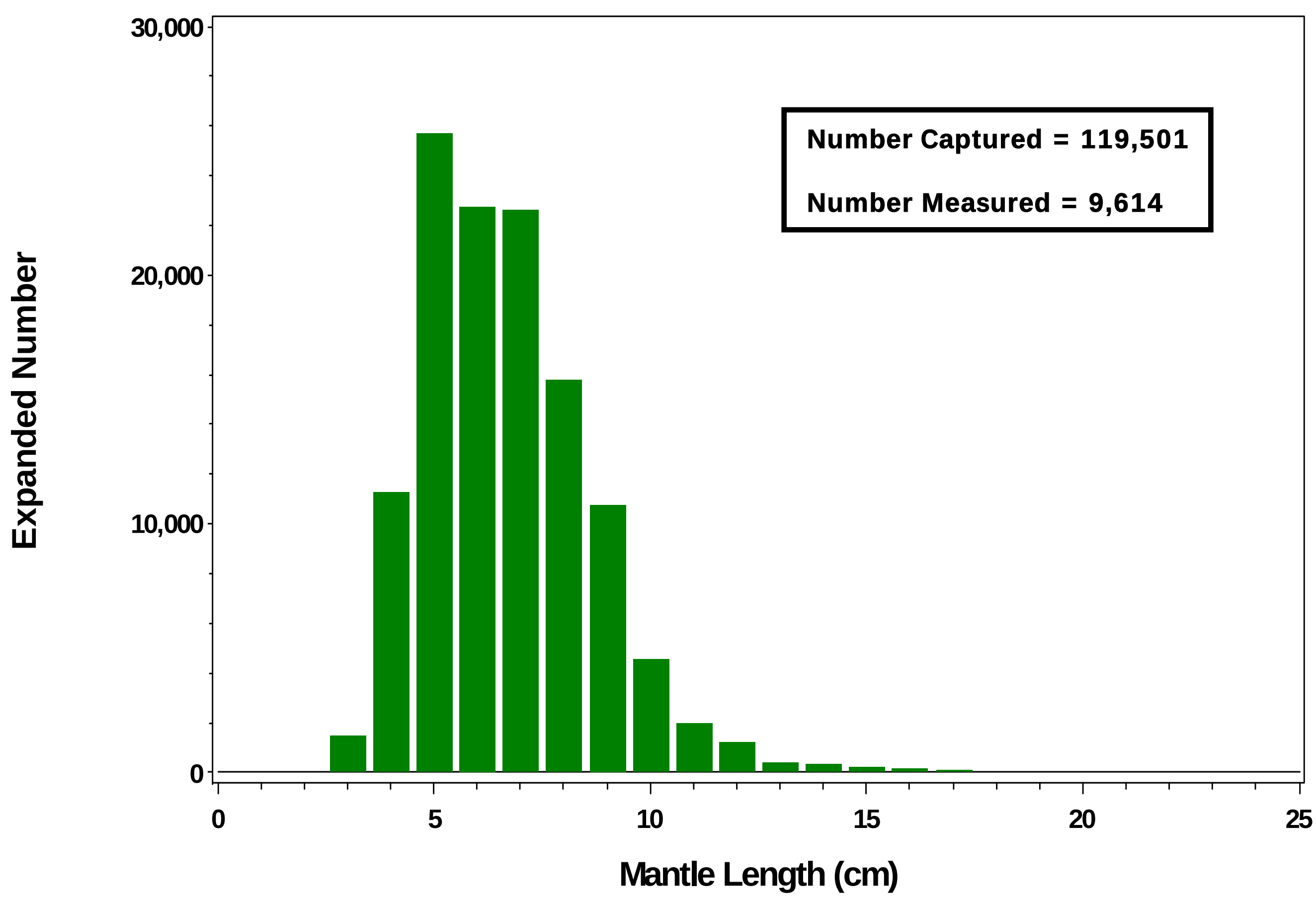
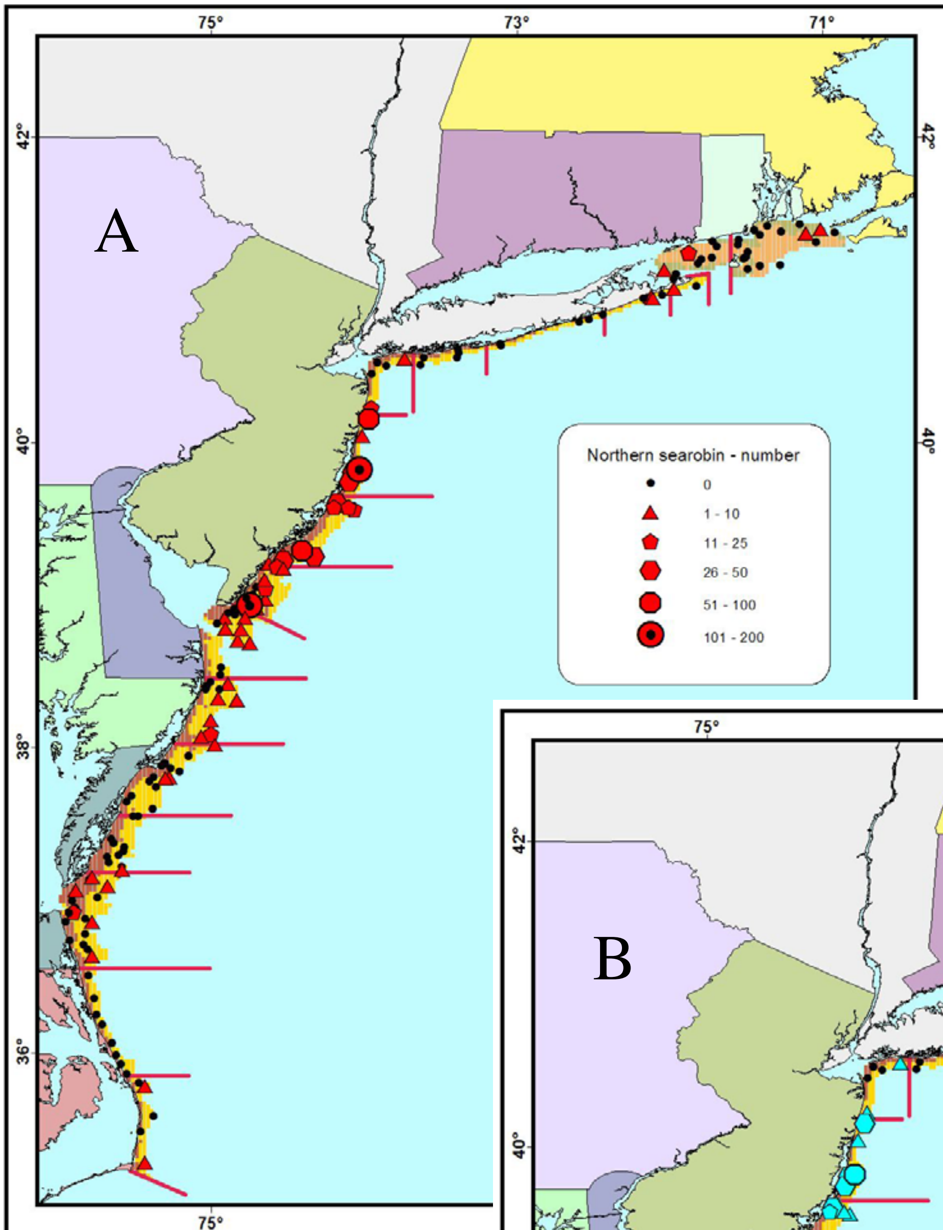


Figure 89. Length frequency histogram for Loligo squid.



Northern Searobin (Priority D)



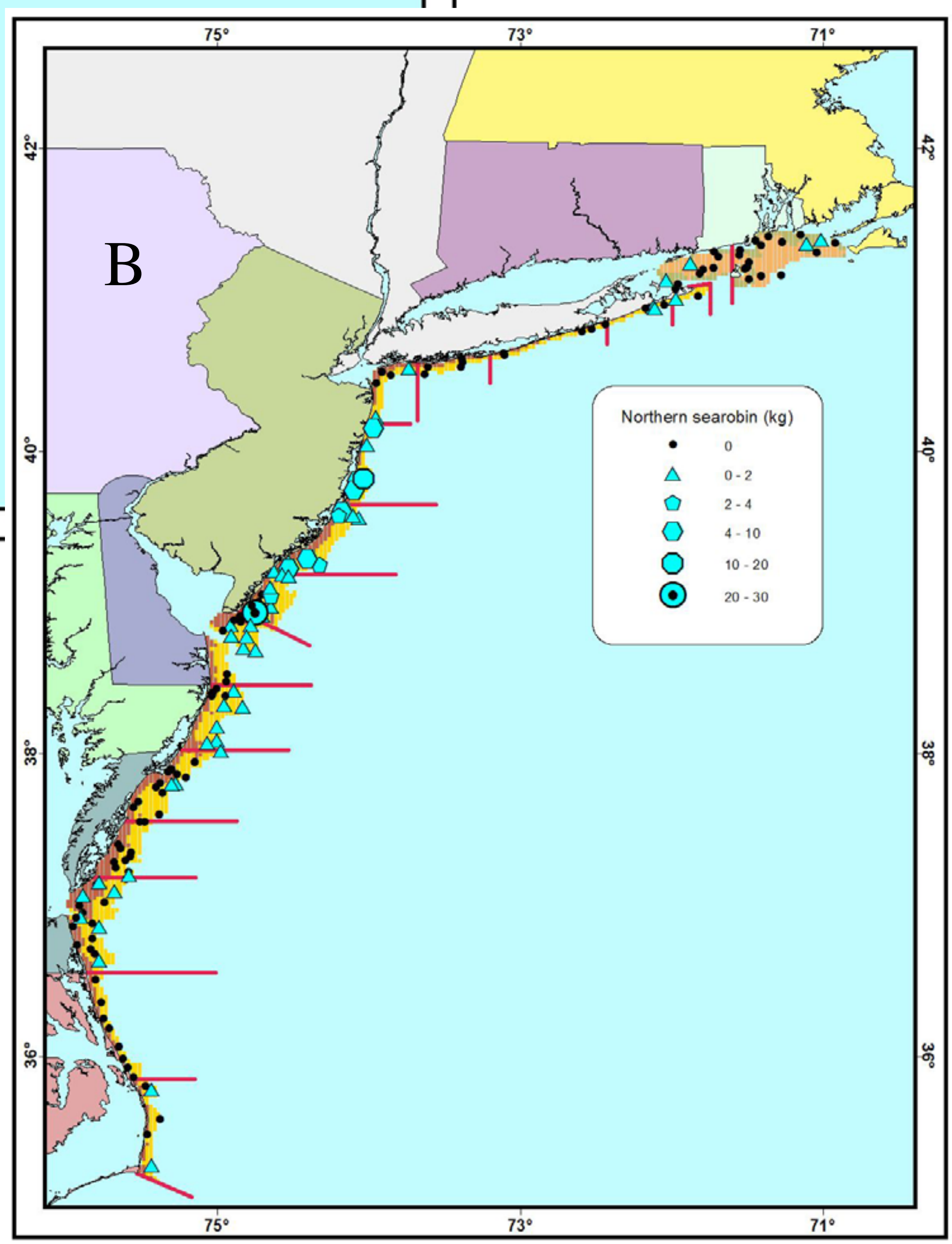


Figure 90. Number (A) and biomass (B) of specimens captured at each station for northern searobin.

Figure 91. Minimum trawlable number and biomass by state for northern searobin.

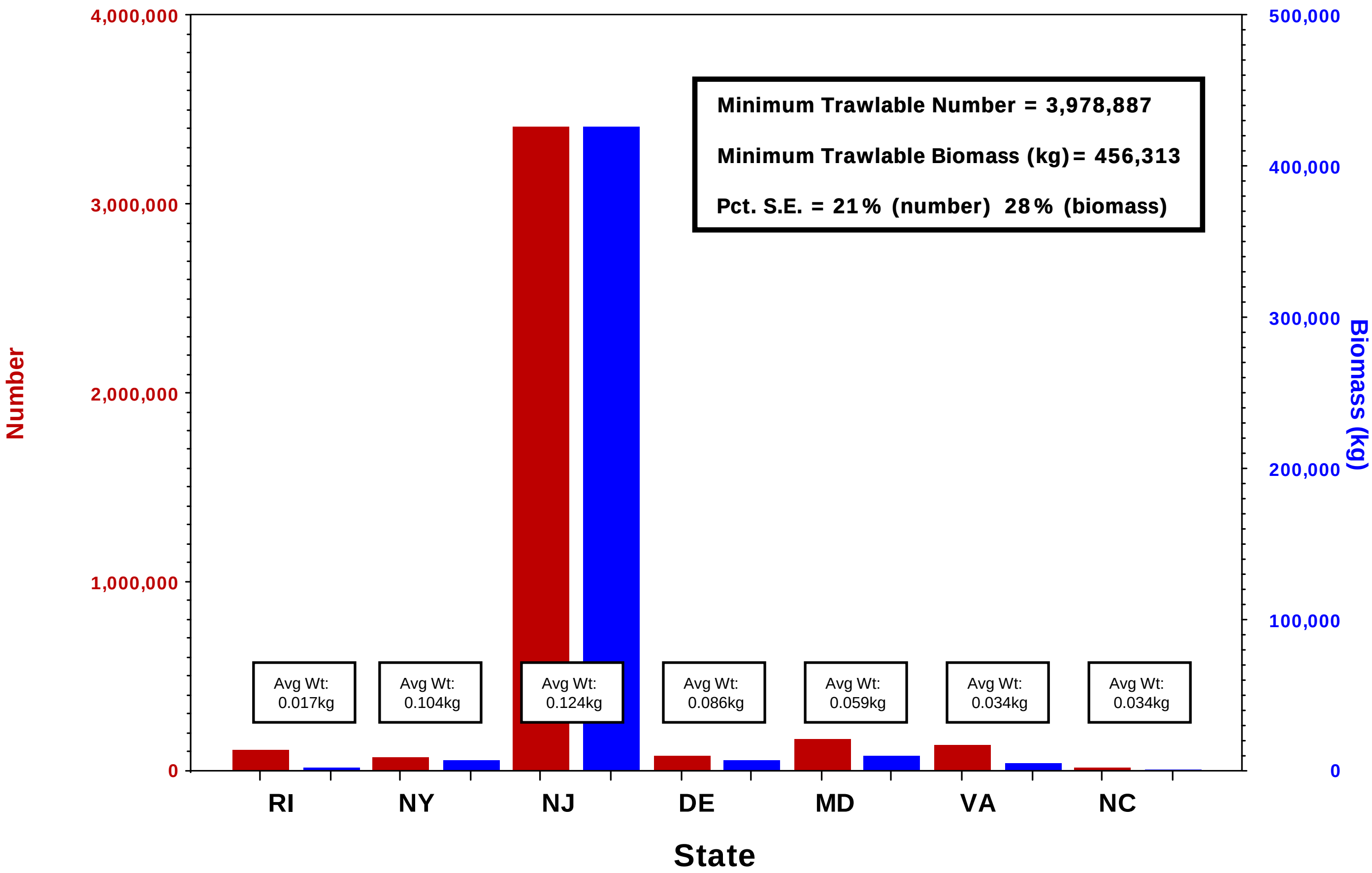
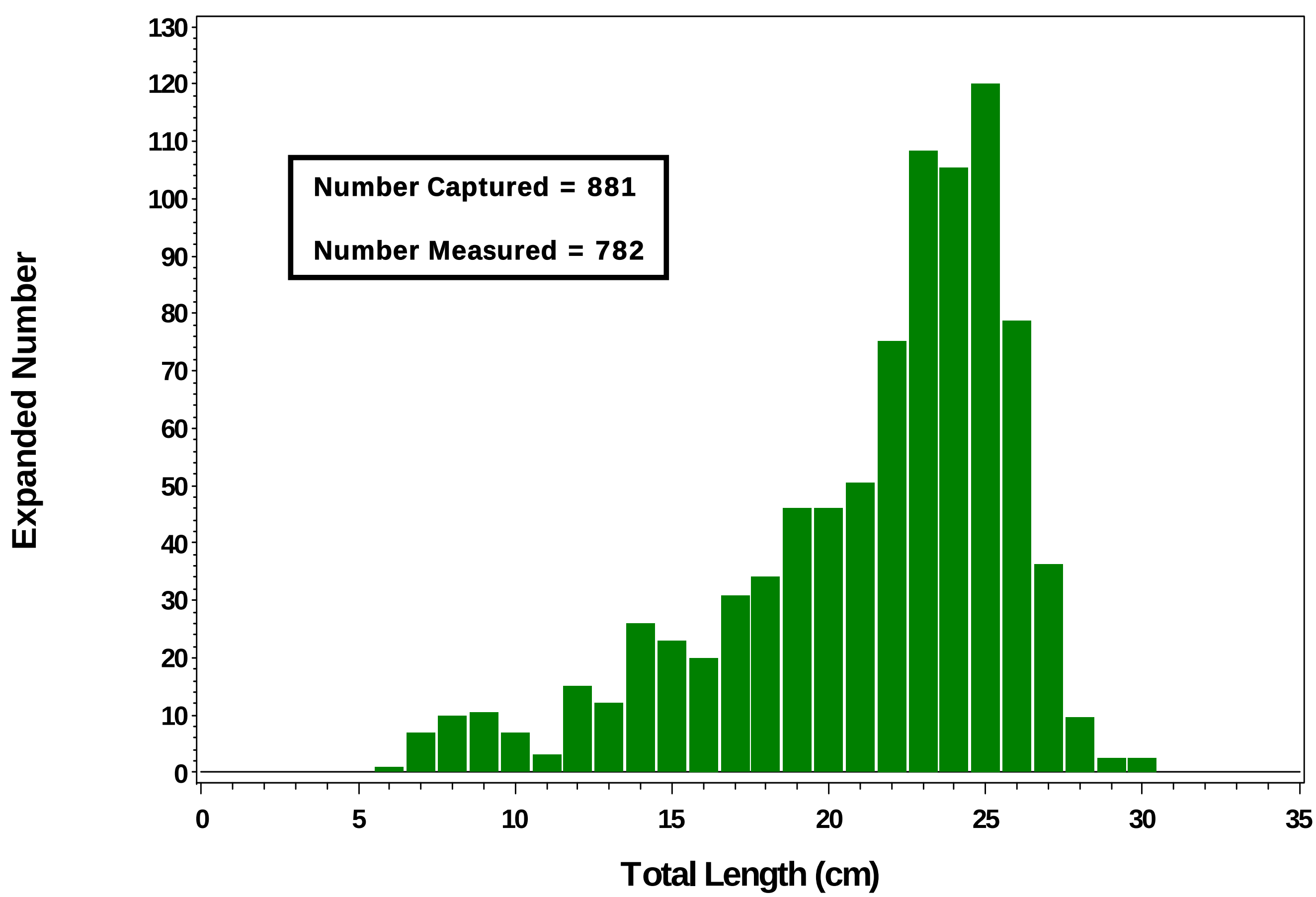
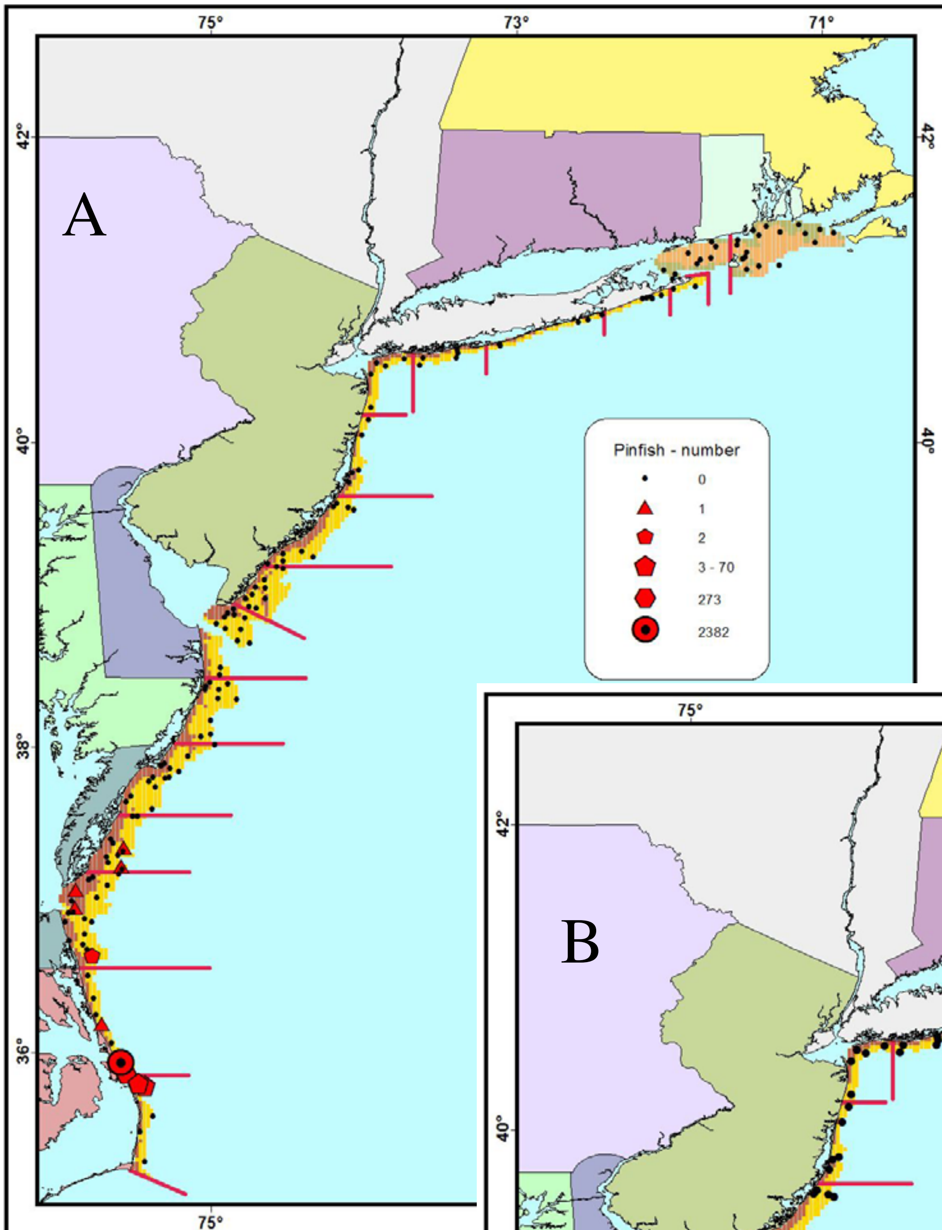


Figure 92. Length frequency histogram for northern searobin.



Pinfish (Priority D)



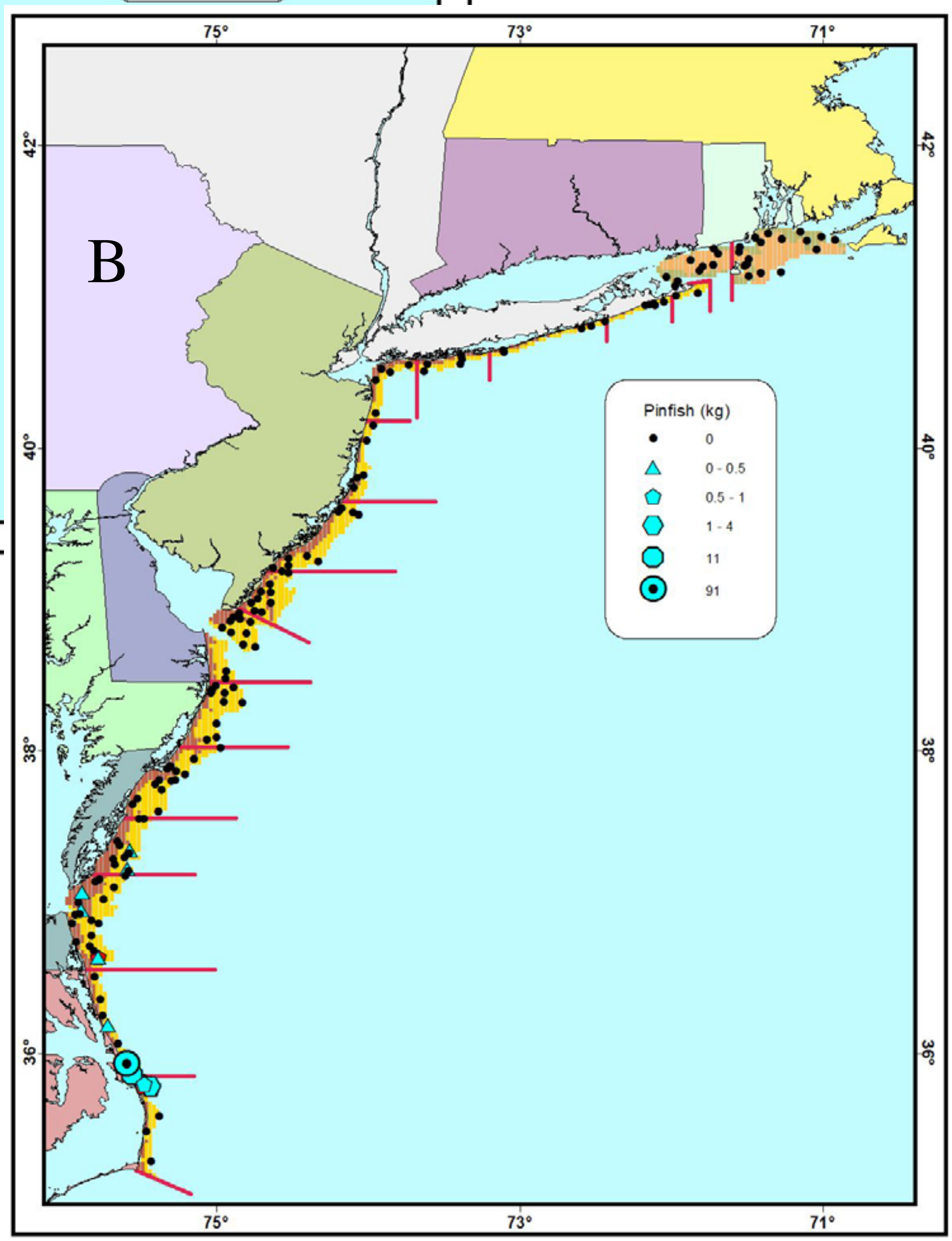


Figure 93. Number (A) and biomass (B) of specimens captured at each station for pinfish.

Figure 94. Minimum trawlable number and biomass by state for pinfish.

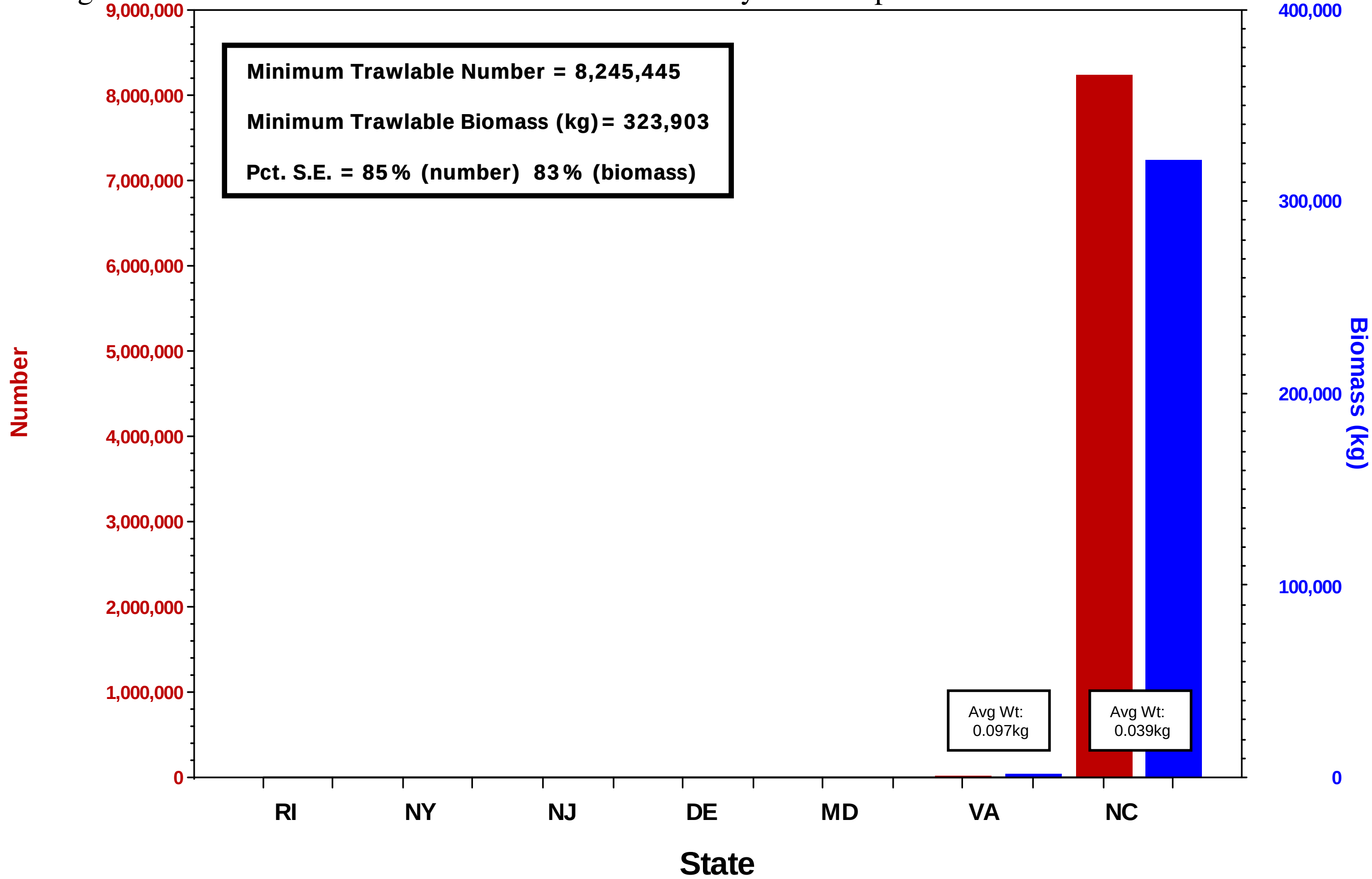
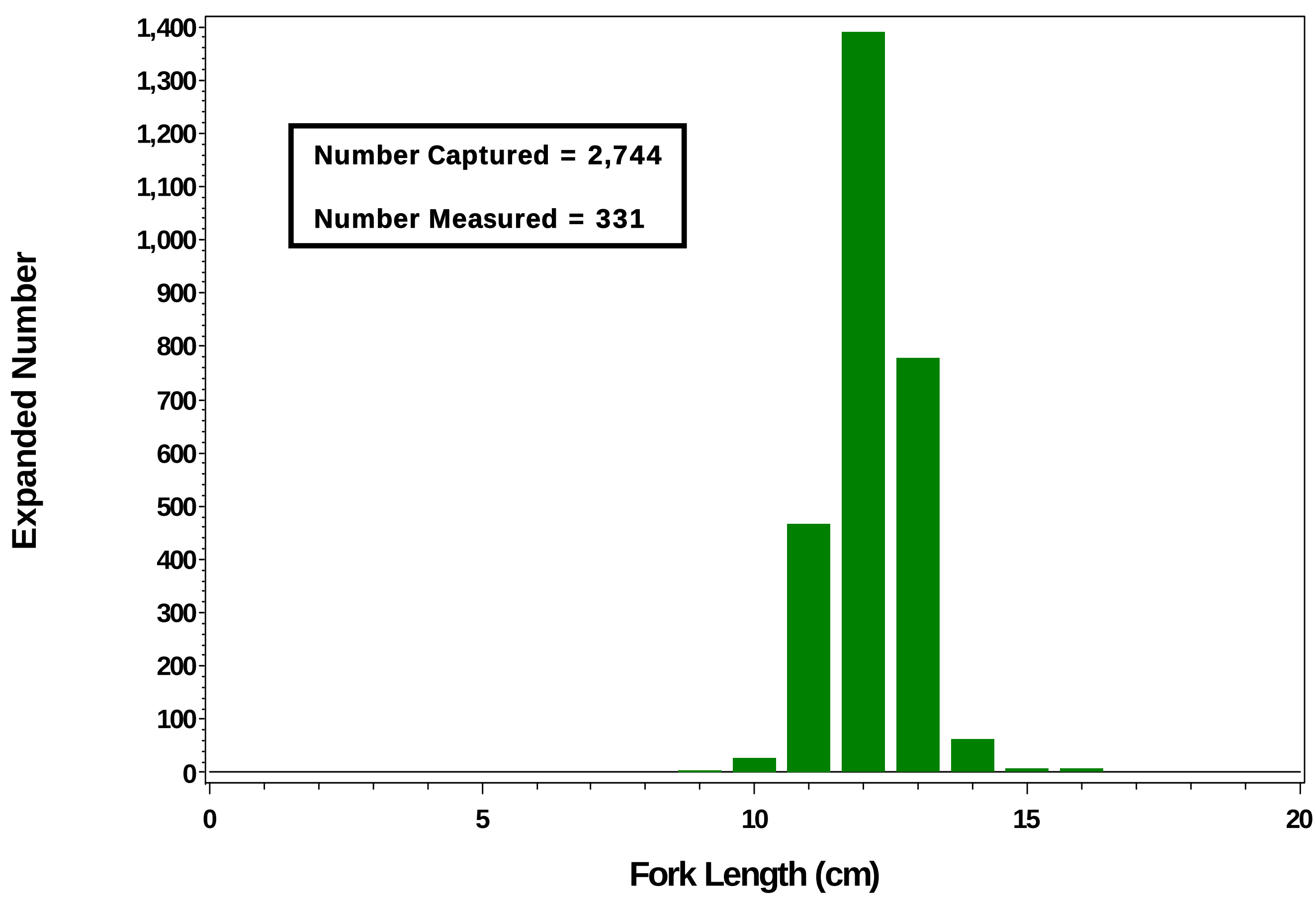
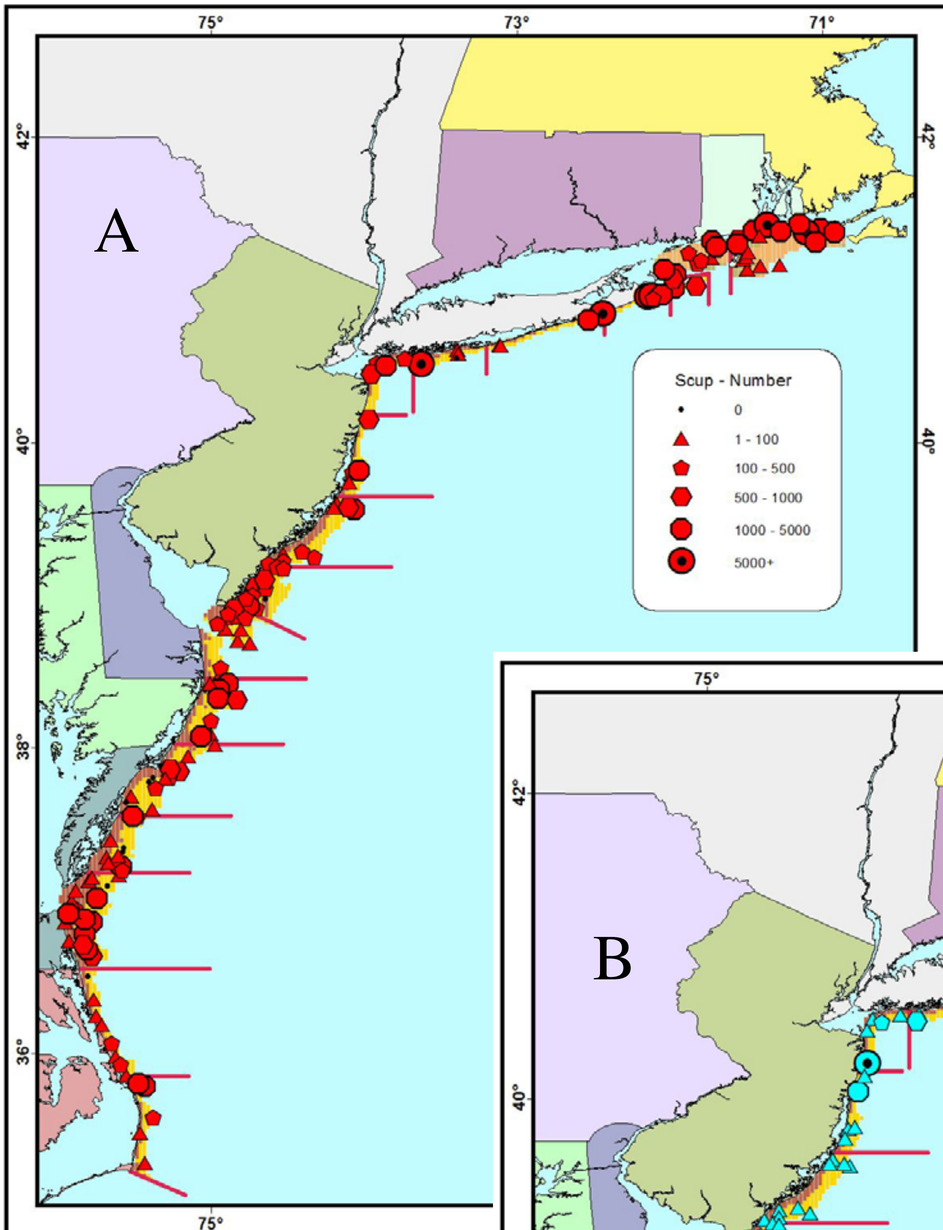


Figure 95. Length frequency histogram for pinfish.



Scup (Priority A)



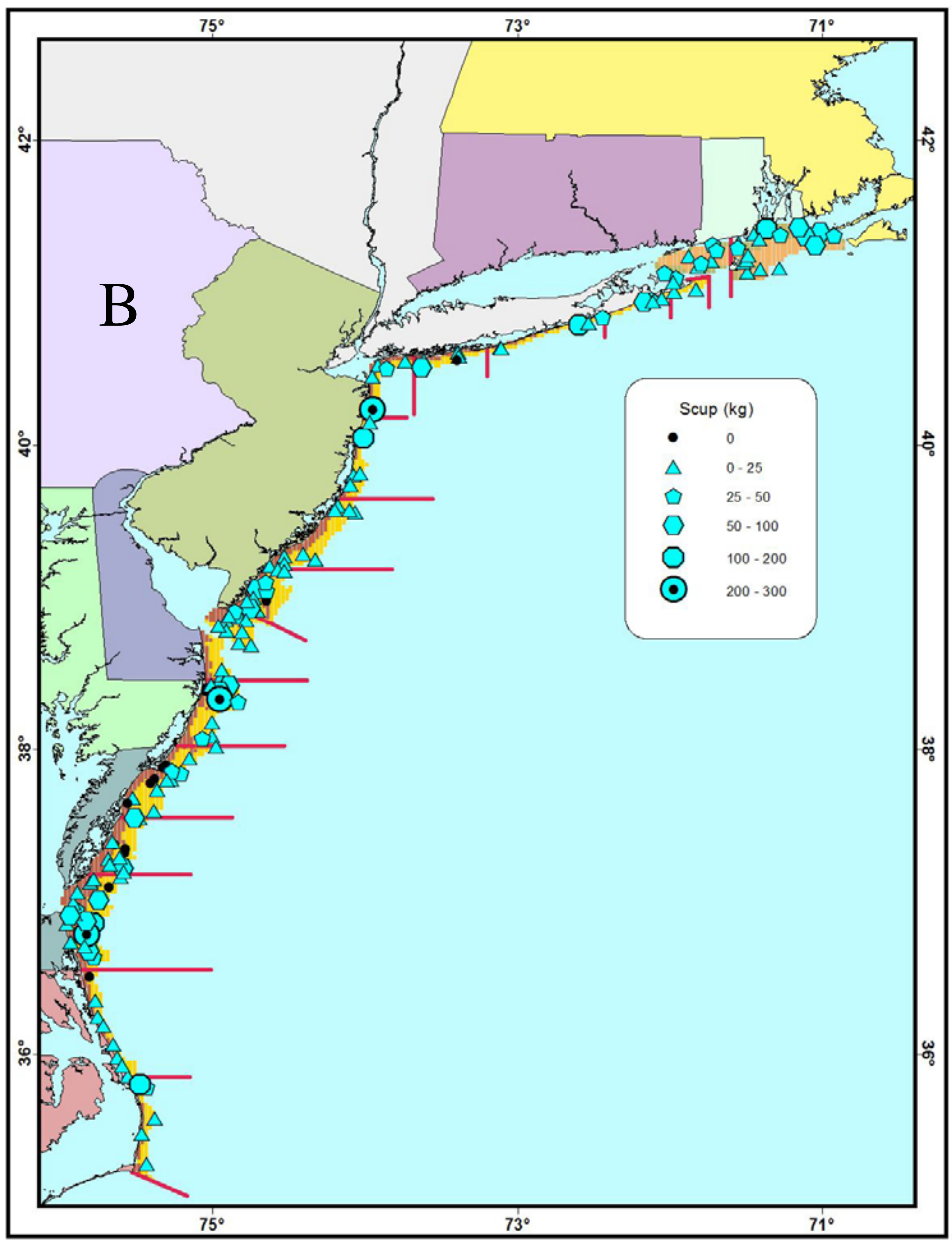


Figure 96. Number (A) and biomass (B) of specimens captured at each station for scup.

Figure 97. Minimum trawlable number and biomass by state for scup.

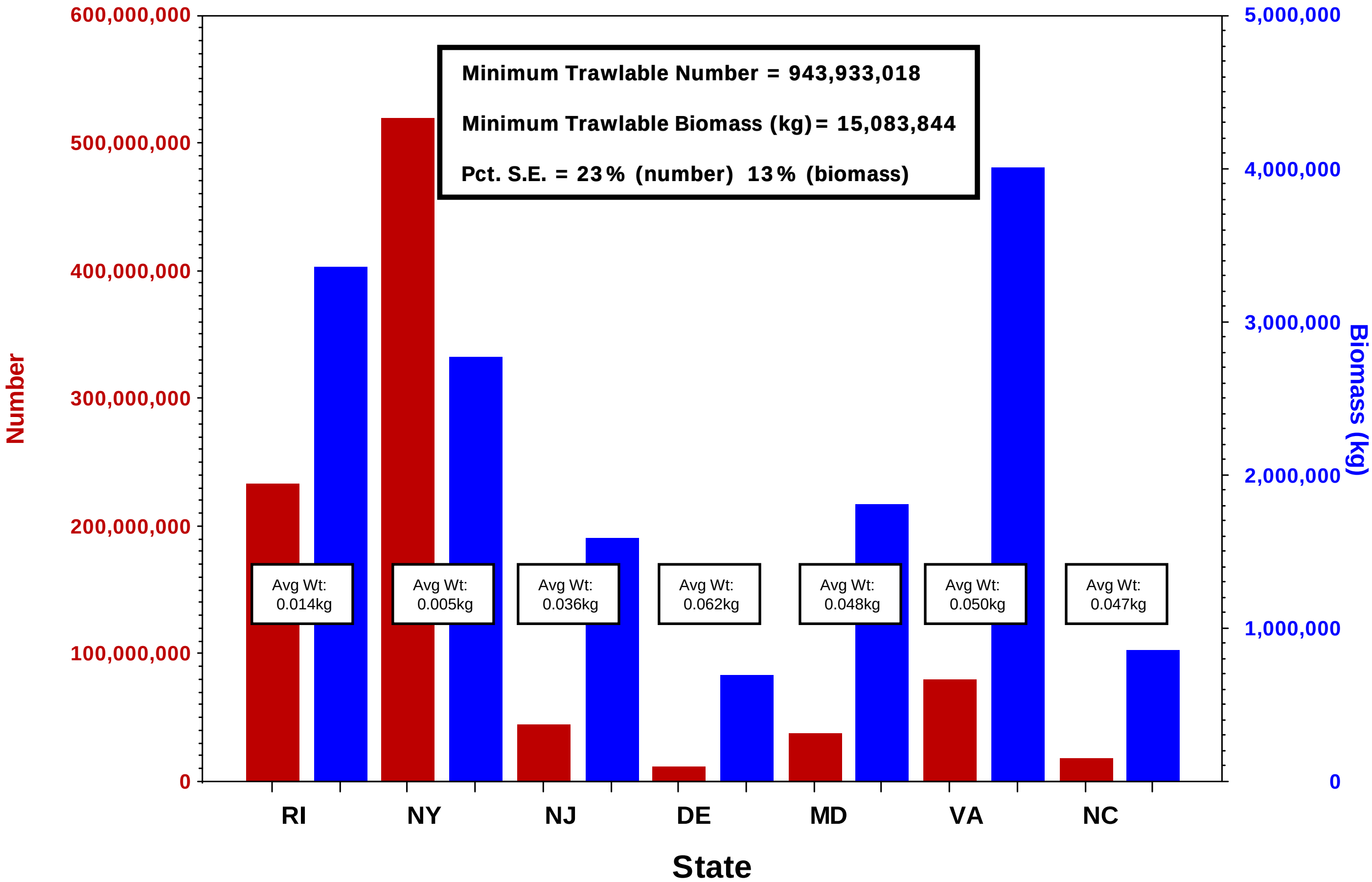


Figure 98. Length frequency histogram for scup.

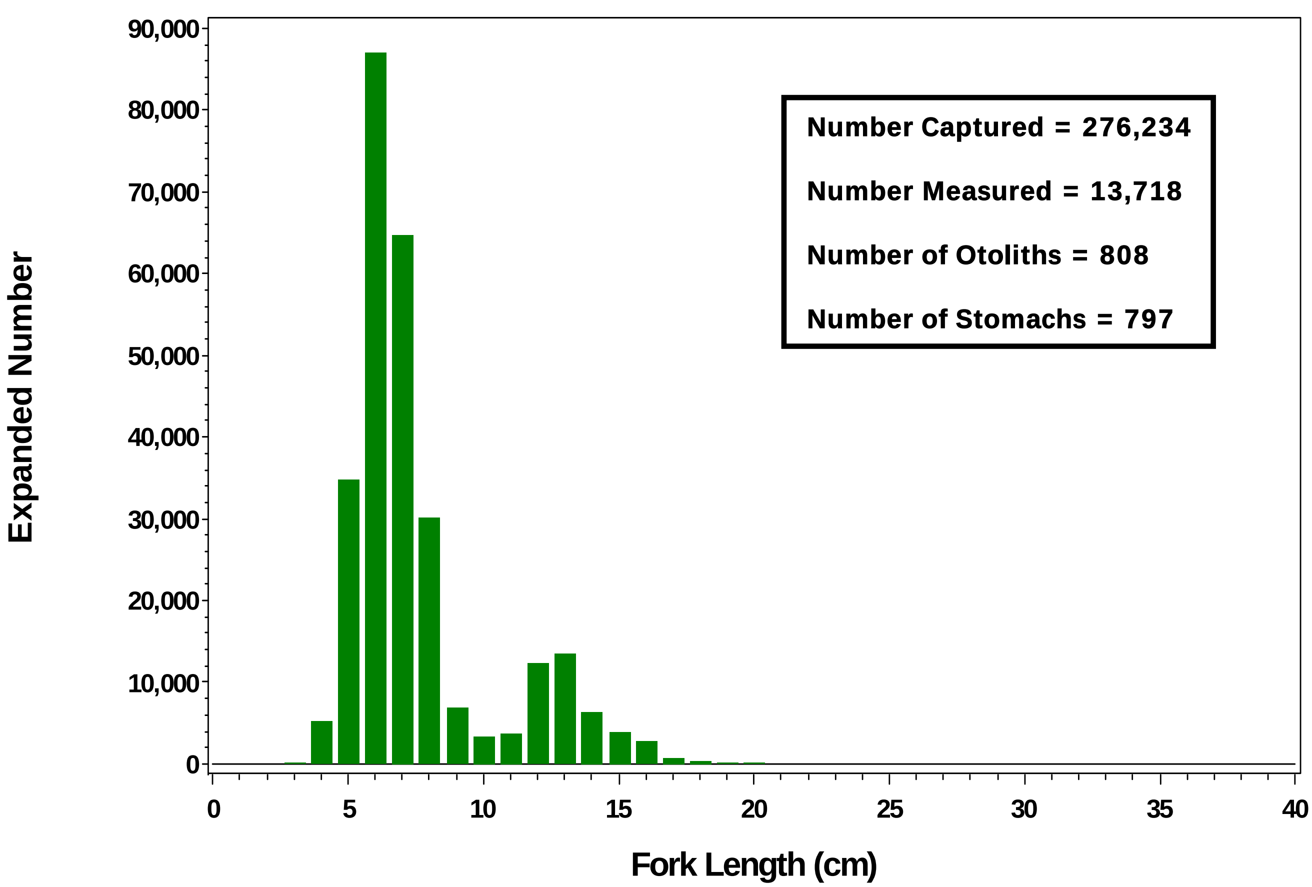
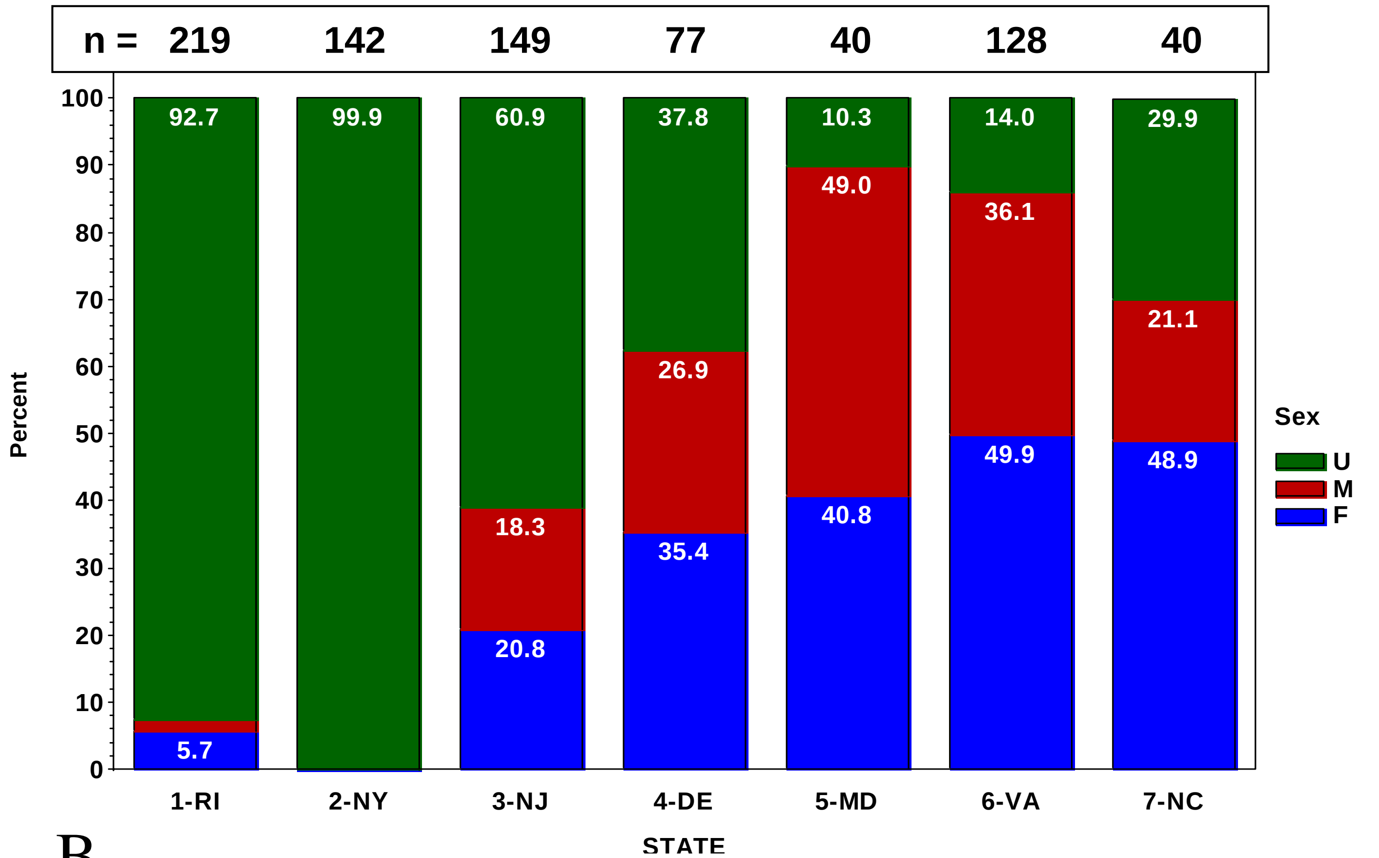


Figure 99. Sex ratios for scup by state (A) and length group (B).

A



B

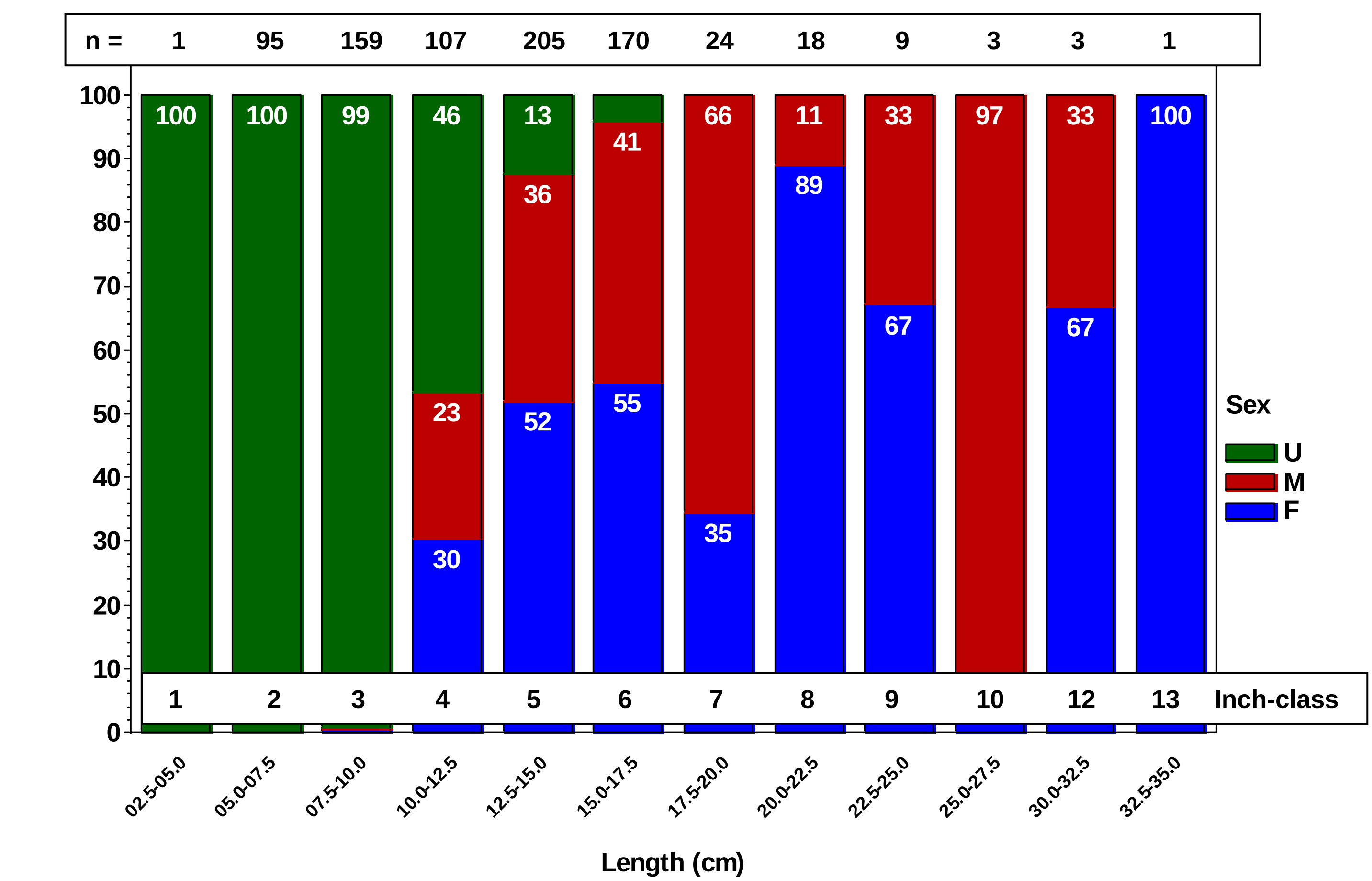


Figure 100. Maturity logistic regression for scup, by sex.

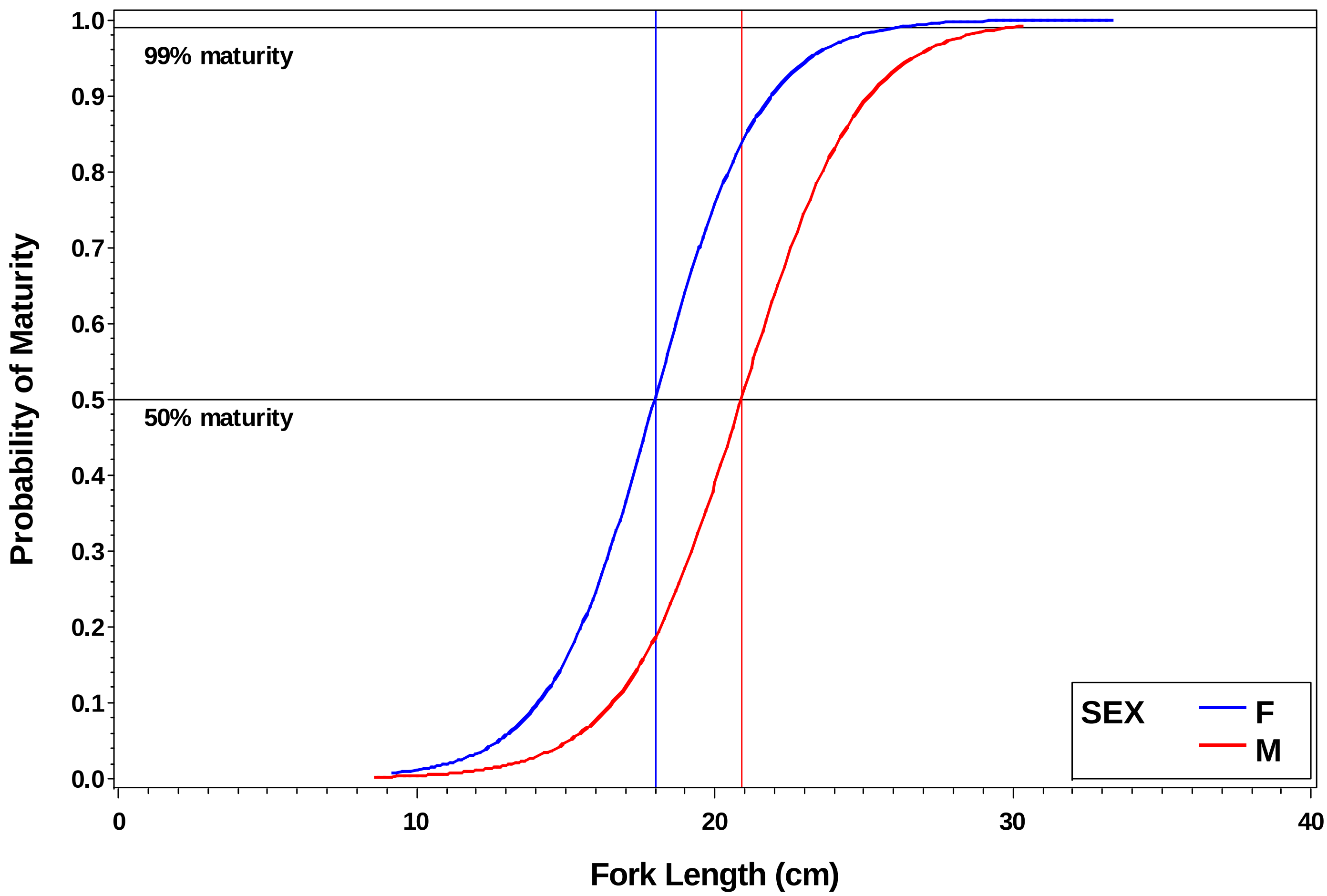


Figure 101. Expanded age frequency histogram for scup.

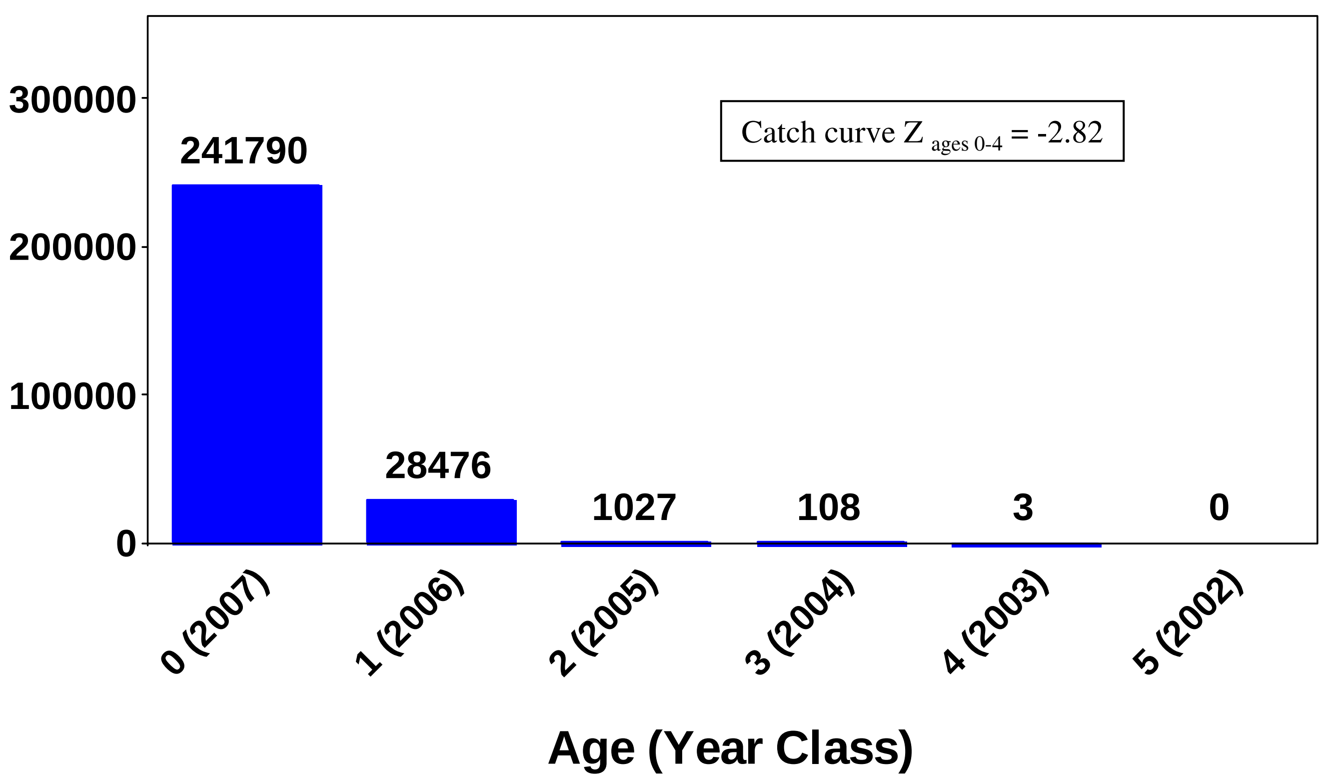


Figure 102. Age-specific length-frequency histograms for scup for ages 0 through 3.

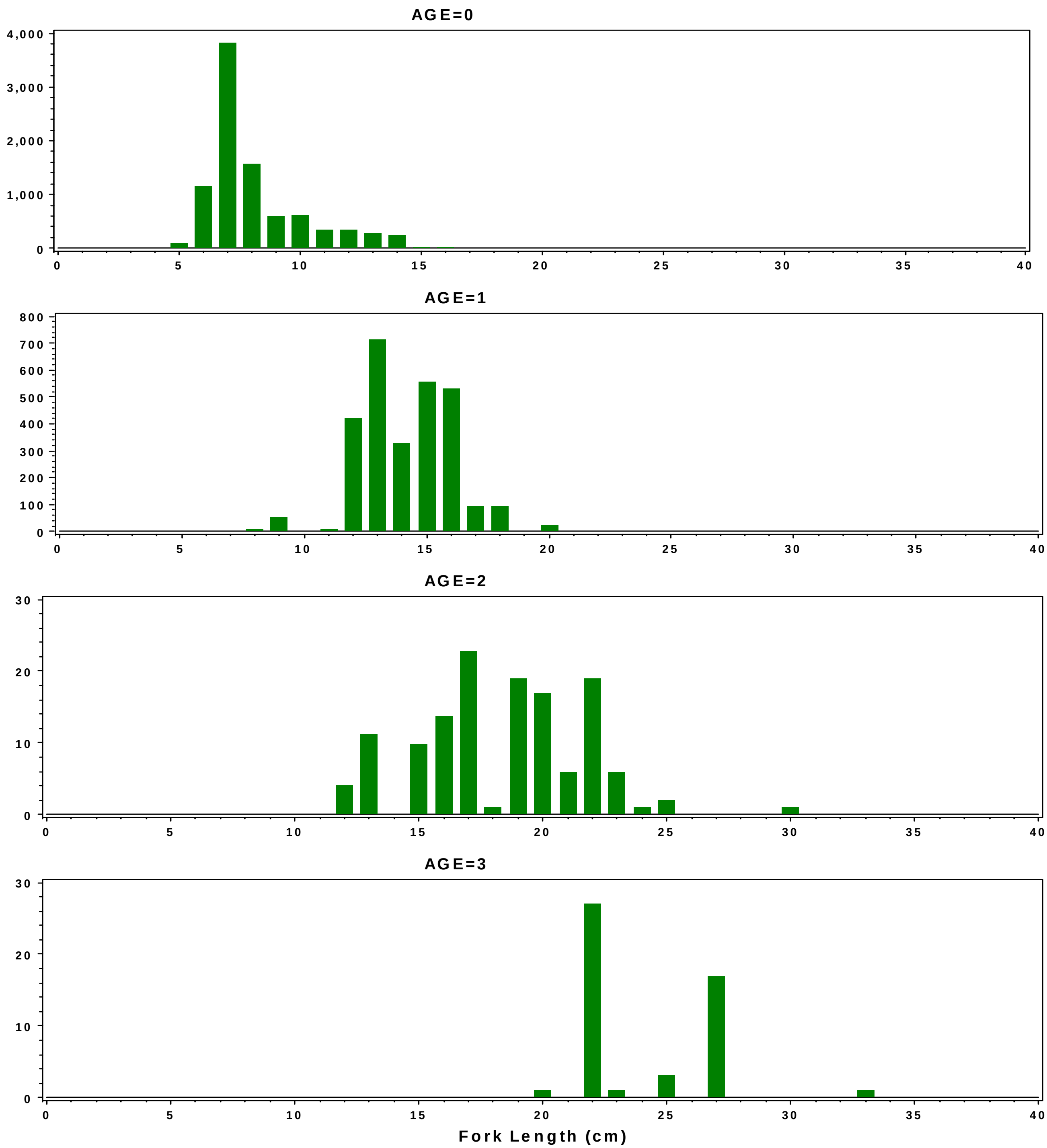


Figure 103. von Bertalanffy growth curves for scup, by sex.

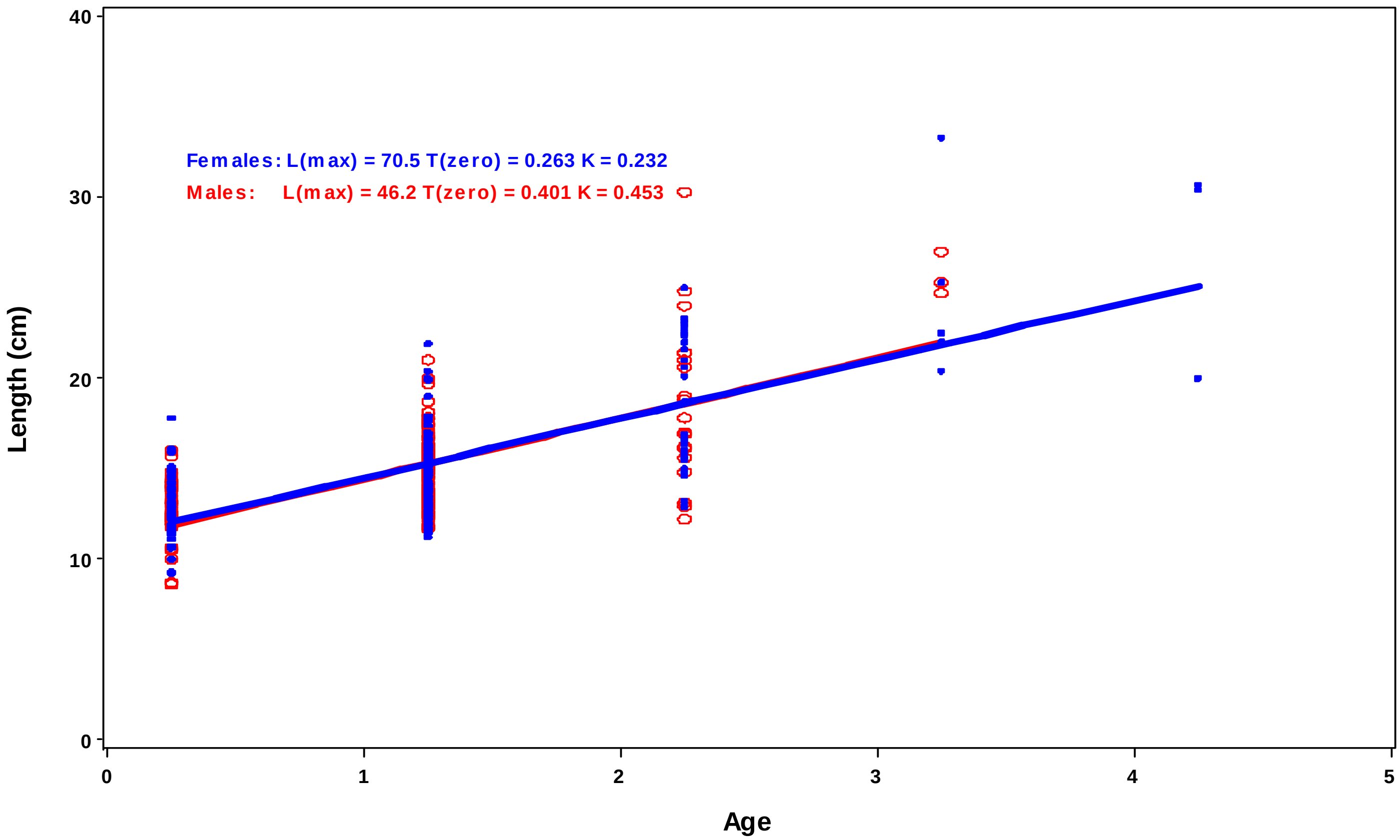


Figure 104. Length-weight regression for little skate, sexes combined (A) and by sex (B).

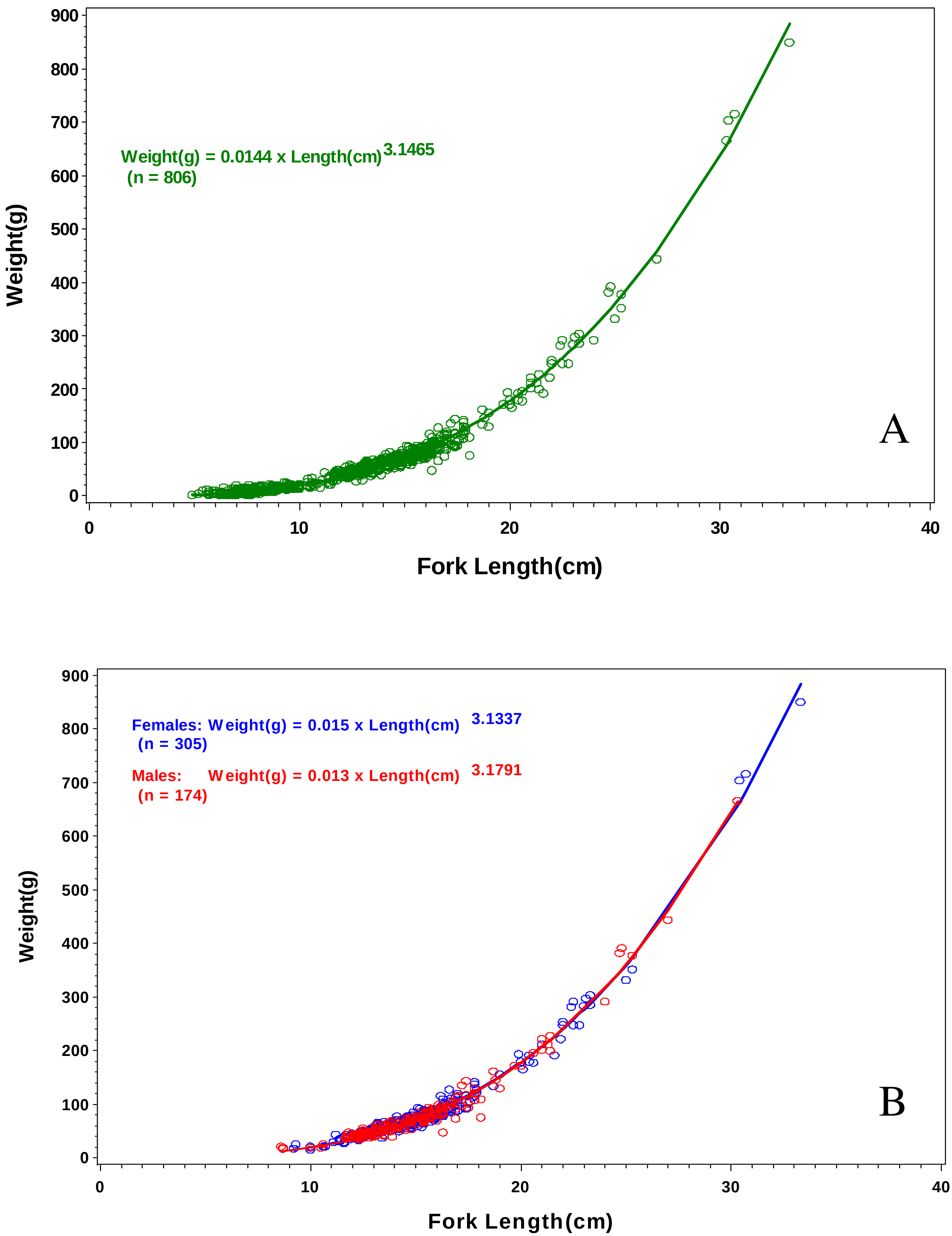
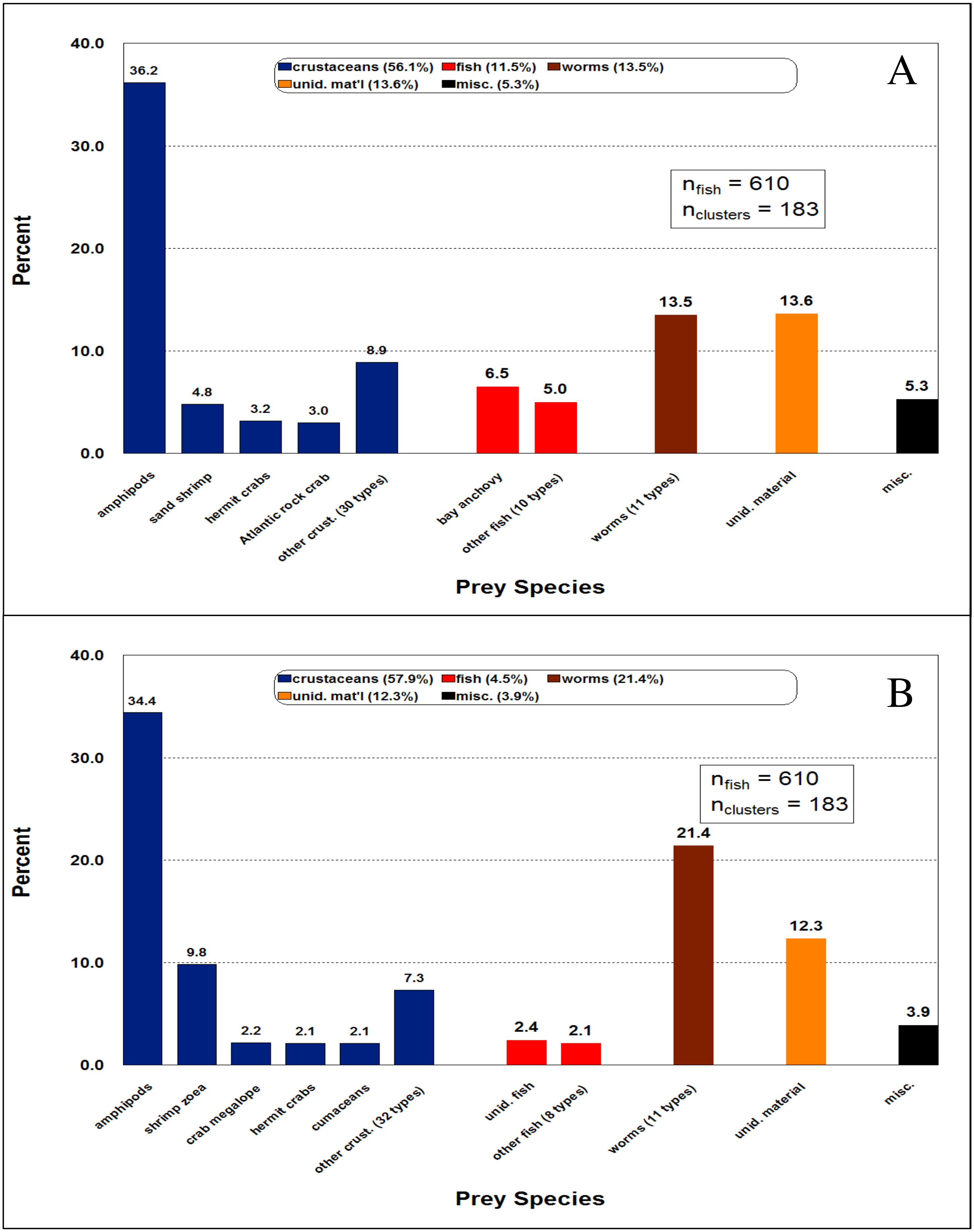
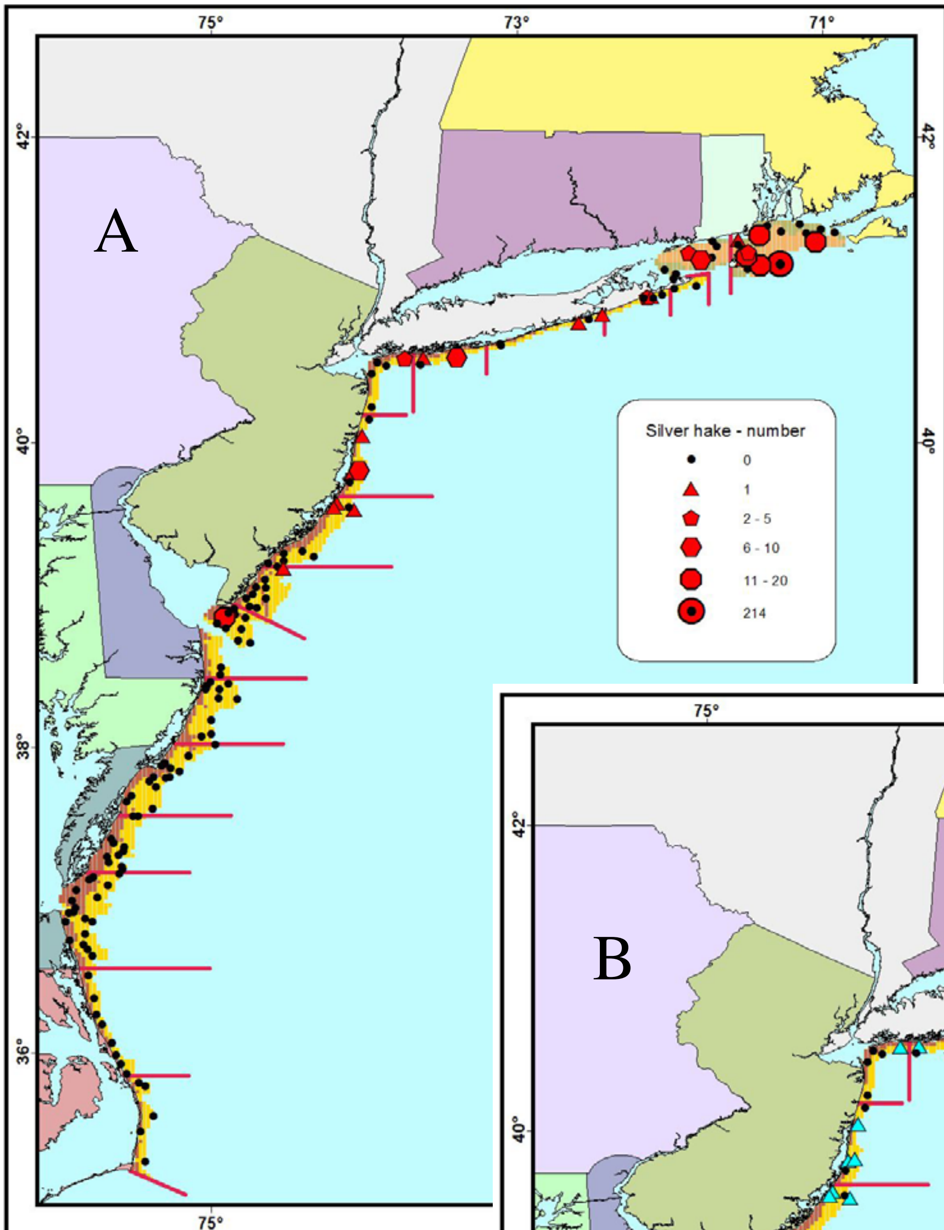


Figure 105. Diets of scup by percent weight (A) and percent number (B).



Silver Hake (Whiting) (Priority A)



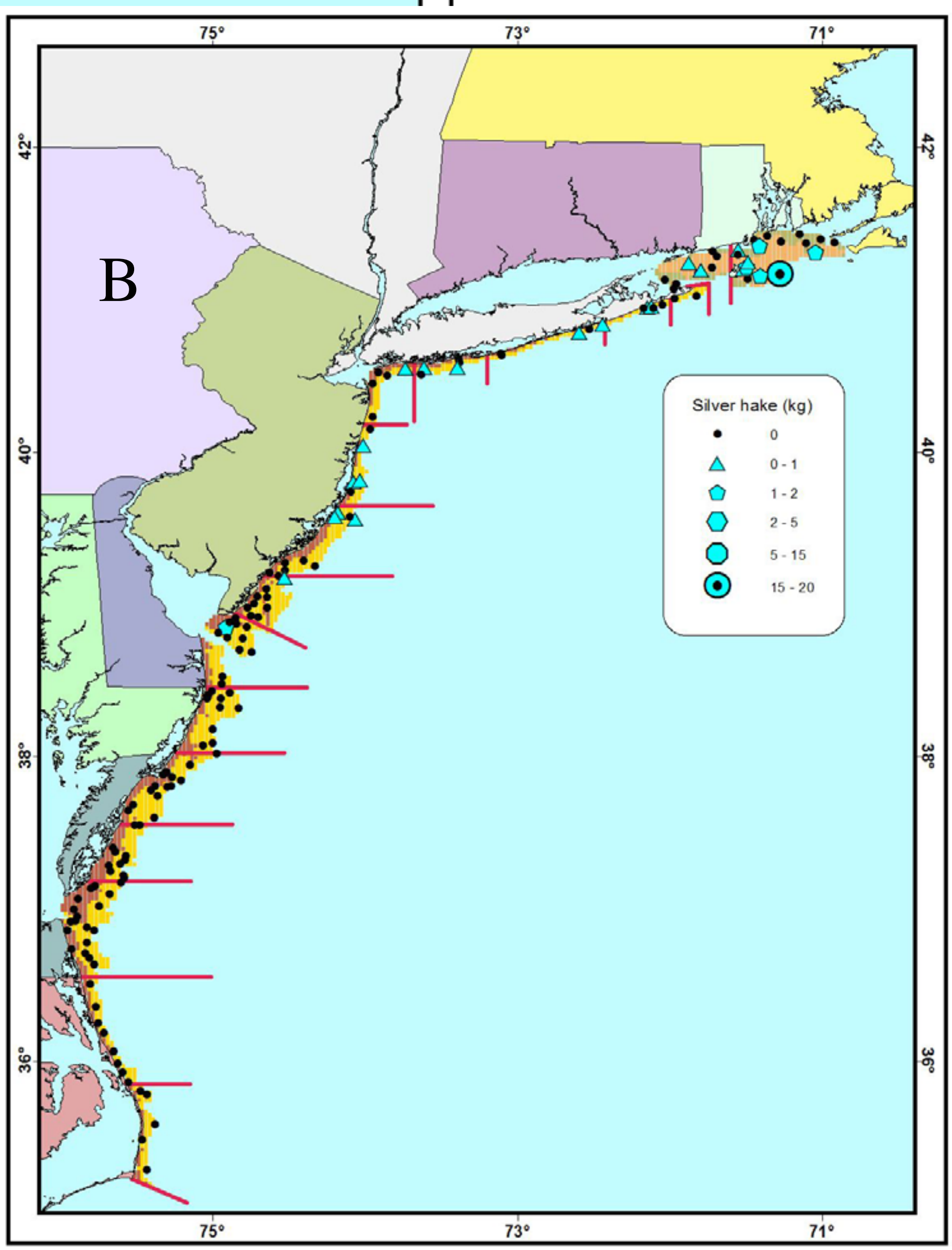


Figure 106. Number (A) and biomass (B) of specimens captured at each station for silver hake.

Figure 107. Minimum trawlable number and biomass by state for silver hake.

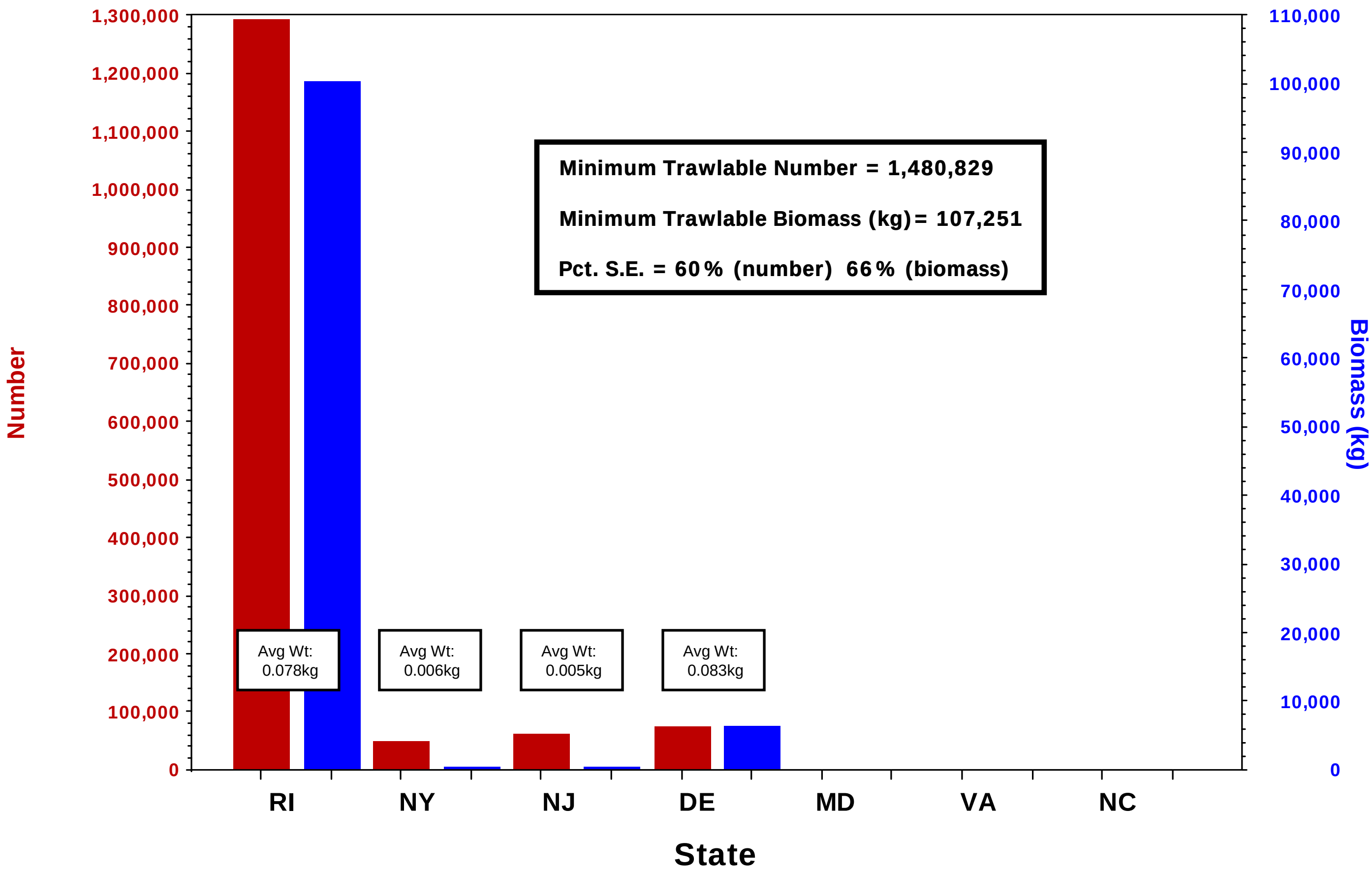


Figure 108. Length frequency histogram for silver hake.

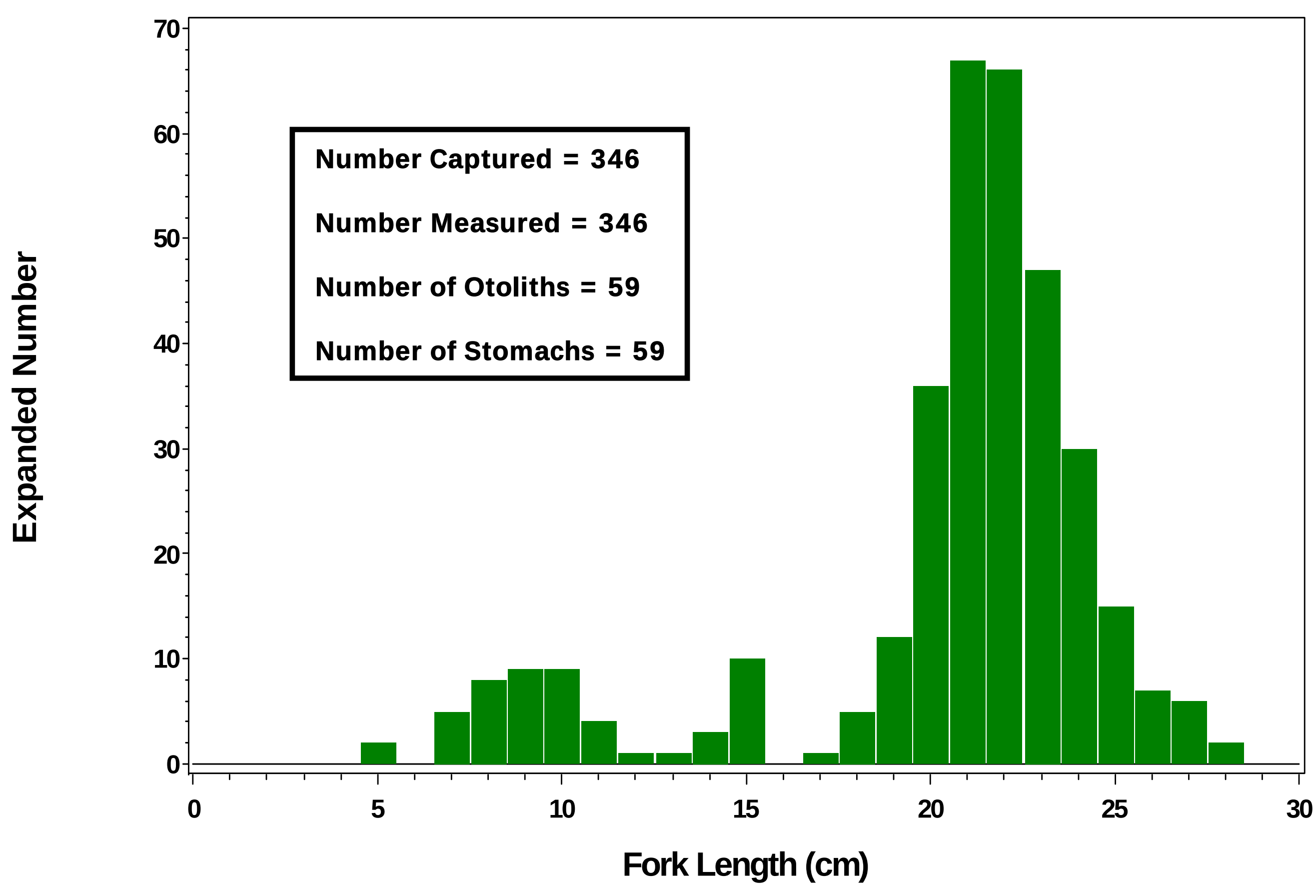
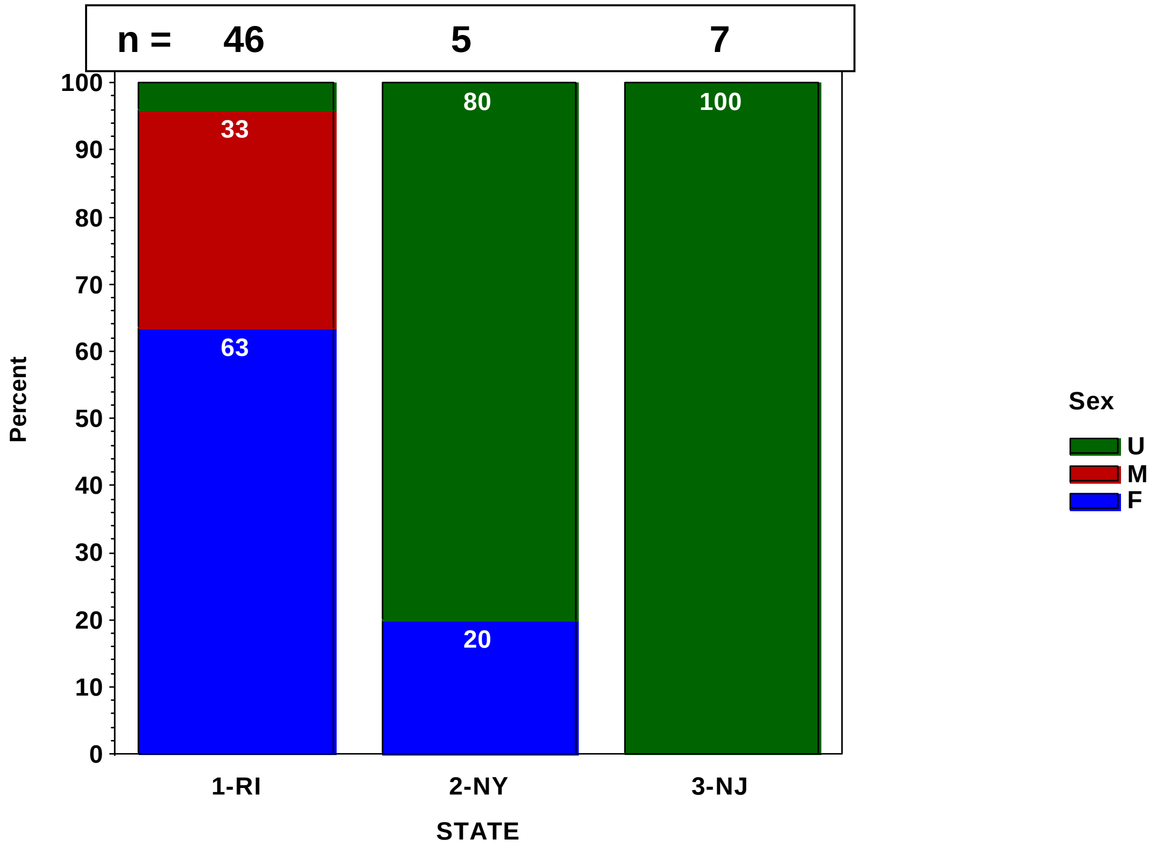


Figure 109. Sex ratios for silver hake by state (A) and length group (B).

A



B

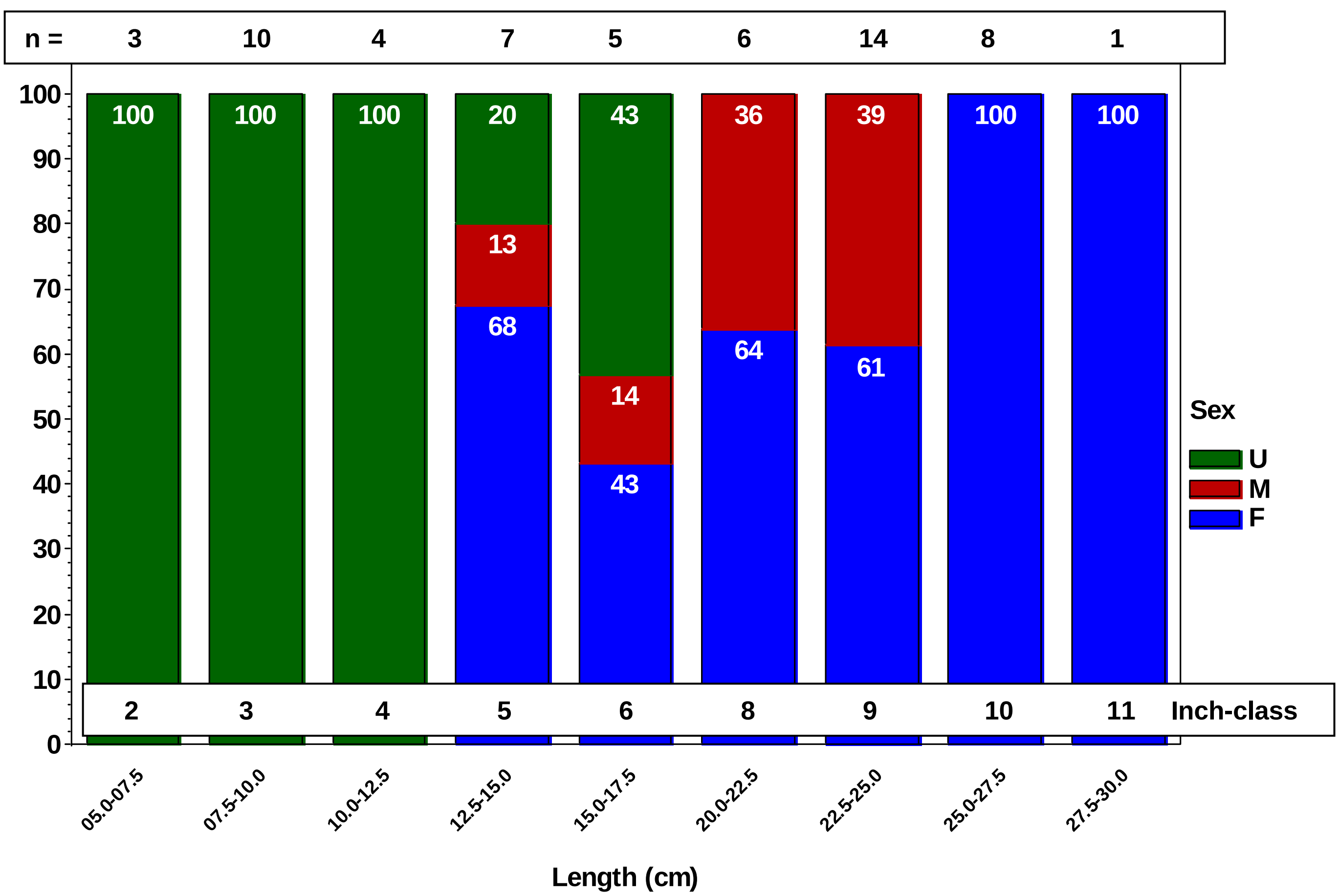


Figure 110. Maturity logistic regression for silver hake, by sex.

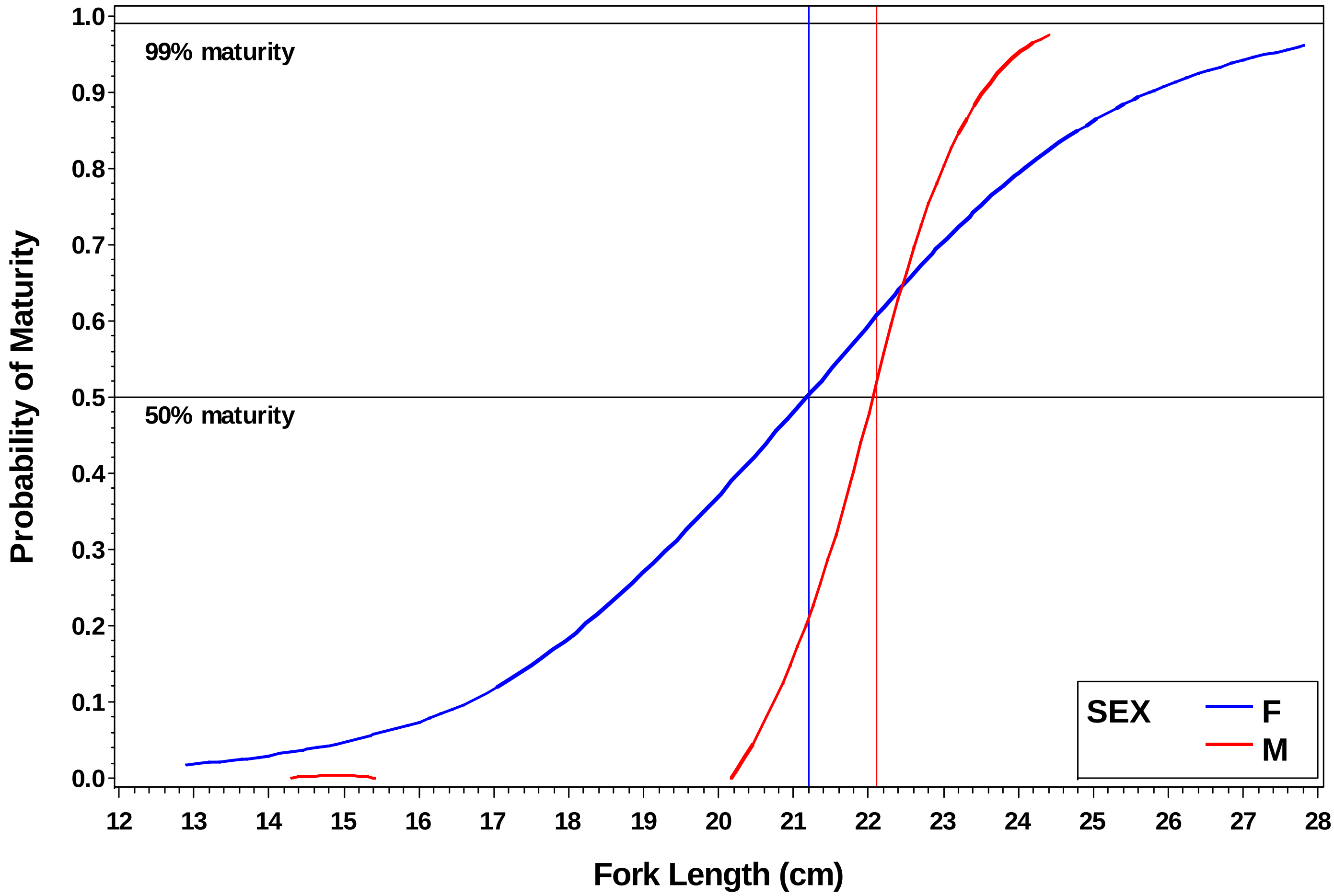
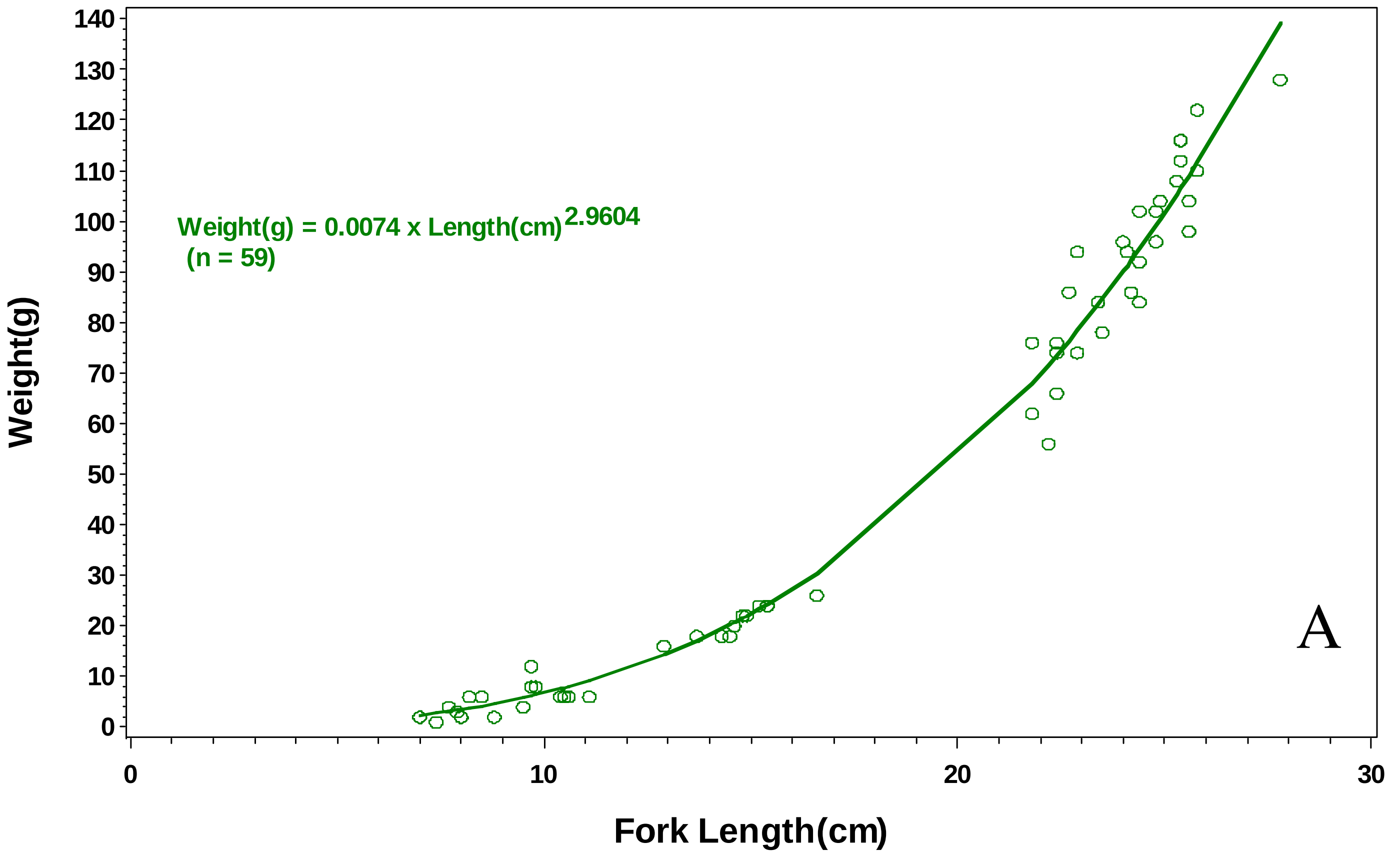
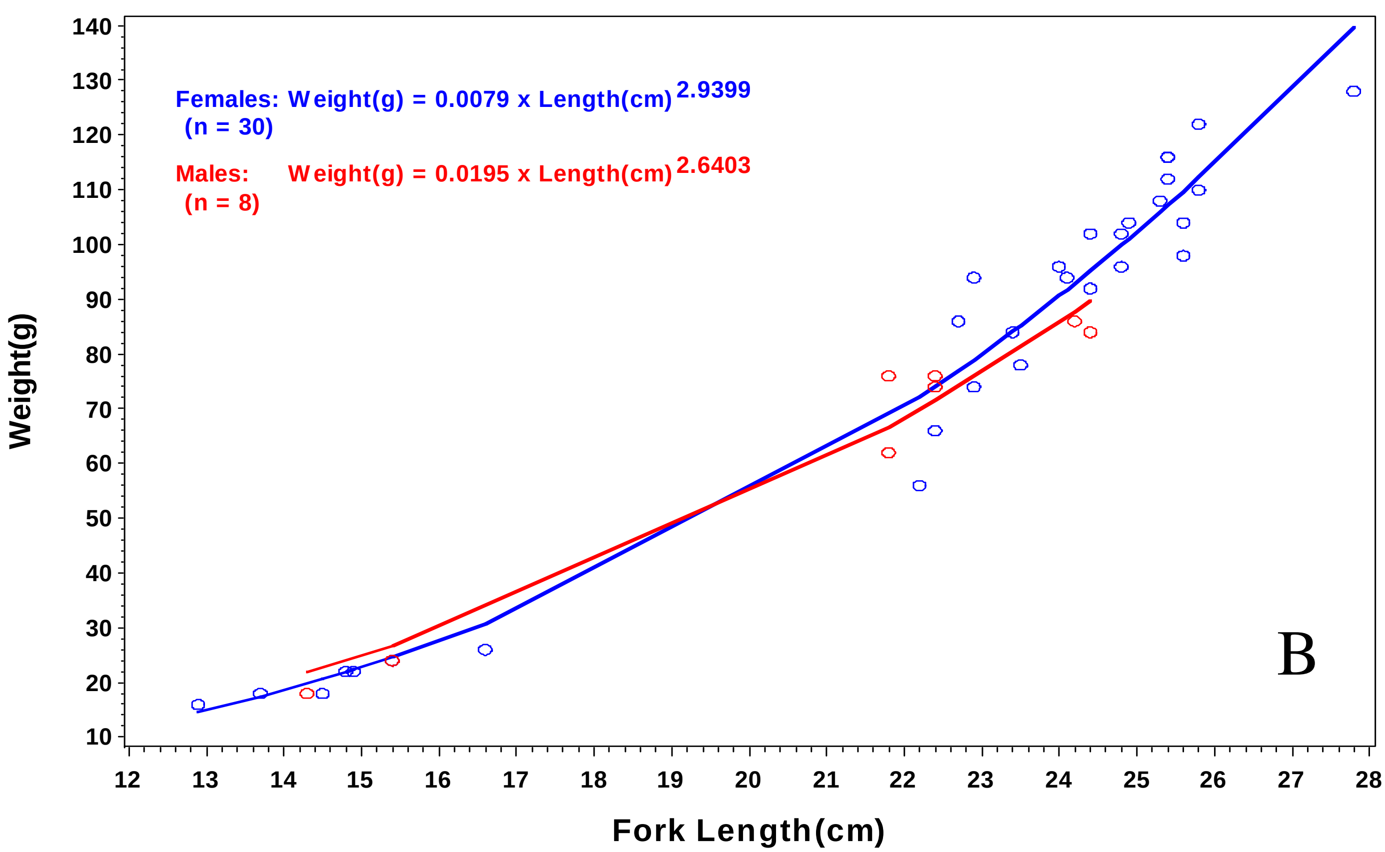
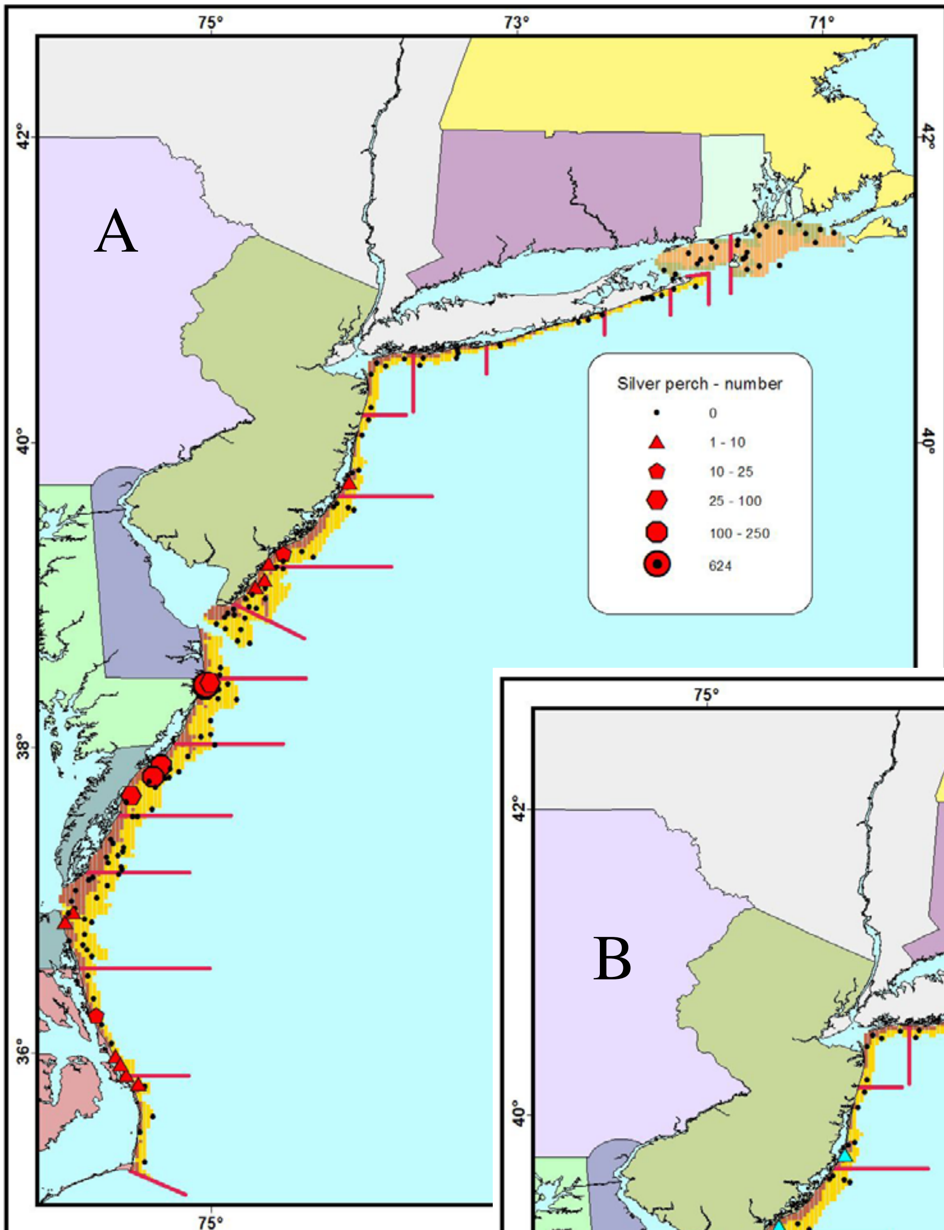


Figure 111. Length-weight regression for silver hake, sexes combined (A) and by sex (B).





Silver Perch (Priority D)



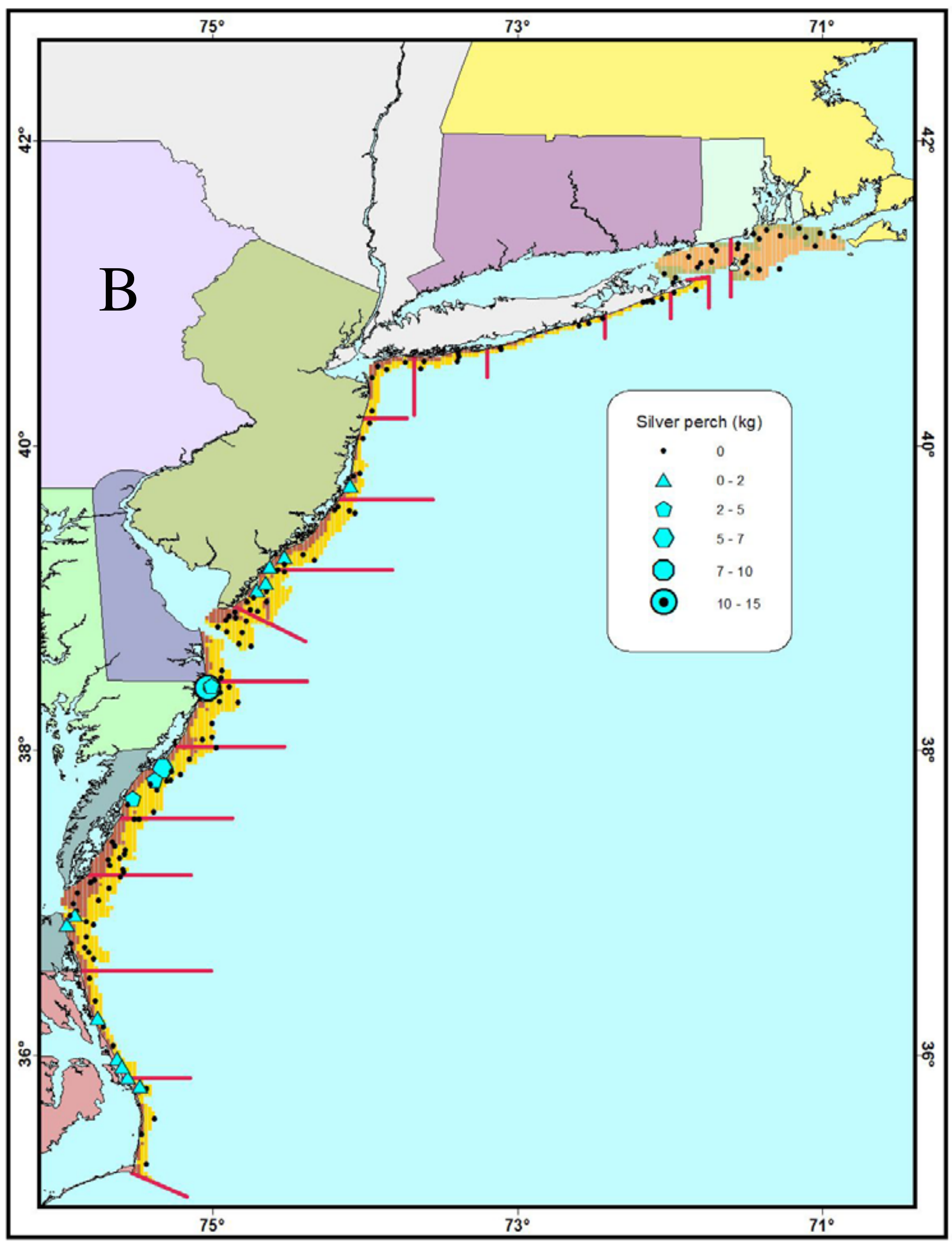


Figure 112. Number (A) and biomass (B) of specimens captured at each station for silver perch.

Figure 113. Minimum trawlable number and biomass by state for silver perch.

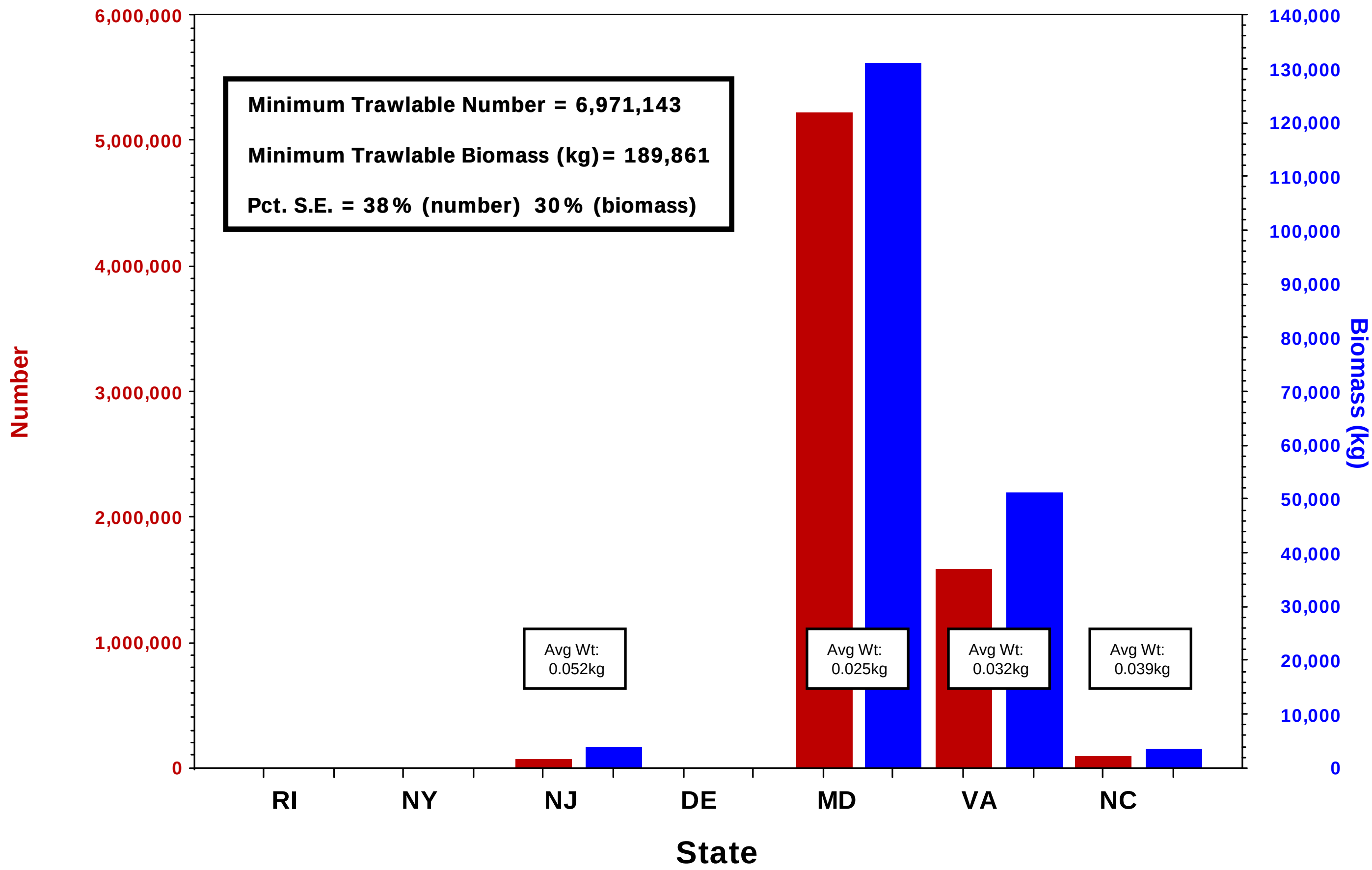
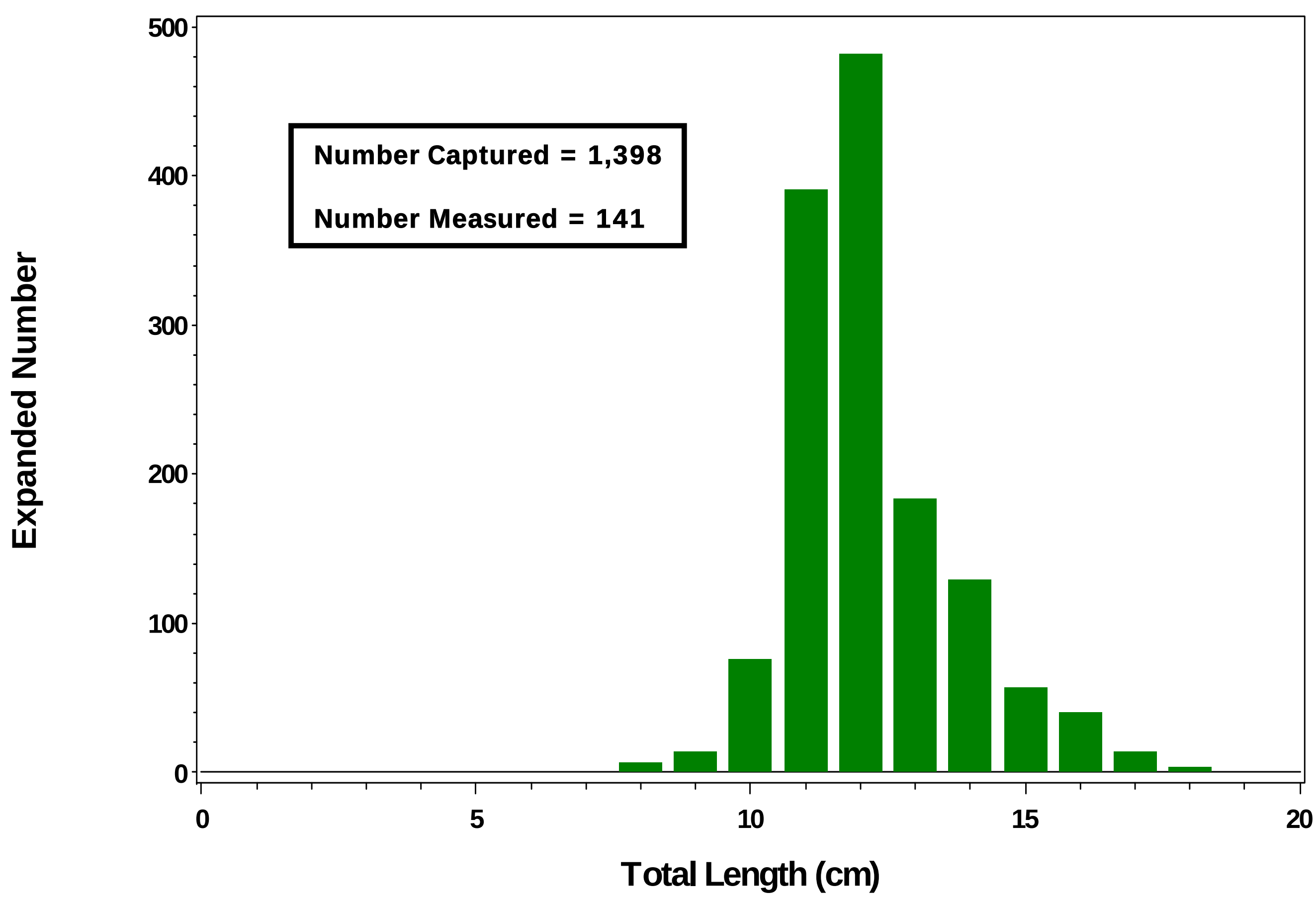
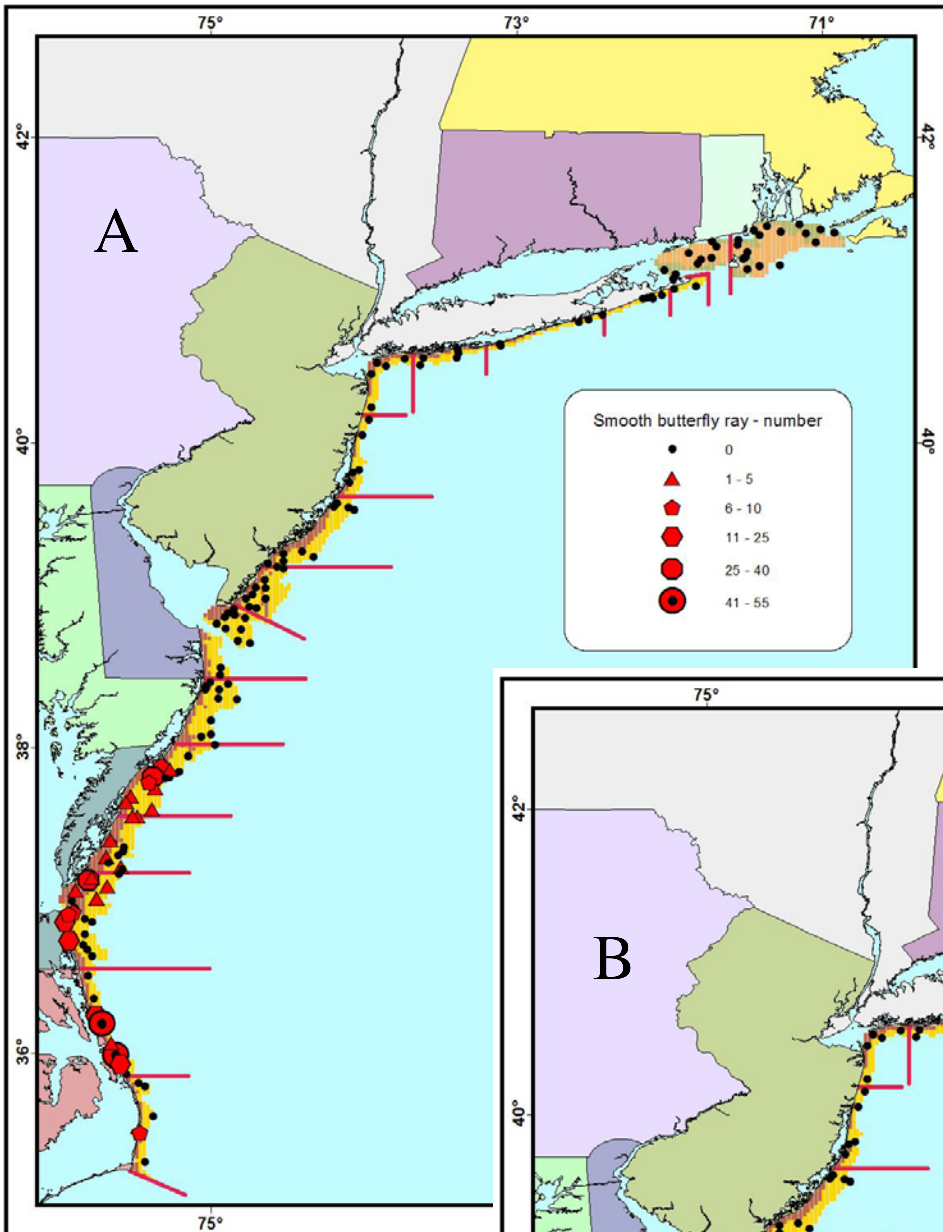


Figure 114. Length frequency histogram for silver perch.



Smooth Butterfly Ray (Priority B)



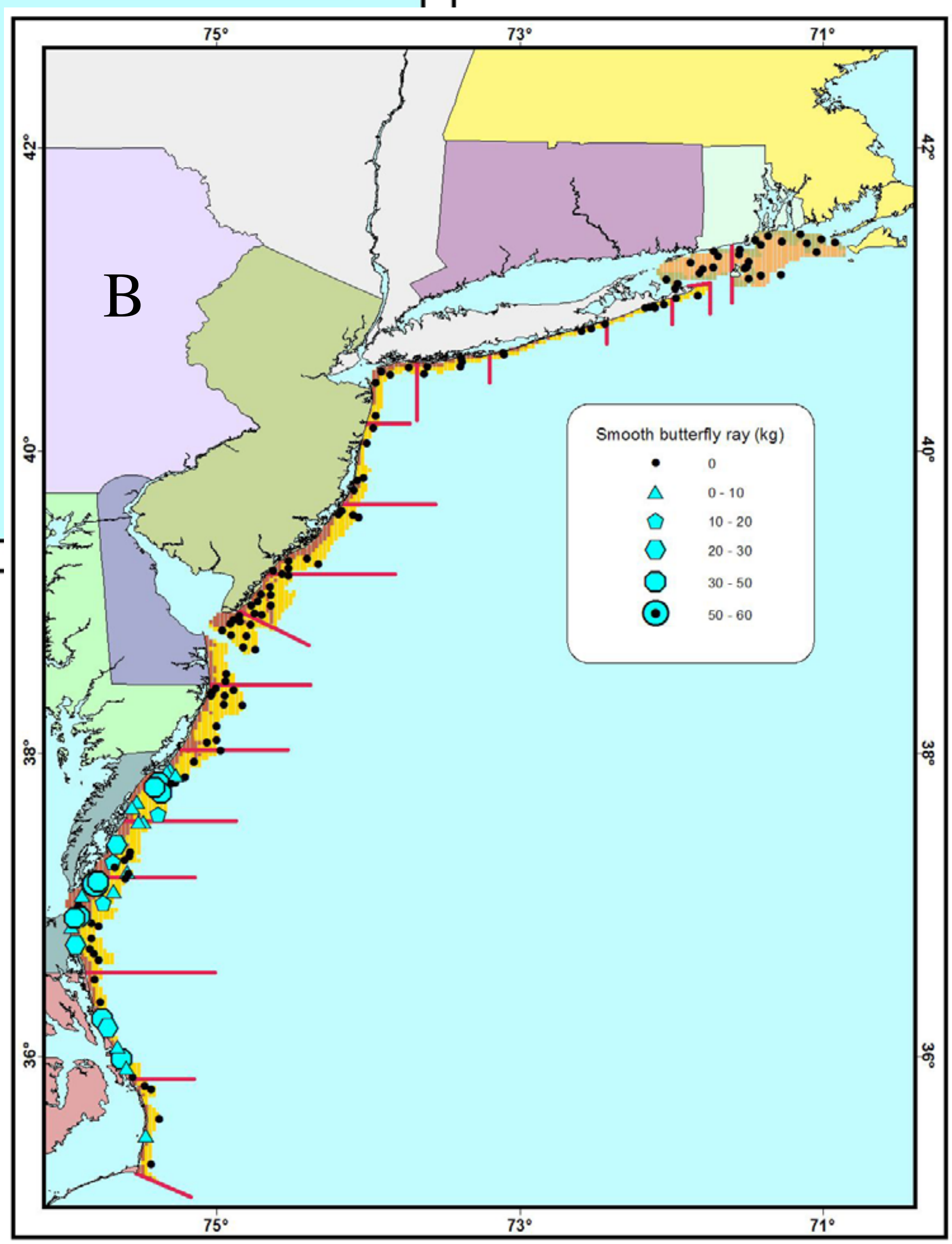


Figure 115. Number (A) and biomass (B) of specimens captured at each station for smooth butterfly ray.

Figure 116. Minimum trawlable number and biomass by state for smooth butterfly ray.

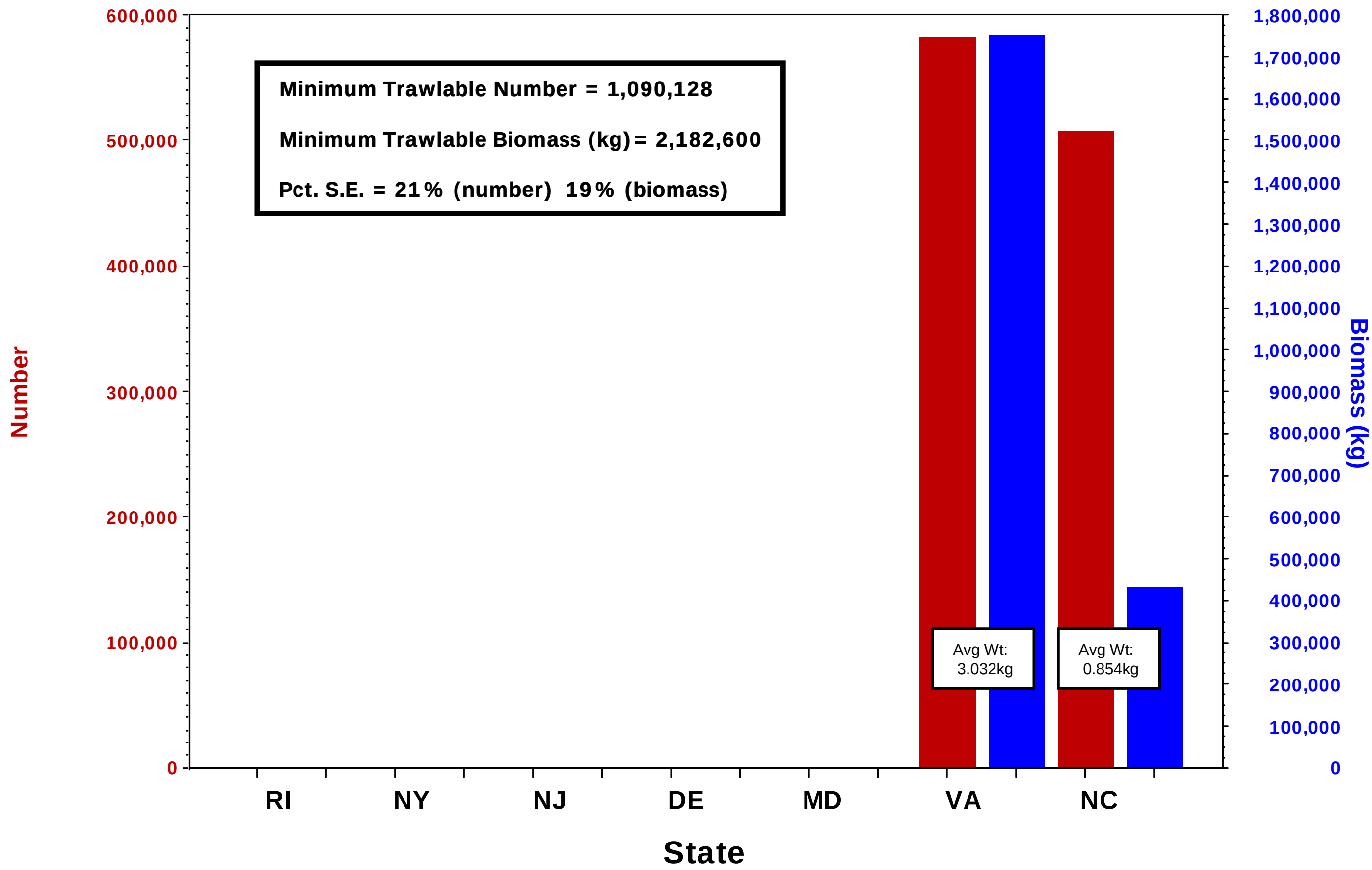
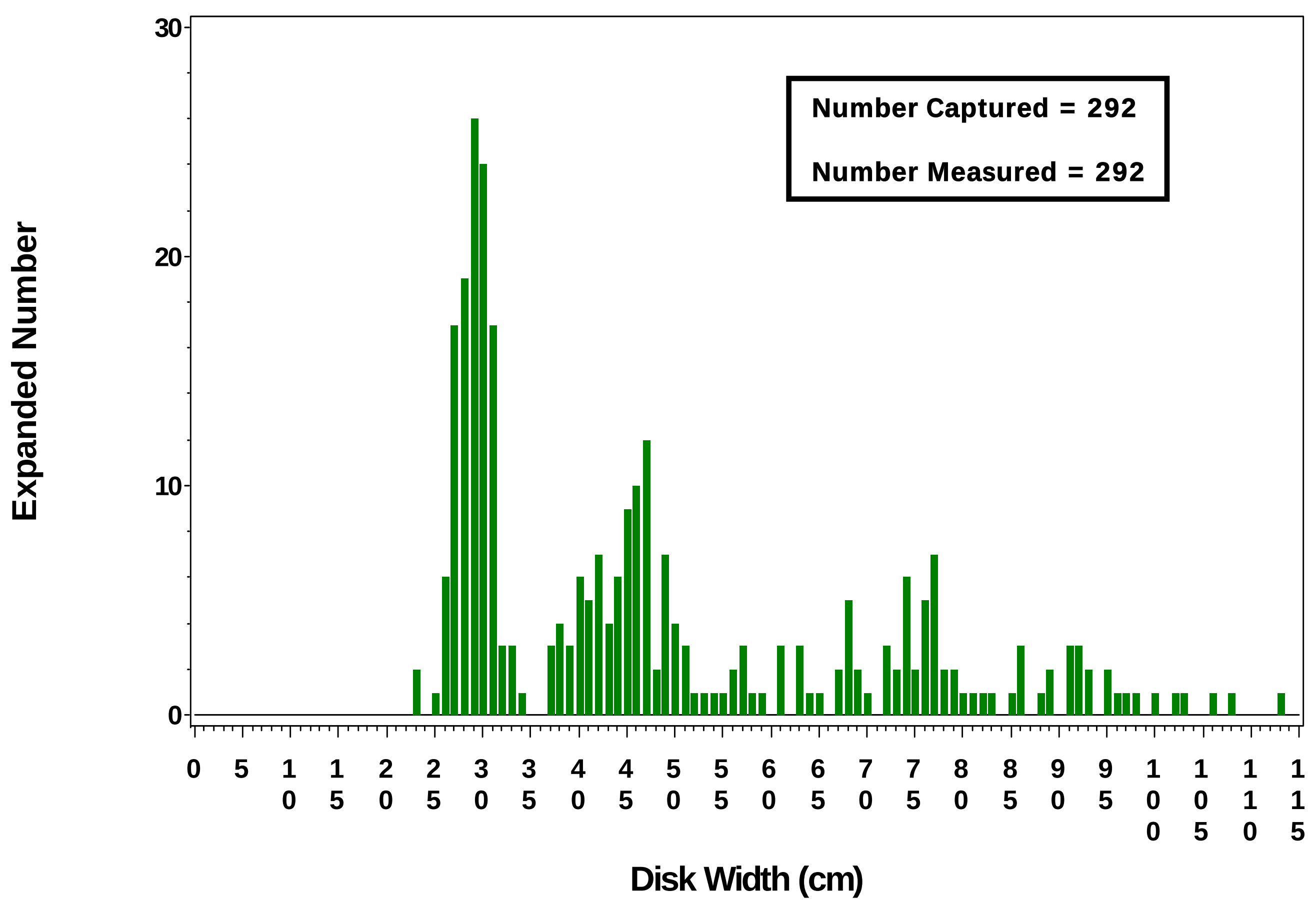
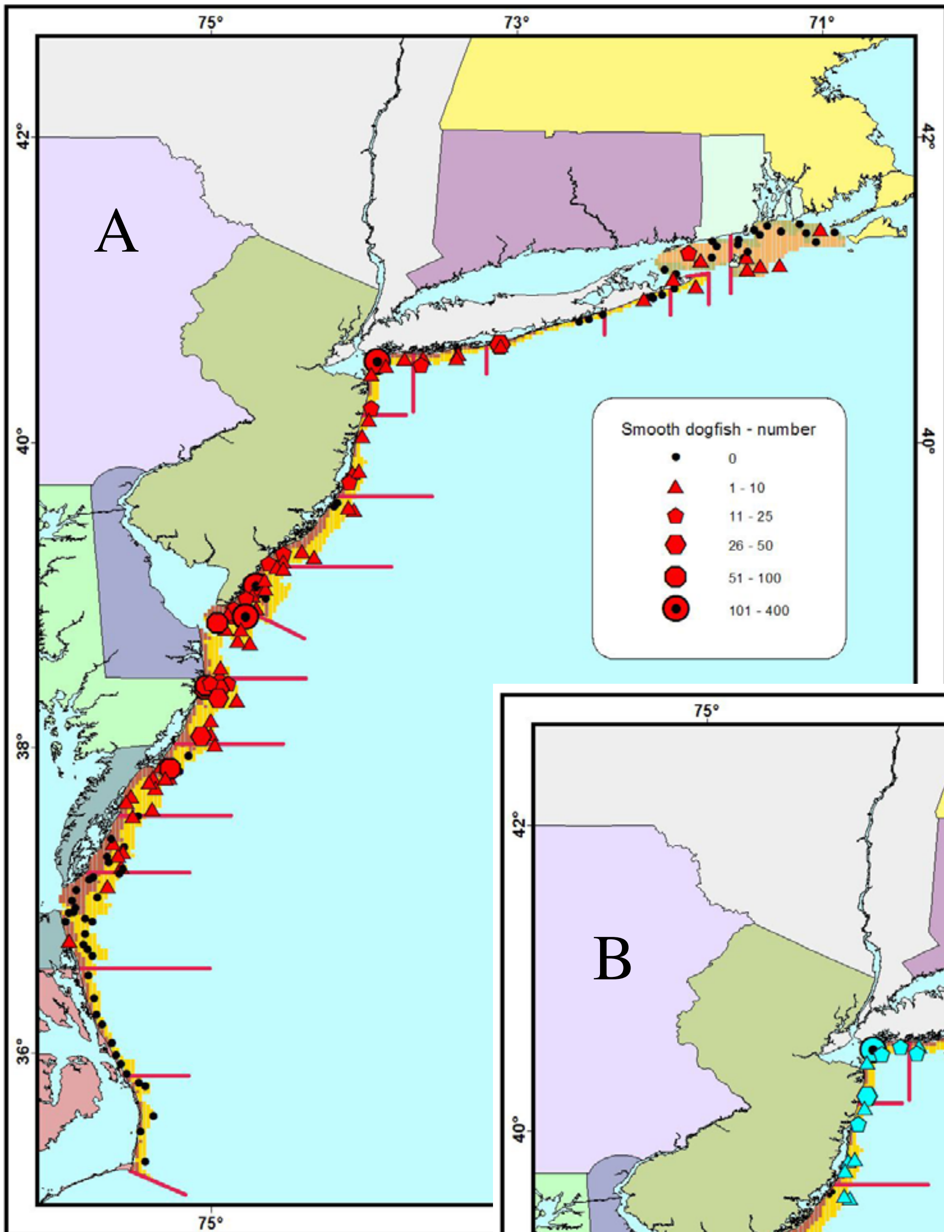


Figure 117. Width frequency histogram for smooth butterfly ray.



Smooth Dogfish (Priority B)



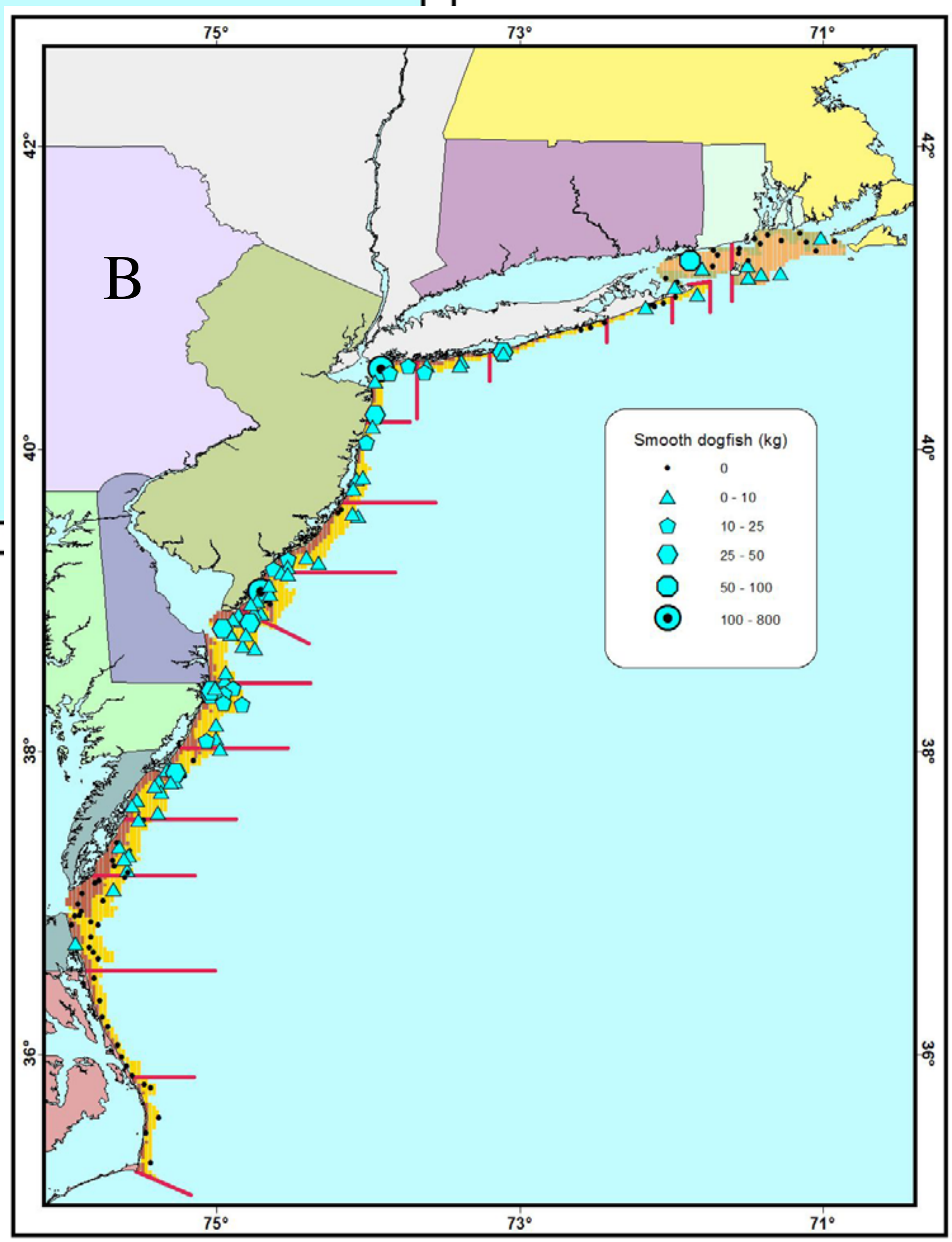


Figure 118. Number (A) and biomass (B) of specimens captured at each station for smooth dogfish.

Figure 119. Minimum trawlable number and biomass by state for smooth dogfish.

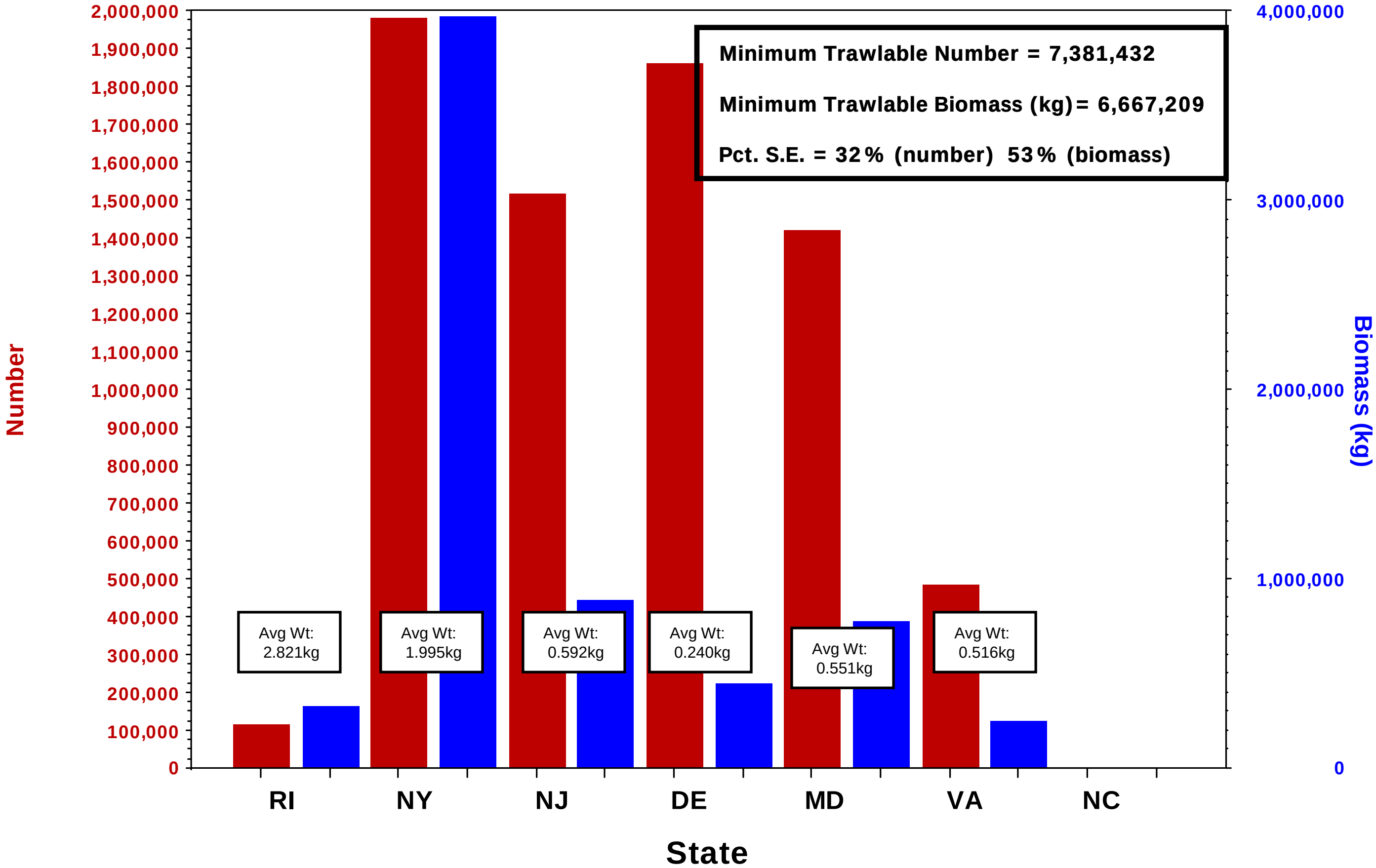


Figure 120. Length frequency histogram for smooth dogfish.

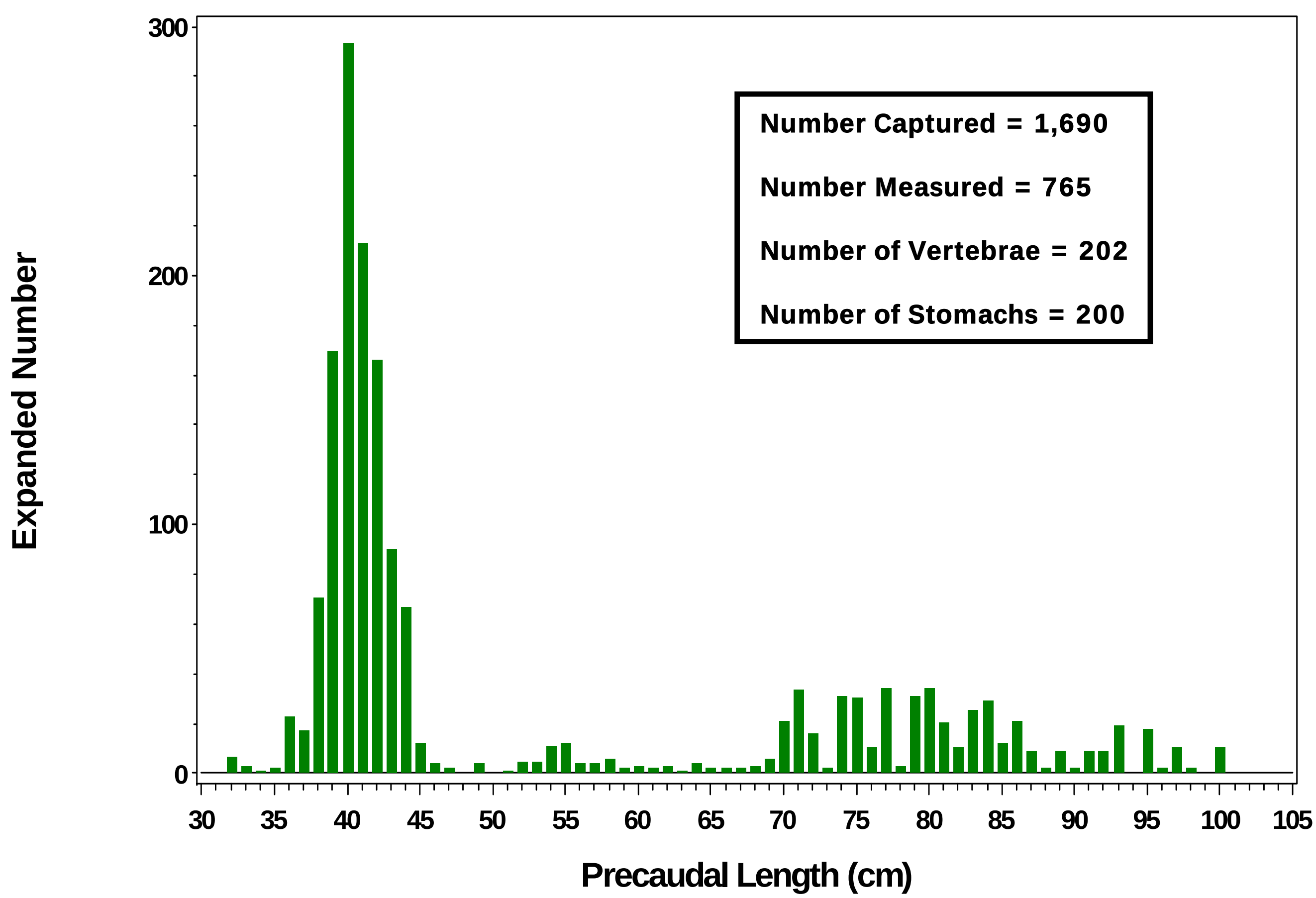


Figure 121. Sex ratios for smooth dogfish by state (A) and length group (B).

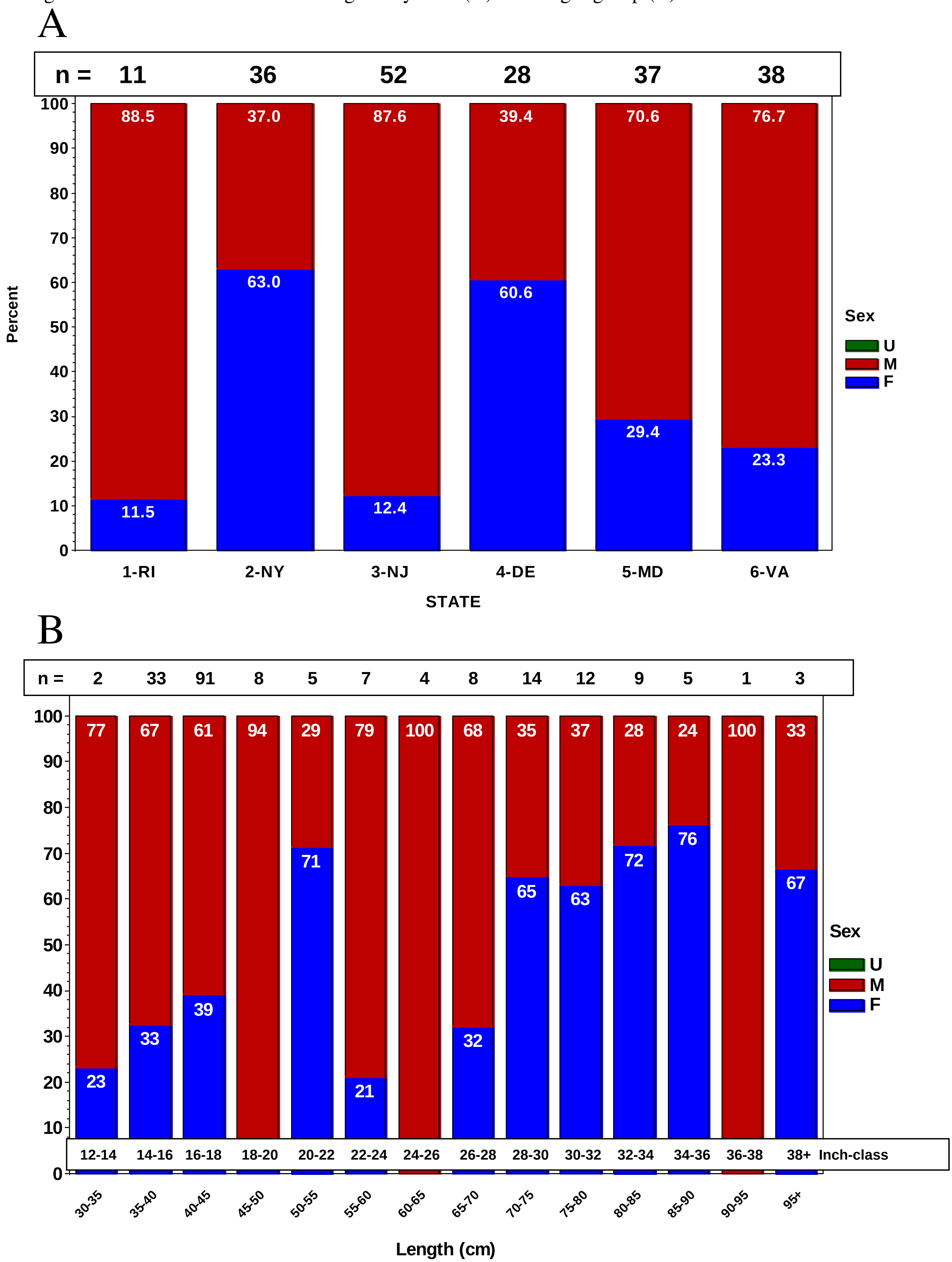


Figure 122. Maturity logistic regression for smooth dogfish, by sex.

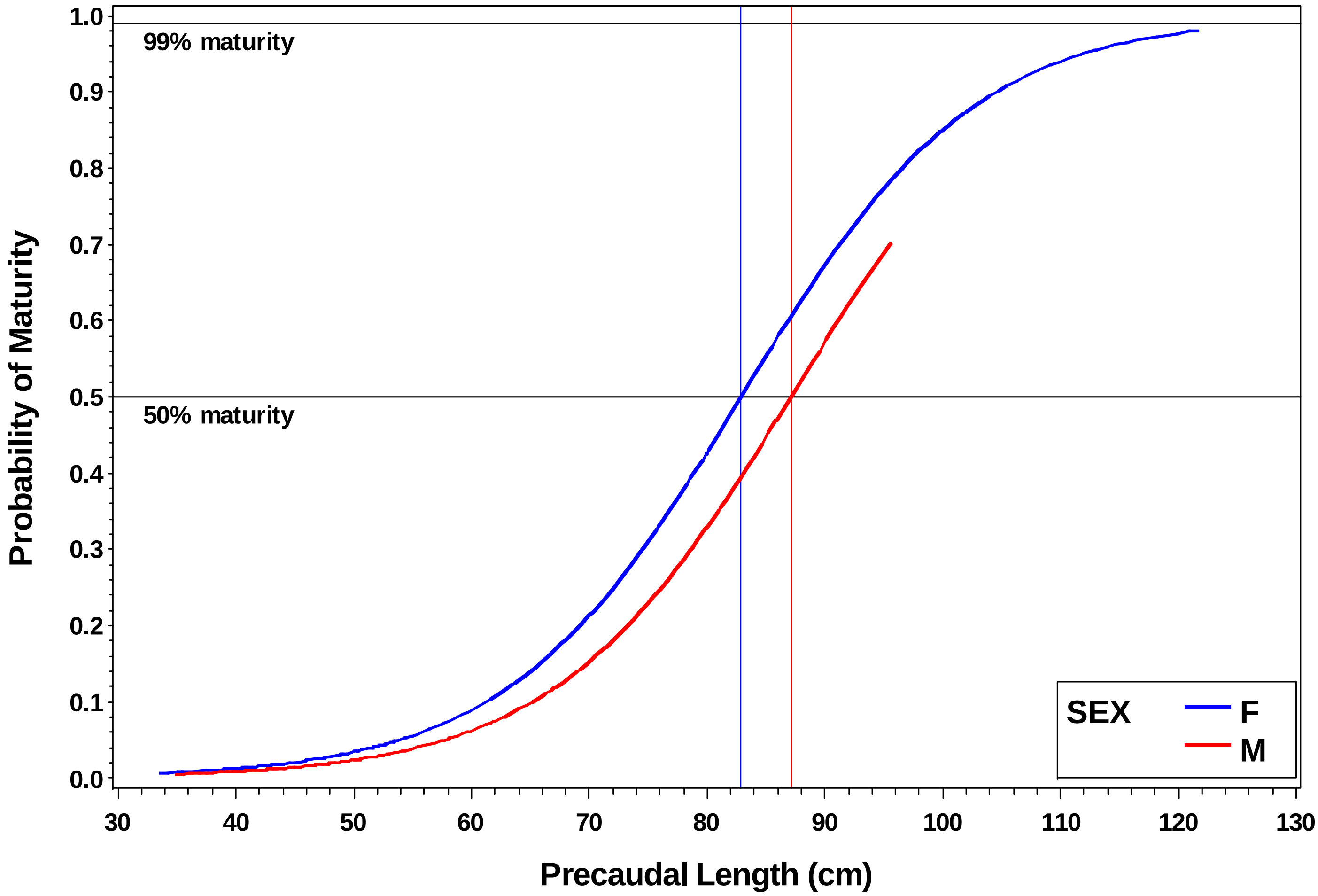
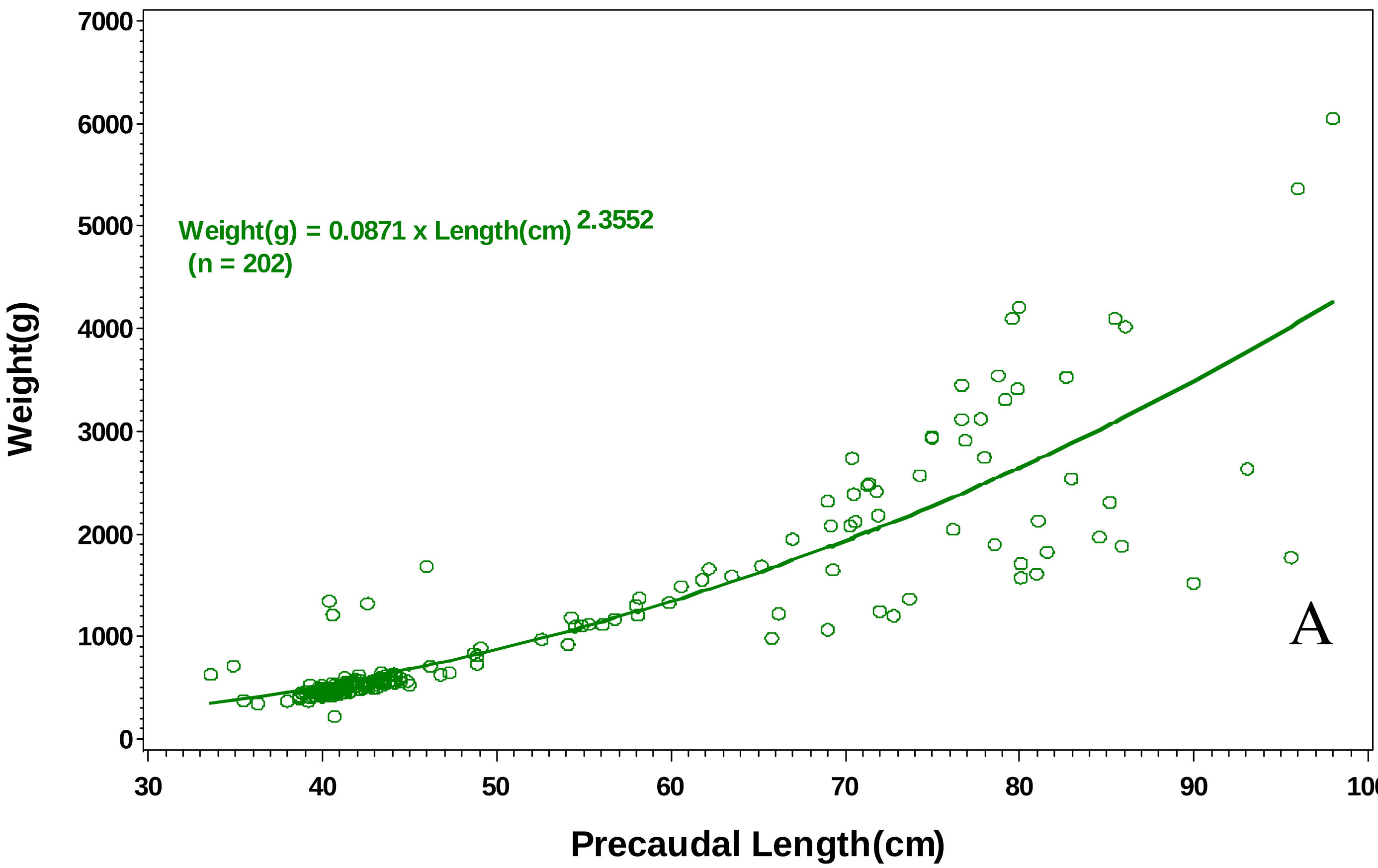
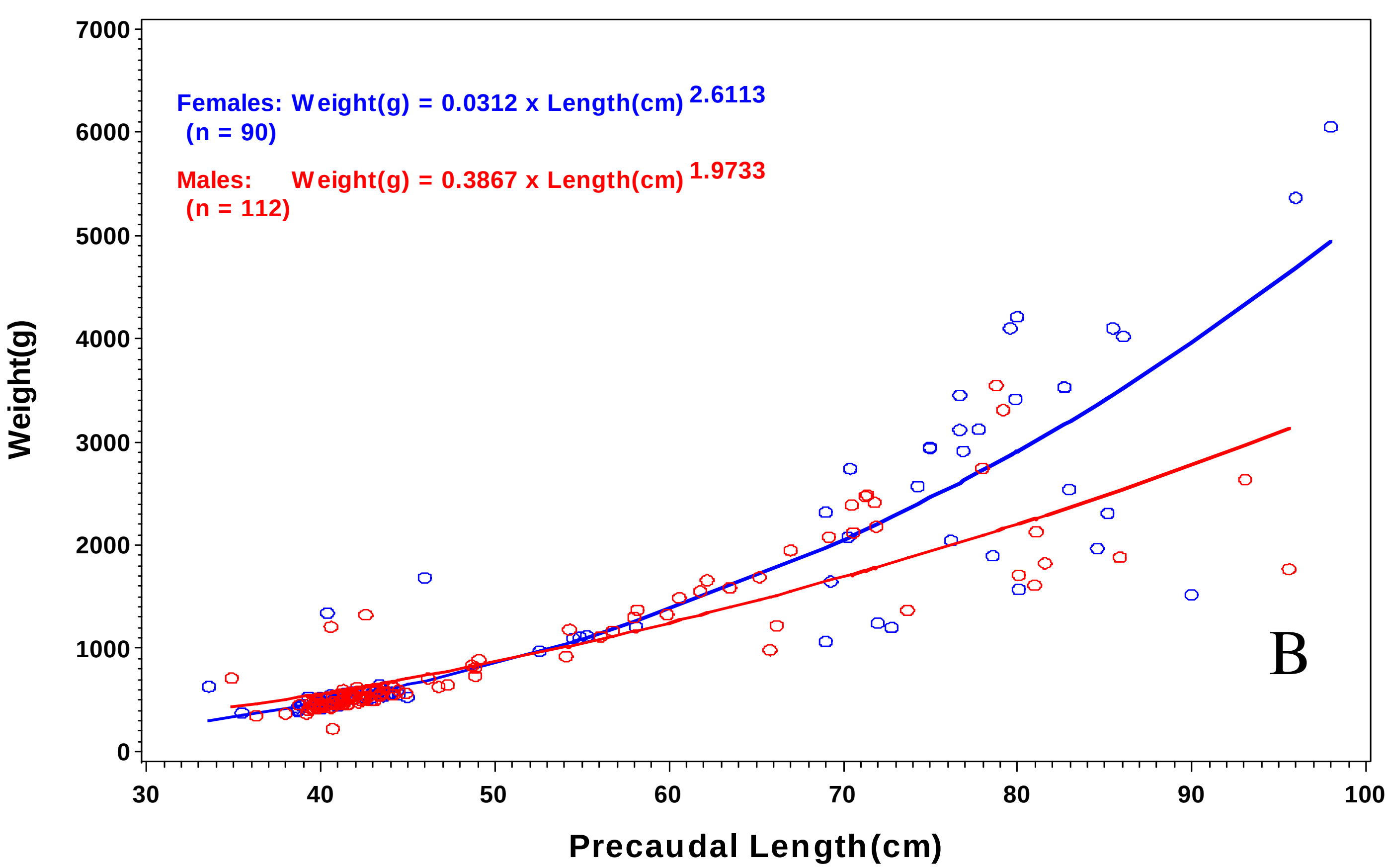
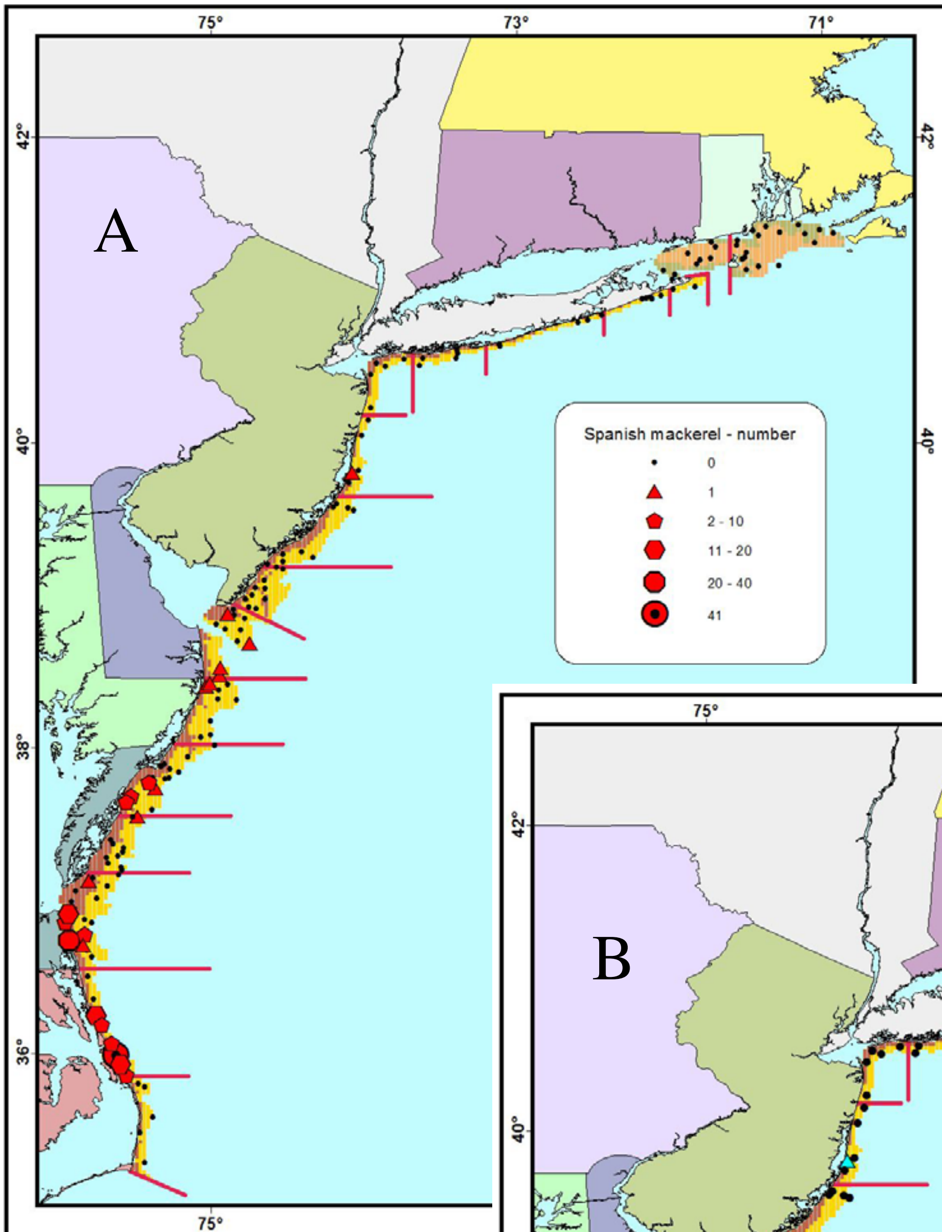


Figure 123. Length-weight regression for smooth dogfish, sexes combined (A) and by sex (B).





Spanish Mackerel (Priority D)



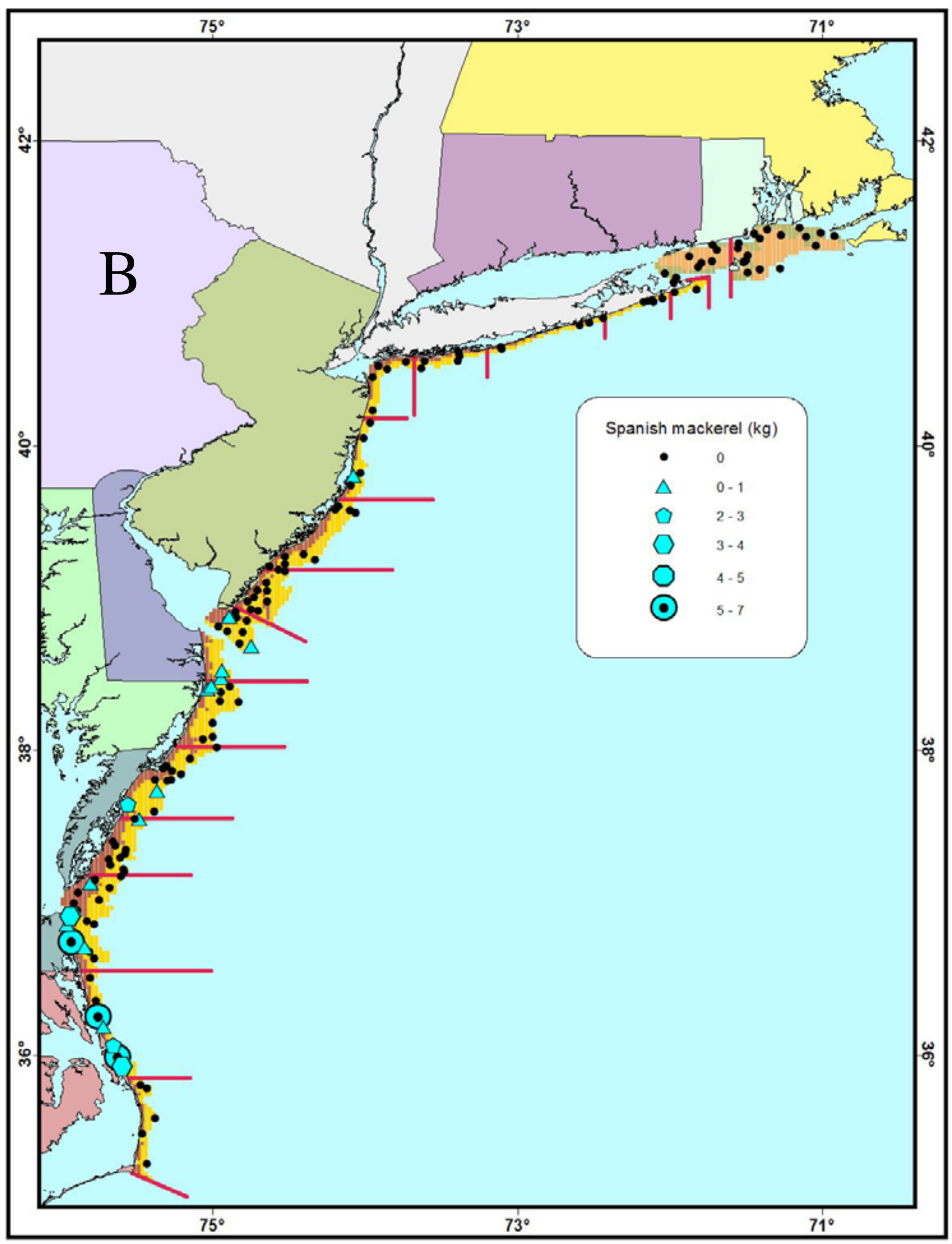


Figure 124. Number (A) and biomass (B) of specimens captured at each station for Spanish mackerel.

Figure 125. Minimum trawlable number and biomass by state for Spanish mackerel.

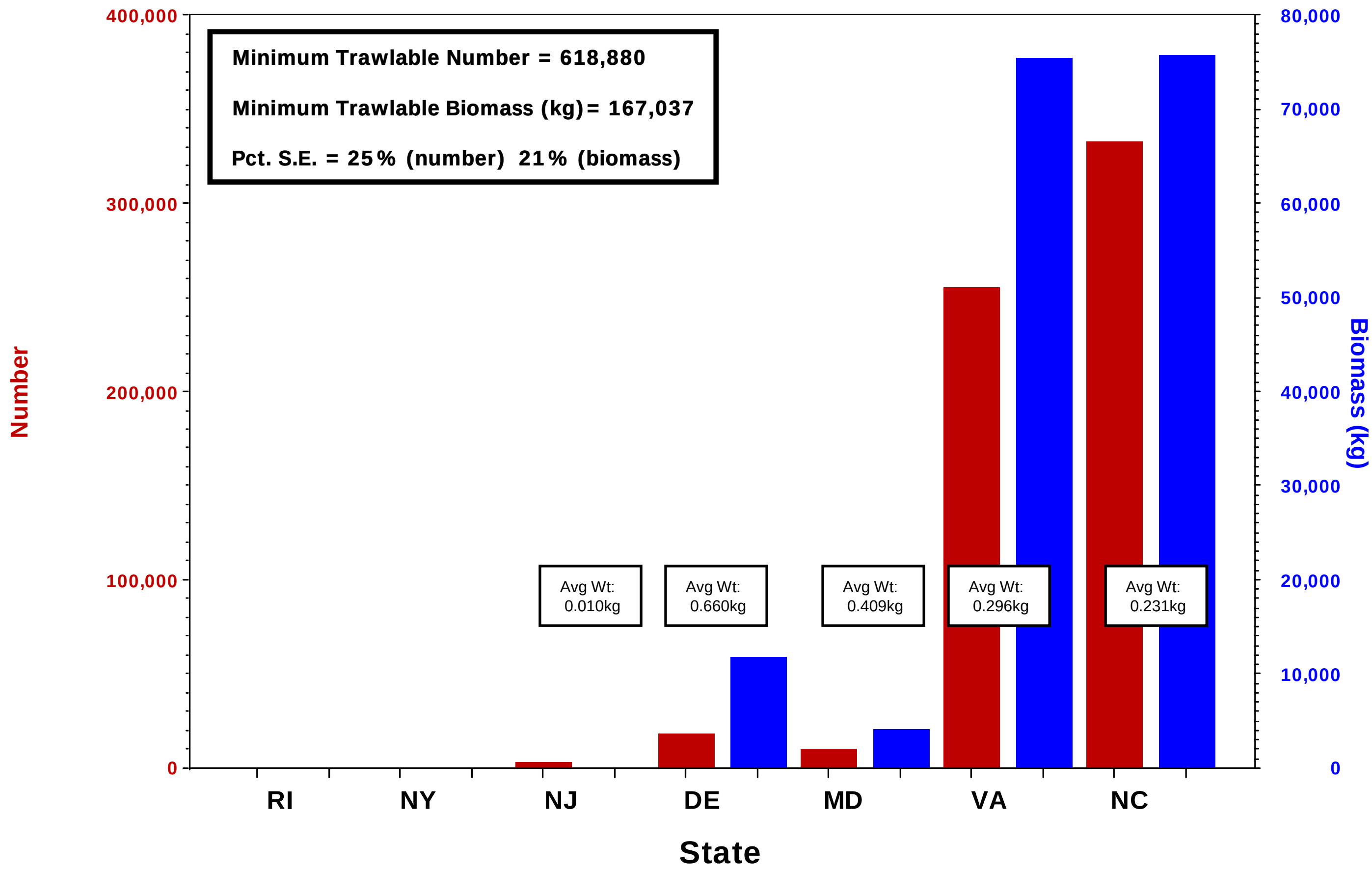
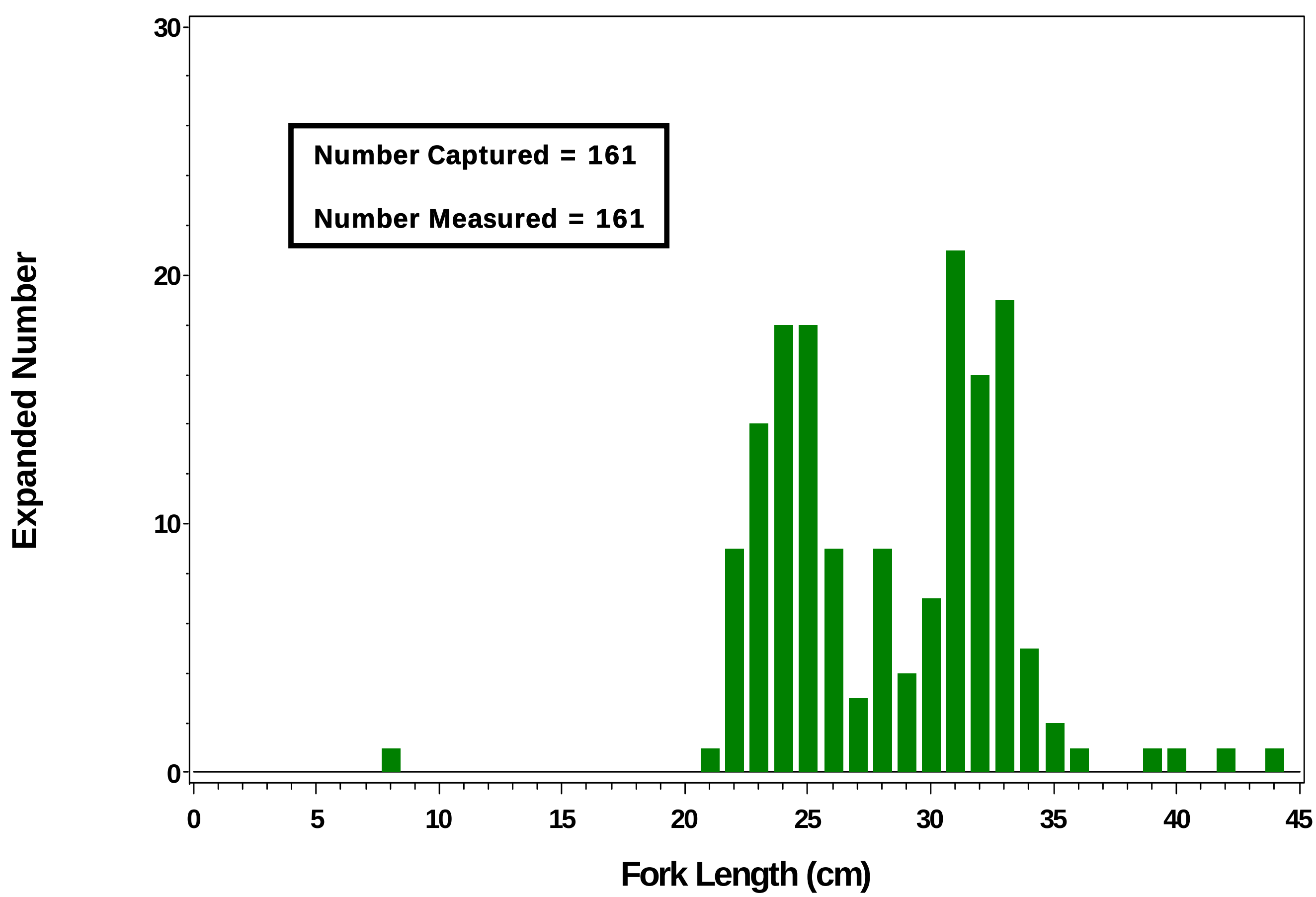
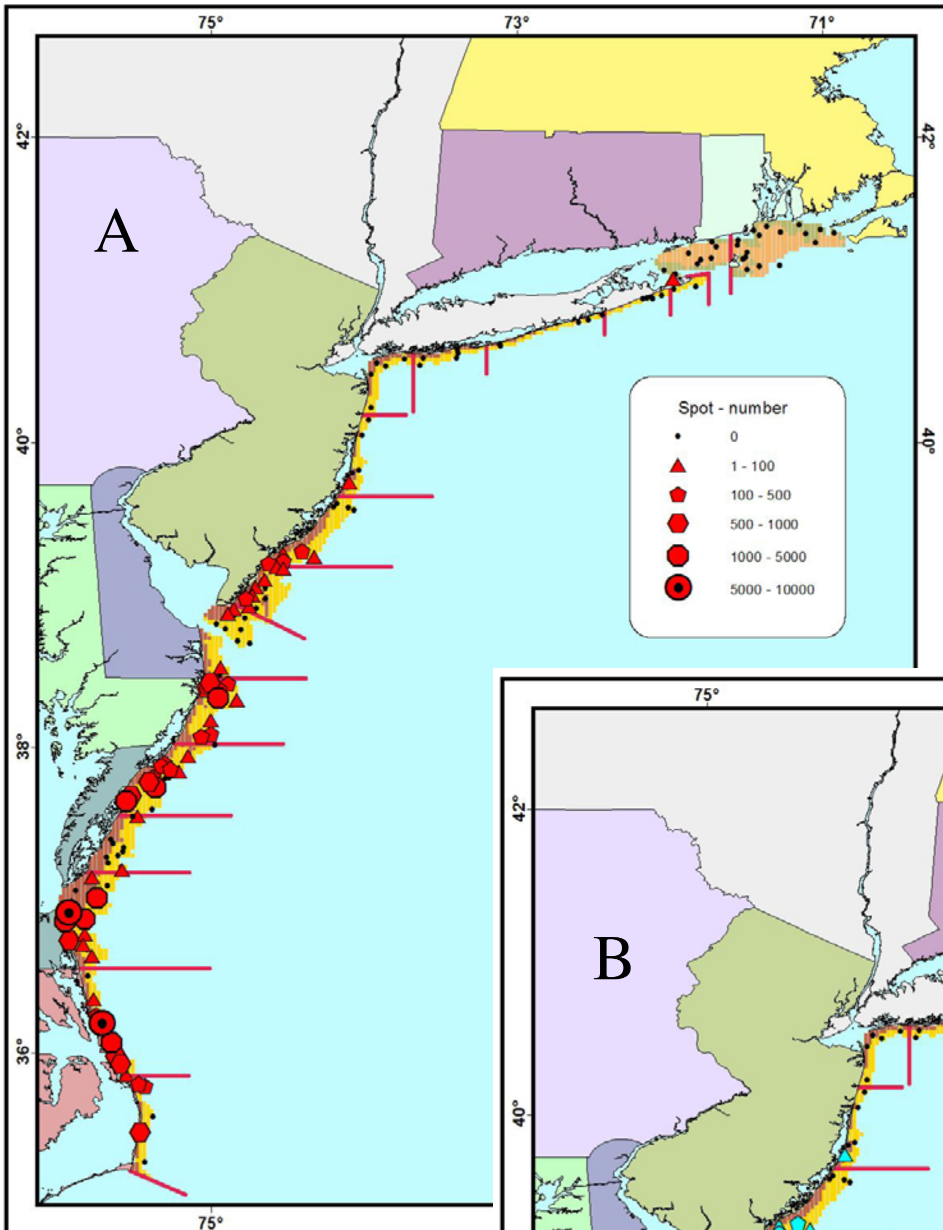


Figure 126. Length frequency histogram for Spanish mackerel.



Spot (Priority B)



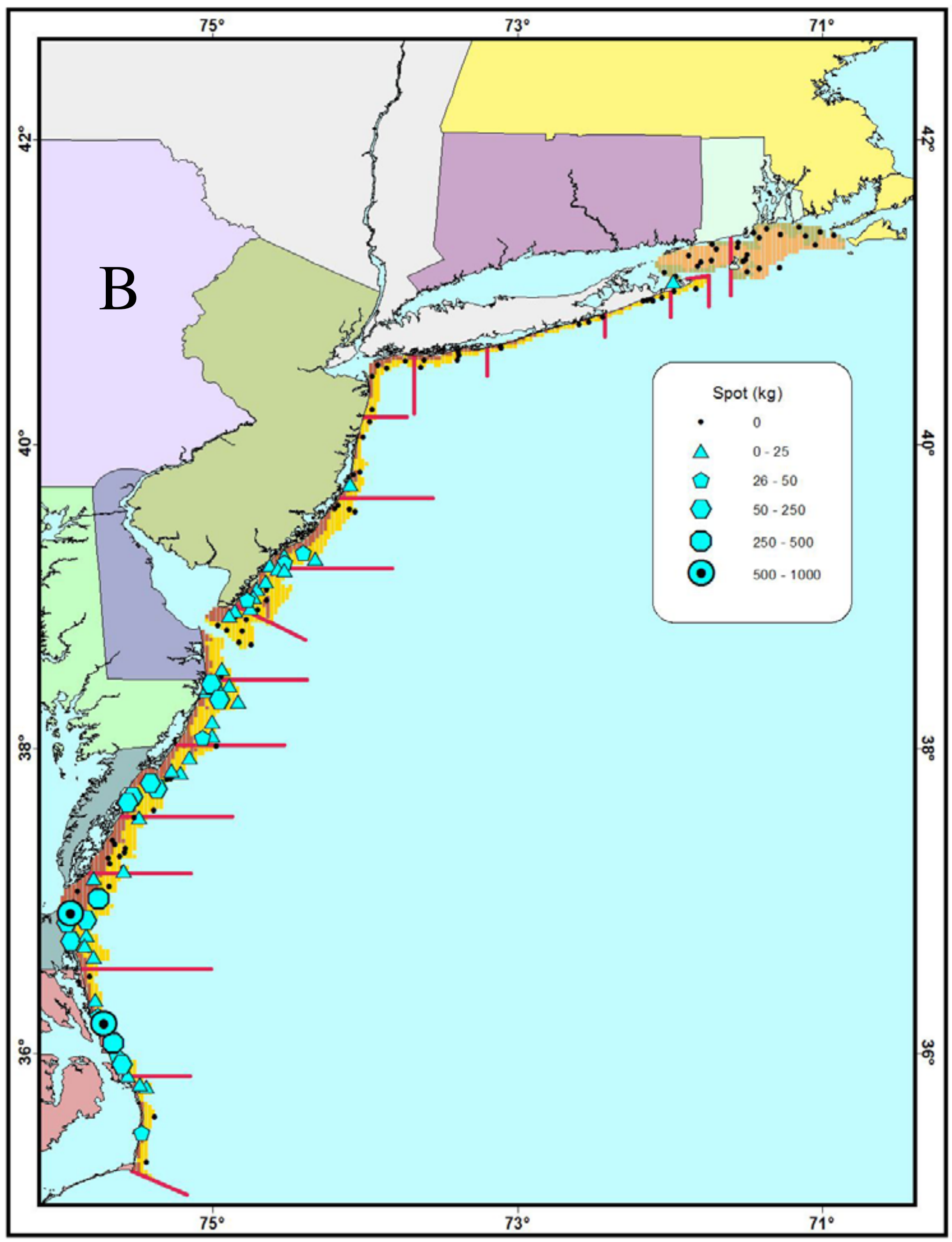


Figure 127. Number (A) and biomass (B) of specimens captured at each station for spot.

Figure 128. Minimum trawlable number and biomass by state for spot.

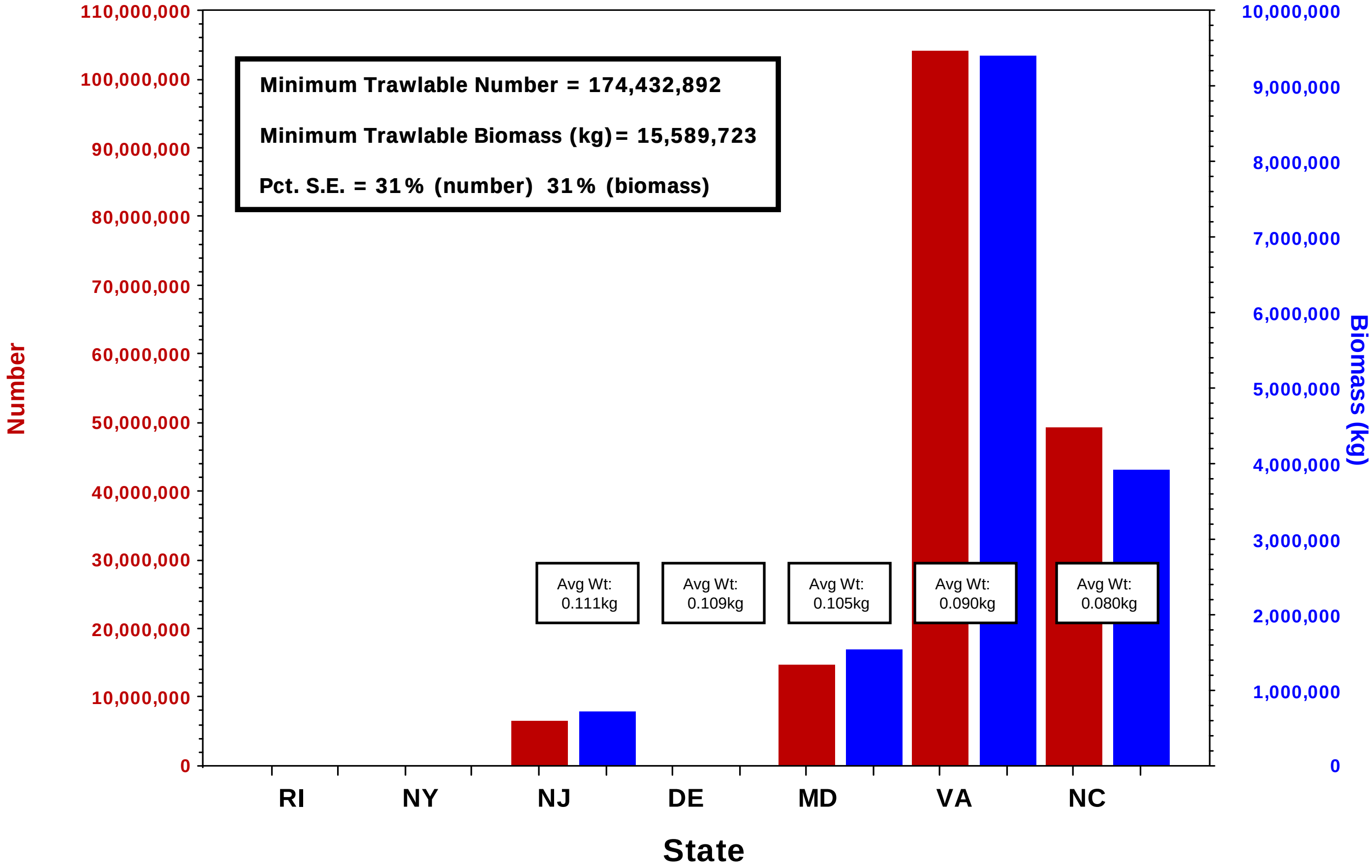


Figure 129. Length frequency histogram for spot.

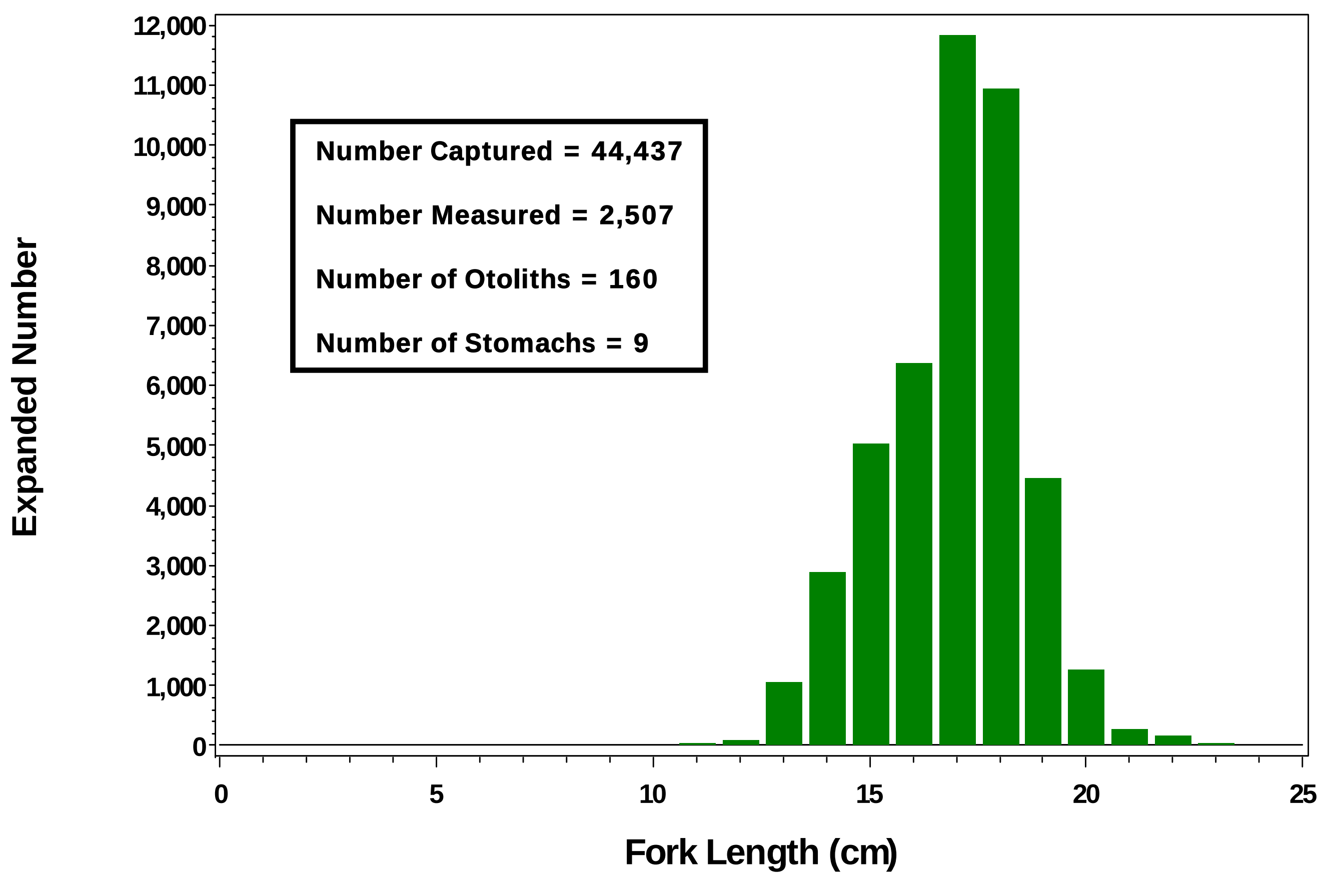
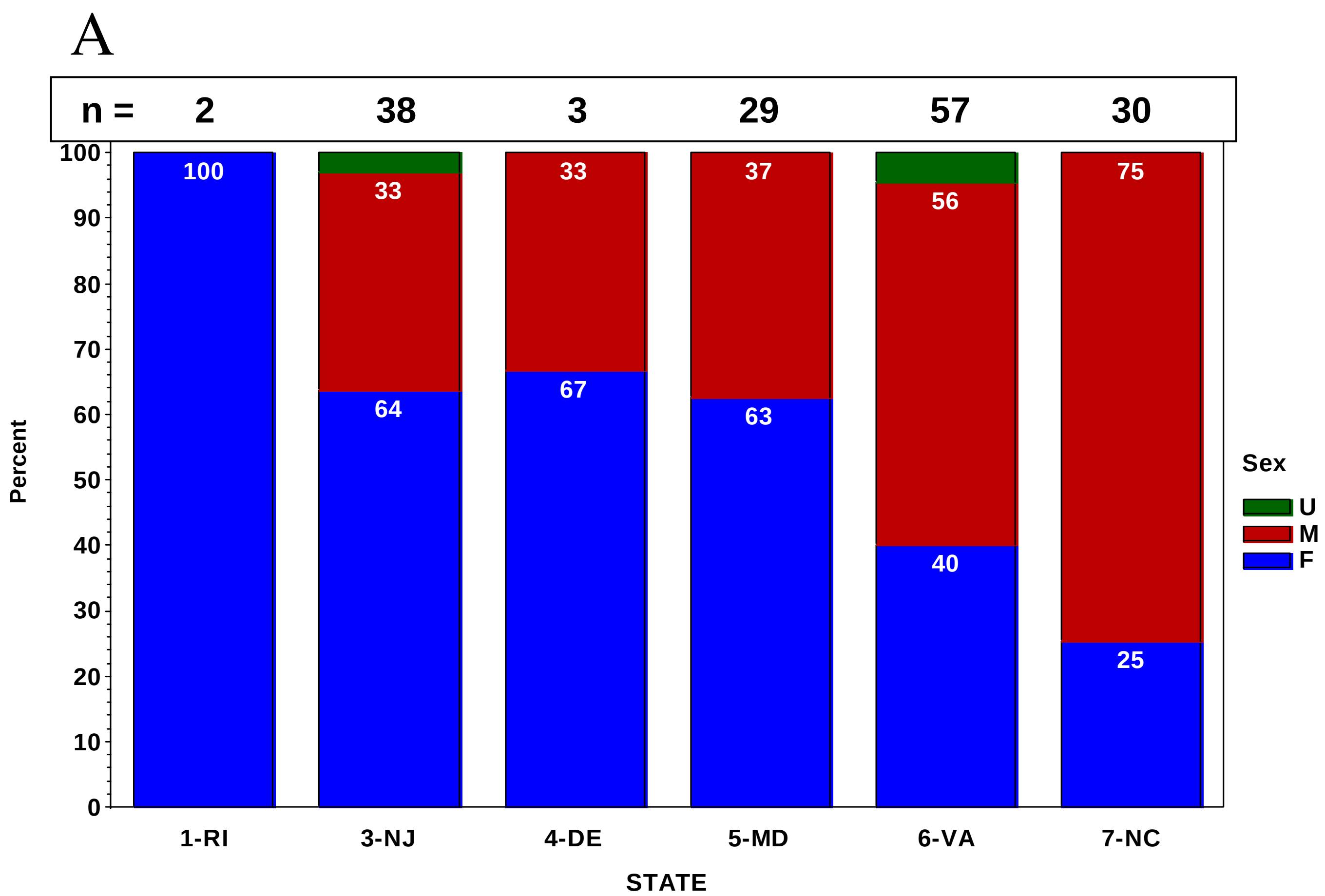


Figure 130. Sex ratios for spot by state (A) and length group (B).



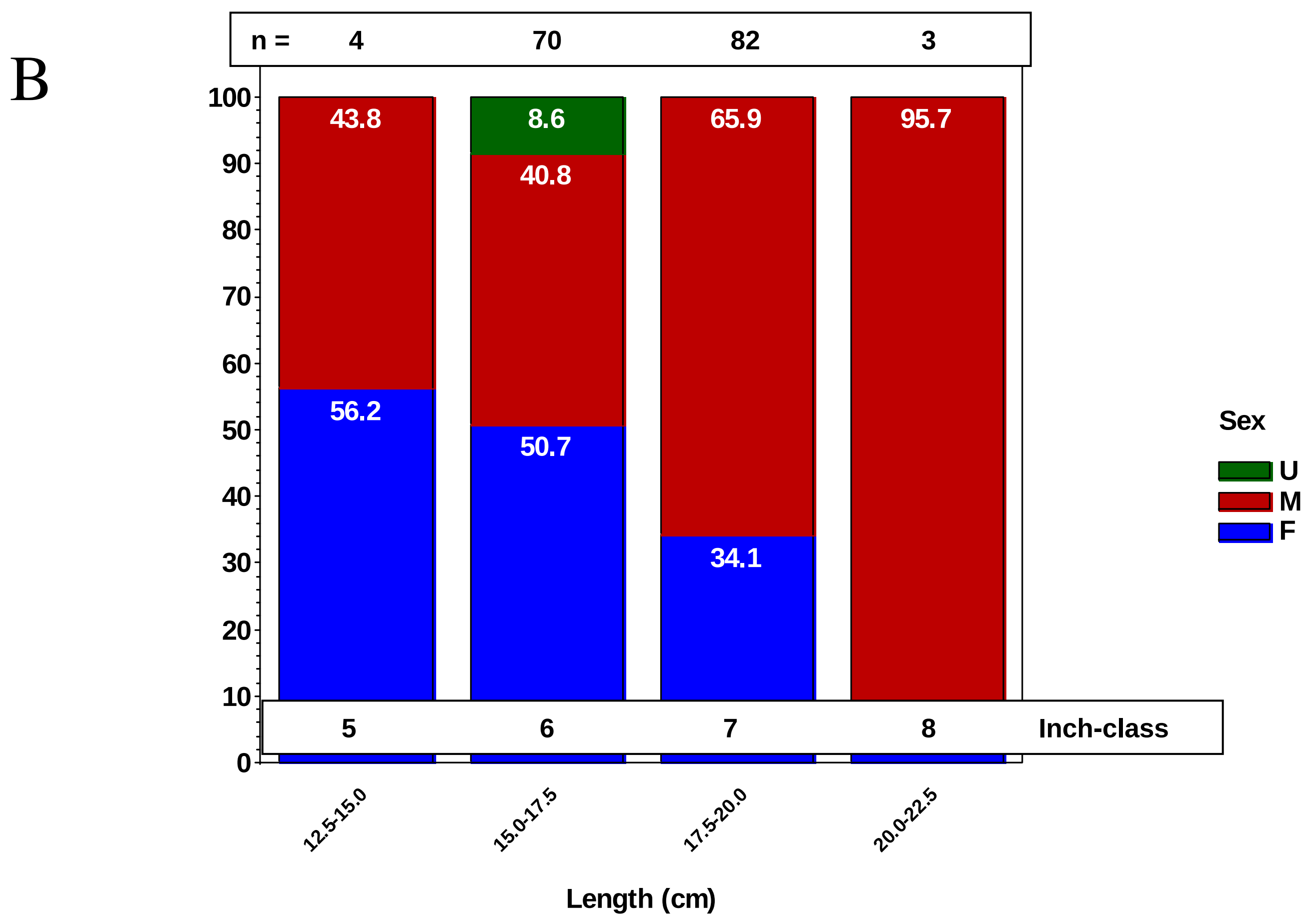


Figure 131. Maturity logistic regression for spot, by sex.

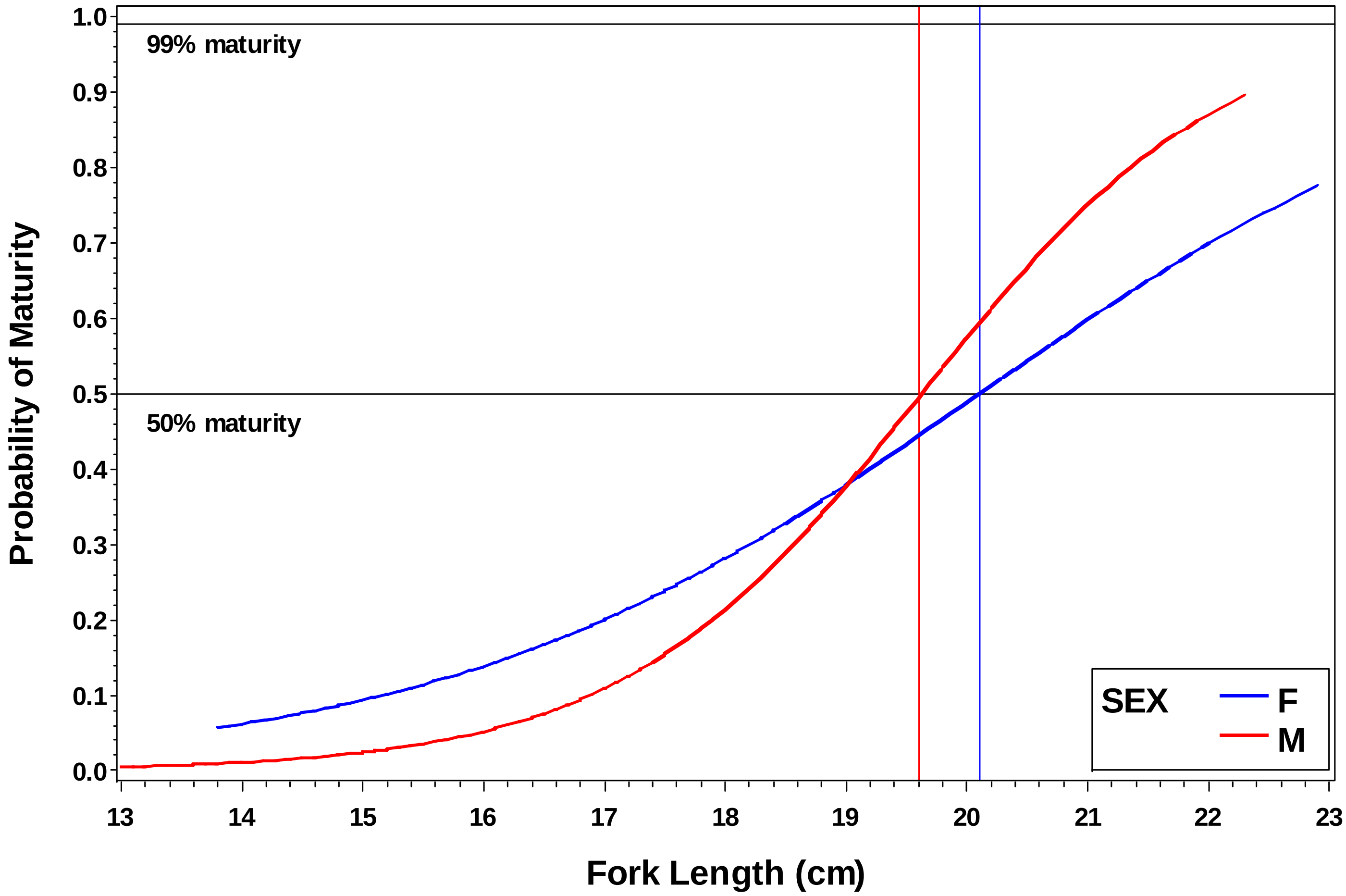
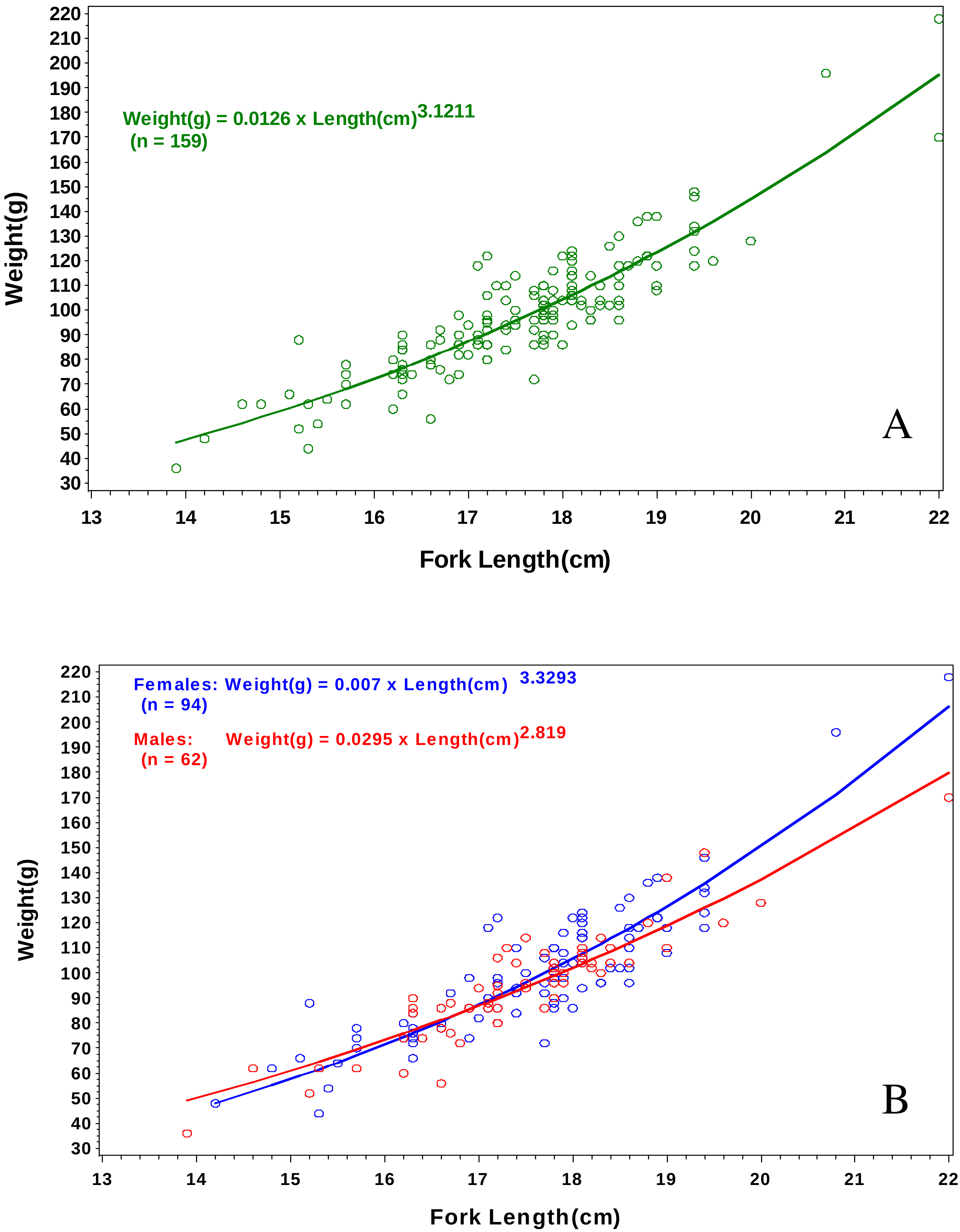
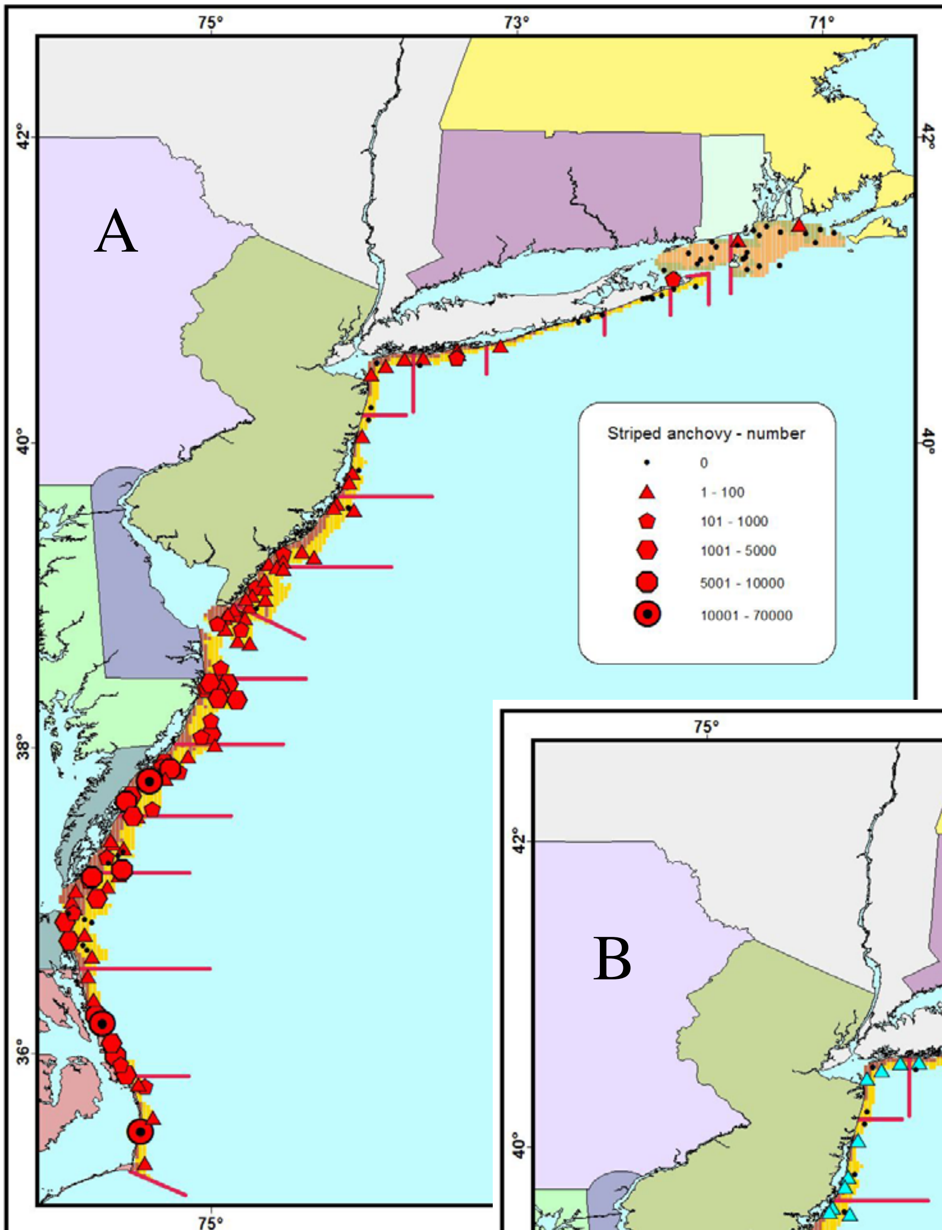


Figure 132. Length-weight regression for spot, sexes combined (A) and by sex (B).



Striped Anchovy (Priority D)



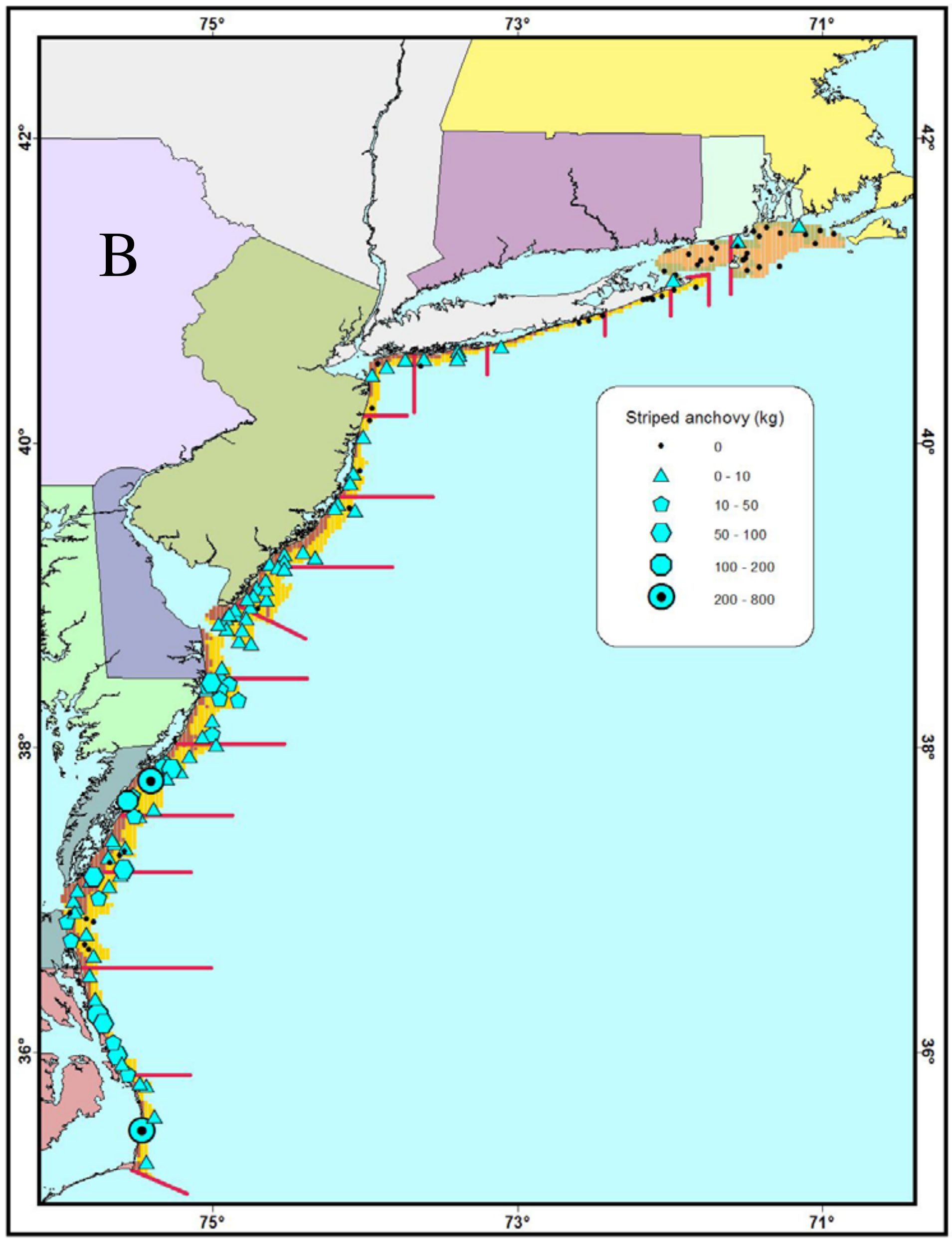


Figure 133. Number (A) and biomass (B) of specimens captured at each station for striped anchovy.

Figure 134. Minimum trawlable number and biomass by state for striped anchovy.

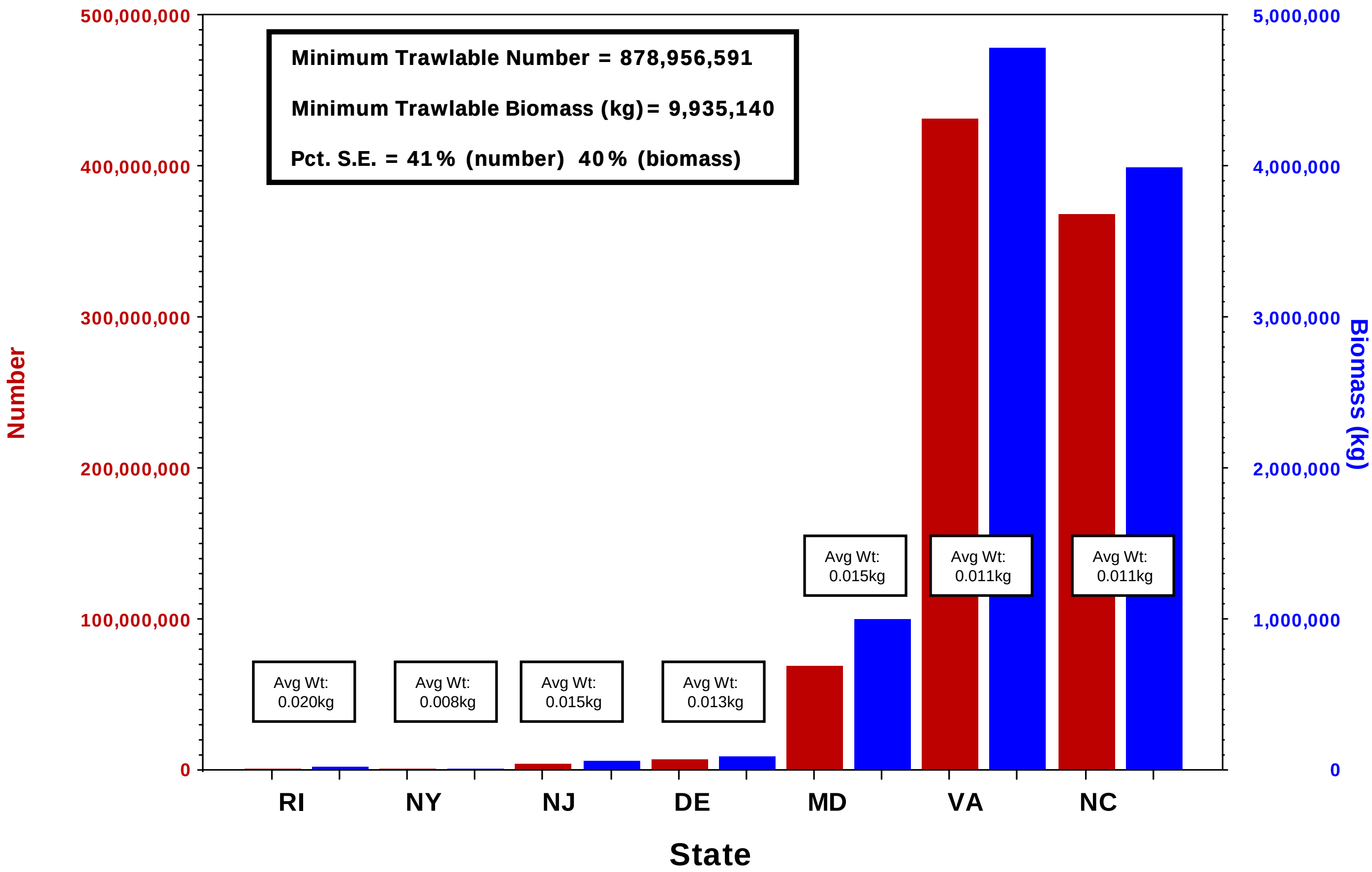
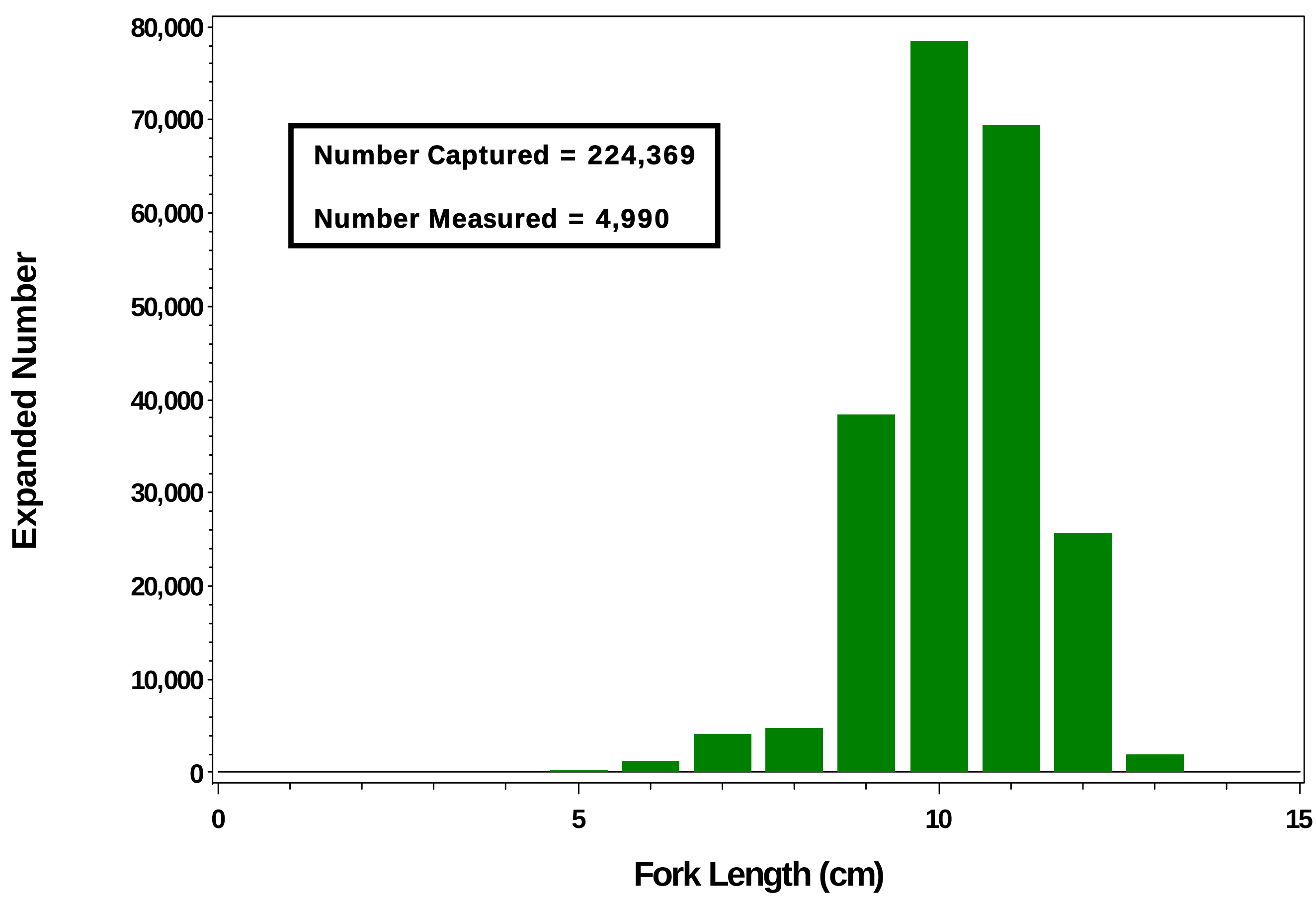
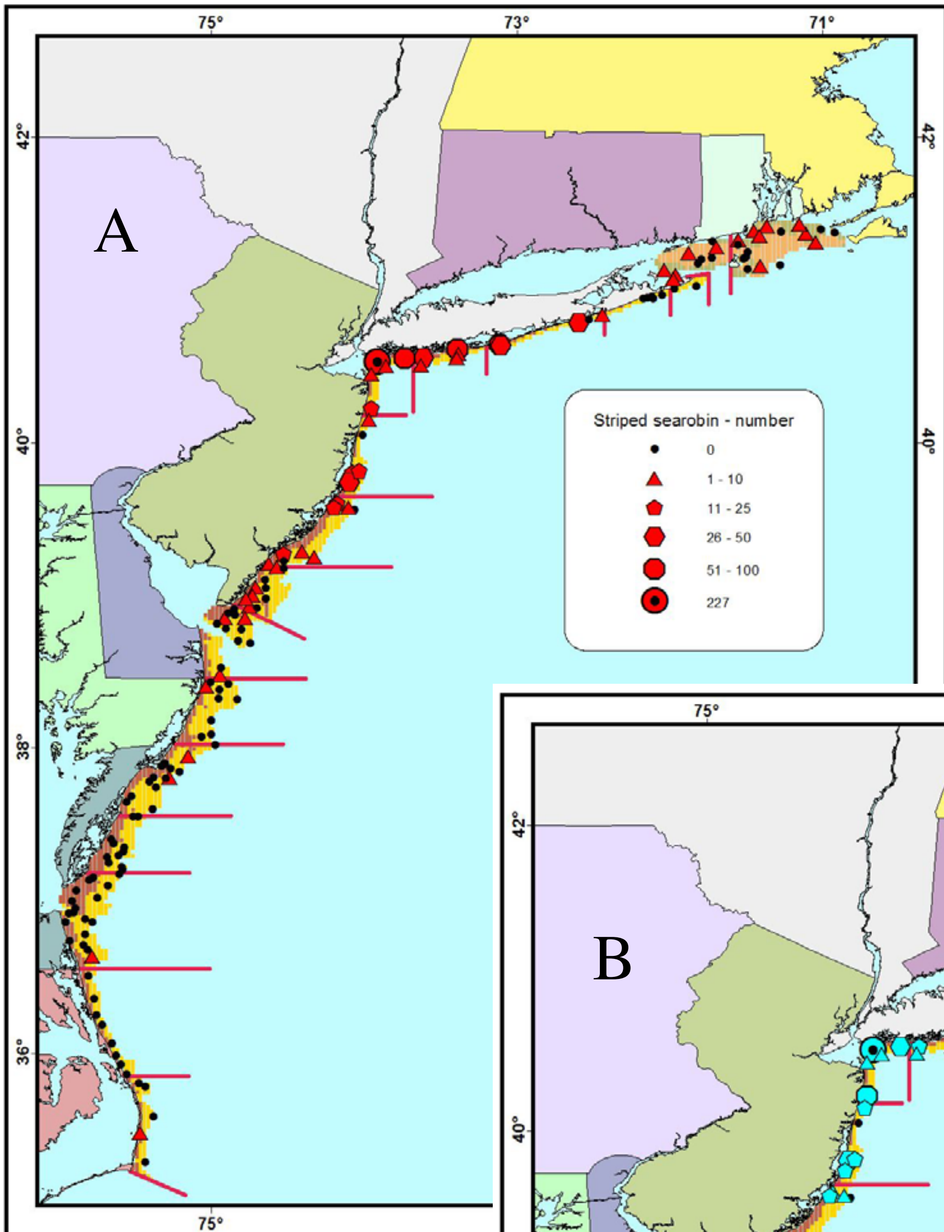


Figure 135. Length frequency histogram for striped anchovy.



Striped Searobin (Priority D)



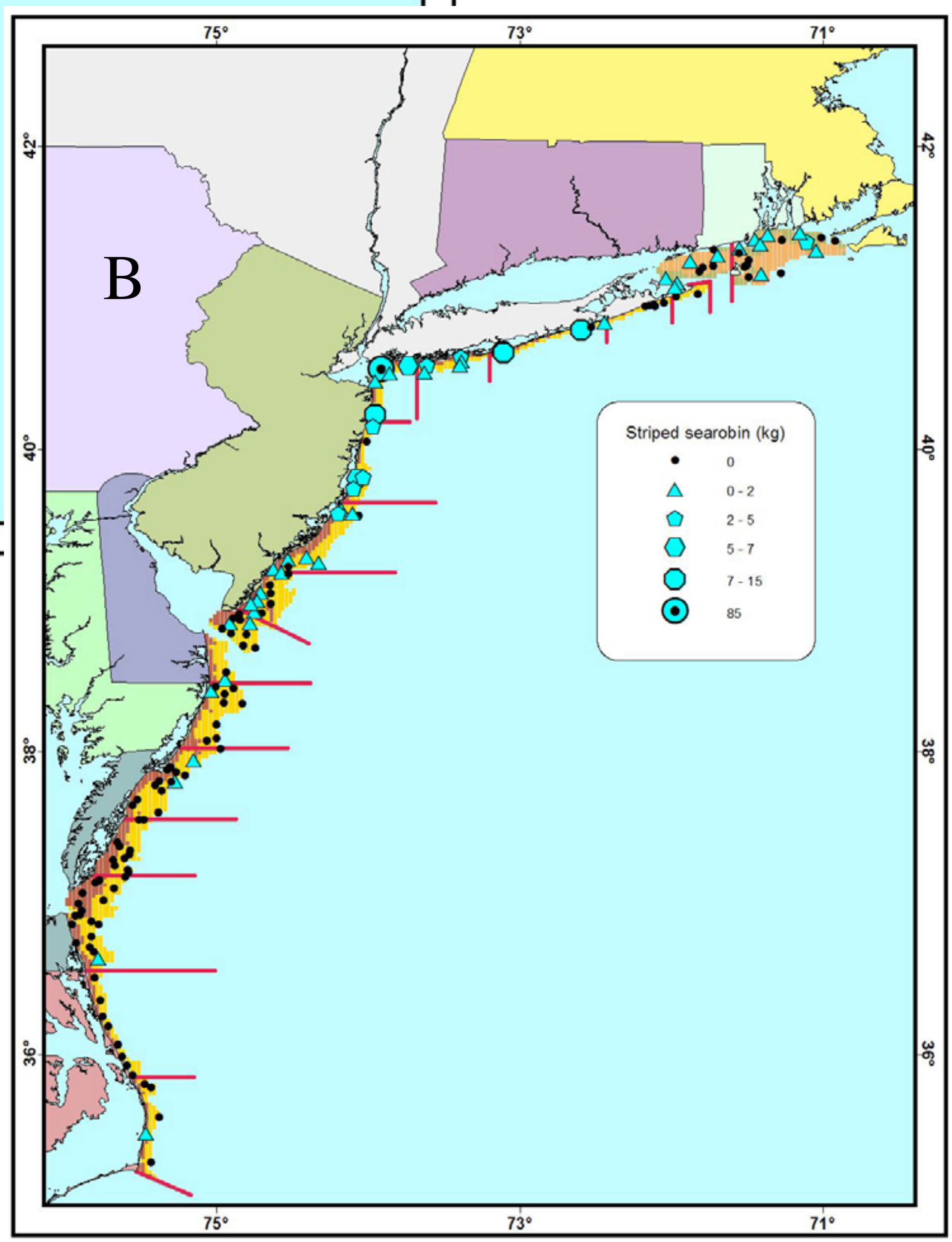


Figure 136. Number (A) and biomass (B) of specimens captured at each station for striped searobin.

Figure 137. Minimum trawlable number and biomass by state for striped searobin.

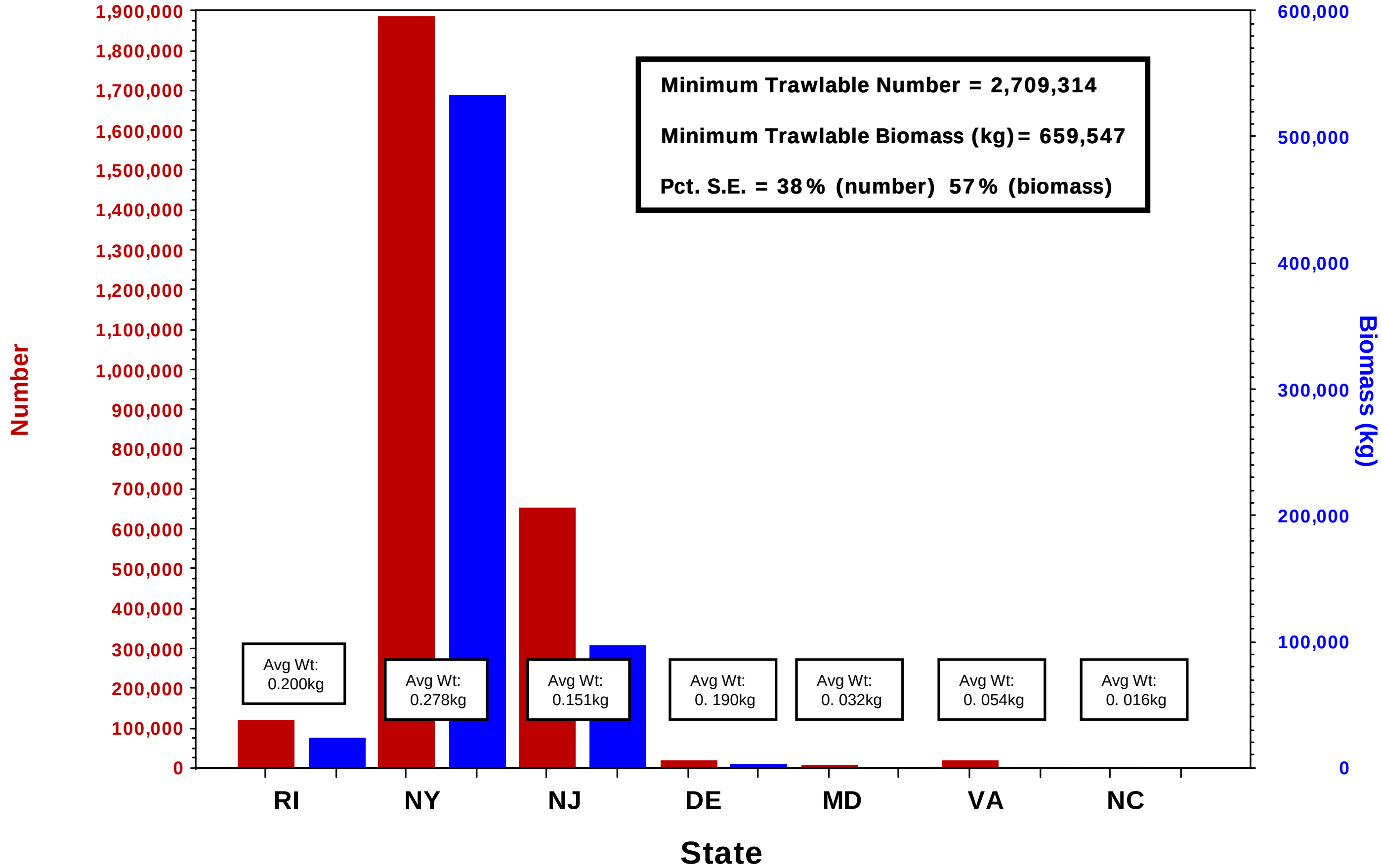
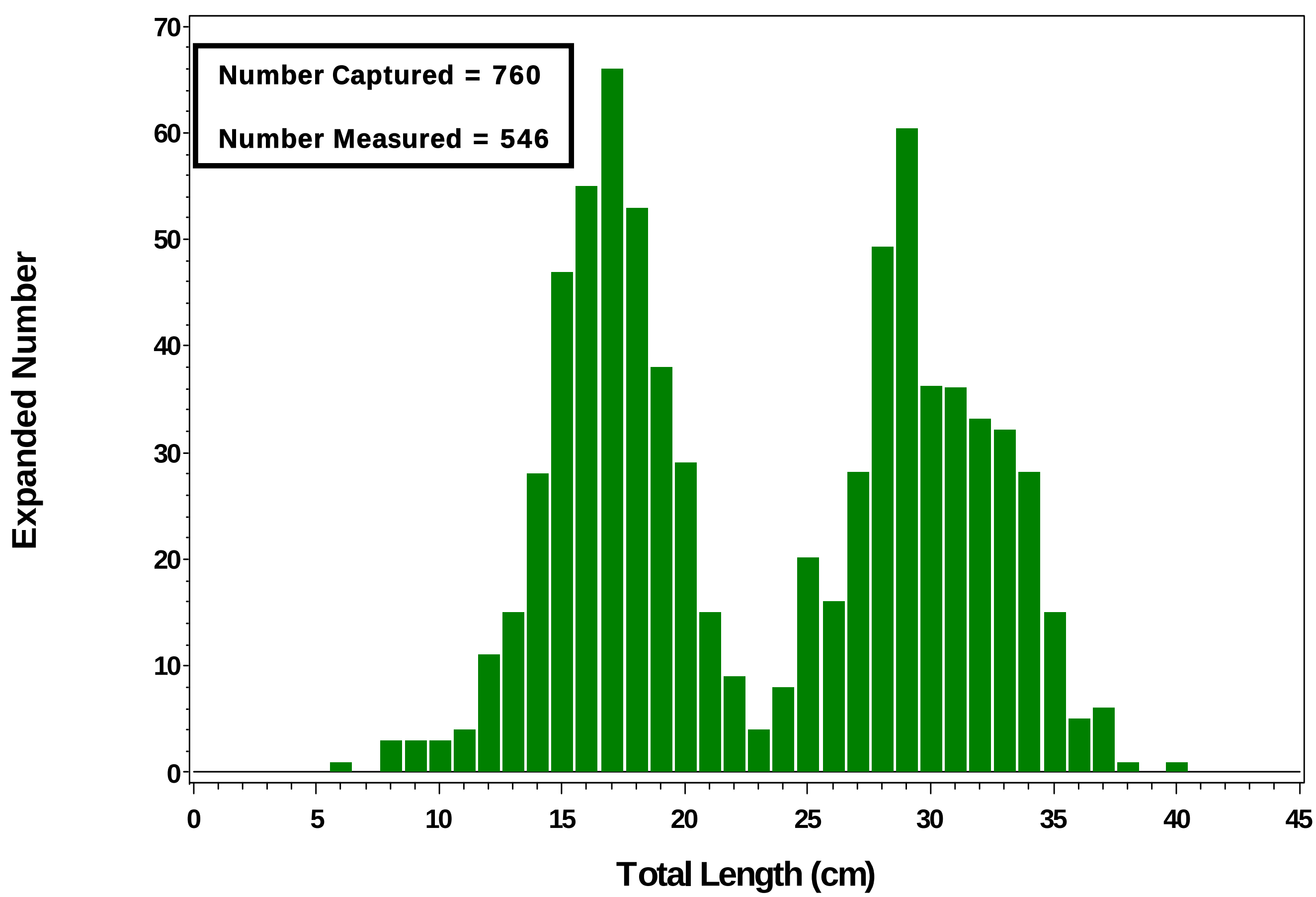
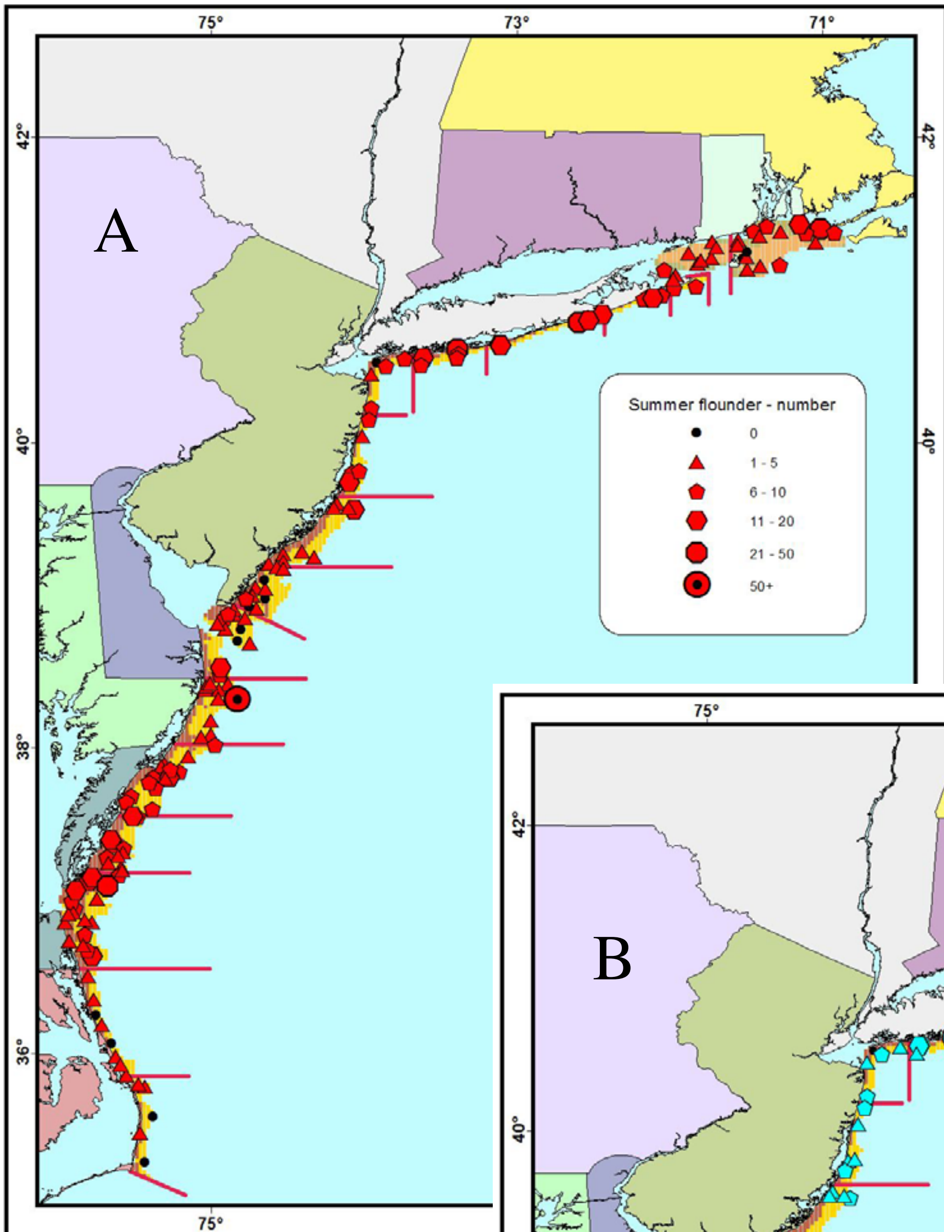


Figure 138. Length frequency histogram for striped searobin.



Summer Flounder (Priority A)



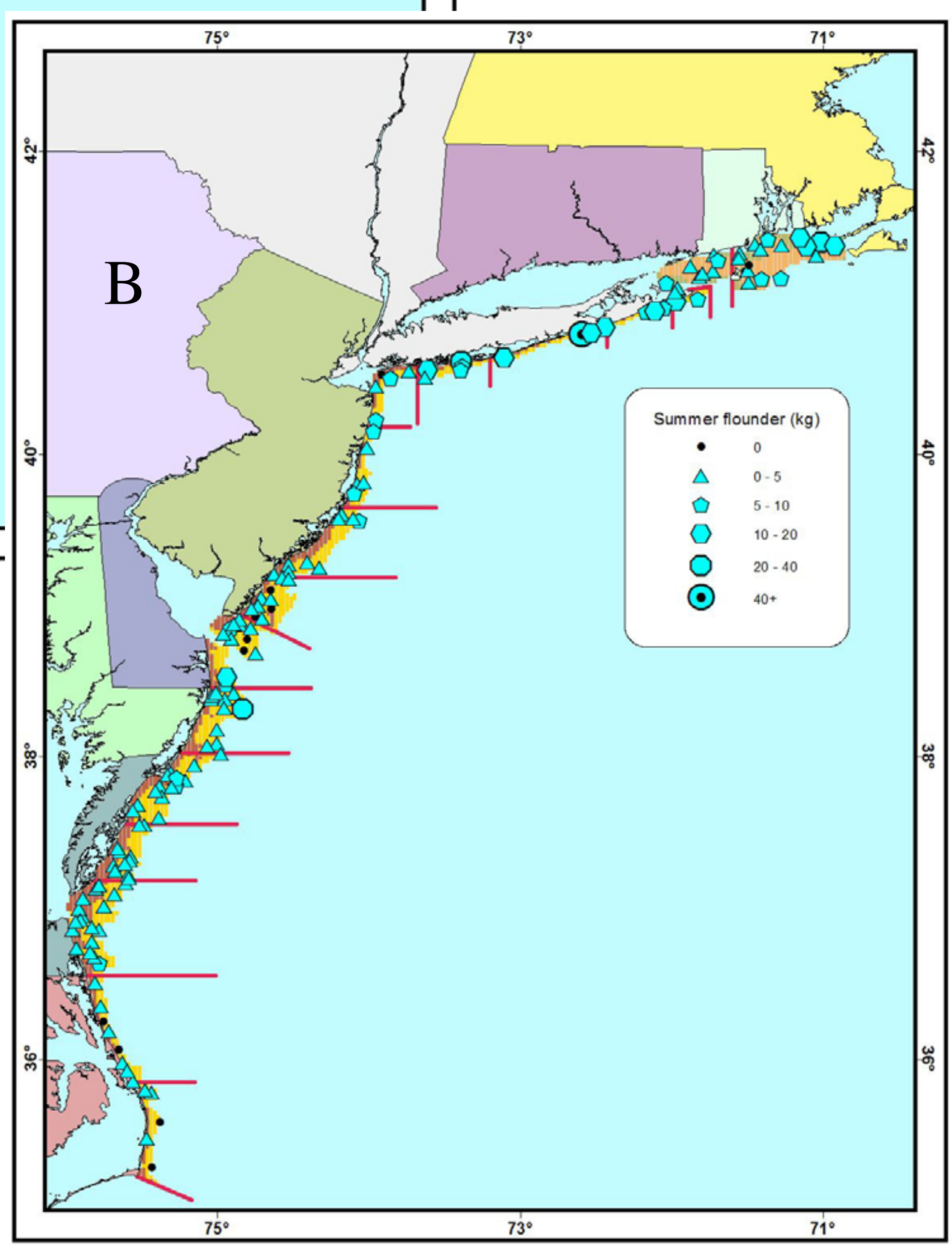


Figure 139. Number (A) and biomass (B) of specimens captured at each station for summer flounder.

Figure 140. Minimum trawlable number and biomass by state for summer flounder.

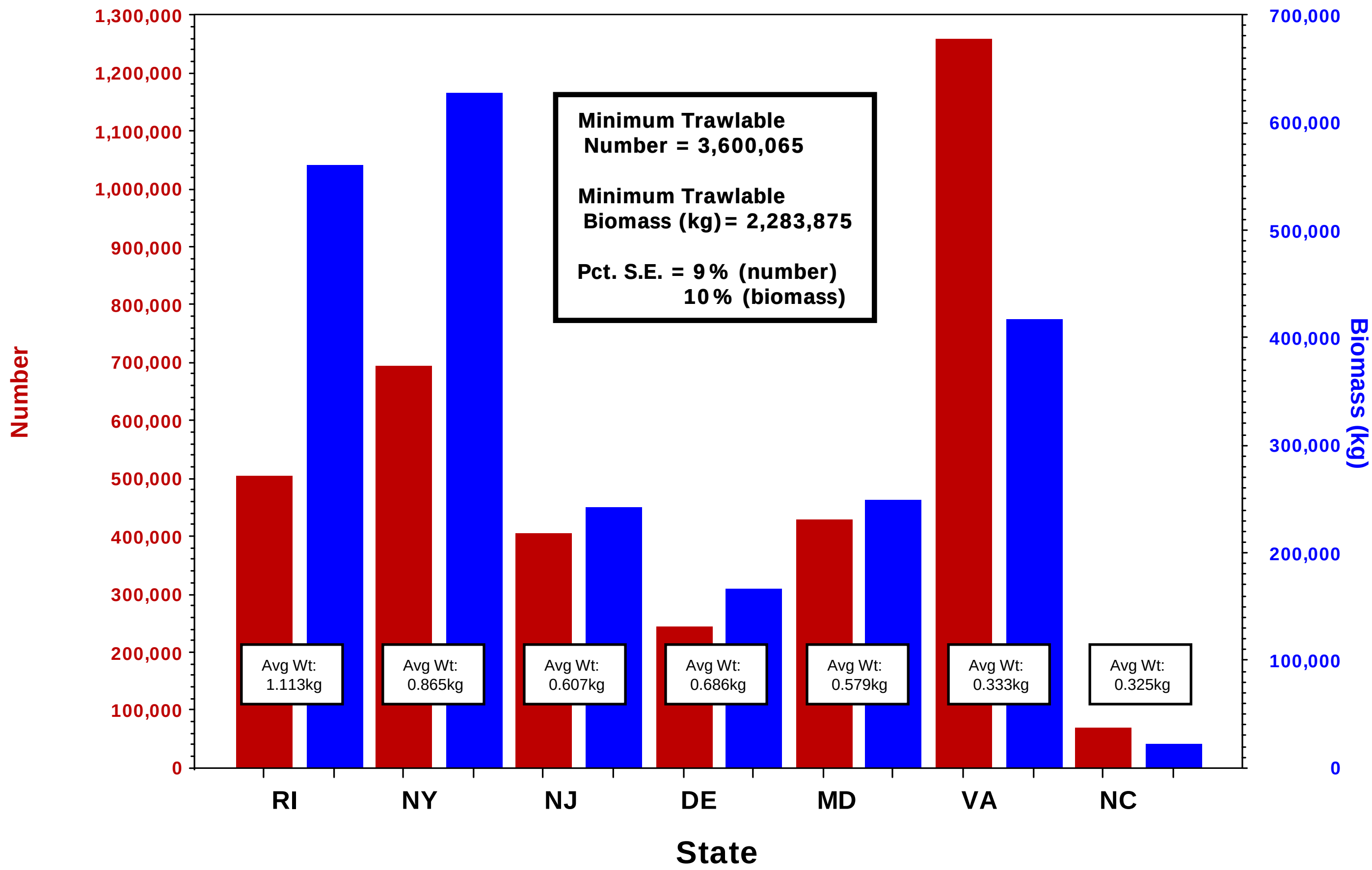


Figure 141. Length frequency histogram for summer flounder.

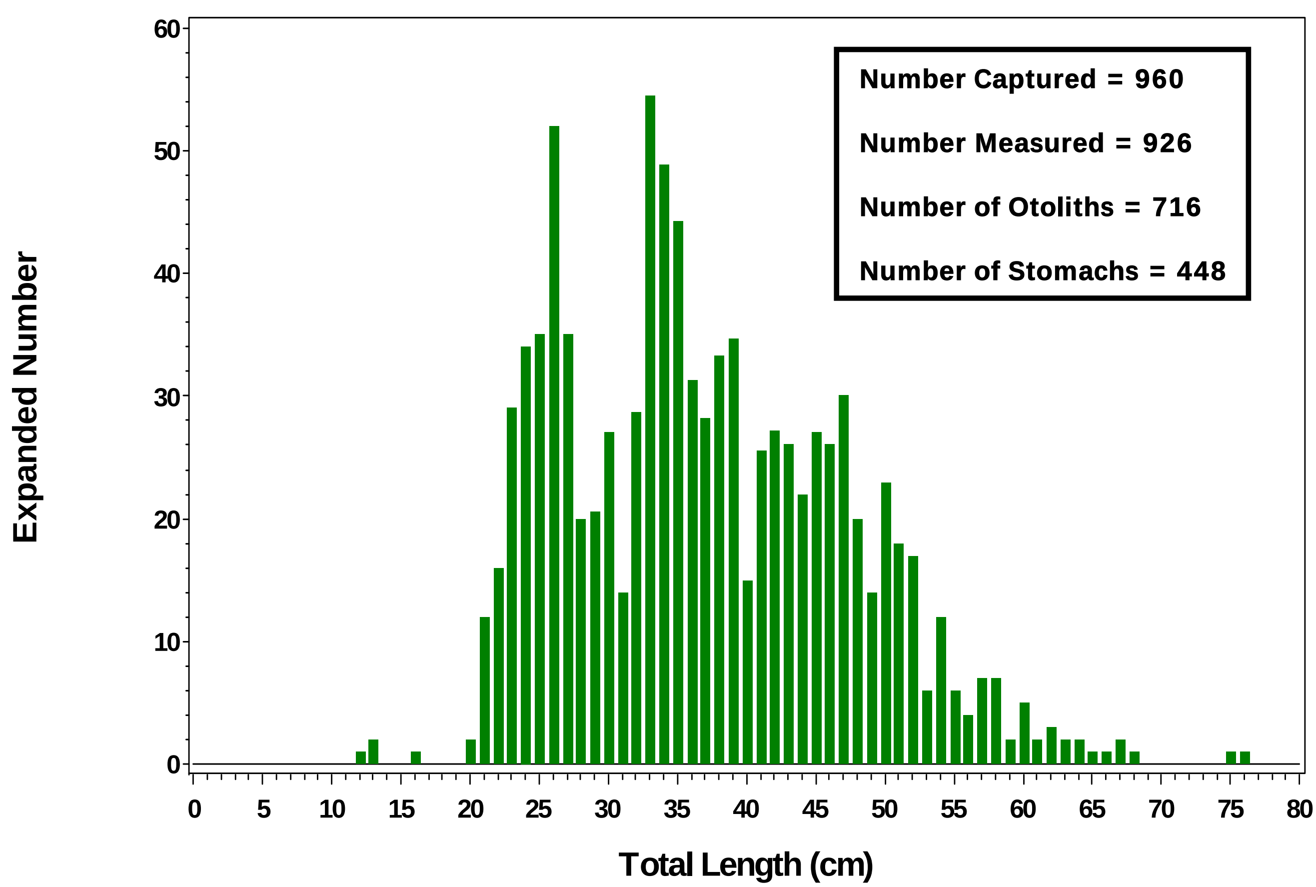
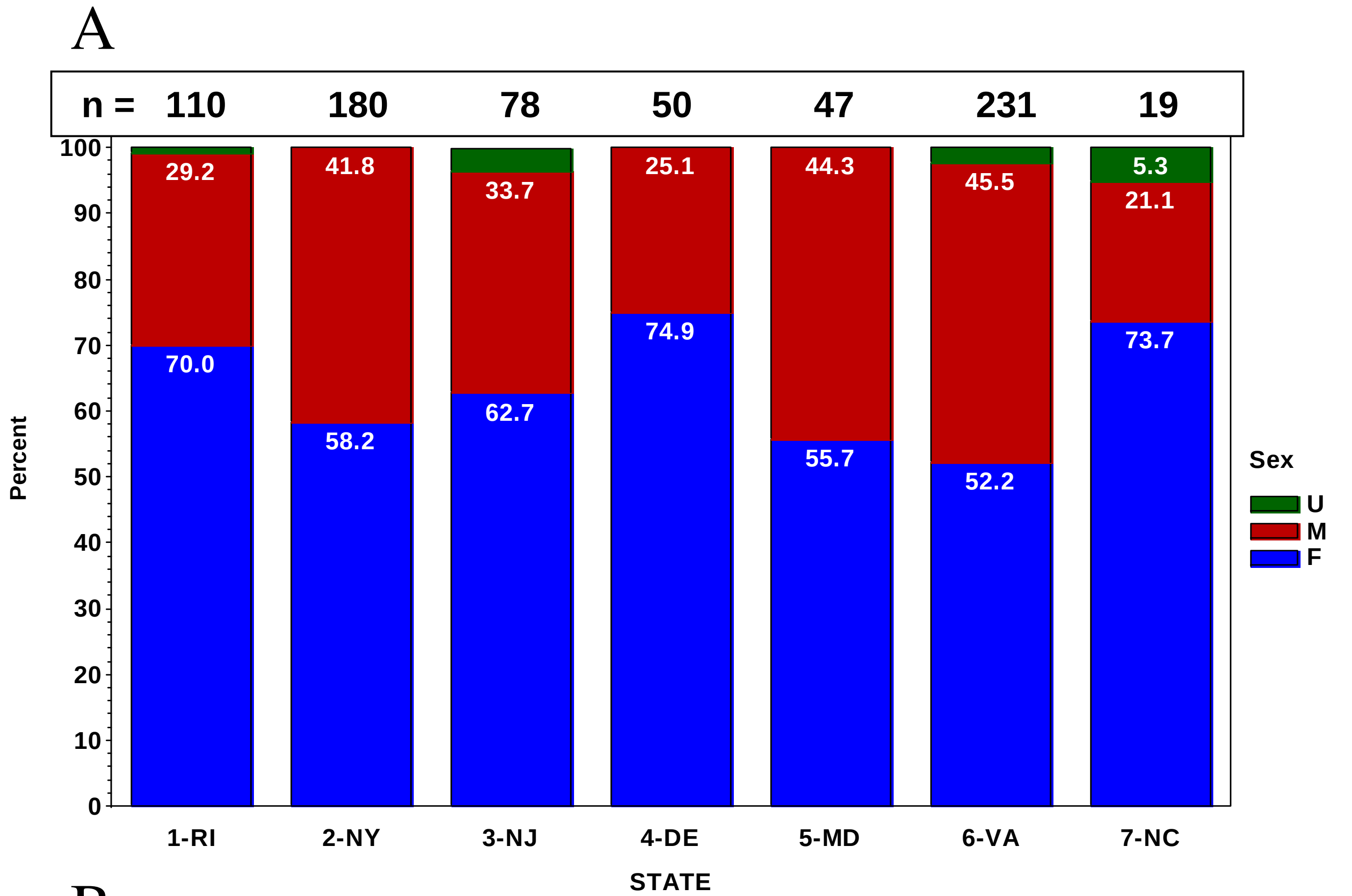


Figure 142. Sex ratios for summer flounder by state (A) and length group (B).



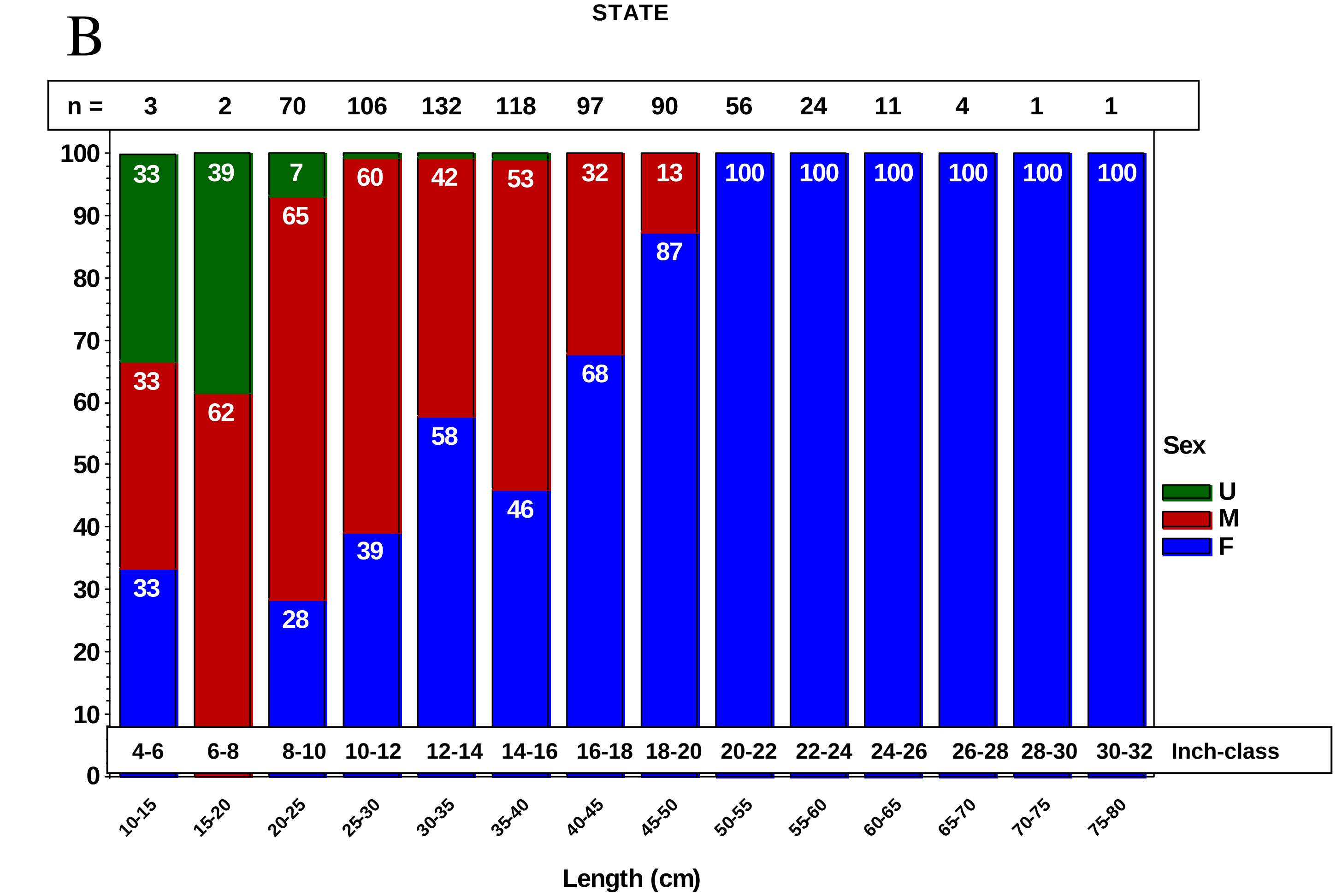


Figure 143. Maturity logistic regression for summer flounder, by sex.

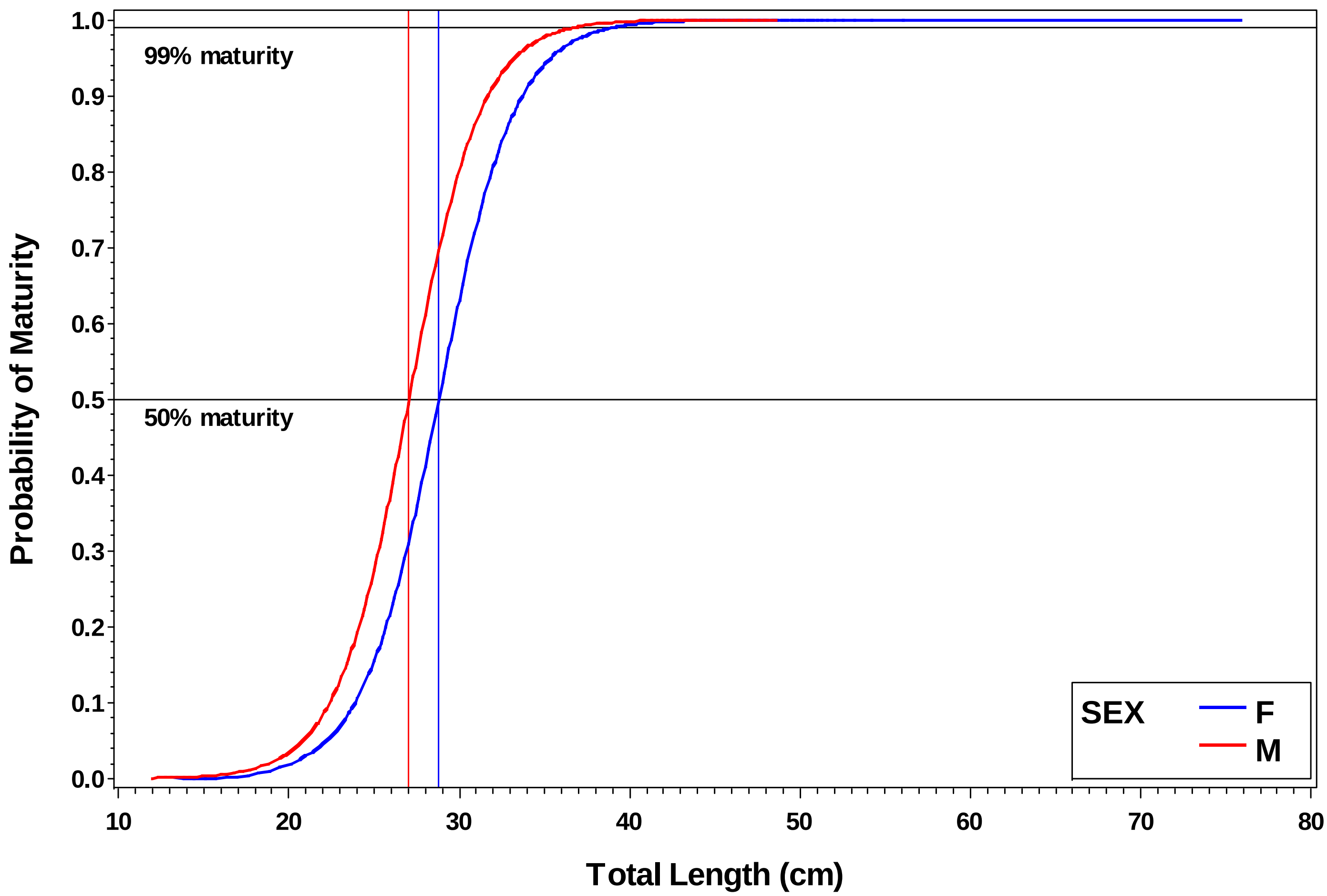


Figure 144. von Bertalanffy growth curves for summer flounder, by sex.

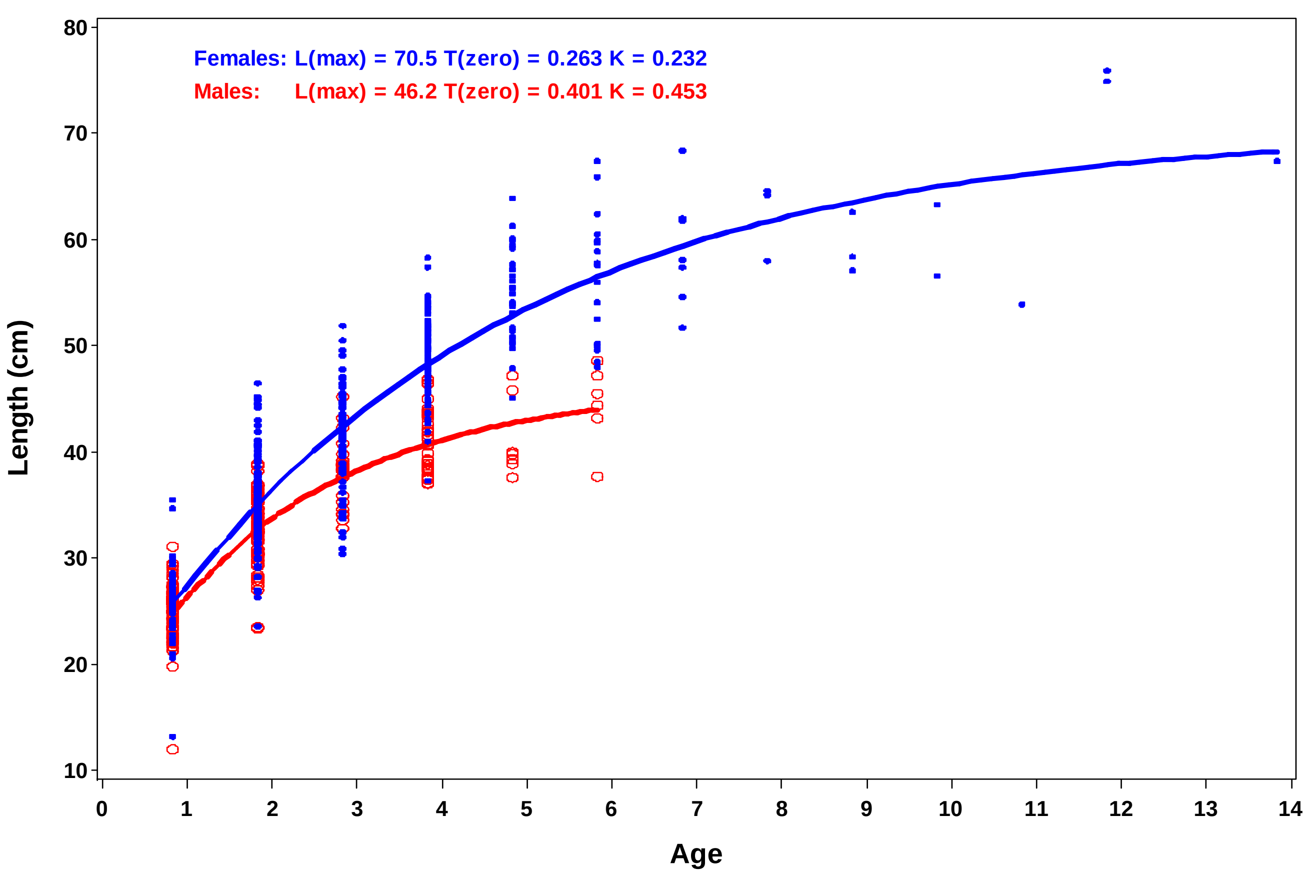
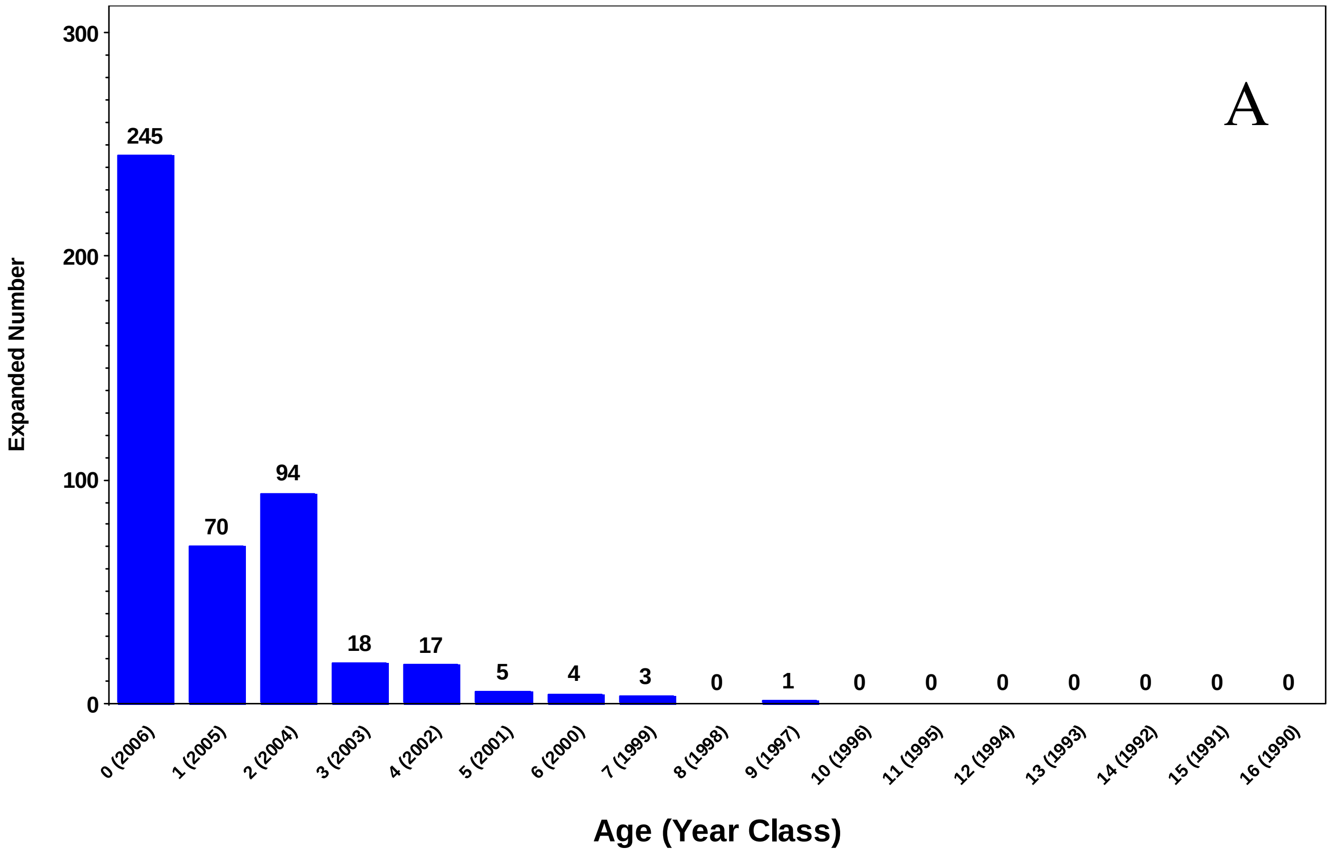


Figure 145. Age frequency histogram for summer flounder for 2006 (A) and 2007 (B).



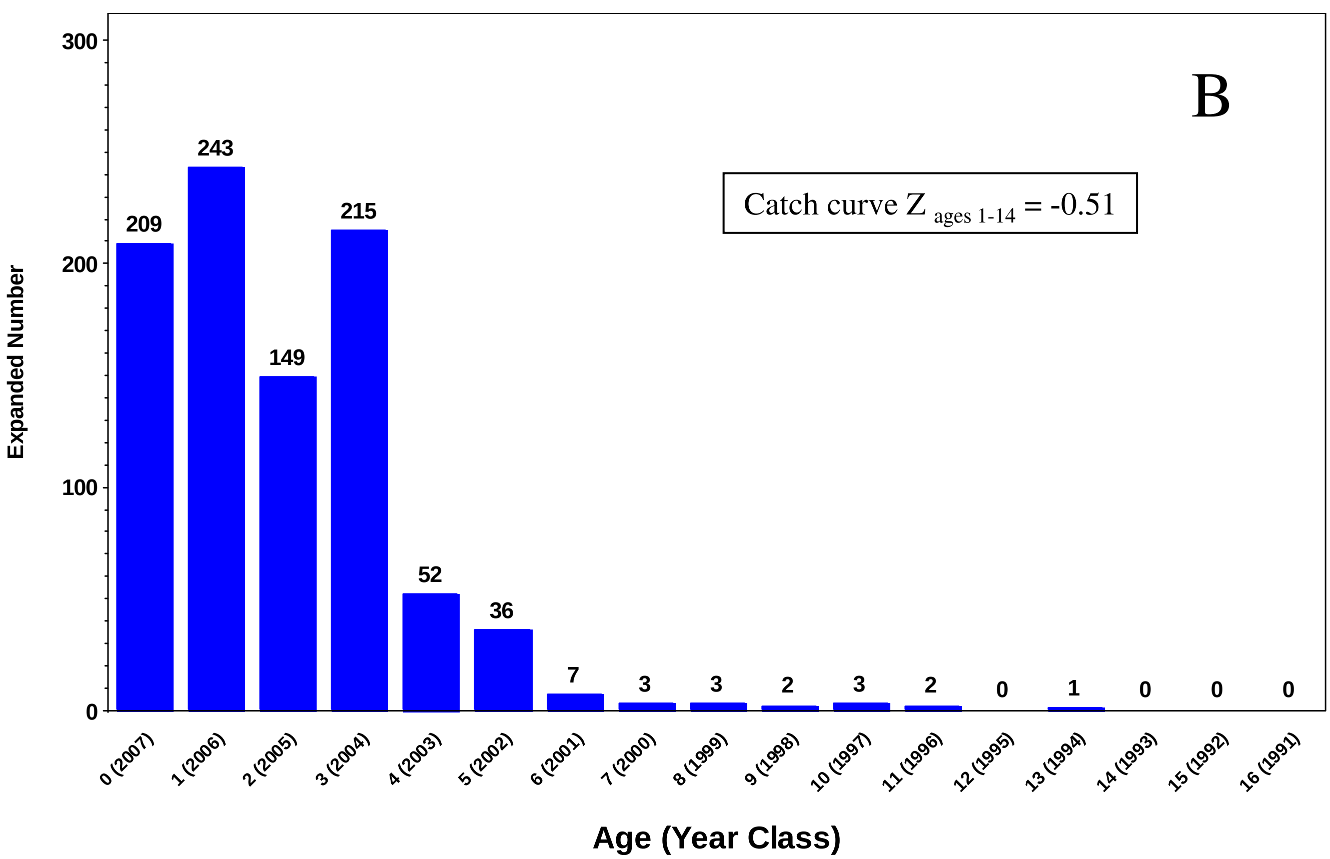


Figure 146. Age-specific length-frequency histograms for summer flounder for ages 0 through 6.

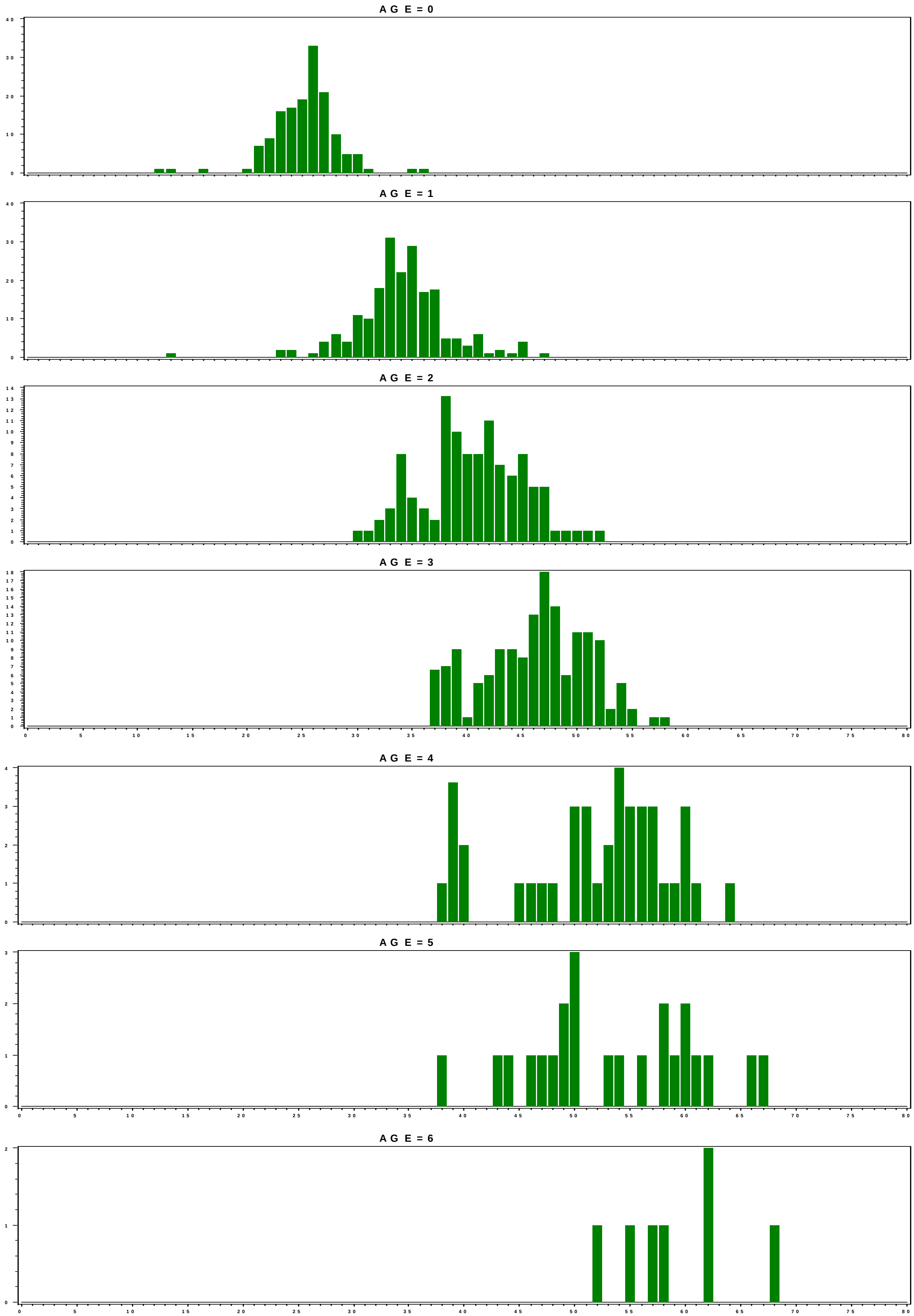
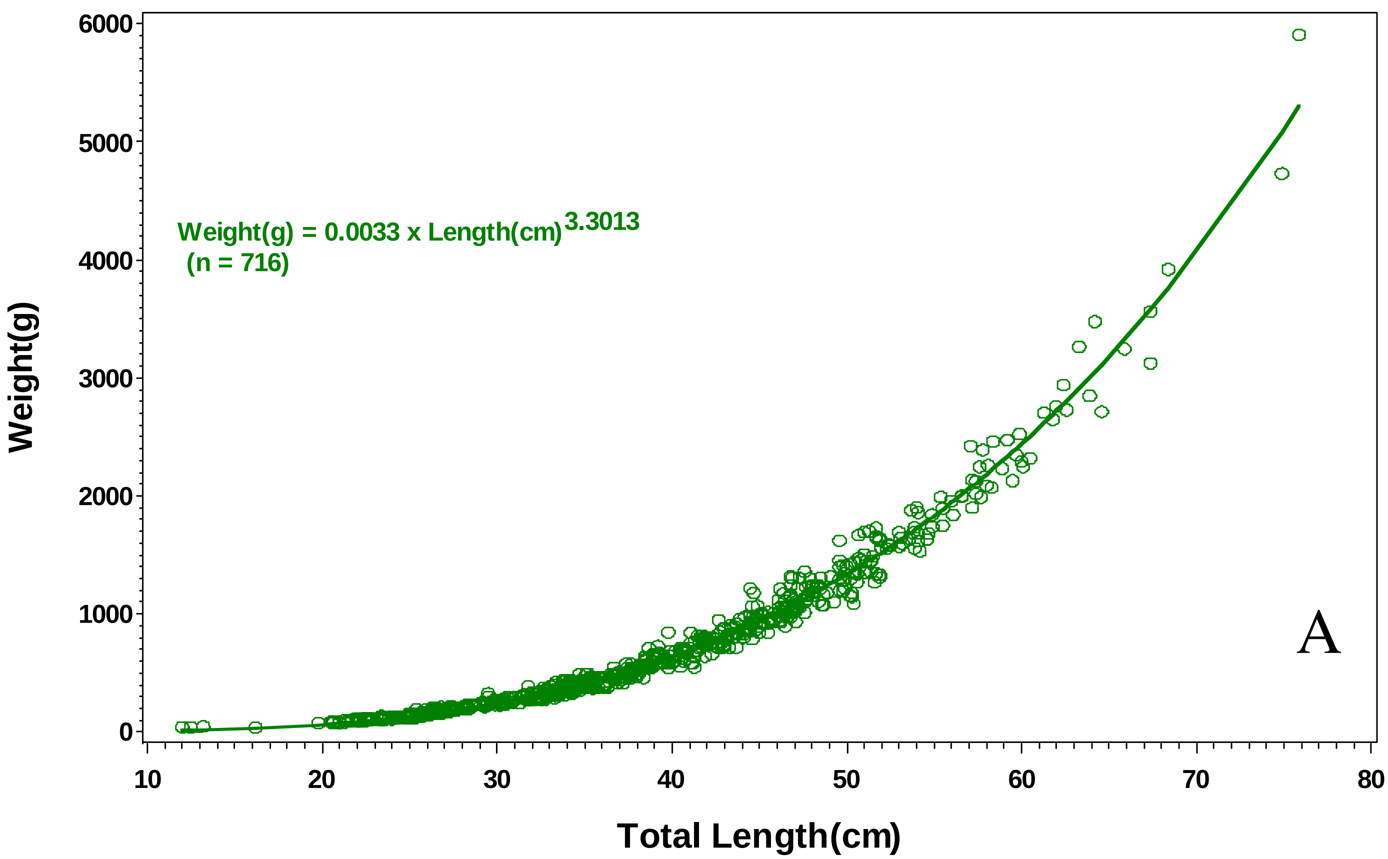


Figure 147. Length-weight regression for summer flounder, sexes combined (A) and by sex (B).



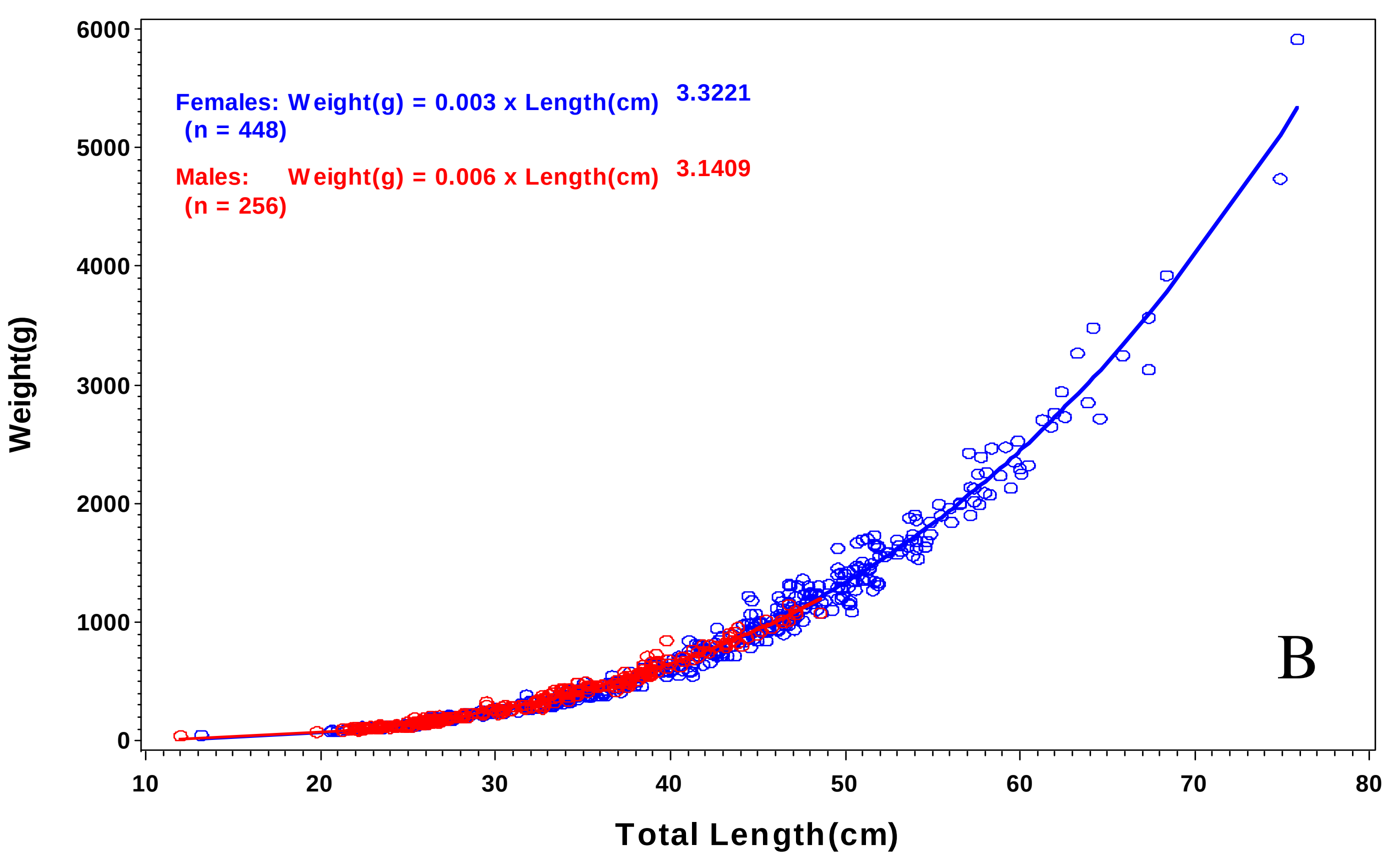
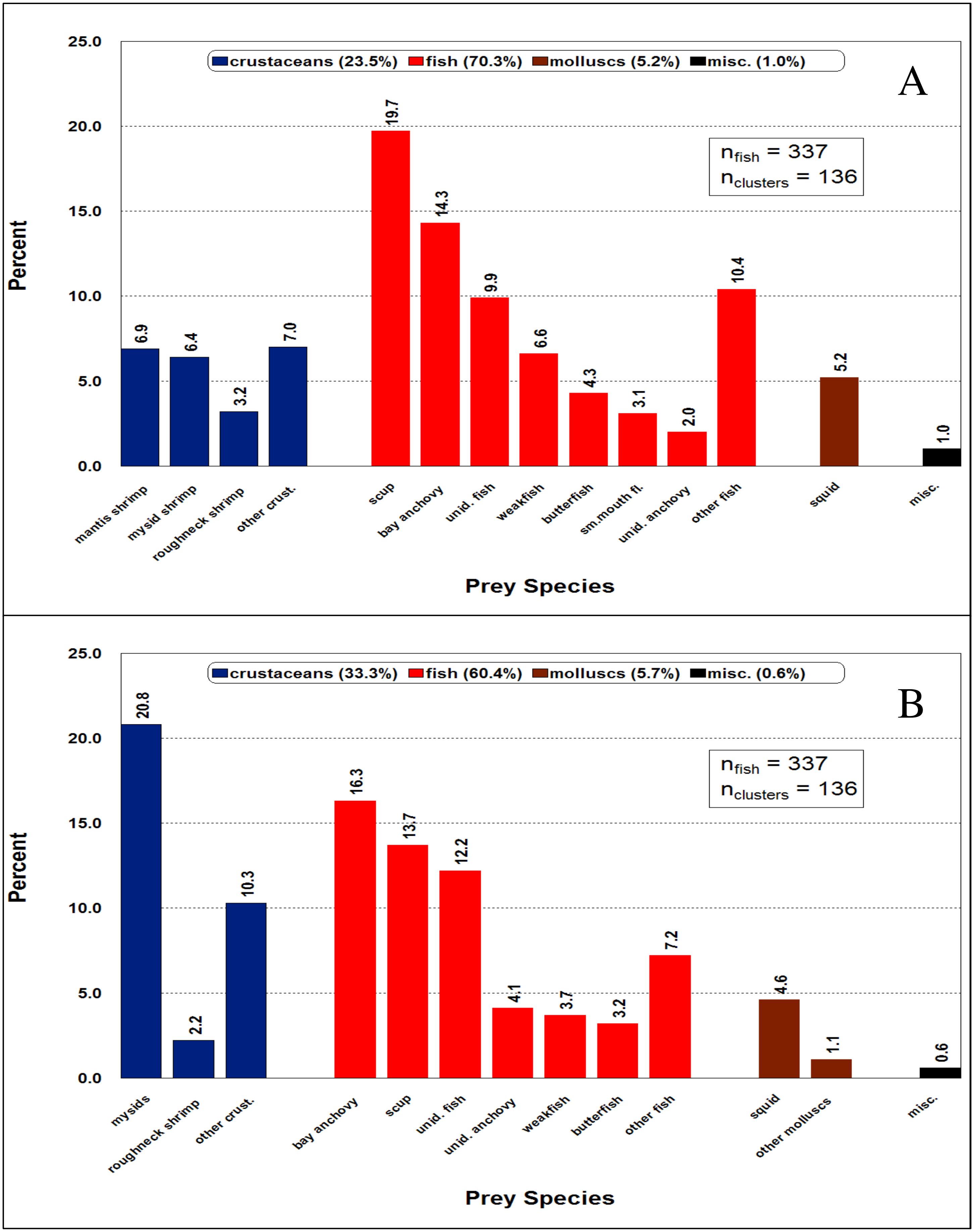


Figure 148. Diets of summer flounder by percent weight (A) and percent number (B).



Weakfish (Priority A)

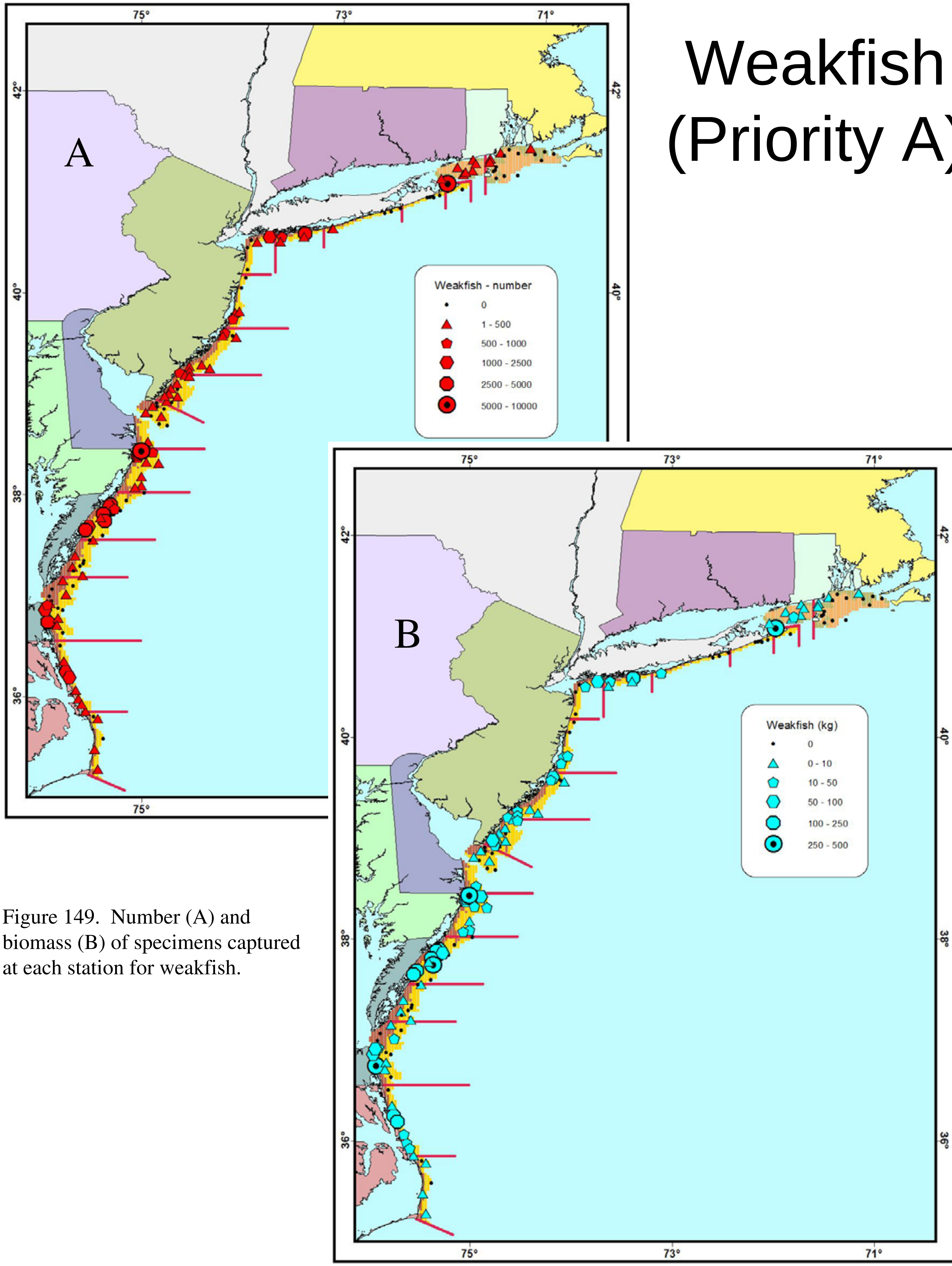


Figure 149. Number (A) and biomass (B) of specimens captured at each station for weakfish.

Figure 150. Minimum trawlable number and biomass by state for summer weakfish.

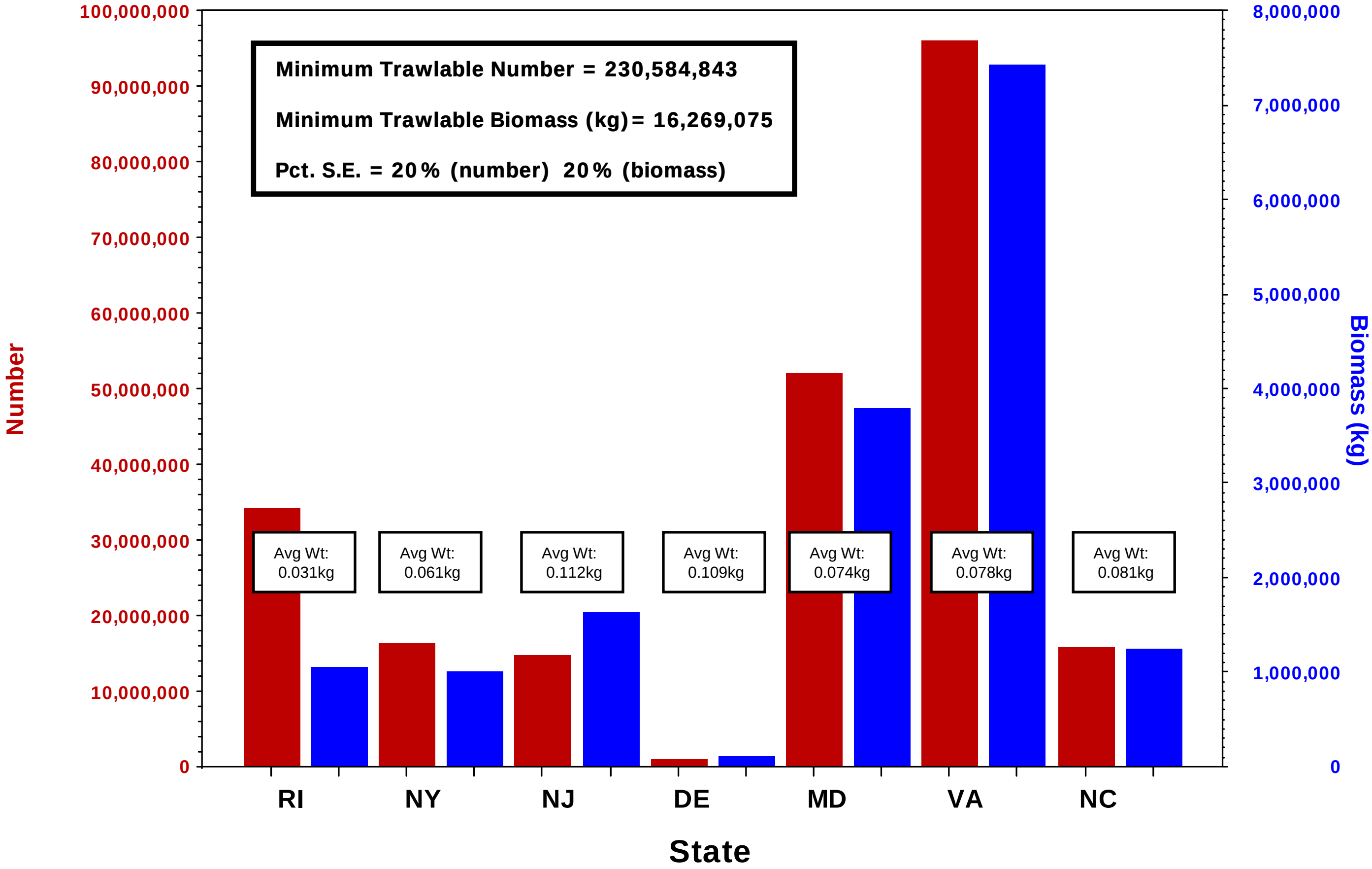


Figure 151. Length frequency histogram for weakfish.

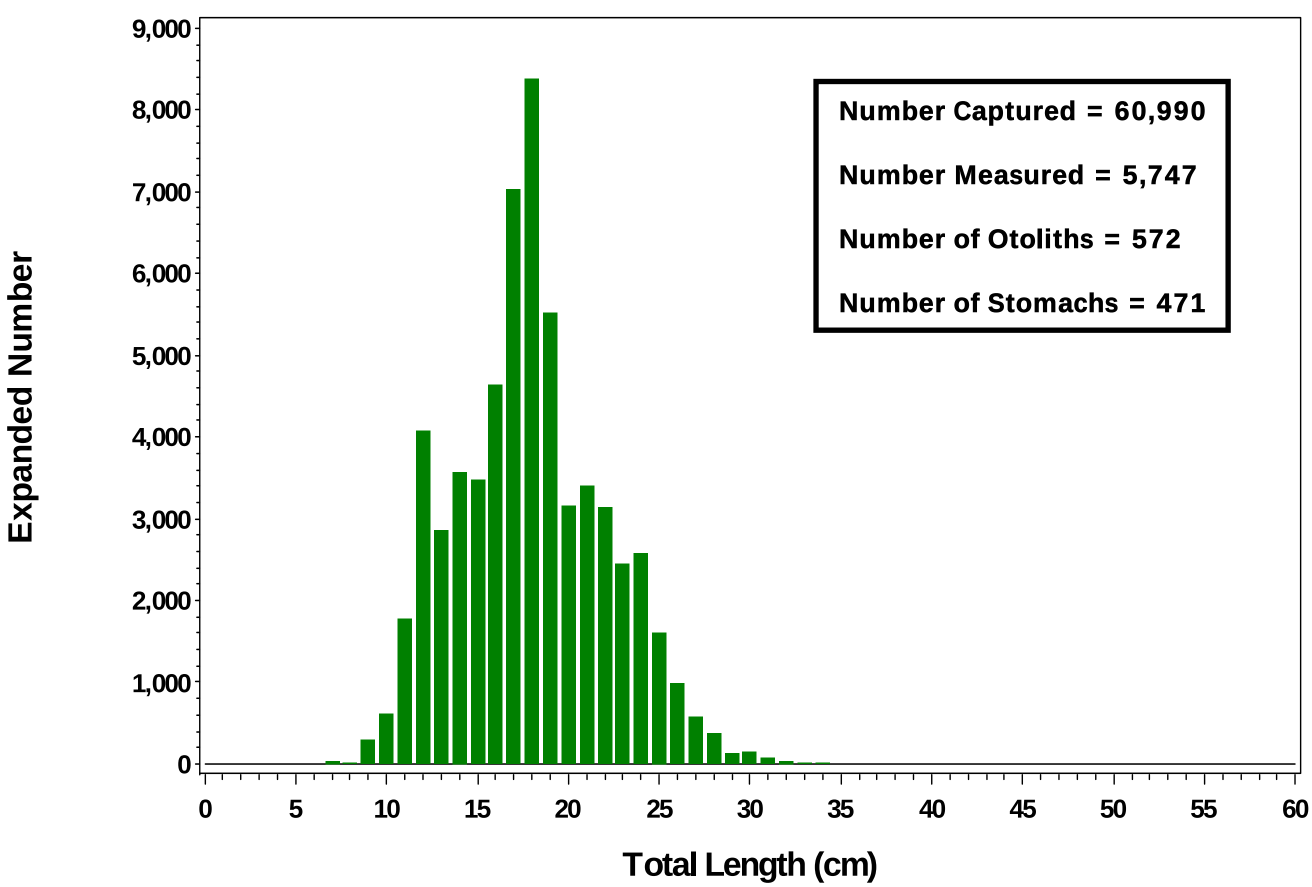
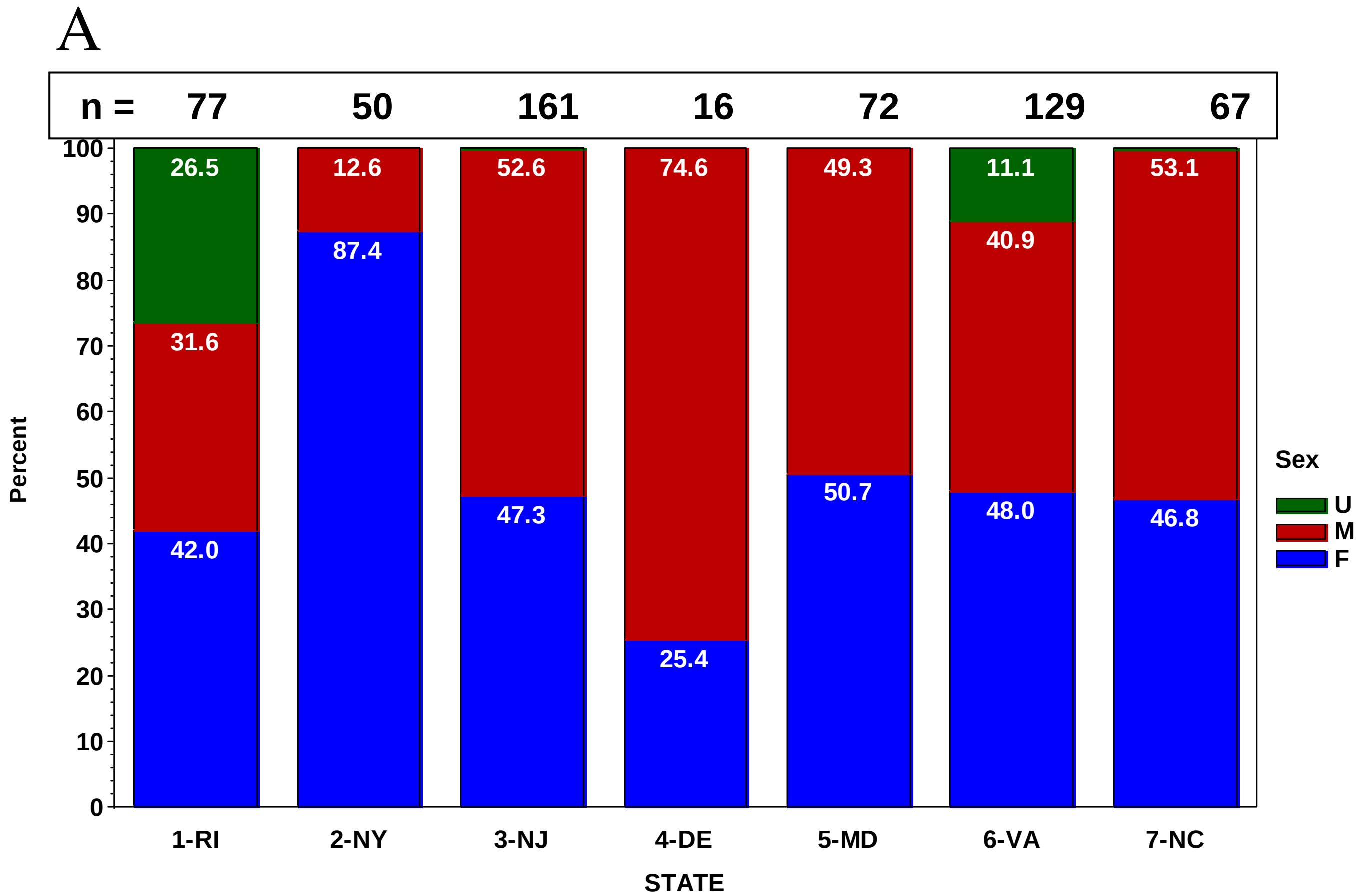


Figure 152. Sex ratios for weakfish by state (A) and length group (B).



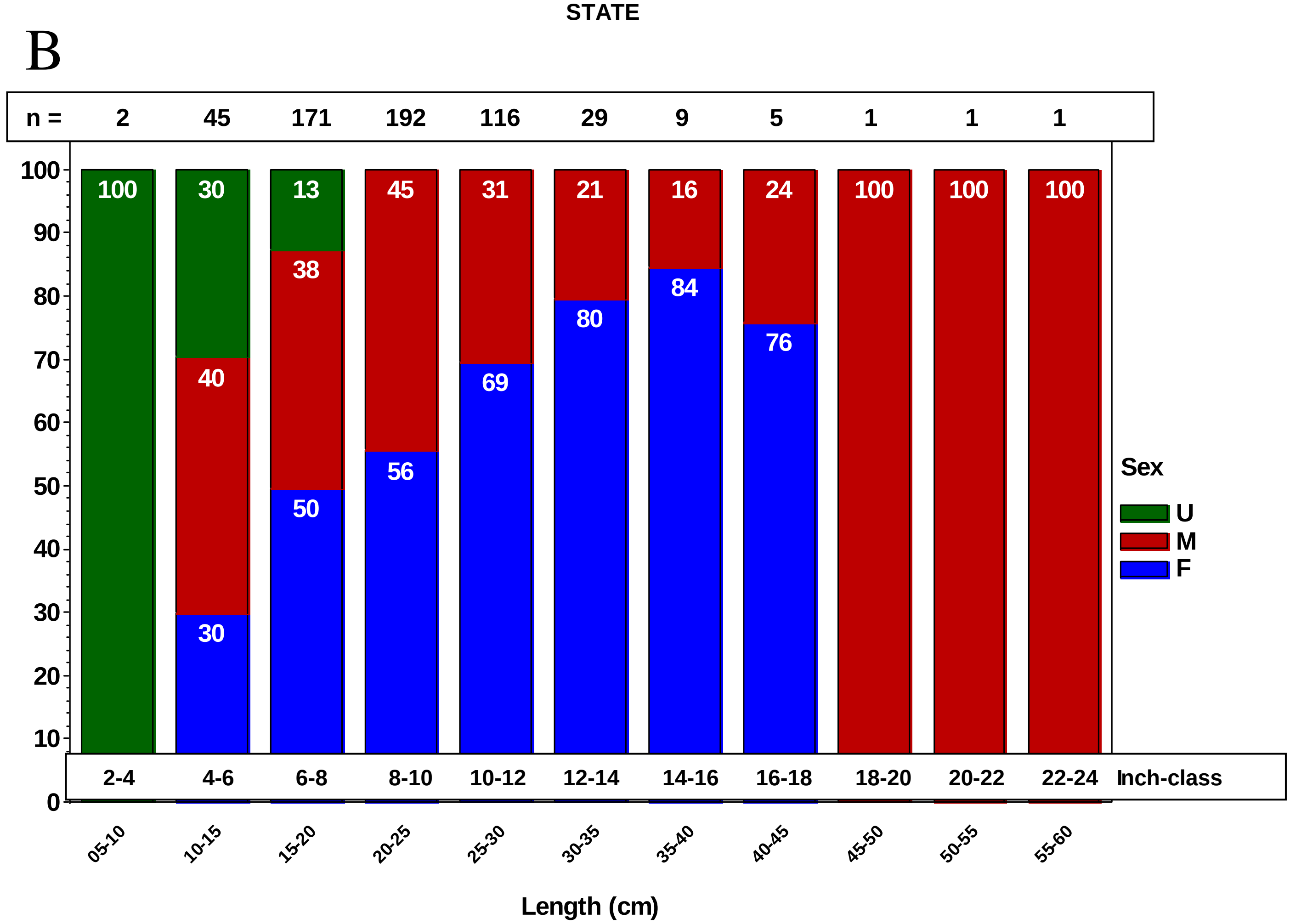


Figure 153. Maturity logistic regression for weakfish, by sex.

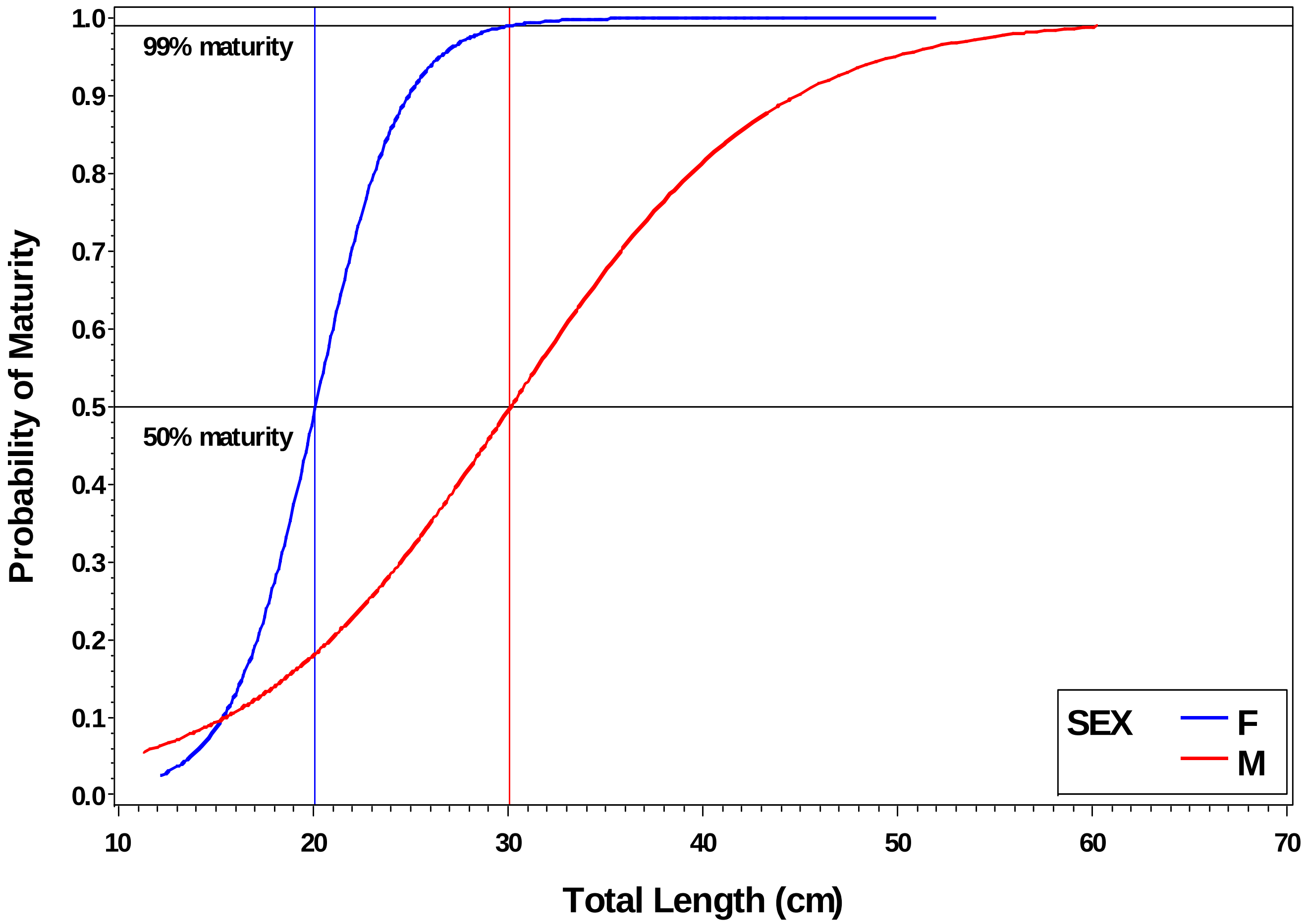


Figure 154. Age frequency histogram for weakfish.

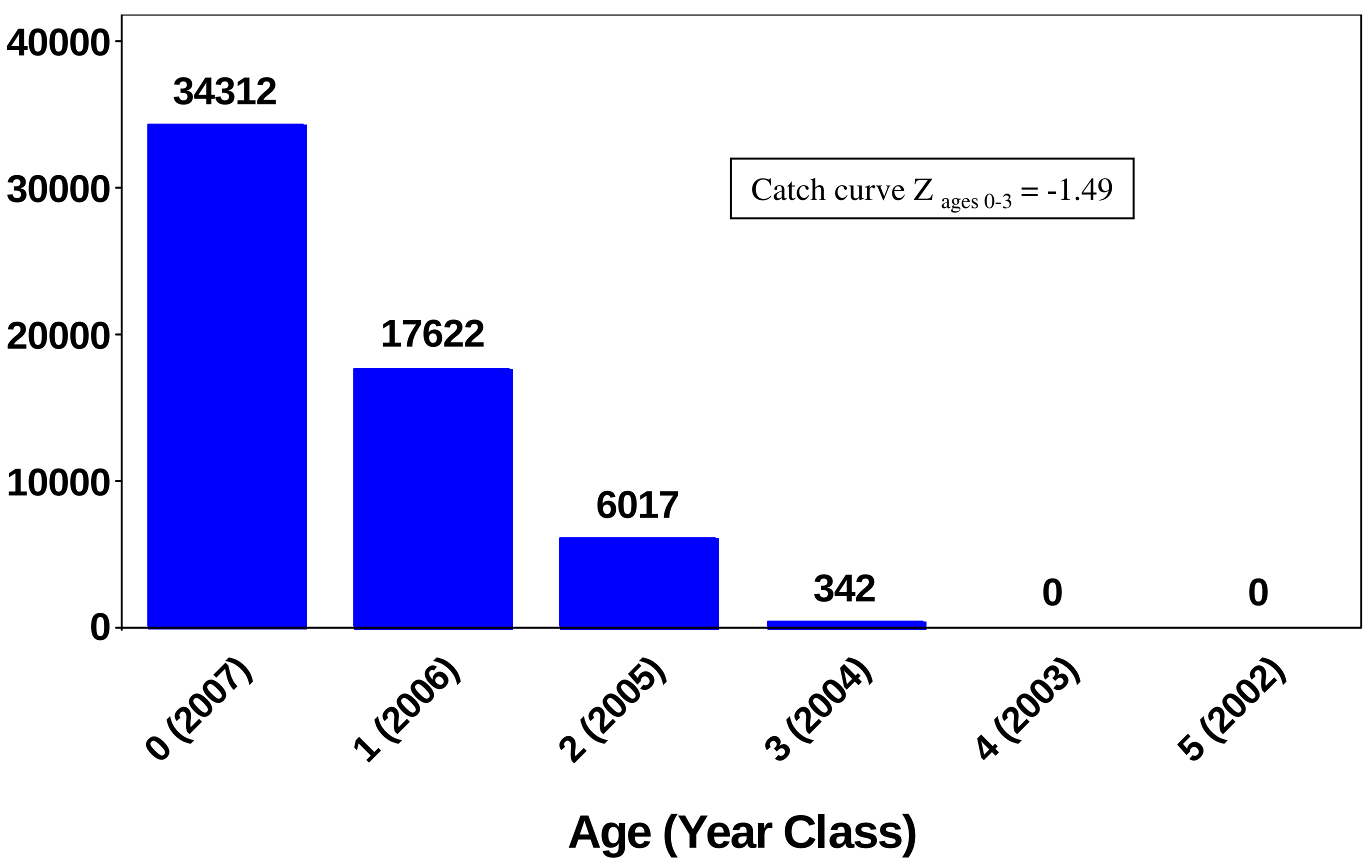


Figure 155. Age-specific length-frequency histograms for weakfish for ages 0 through 3.

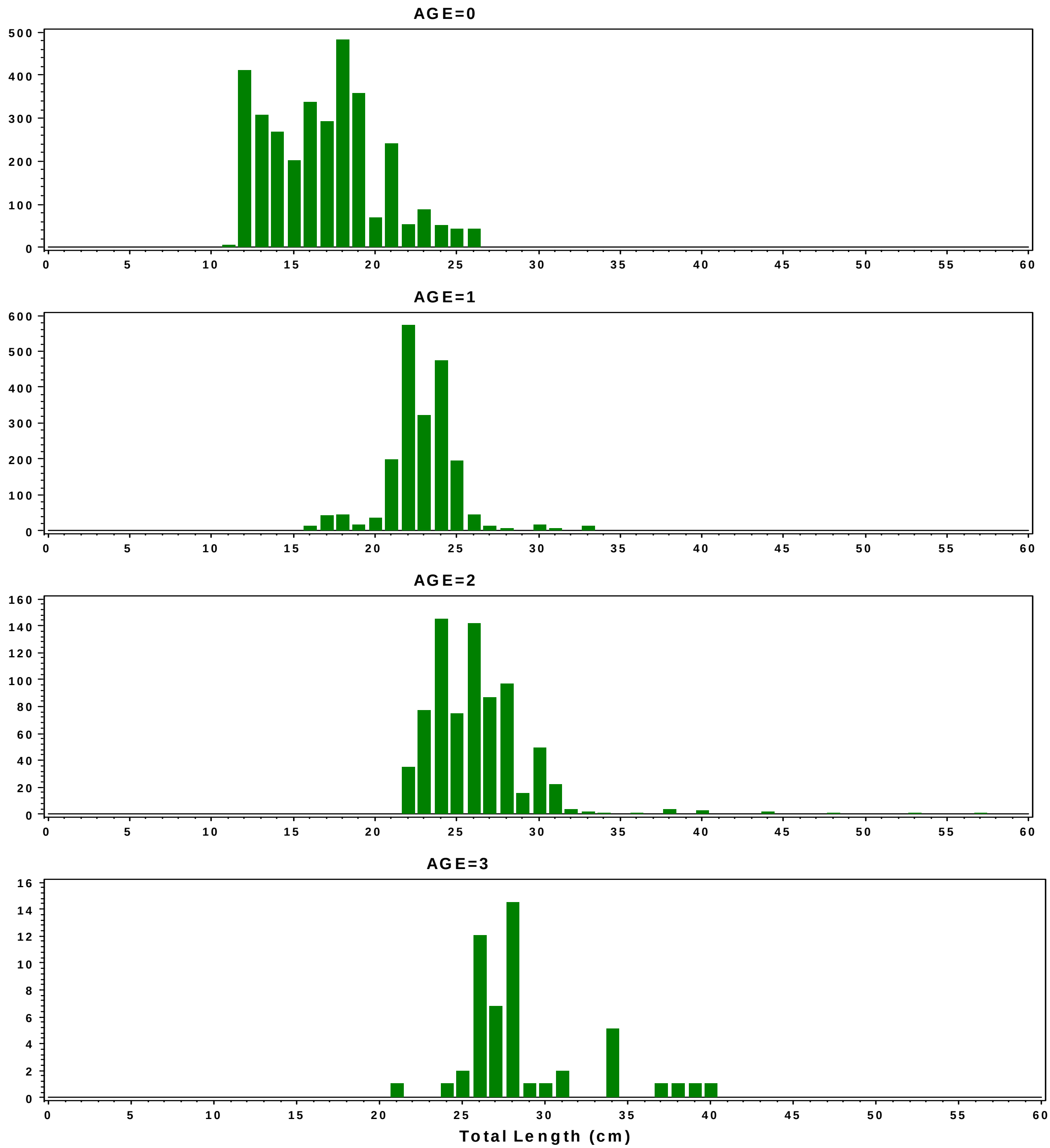


Figure 156. von Bertalanffy growth curves for weakfish, by sex.

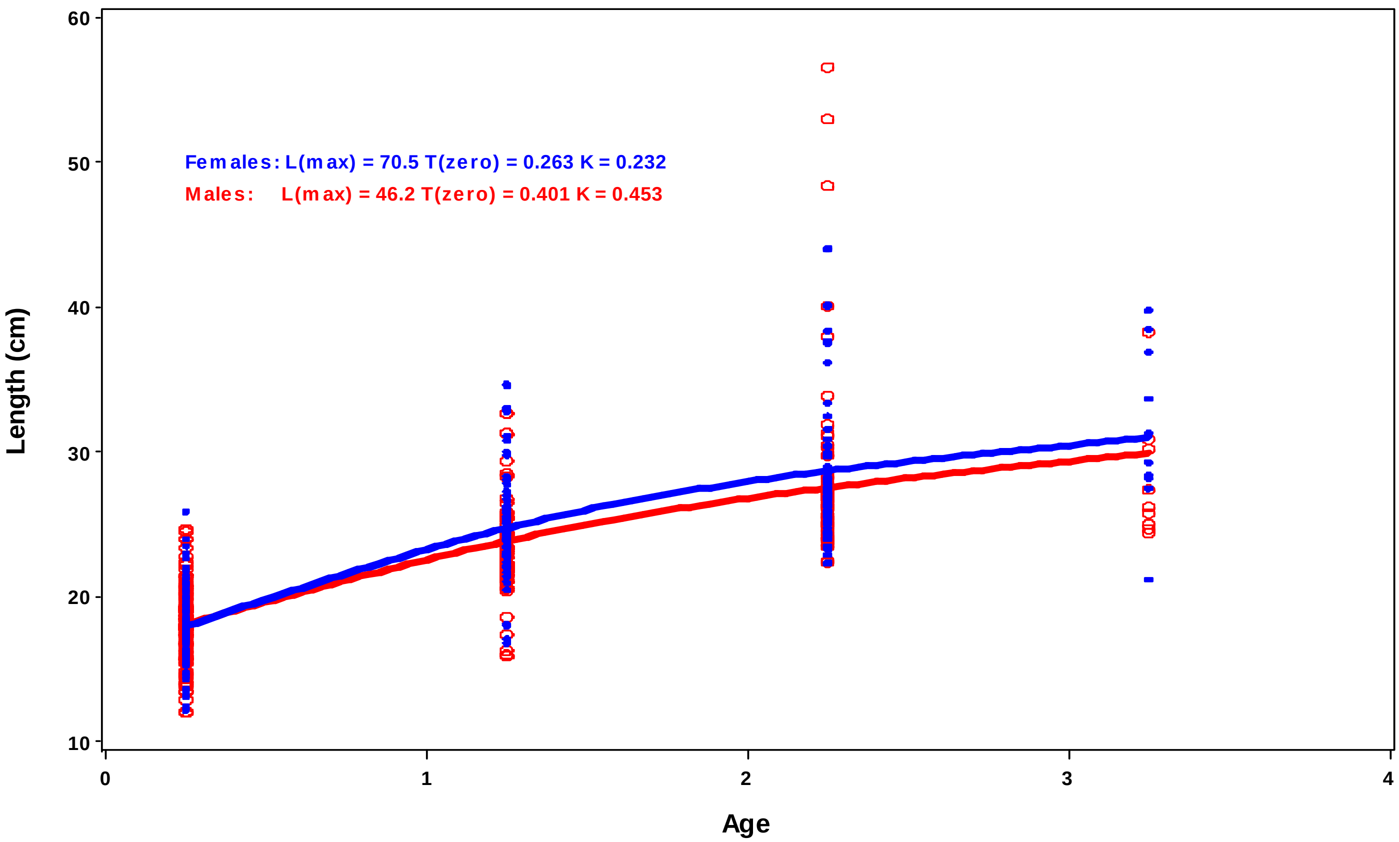


Figure 157. Length-weight regression for weakfish, sexes combined (A) and by sex (B)..

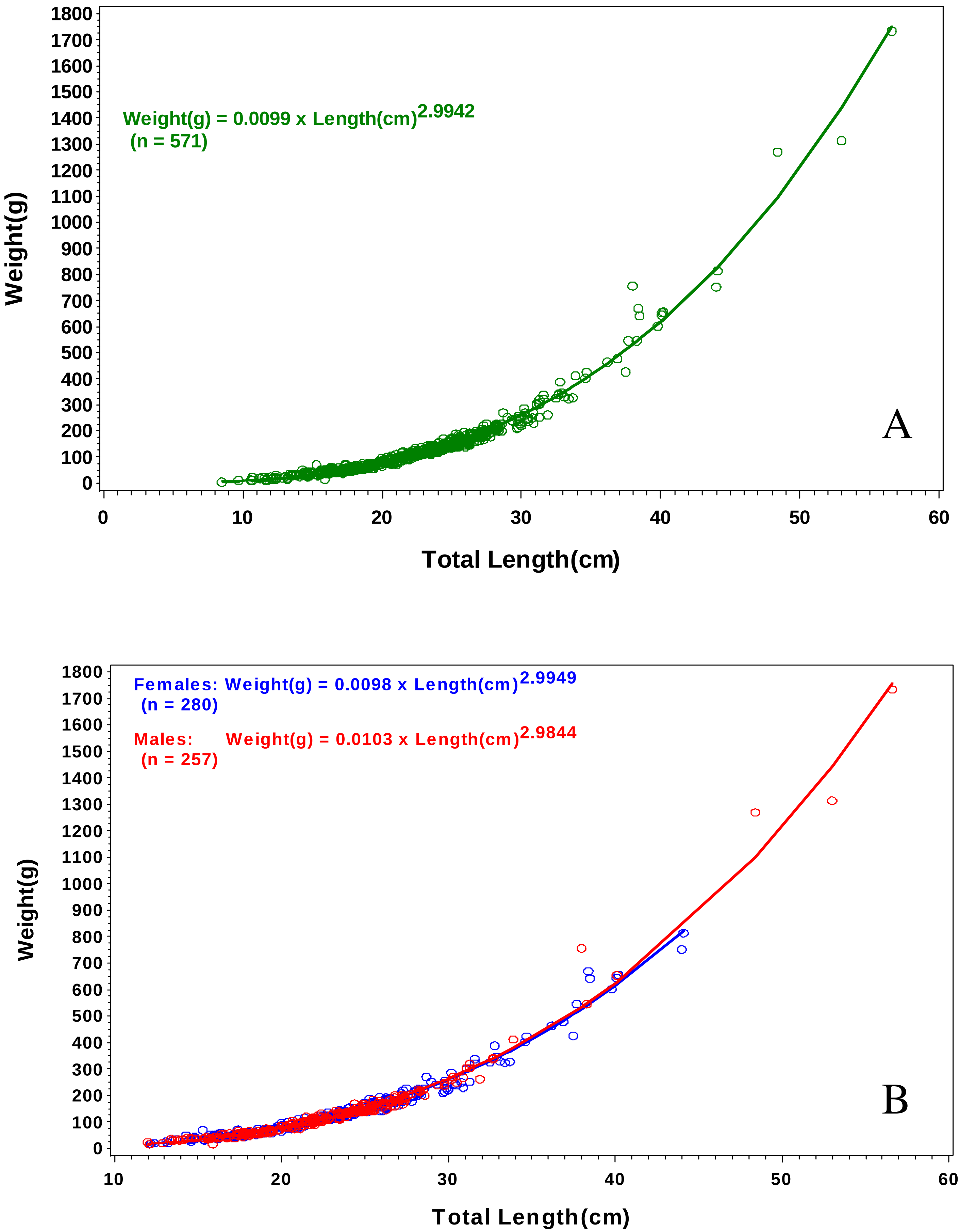
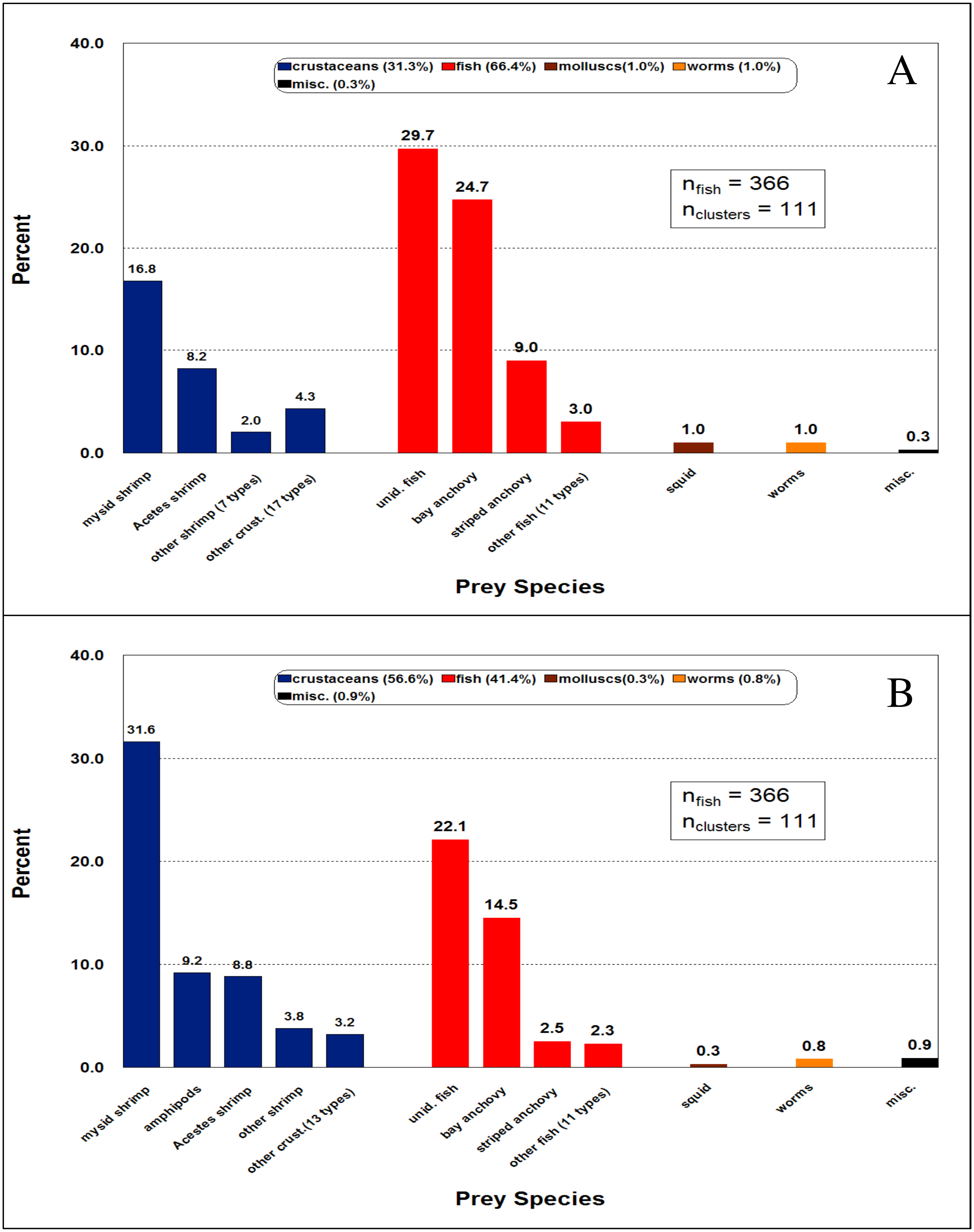
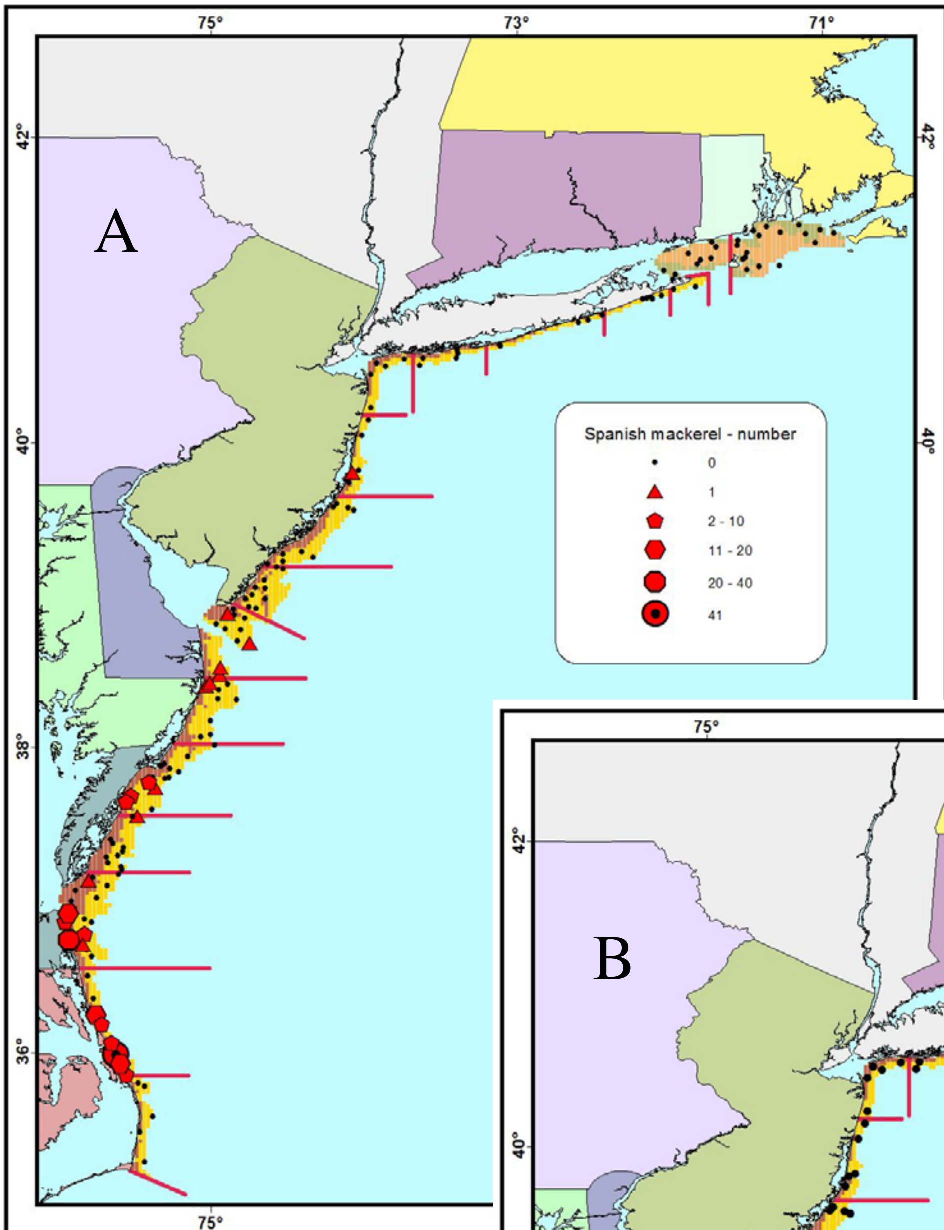


Figure 158. Diets of weakfish by percent weight (A) and percent number (B).



Winter Flounder (Priority A)



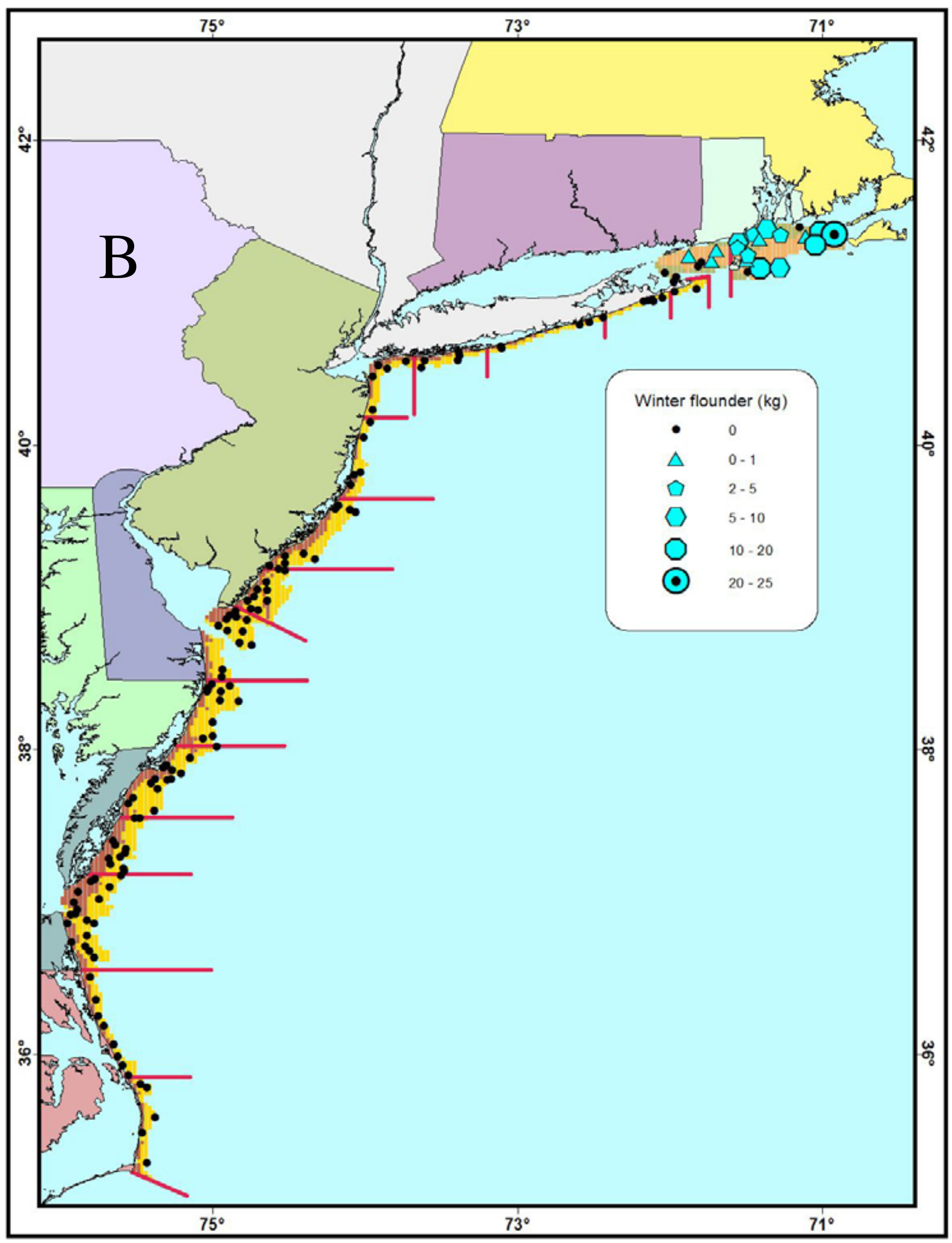


Figure 159. Number (A) and biomass (B) of specimens captured at each station for winter flounder.

Figure 160. Minimum trawlable number and biomass by state for winter flounder.

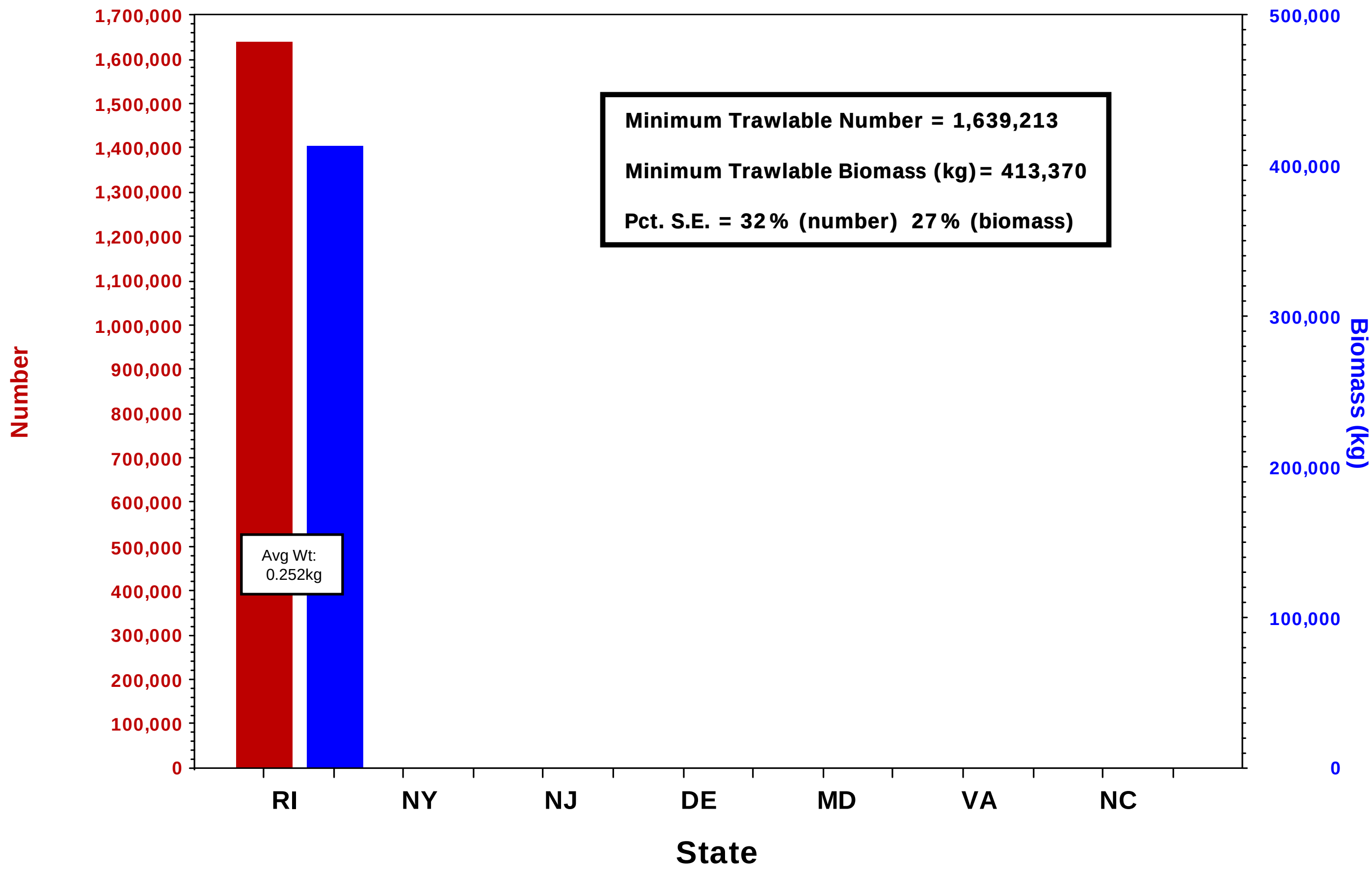


Figure 161. Length frequency histogram for winter flounder.

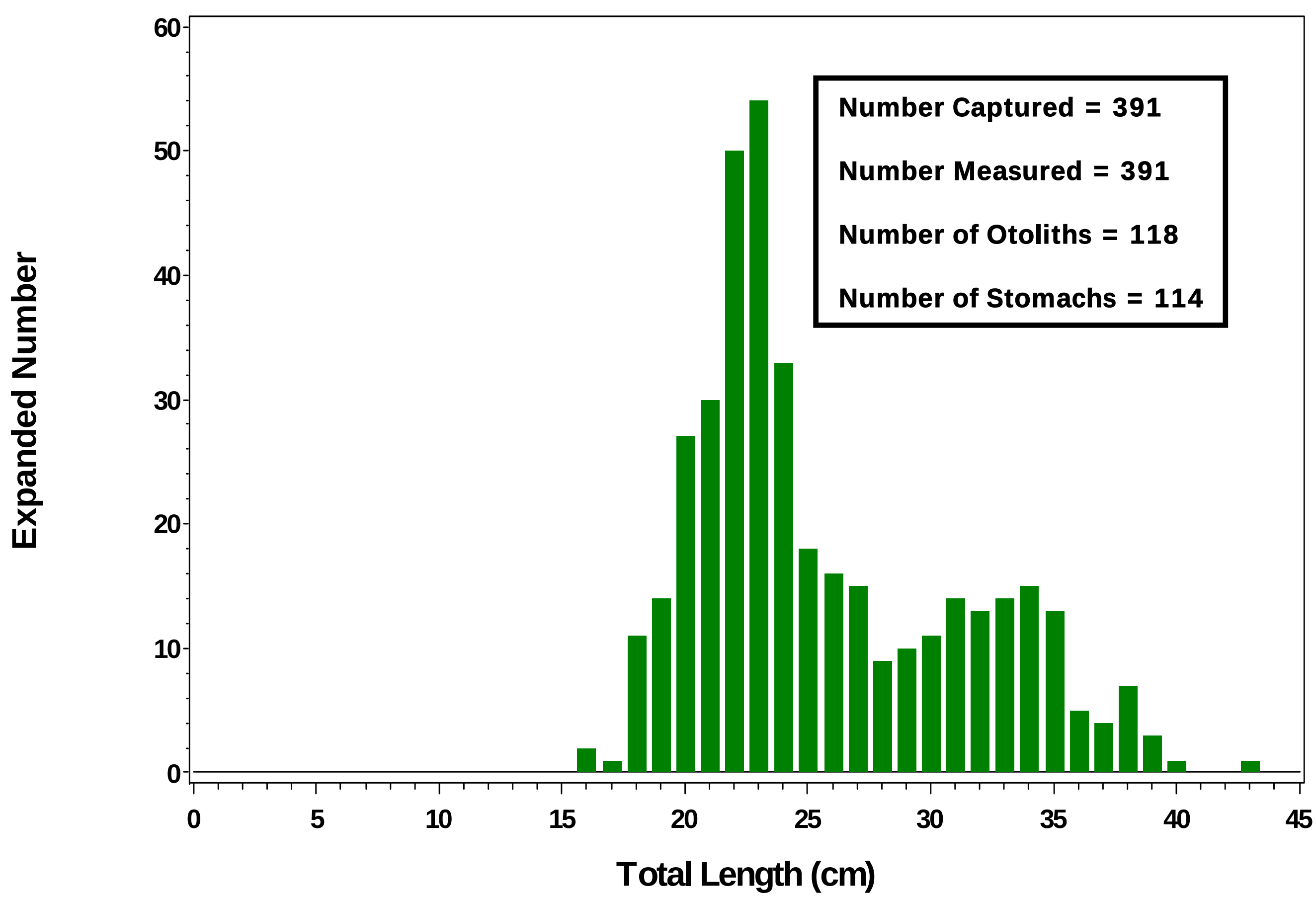
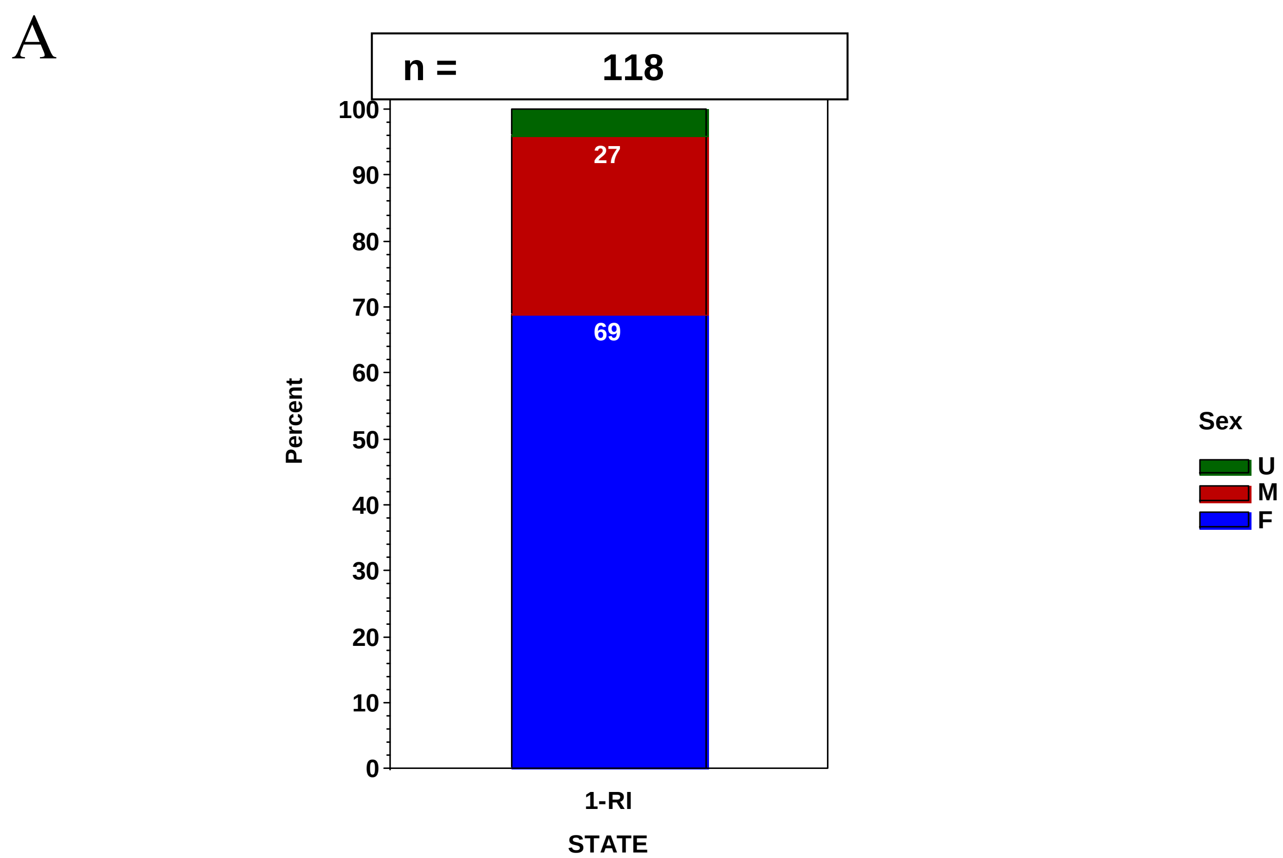


Figure 162. Sex ratios for winter flounder by state (A) and length group (B).



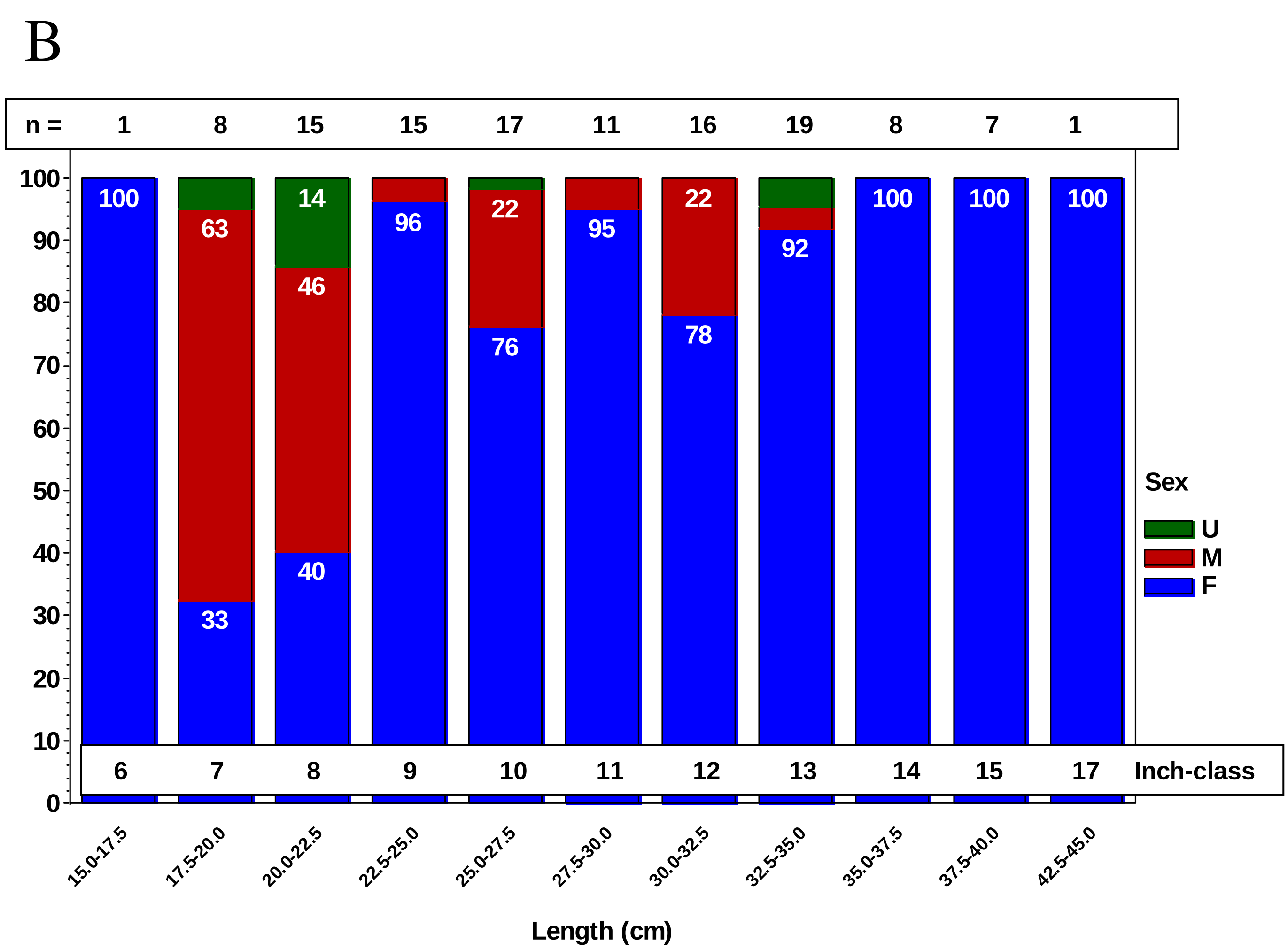


Figure 163. Maturity logistic regression for winter flounder, by sex.

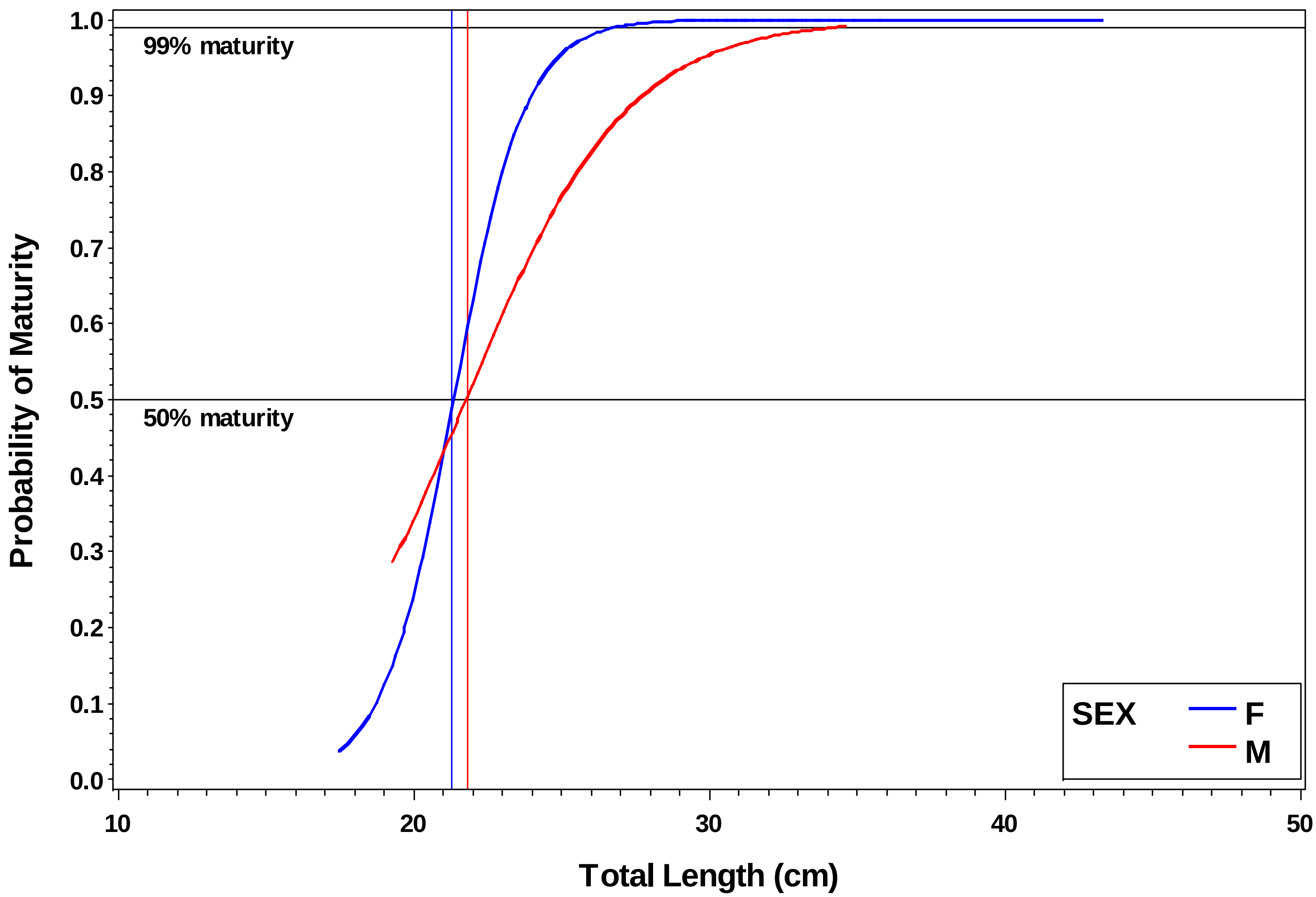


Figure 164. Age frequency histogram for winter flounder.

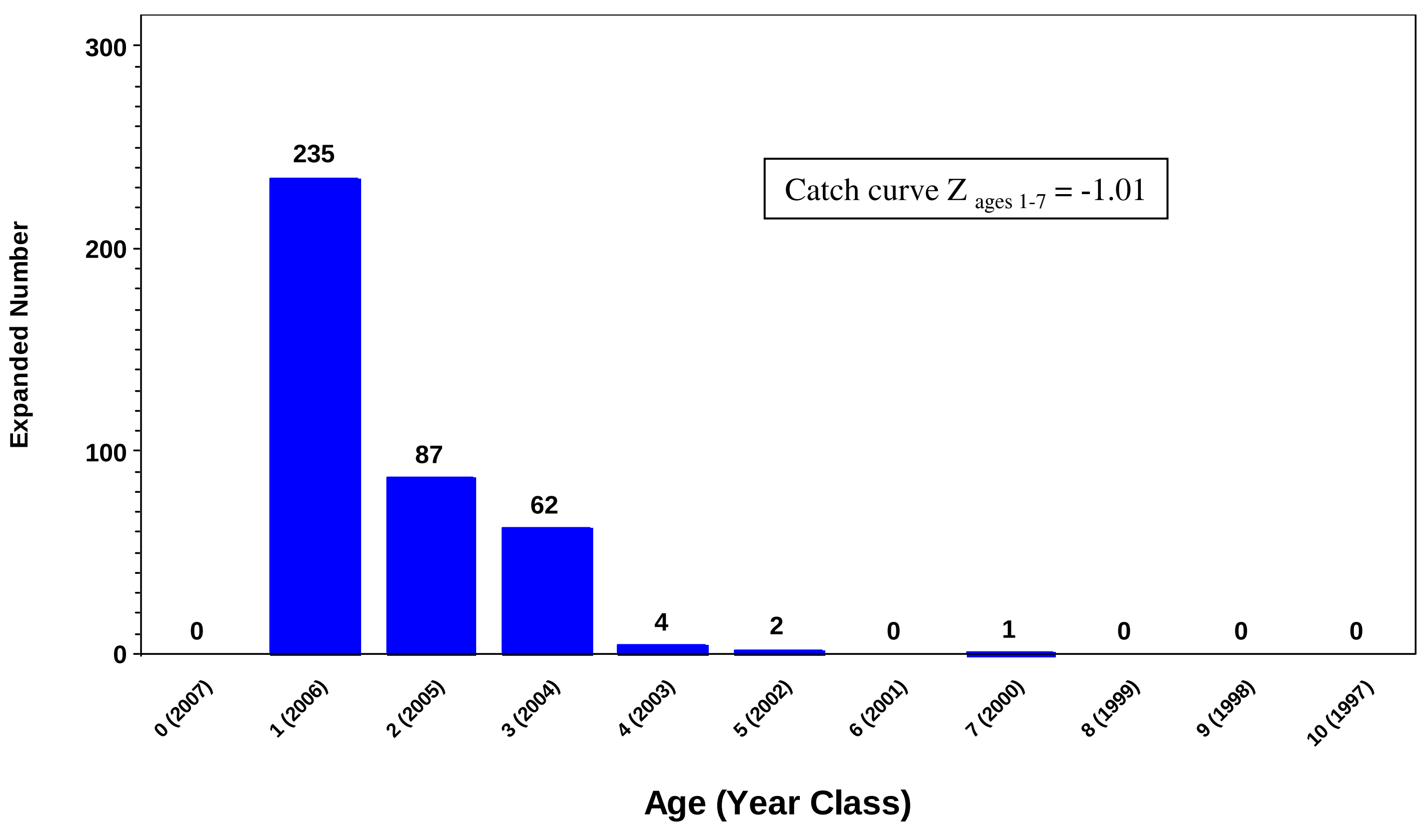


Figure 165. Age-specific length-frequency histograms for winter flounder for ages 1 through 3.

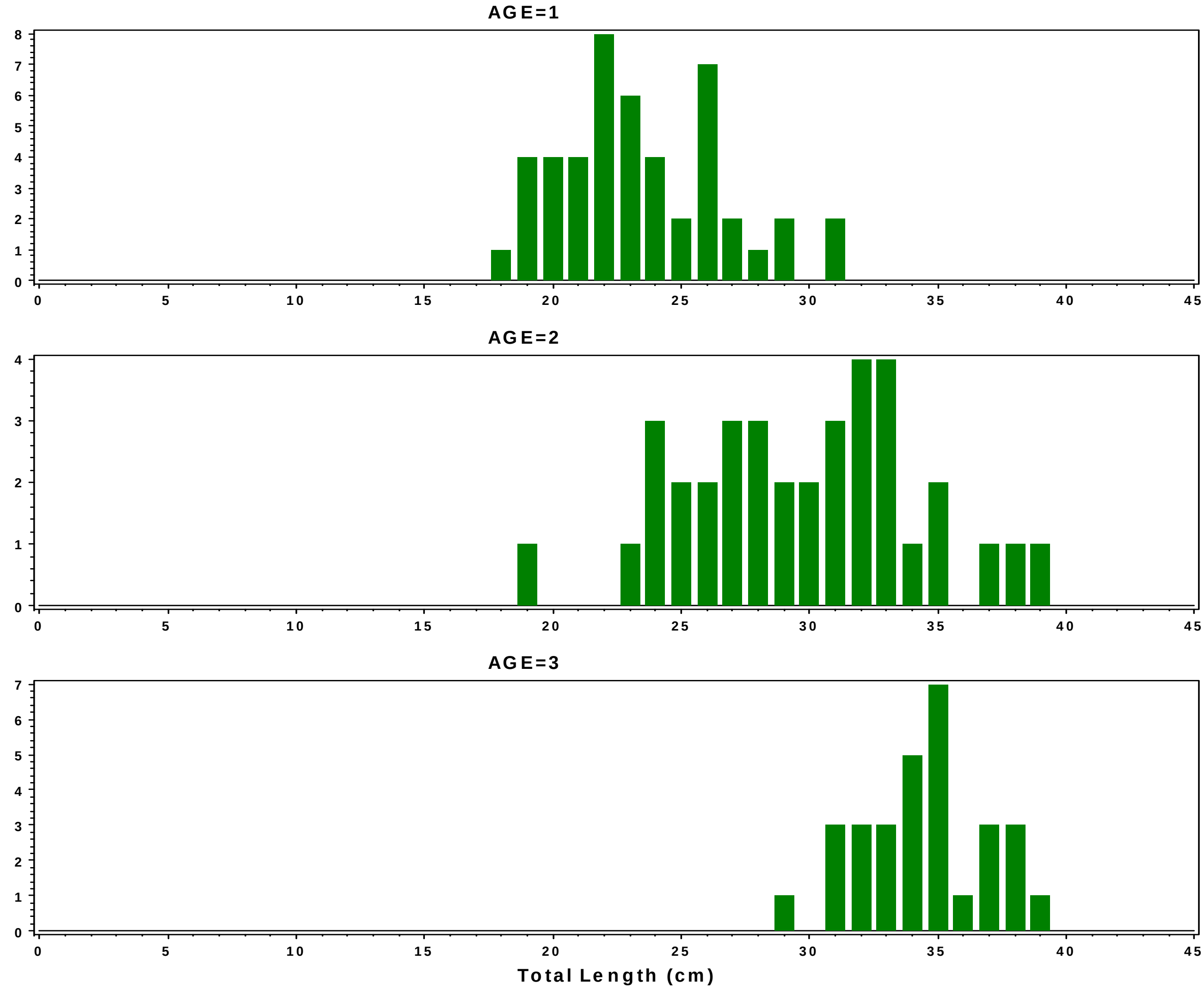


Figure 166. von Bertalanffy growth curves for winter flounder, by sex.

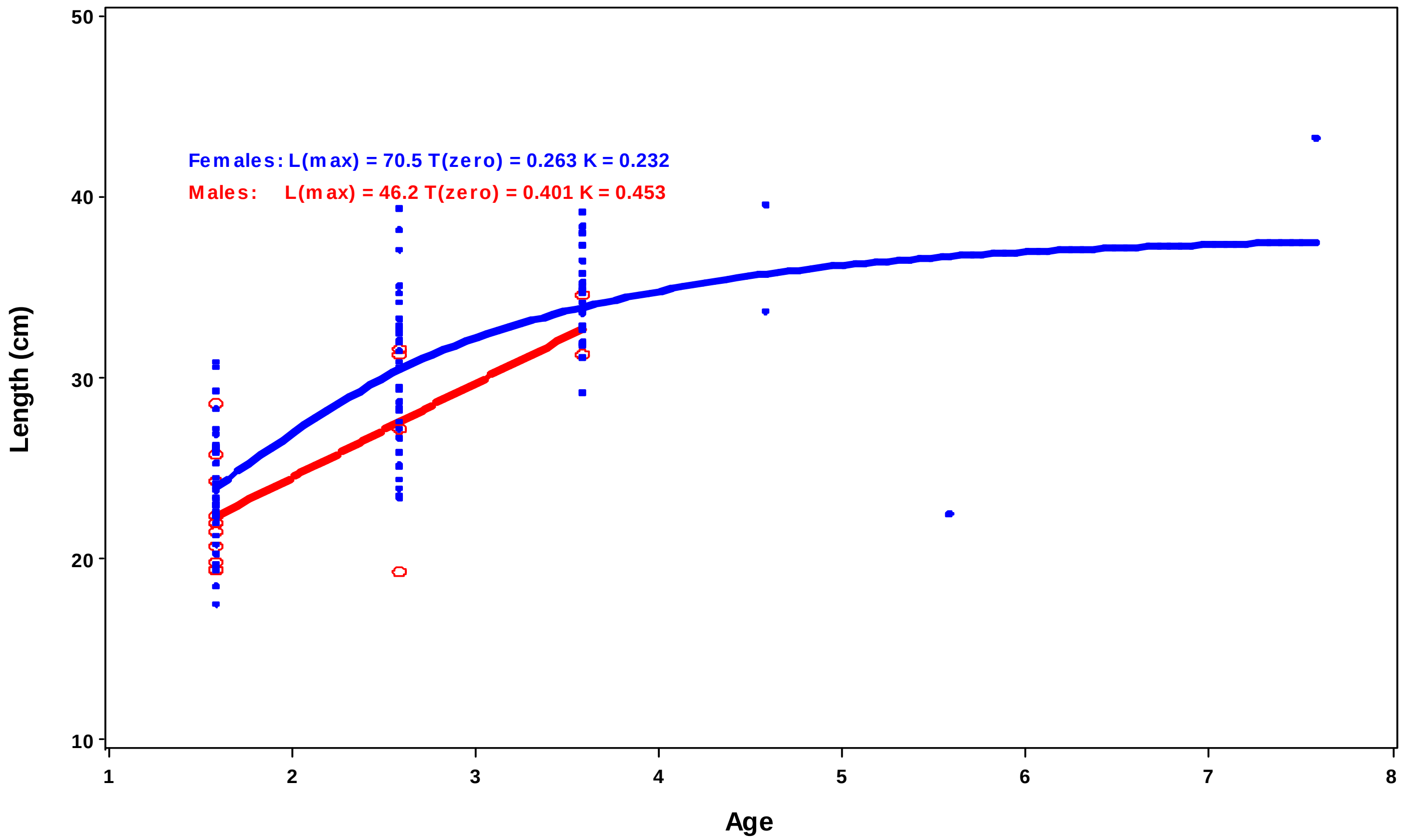


Figure 167. Length-weight regression for winter flounder, sexes combined (A) and by sex (B).

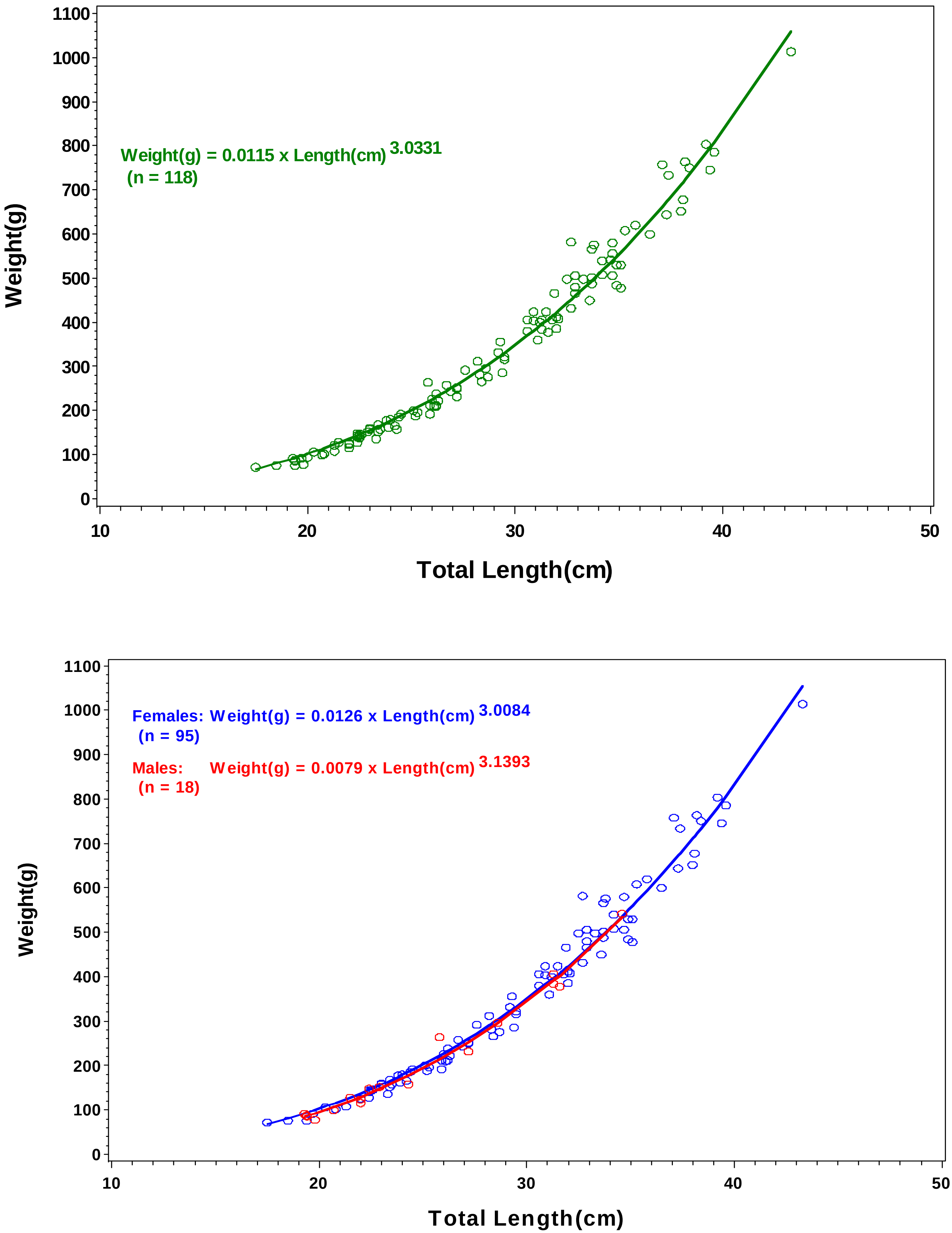
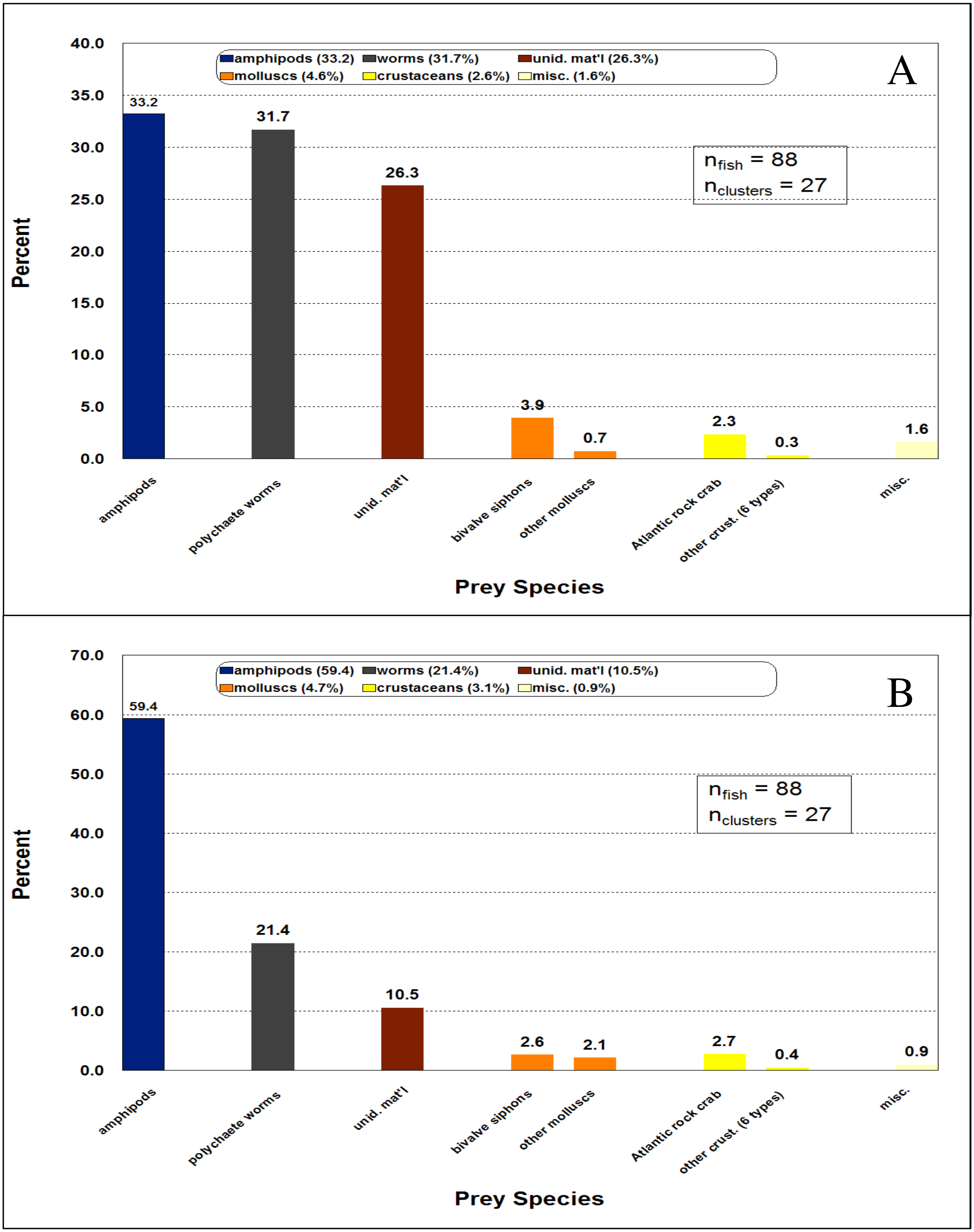
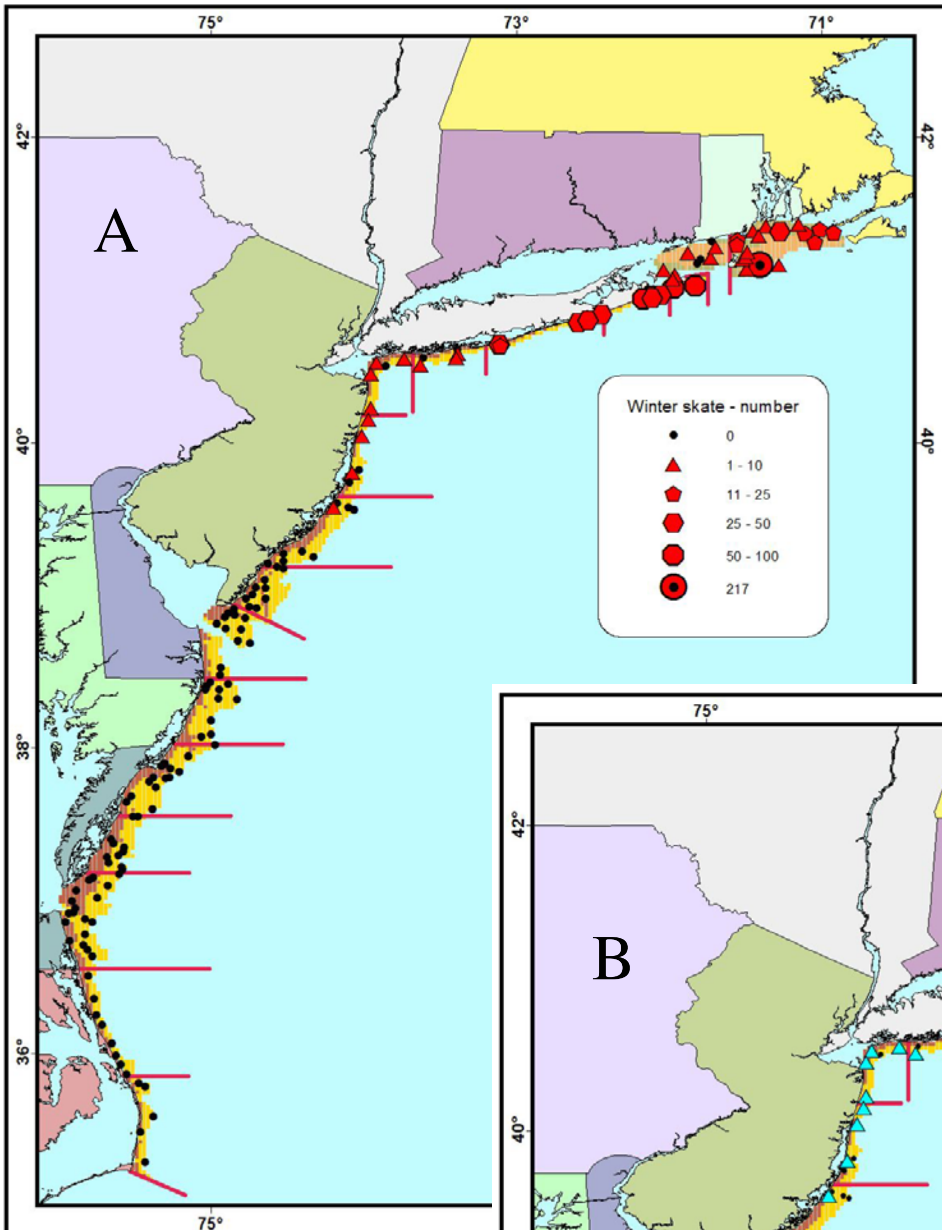


Figure 168. Diets of winter flounder by percent weight (A) and percent number (B).



Winter Skate (Priority B)



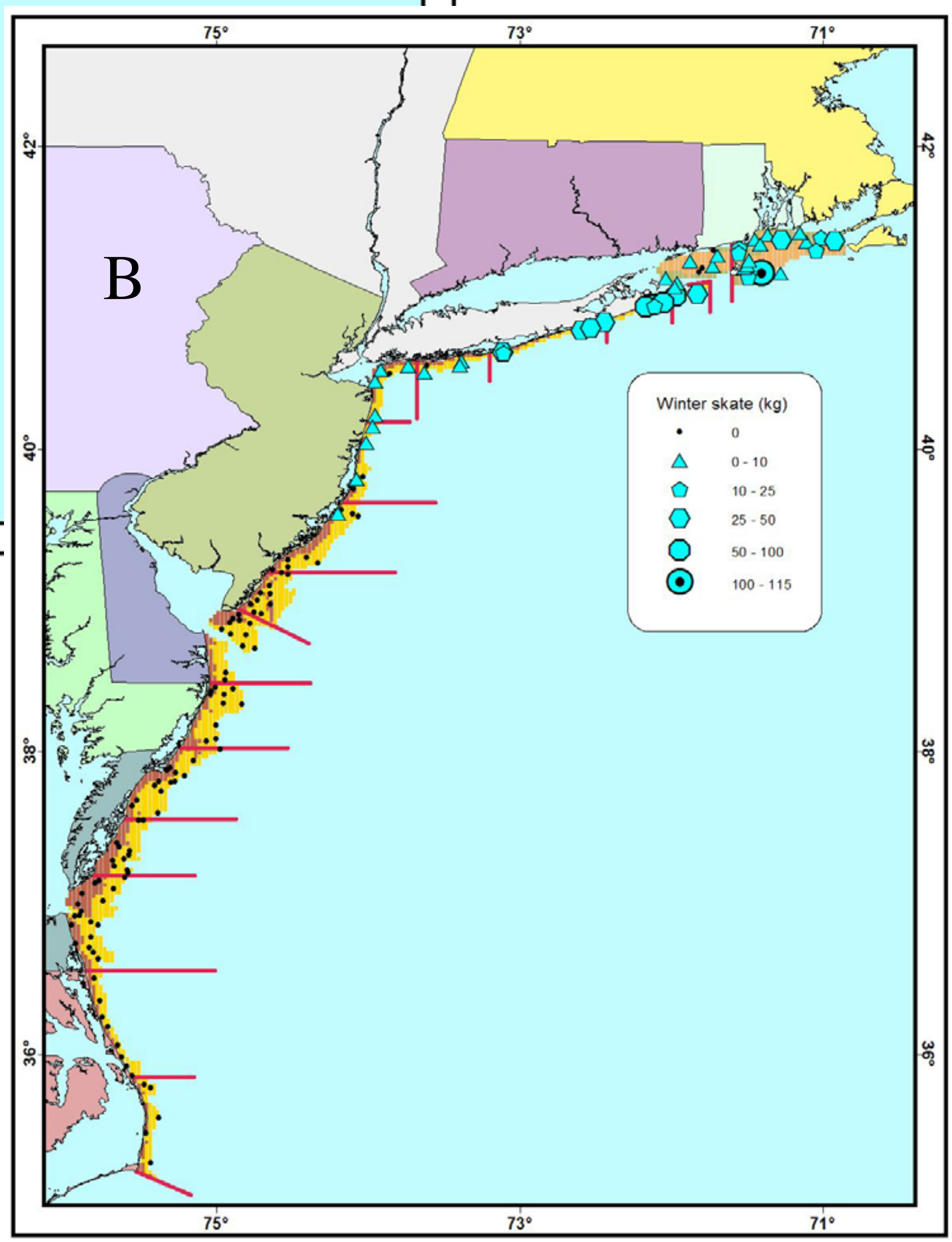


Figure 169. Number (A) and biomass (B) of specimens captured at each station for winter skate.

Figure 170. Minimum trawlable number and biomass by state for winter skate.

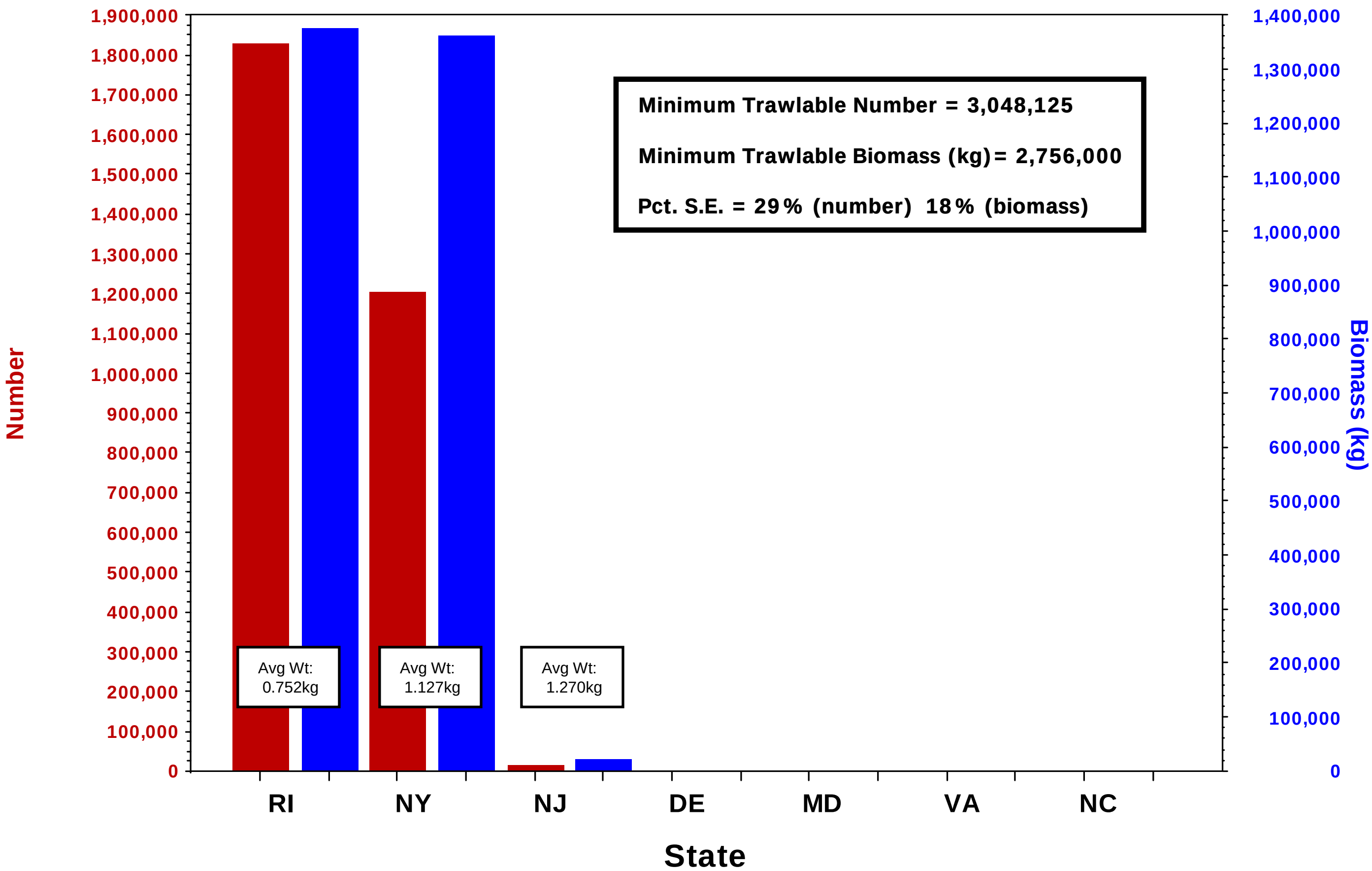


Figure 171. Width frequency histogram for winter skate.

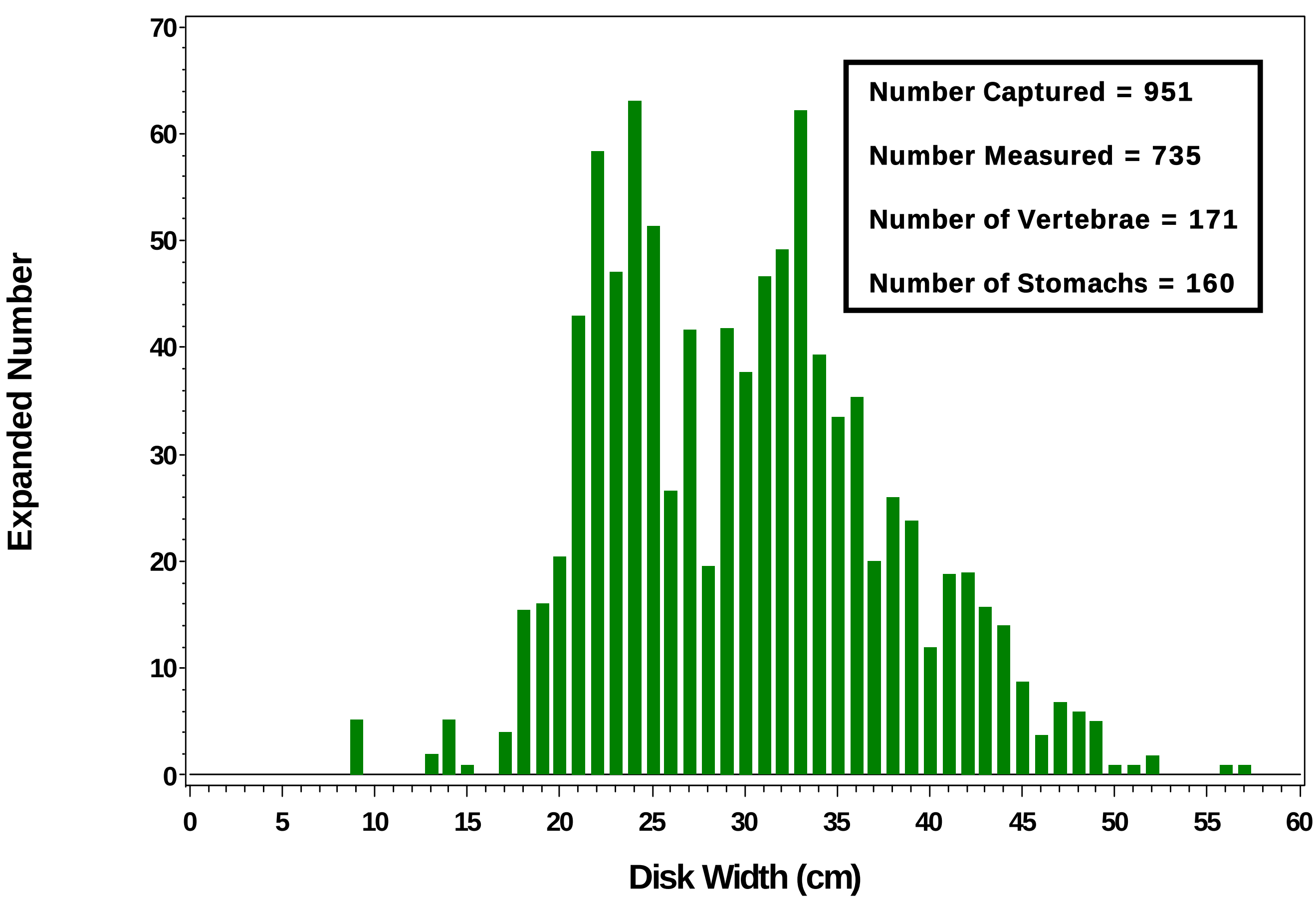
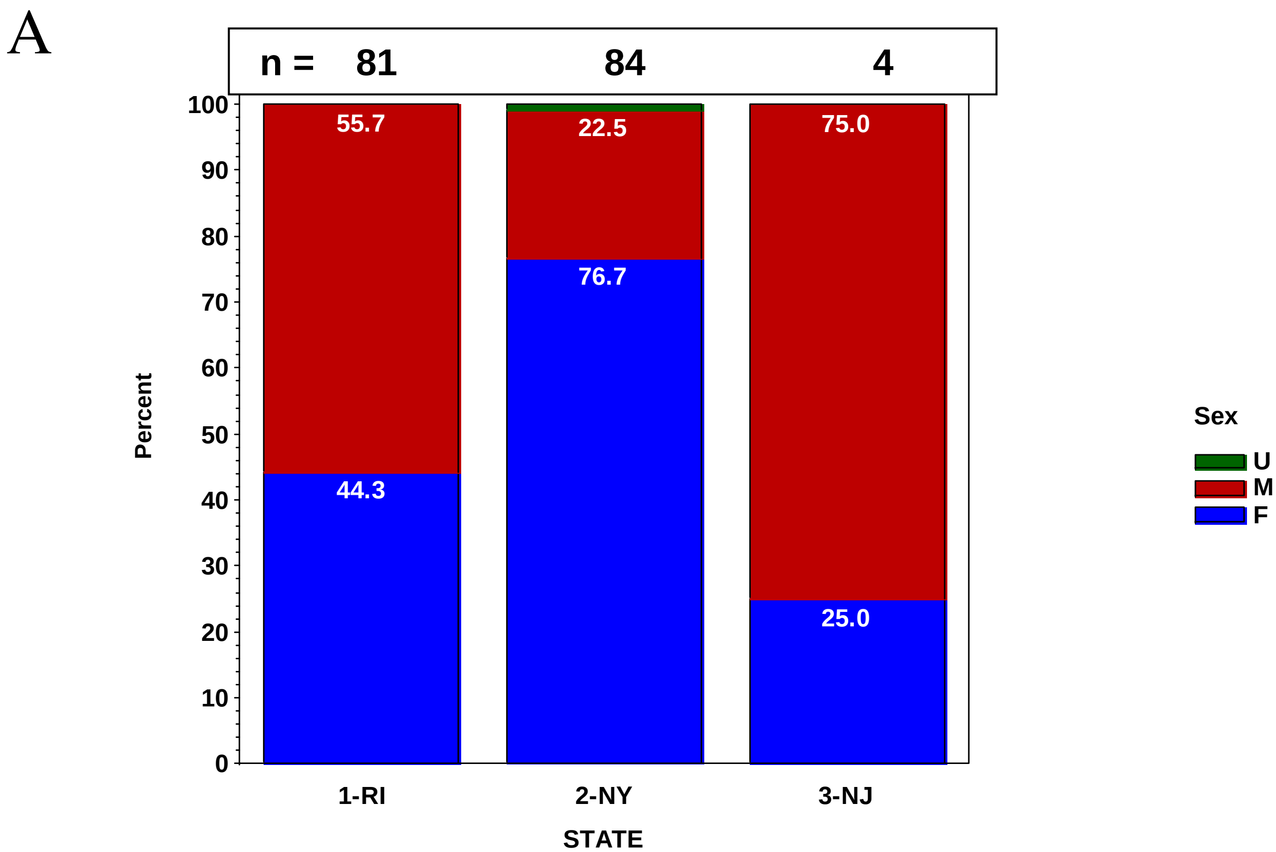


Figure 172. Sex ratios for winter skate by state (A) and width group (B).



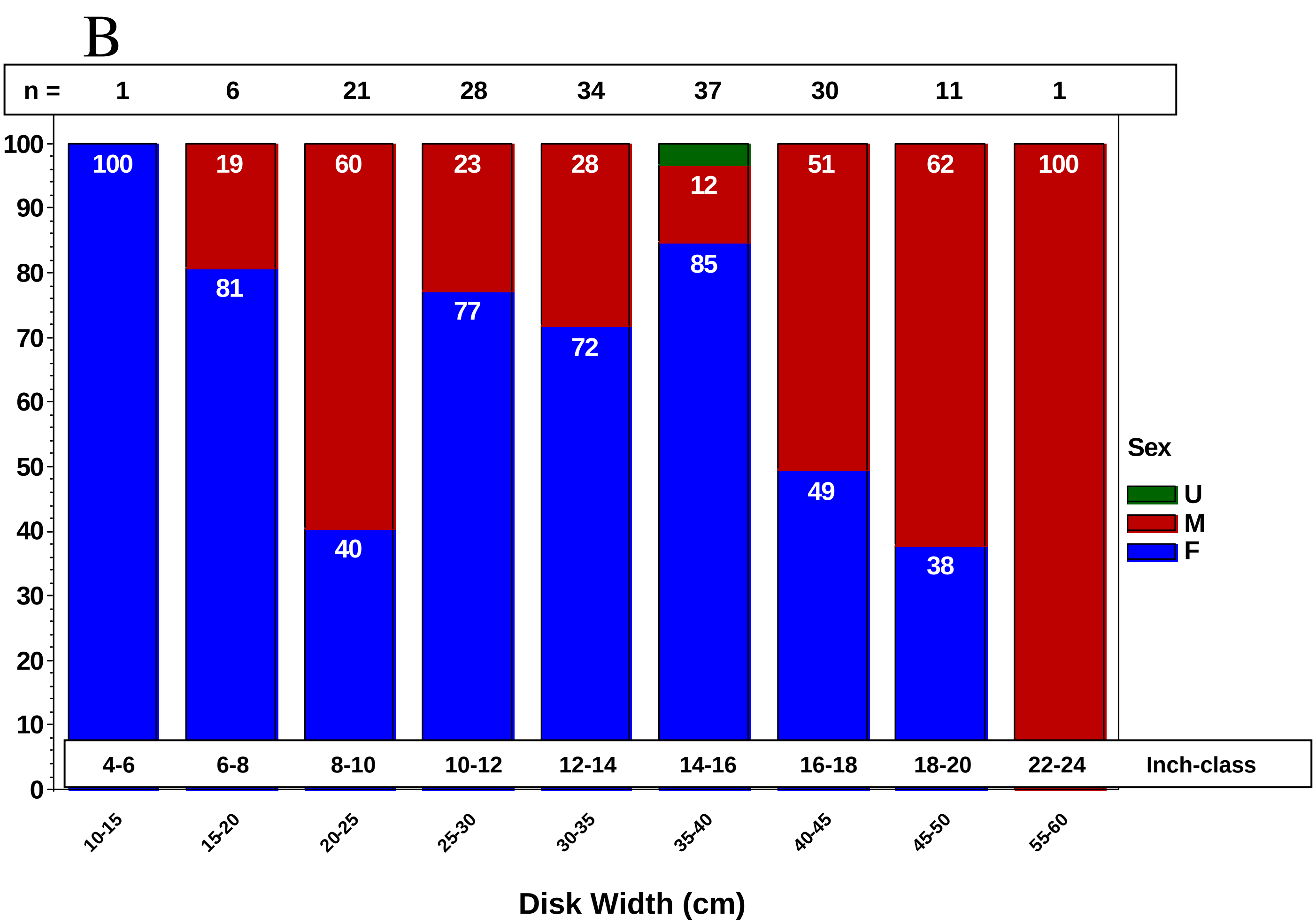


Figure 173. Width-weight regression for winter skate, sexes combined (A) and by sex (B).