Massachusetts
Division of Marine Fisheries

Massachusetts 2016 Compliance Report to the Atlantic States Marine Fisheries Commission – Horseshoe Crab

Submitted by:
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I. Introduction

Summary of the year highlighting significant changes in monitoring, regulations or harvest.

MarineFisheries staff and numerous volunteer groups conducted spawning beach surveys during the full and new moons from mid-April through the end of June. Prosomal widths taken from 3,118 crabs measured as part of our market sampling program showed no difference compared to the size distribution from past years. We attempted a pilot survey to monitor juvenile horseshoe crab abundance. The method shows promise but needs to be refined. Dealers reported 100,095 crabs harvested for bait, while fishermen reported catching 101,642 crabs for bait in 2016. The number of crabs bled for biomedical purposes remains confidential due to the limited number of biomedical facilities in the state (one).

II. *de minimus* status – not applicable

III. Previous calendar year's fishery

a. Bait Harvest

In 2016, 52 of 230 horseshoe crab bait permits issued by *MarineFisheries* were actively fished, representing a decrease of 6 active permits and 4 permits issued from 2015. Seven letters of authorization (LOA) were issued by *MarineFisheries* to allow the harvest of horseshoe crabs by mobile gear fishermen with a Coastal Access Permit. Fishermen reported 101,642 crabs harvested for bait use. This represents 31% of the quota issued by ASMFC to Massachusetts (330,377 crabs), and 62% of the more restrictive state quota voluntarily imposed by Massachusetts (165,000 crabs). Total catch consisted of 26,226 females, 19,210 males, and 56,205 unclassified crabs. Hand harvesters (including rakes, dipnets, and hand tongs) caught 64,108 crabs, mobile gear (trawl or dredge) 36,161, and 1,372 by other means (gill net, weirs, pots, etc). Approximately 90% of crabs harvested came from areas south of Cape Cod. Harvester reported monthly bait harvest peaked in May (Table 1).

Table 1. Weight (lb) and count of horseshoe crabs harvested by the bait fishery from Massachusetts Trip Level Reports and NMFS Vessel Trip Reports (* indicates data is confidential due to less than three harvesters reporting for a given month).

	Bait	
Month	lb.	Count
JAN	*	*
FEB	*	*
MAR	*	*
APR	7,720	2,891
MAY	139,268	52,160
JUN	36,397	13,632
JUL	23,848	8,932
AUG	27,819	10,419
SEP	10,742	4,023
OCT	15,128	5,666
NOV	*	*
DEC	*	*

b. Scientific and Research Harvest

As a condition of permit renewal, researchers that wish to harvest horseshoe crabs in Massachusetts are required to report the number of horseshoe crabs taken for scientific purposes. A permit was used to tag 529 horseshoe crabs in Eastern Nantucket Sound. They did not report retaining any horseshoe crabs. Another researcher collected 181 crabs from a local dealer, and an additional researcher received a permit to collect partial clutches of eggs and less than 100 juvenile horseshoe crabs.

c. Biomedical Fishery

Associates of Cape Cod (ACC) is the single biomedical company producing Limulus Amebocyte Lysate (LAL) in Massachusetts. ACC filed monthly catch reports listing the dealers from whom they purchased crabs, location of harvest, the number and sex of crabs purchased, and how the crabs were used (released or returned to bait market). ACC also reported the number of crabs they rejected or received dead. Per the terms of the LOA issued to ACC, they must keep crabs moist during transport and storage, transport crabs in a temperature controlled truck with the thermostat set between 50 and 60 °F, keep crabs in the laboratory at ≤70 °F, and hold crabs in barrels no more than approximately 2/3 full.

MarineFisheries issued 14 biomedical harvest permits, 4 of which were actively fished in 2016. This represents an increase of one issued permit and a decrease of one actively fished permit from 2015. Data collected from ACC is confidential.

d. <u>Shorebird monitoring</u>- Not applicable

e. <u>Benthic Sampling</u>

The *MarineFisheries* Resource Assessment Project has conducted seasonal spring (May) and fall (September) bottom trawl surveys in state waters since 1978. Approximately 100 tows are made during each season in five bio-geographic areas (Figure 1), using a stratified random sampling design, with 22 total strata. The net's design (¾-sized two seam 39' x 51' otter trawl with 3 ½" cookies on a chain sweep, ¼" knotless codend liner) is appropriate for sampling horseshoe crabs, however, the vessel size precludes towing inside most shallow embayments less than approximately 25 feet. For this report, areas 1-3 are considered Southern New England (SNE), and areas 4 and 5 are the Gulf of Maine (GOM).

Horseshoe crab abundance exceeded survey median levels for both sexes, both regions, and both seasons in 2016 (Figures 2-5). The 2016 survey caught more GOM spring crabs of both sexes, and SNE fall crabs of both sexes than any other point in survey history. These data points are outliers from the rest of the time-series. Upward trends for both sexes in SNE during the spring, and both sexes in GOM in the fall continued in 2016. The first and third most crabs (77 and 34 crabs, respectively) the survey has encountered in an individual tow came during the 2016 fall survey. The previous record was 42 crabs that were caught in one tow in the fall of 1980. In addition to individual tows with higher than normal catch, the percentage of tows that contained horseshoe crabs exceeded survey median levels for both sexes, both regions, and both seasons (Figures 6-13). Size distribution data is given in Figures 14-21. Most figures show an increase in crabs between 15 and 20 cm and a broader size distribution in 2016 compared to other years.

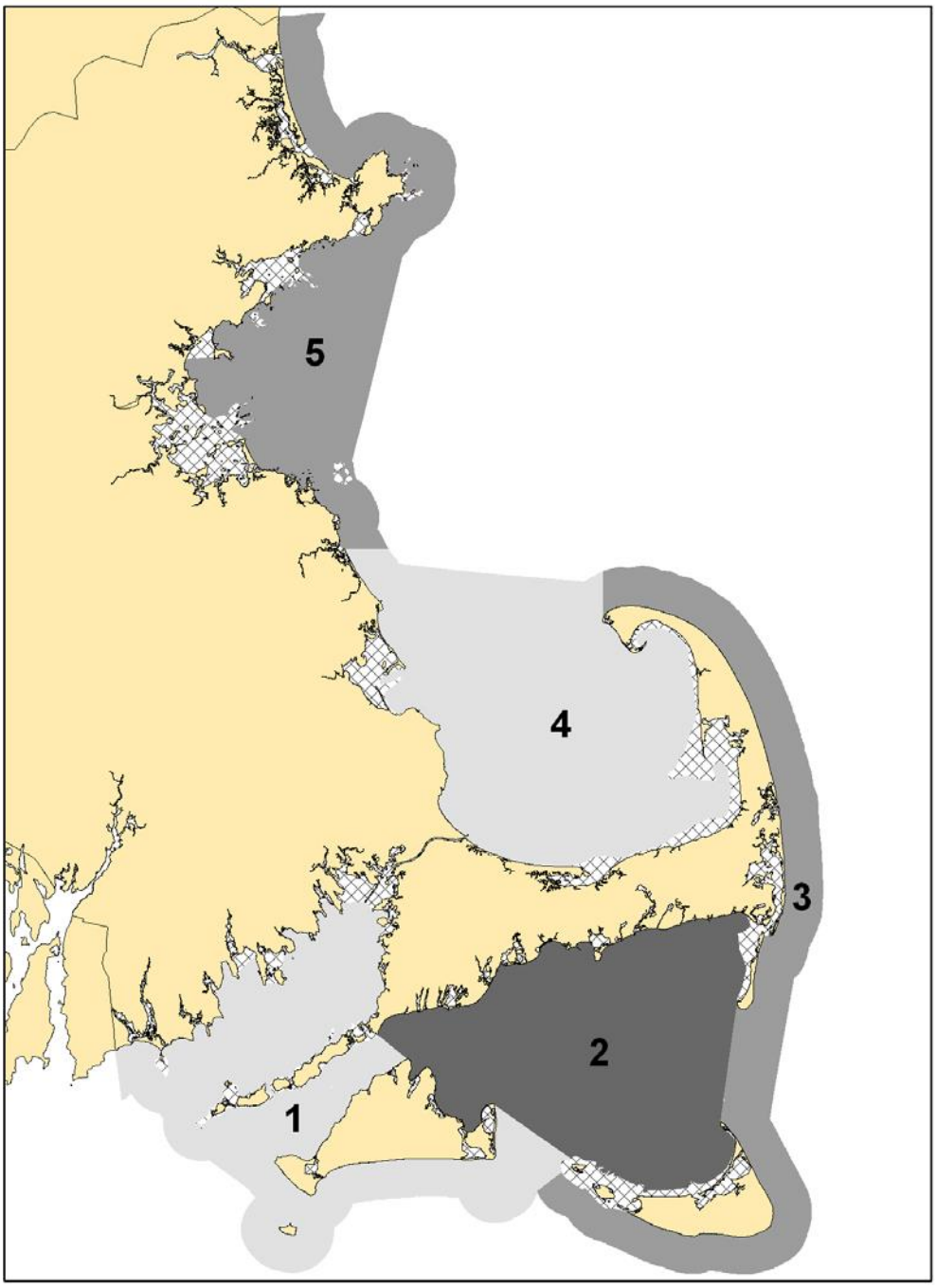

Figure 1. Map of *MarineFisheries* Resource Assessment Program trawl survey regions. For this report, regions 1-3 are considered Southern New England and regions 4 and 5 are Gulf of Maine. Figure supplied by *MarineFisheries'* Resource Assessment Program.

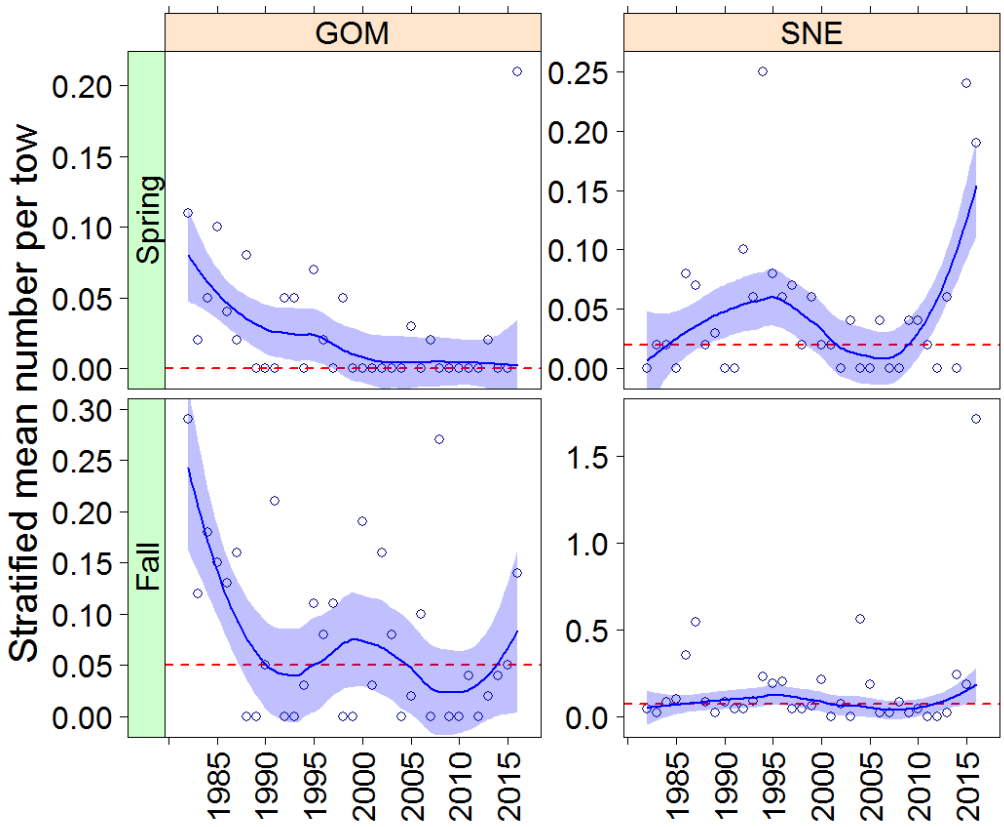

Figure 2. Bootstrapped female horseshoe crab mean number per tow from *MarineFisheries* trawl survey. Upper boxes are from the spring survey, lower boxes are from the fall survey. Left side boxes are from the Gulf of Maine, right side boxes are from Southern New England. Red, dashed line is the time series median, blue line is a loess fit using family=symmetric and span=0.66. These settings provide a resistant fit to outliers at the end of the time-series. Blue shaded area is approximate 95% confidence interval for the fit.

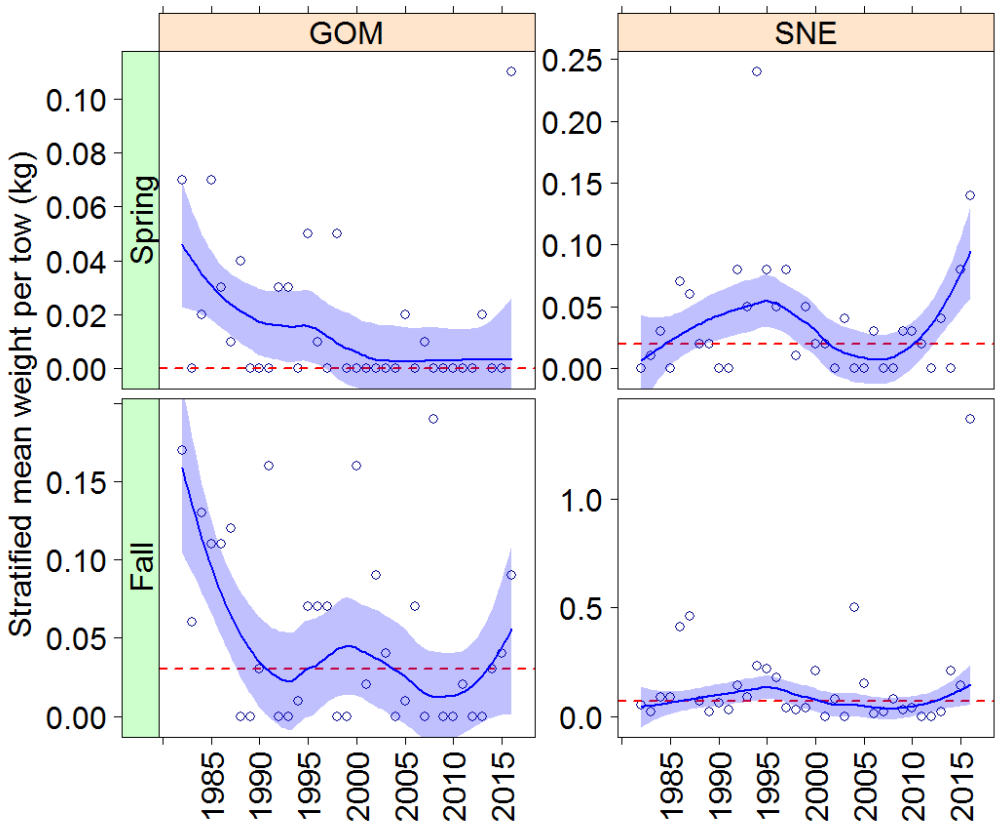

Figure 3. Bootstrapped female horseshoe crab mean weight (kg) per tow from *MarineFisheries* trawl survey. Upper boxes are from the spring survey, lower boxes are from the fall survey. Left side boxes are from the Gulf of Maine, right side boxes are from Southern New England. Red, dashed line is the time series median, blue line is a loess fit using family=symmetric and span=0.66. These settings provide a resistant fit to outliers at the end of the time-series. Blue shaded area is approximate 95% confidence interval for the fit.

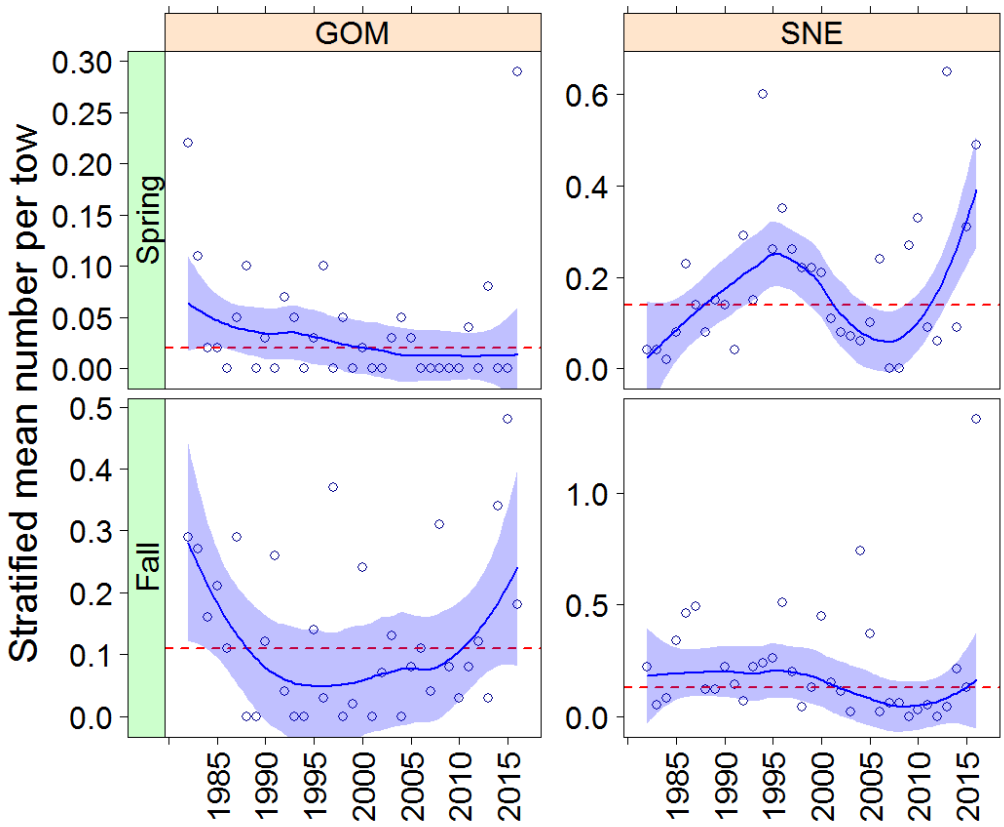

Figure 4. Bootstrapped male horseshoe crab mean number per tow from *MarineFisheries* trawl survey. Upper boxes are from the spring survey, lower boxes are from the fall survey. Left side boxes are from the Gulf of Maine, right side boxes are from Southern New England. Red, dashed line is the time series median, blue line is a loess fit using family=symmetric and span=0.66. These settings provide a resistant fit to outliers at the end of the time-series. Blue shaded area is approximate 95% confidence interval for the fit.

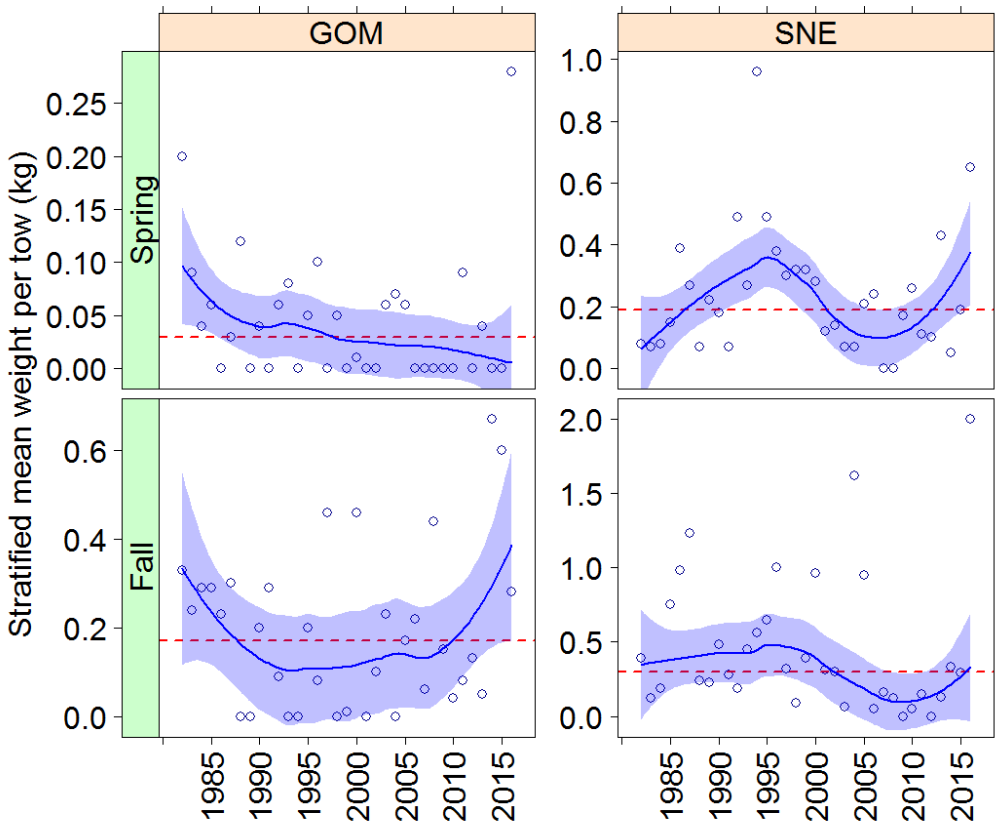

Figure 5. Bootstrapped male horseshoe crab mean weight (kg) per tow from *MarineFisheries* trawl survey. Upper boxes are from the spring survey, lower boxes are from the fall survey. Left side boxes are from the Gulf of Maine, right side boxes are from Southern New England. Red, dashed line is the time series median, blue line is a loess fit using family=symmetric and span=0.66. These settings provide a resistant fit to the time-series. Blue shaded area is approximate 95% confidence interval for the fit.

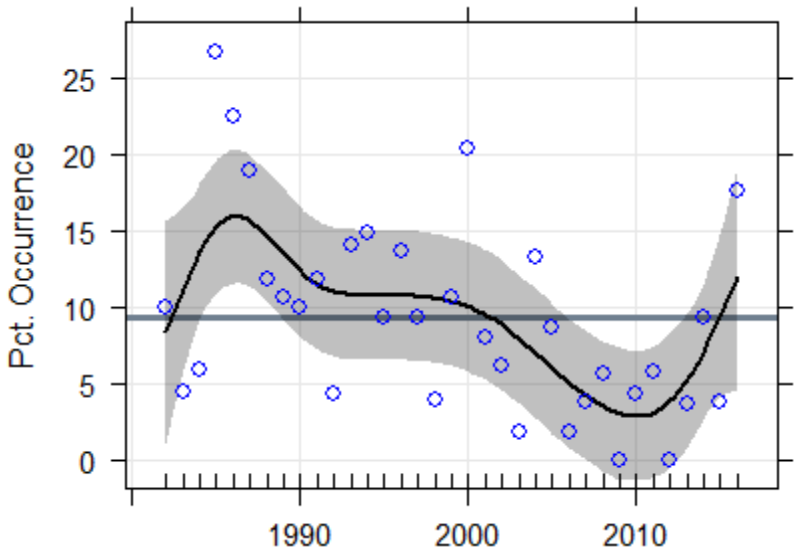

Figure 6. Percent of Southern New England tows that caught female horseshoe crabs from *MarineFisheries* 2016 fall trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.

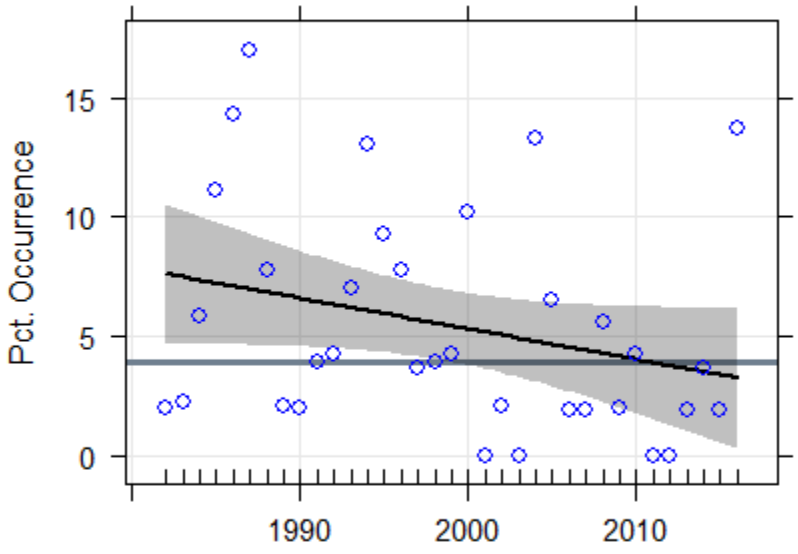

Figure 7. Percent of Southern New England tows that caught male horseshoe crabs from *MarineFisheries* 2016 fall trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.

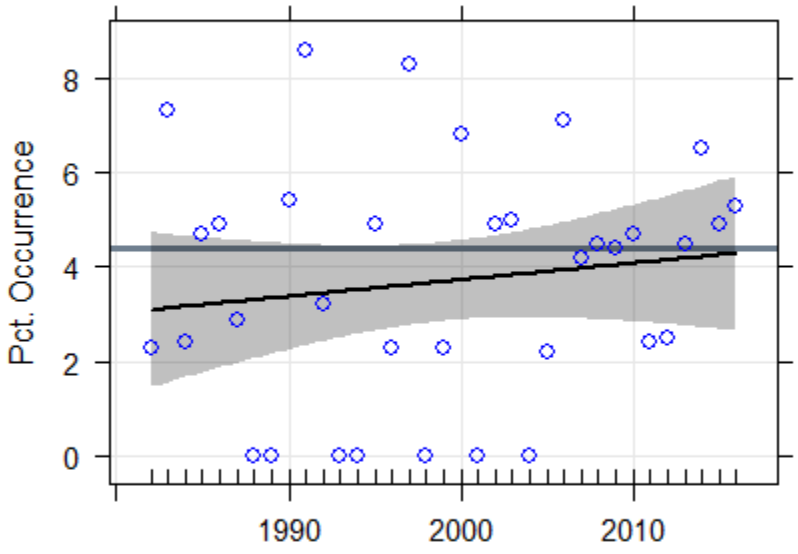

Figure 8. Percent of Gulf of Maine tows that caught female horseshoe crabs from *MarineFisheries* 2016 fall trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.

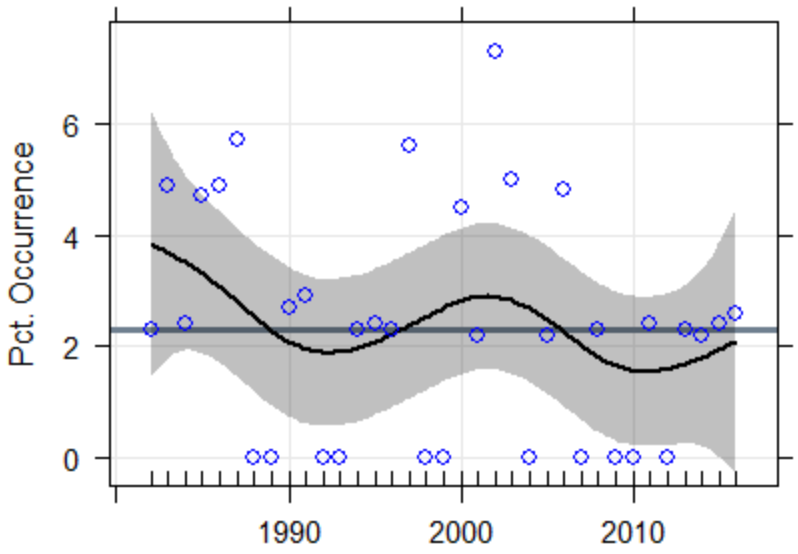

Figure 9. Percent of Gulf of Maine tows that caught male horseshoe crabs from *MarineFisheries* 2016 fall trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.

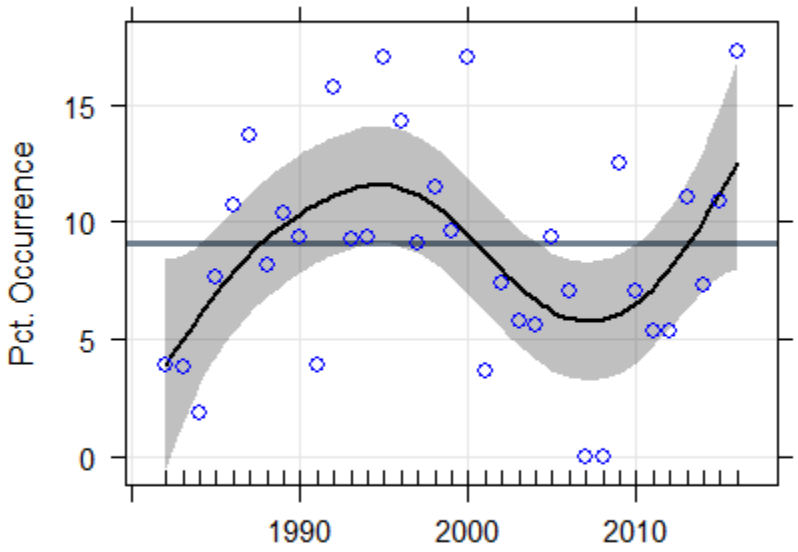

Figure 10. Percent of Southern New England tows that caught female horseshoe crabs from *MarineFisheries* 2016 spring trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.

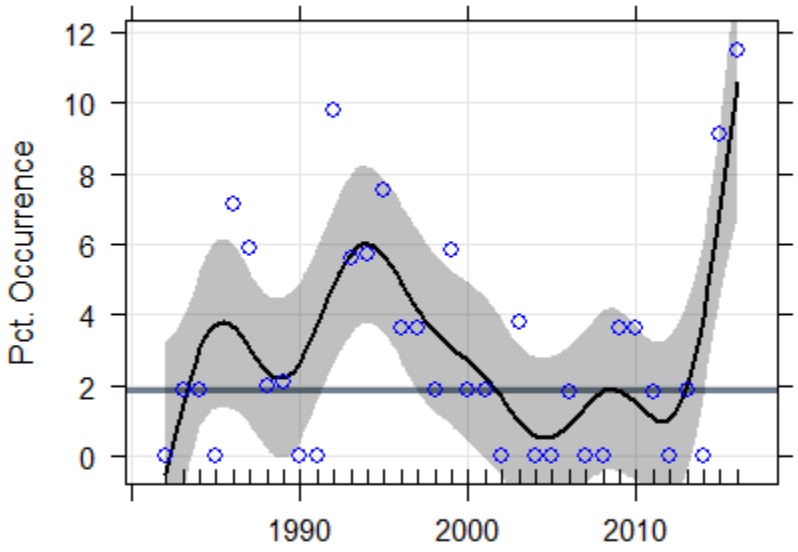

Figure 11. Percent of Southern New England tows that caught male horseshoe crabs from *MarineFisheries* 2016 spring trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.

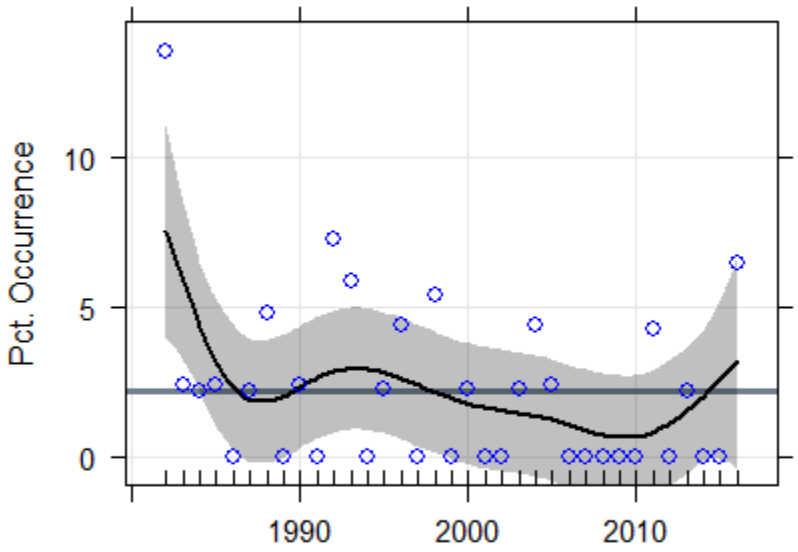

Figure 12. Percent of Gulf of Maine tows that caught female horseshoe crabs from *MarineFisheries* 2016 spring trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.

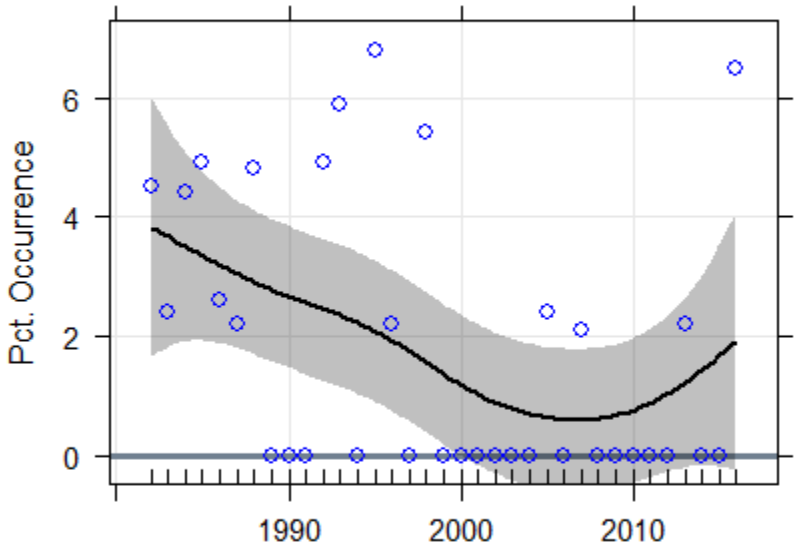

Figure 13. Percent of Gulf of Maine tows that caught male horseshoe crabs from *MarineFisheries* 2016 spring trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.

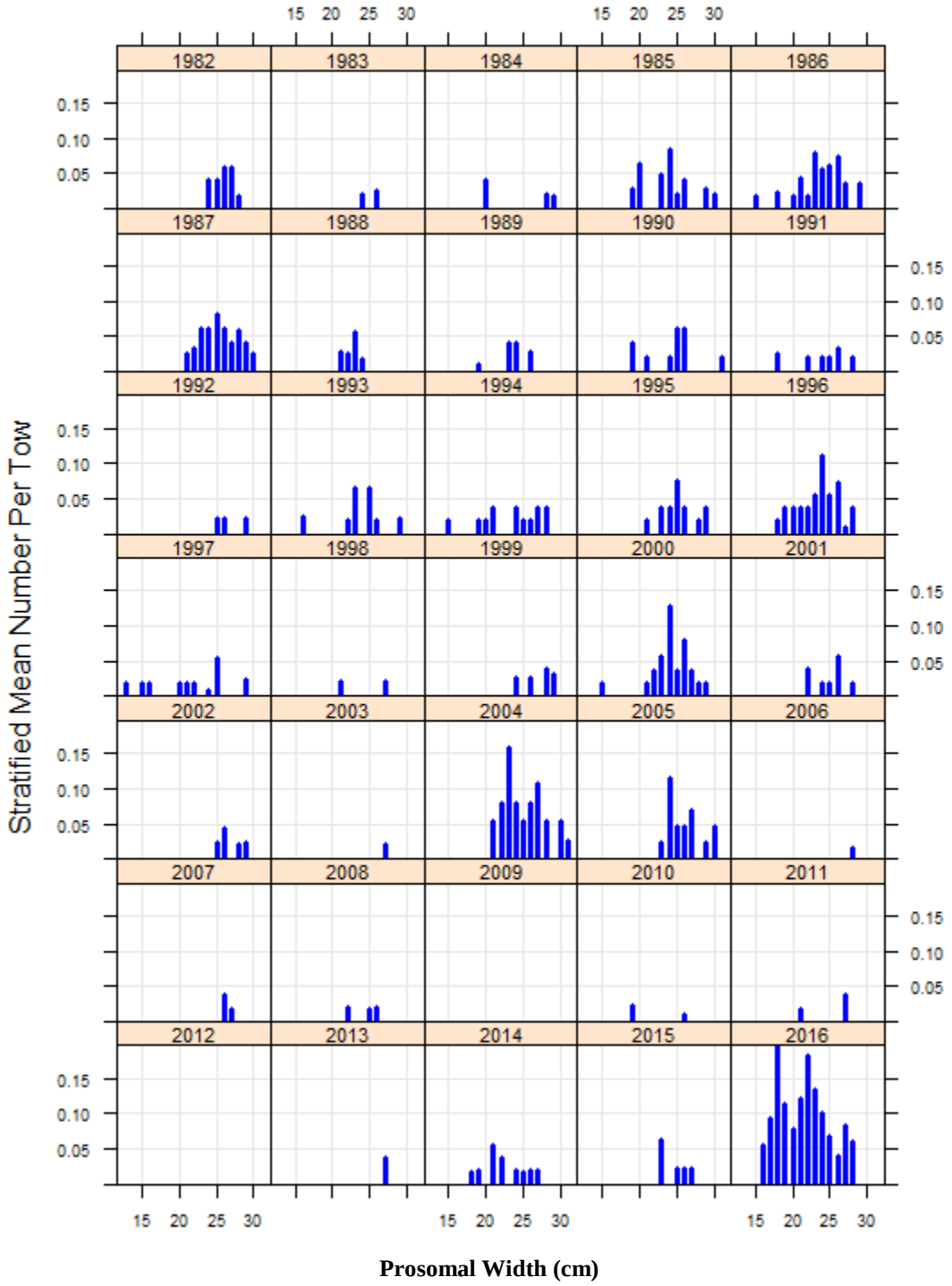

Figure 14. Southern New England female horseshoe crab size distribution (prosomal width (cm)) from the *MarineFisheries* fall trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

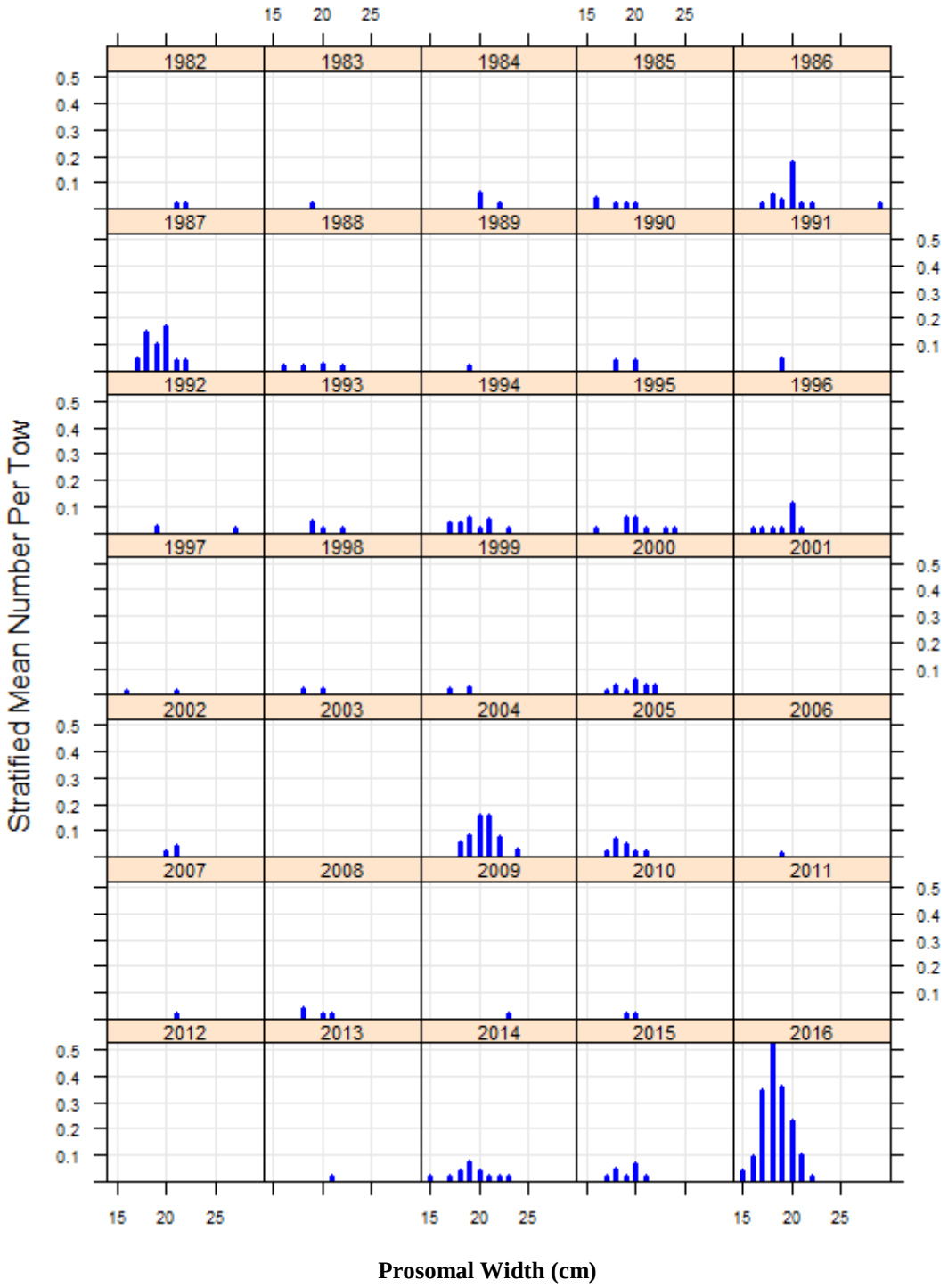

Figure 15. Southern New England male horseshoe crab size distribution (prosomal width (cm)) from the *MarineFisheries* fall trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

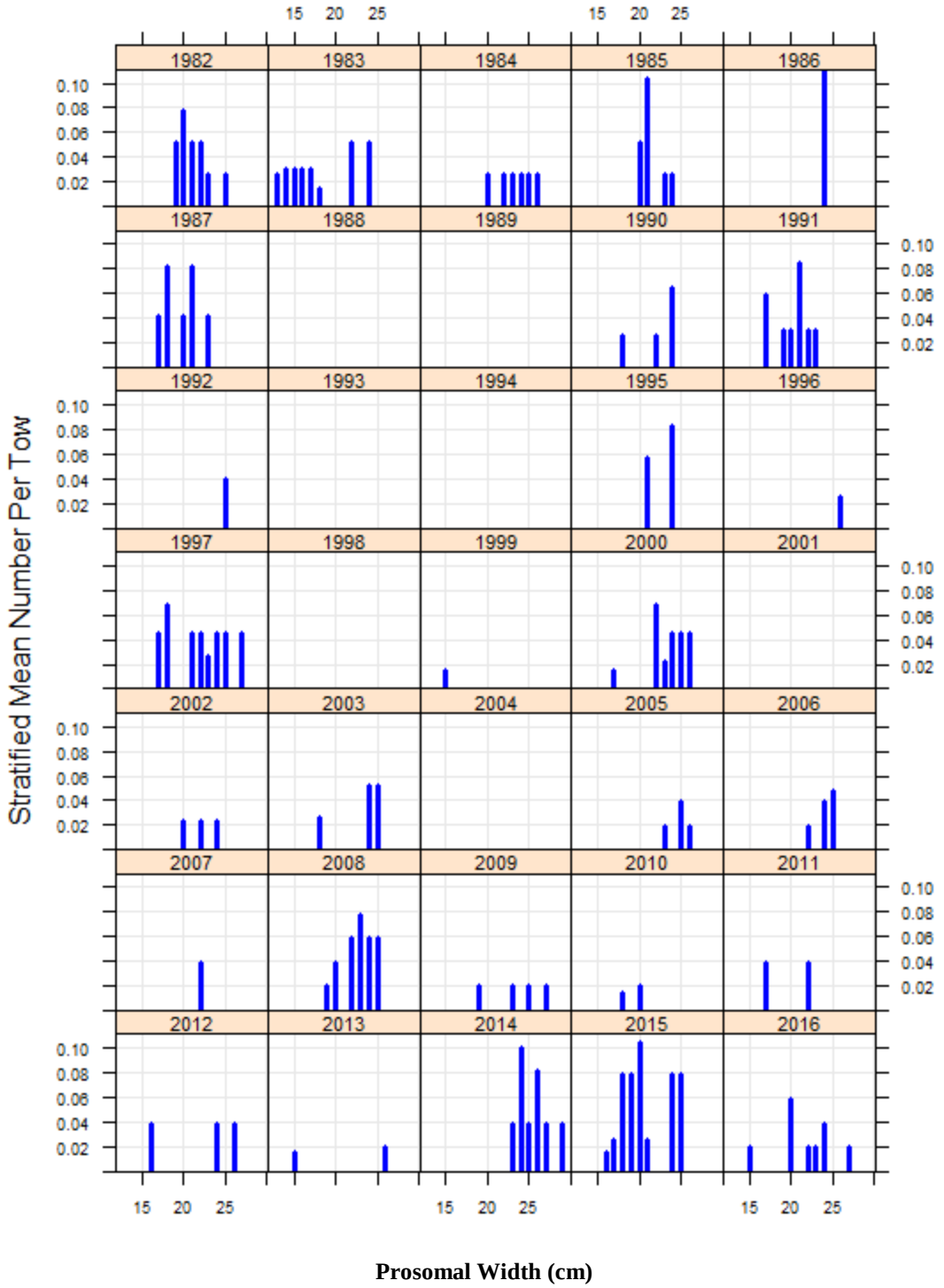

Figure 16. Gulf of Maine female horseshoe crab size distribution (prosomal width (cm)) from the *MarineFisheries* fall trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

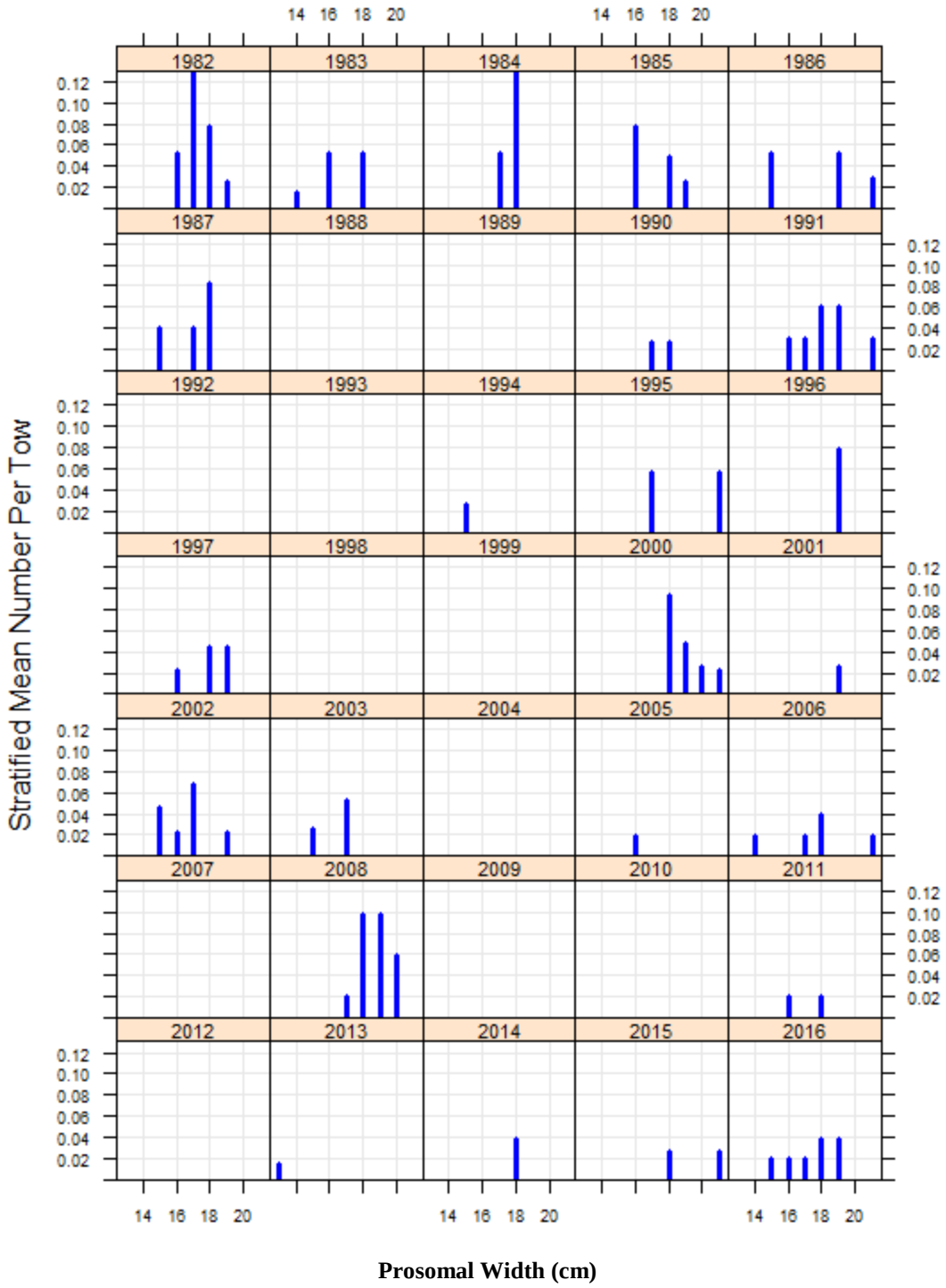

Figure 17. Gulf of Maine male horseshoe crab size distribution (prosomal width (cm)) from the *MarineFisheries* fall trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

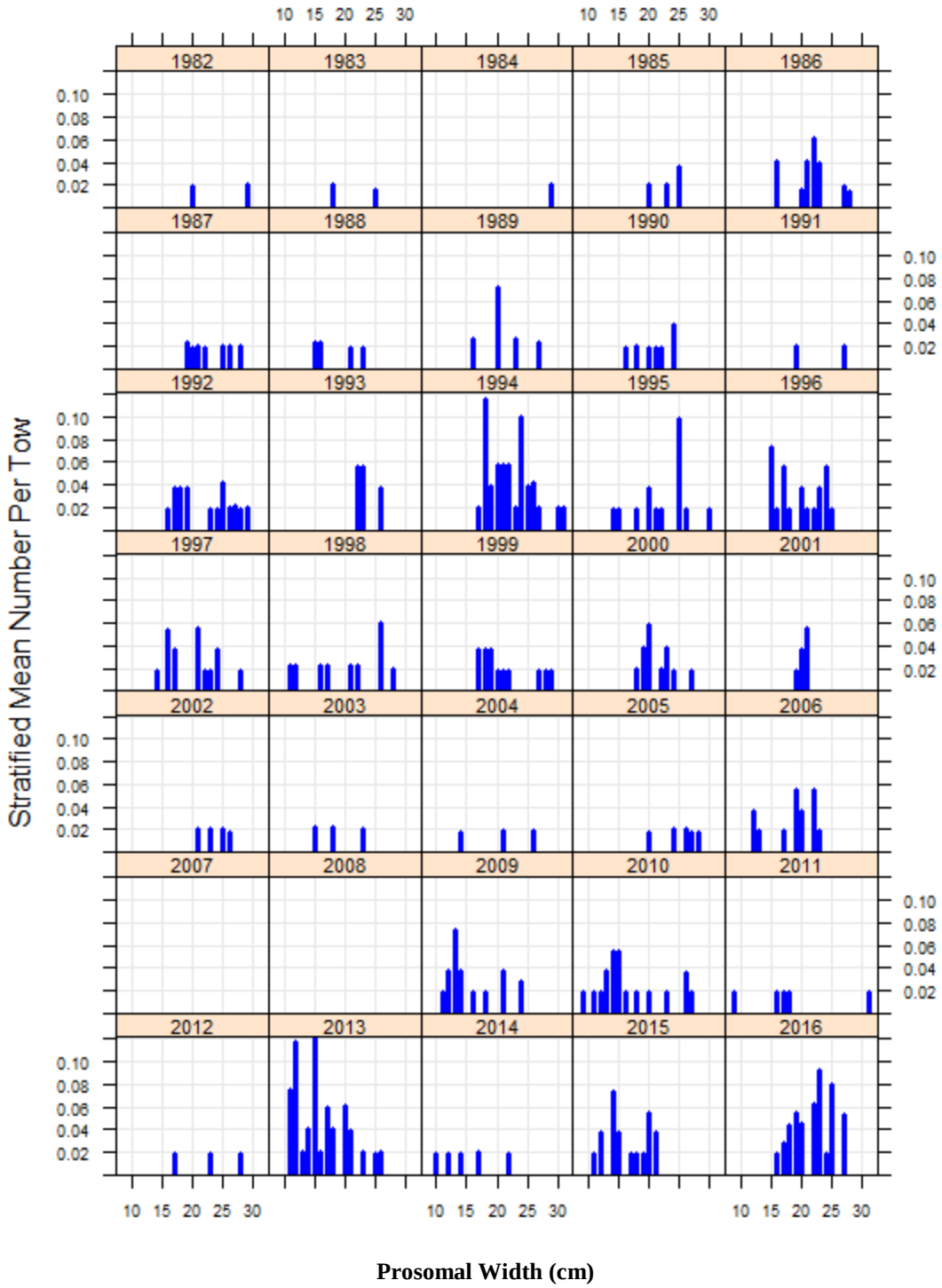

Figure 18. Southern New England female horseshoe crab size distribution (prosomal width (cm)) from the *MarineFisheries* spring trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

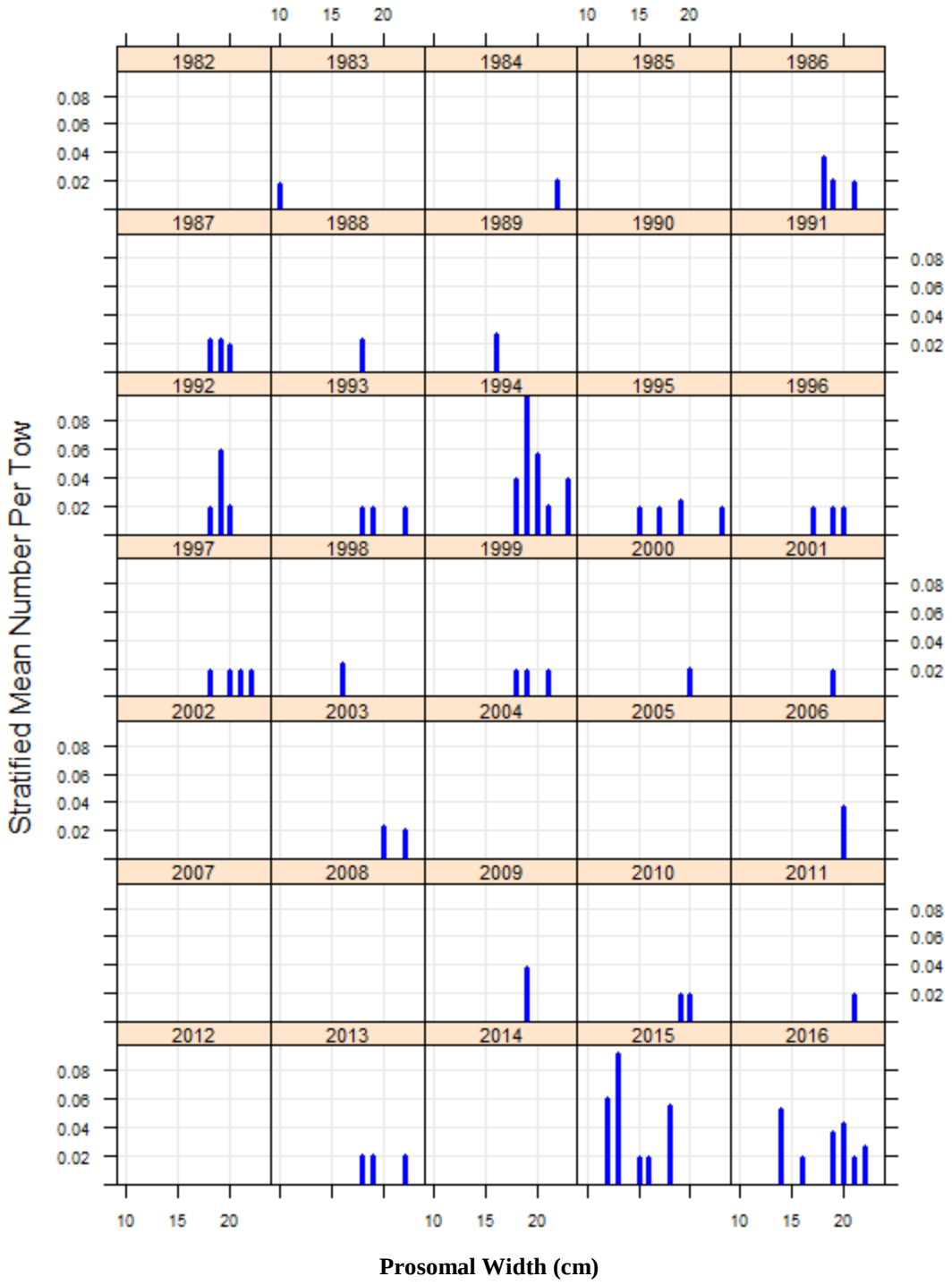

Figure 19. Southern New England male horseshoe crab size distribution (prosomal width (cm)) from the *MarineFisheries* spring trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

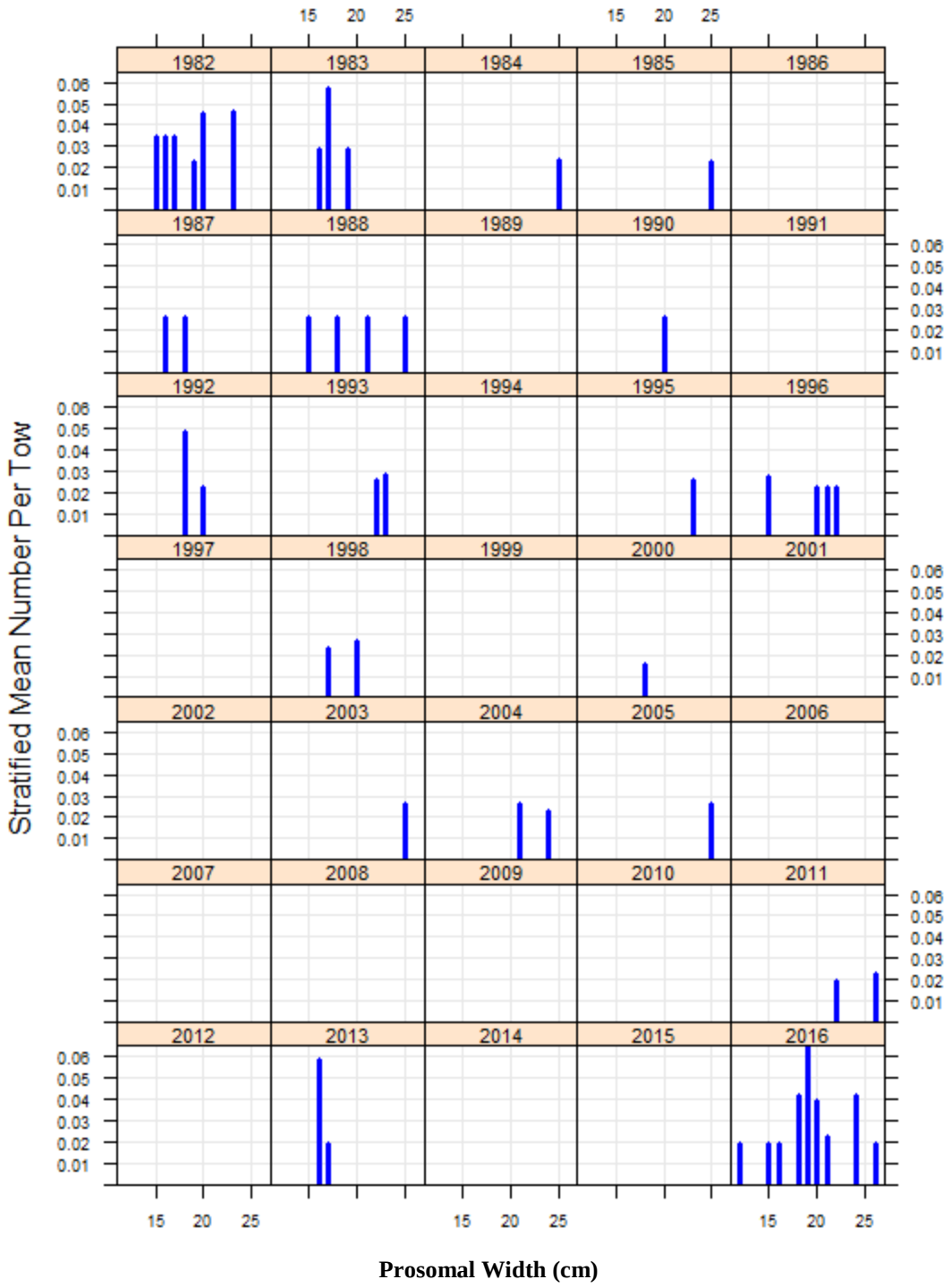

Figure 20. Gulf of Maine female horseshoe crab size distribution (prosomal width (cm)) from the *MarineFisheries* spring trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

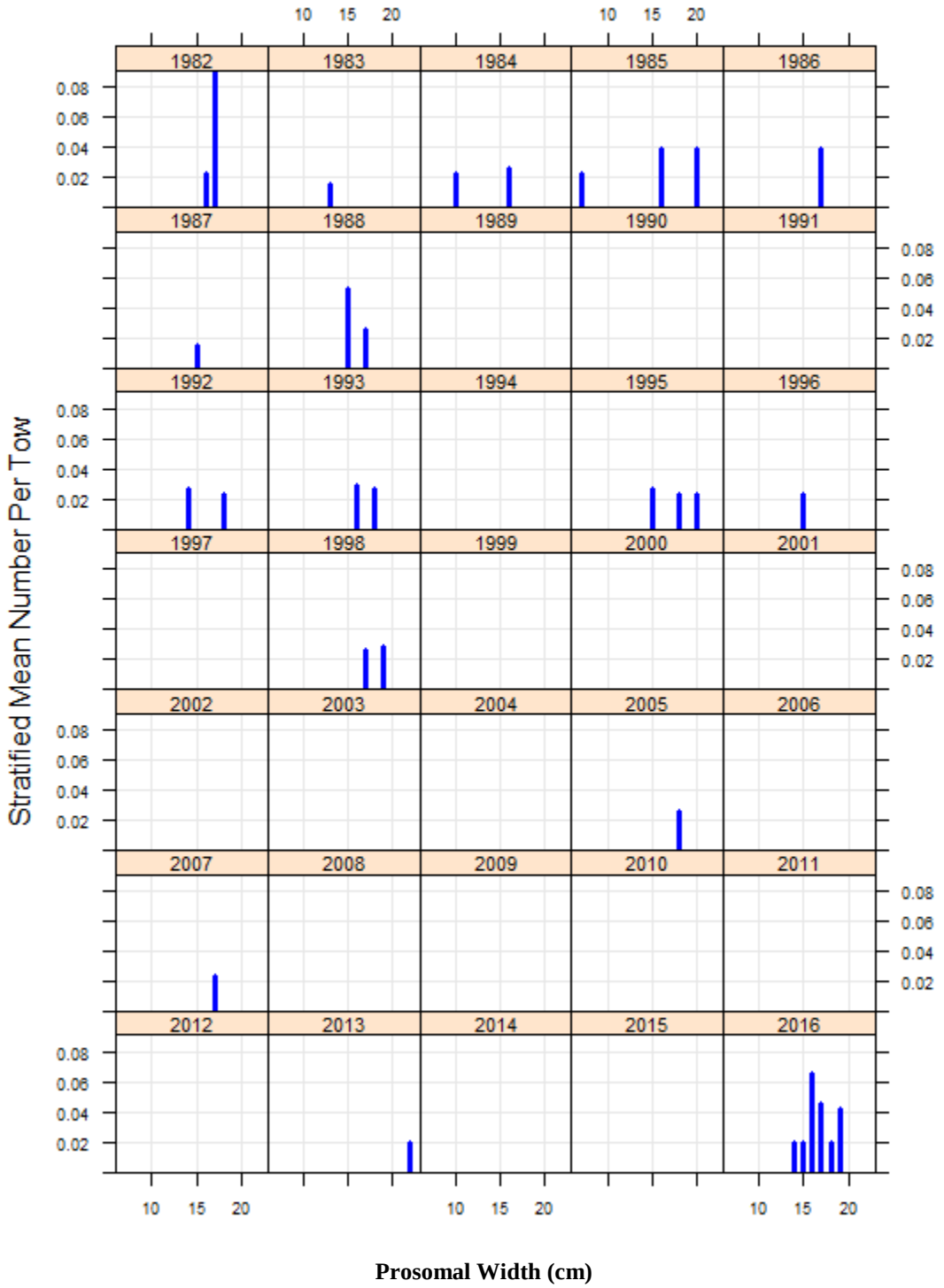

Figure 21. Gulf of Maine male horseshoe crab size distribution (prosomal width (cm)) from the *MarineFisheries* spring trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

IV. Planned management programs for the current calendar year

a. Summary of changes from previous years

None.

b. Summary of monitoring programs that will occur

- *MarineFisheries* will continue collecting catch reports from all crab harvesters, dealers, and scientific permit holders.
- ACC (biomedical company) will continue to submit monthly reports.
- *MarineFisheries* will also continue to characterize the commercial fishery through market sampling.
- The *MarineFisheries* spring and fall trawl surveys will continue to monitor and record weight, number and prosomal width by sex of individuals collected

V. Law Enforcement reporting requirements

Chilmark police, environmental police, and state police cooperated in an operation that resulted in the return of 229 horseshoe crabs to the water after a fisherman was observed fishing during the lunar closure.