Massachusetts
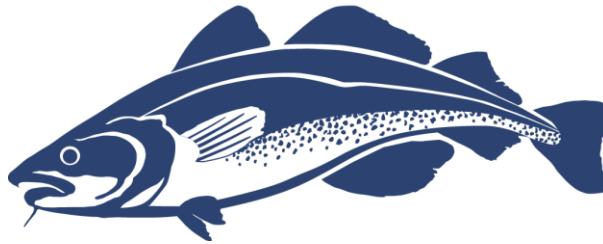# Division of Marine Fisheries

MarineFisheries
Commonwealth of Massachusetts

Massachusetts 2017 Compliance Report to the Atlantic States Marine Fisheries Commission – Horseshoe Crab

Submitted by:
Derek Perry, Marine Fisheries Biologist
Massachusetts Division of Marine Fisheries
South Shore Field Station
836 South Rodney French Boulevard
New Bedford, MA 02744

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 were taken from 1,517 biomedical and bait crabs as part of our market sampling program. Dealers reported 134,707 crabs harvested for bait, while fishermen reported catching 120,960 crabs for bait in 2017. The number of crabs bled for biomedical purposes remains confidential due to the limited number of biomedical facilities in the state (one). *MarineFisheries* and a commercial fisherman began working on a net design that would retain horseshoe crabs but minimize bycatch.

II. *de minimus* status – not applicable

III. Previous calendar year's fishery
a. <u>Bait Harvest</u>
In 2017, 48 of 229 horseshoe crab bait permits issued by *MarineFisheries* were actively fished, representing a decrease of 4 active permits and 1 permit issued from 2015. Eight letters of authorization (LOA) were issued by *MarineFisheries* to allow the harvest of horseshoe crabs by mobile gear fishermen with a Coastal Access Permit. Dealers reported 134,707 crabs harvested for bait use. This represents 41% of the quota issued by ASMFC to Massachusetts (330,377 crabs), and 82% of the more restrictive state quota voluntarily imposed by Massachusetts (165,000 crabs). Total catch reported by harvesters consisted of 30,781 females, 21,687 males, and 68,493 unclassified crabs. Hand harvesters (including rakes, dipnets, and hand tongs) caught 68,554 crabs, mobile gear (trawl or dredge) 47,695, and 4,711 by other means (gill net, weirs, pots, etc). Bait crabs harvested in May and June accounted for 66% of all bait crabs landed in 2017. (Table 1).

MarineFisheries began gear development work with a commercial trawler to develop a net that would catch horseshoe crabs while minimizing by-catch of finfish, especially those finfish species that are closed for quota management purposes (fluke, black sea bass, and scup). The objective of this research is to develop a net design that could harvest horseshoe crabs for biomedical and bait purposes when the finfish quotas (scup, back sea bass, or fluke) would be closed –or exclusively biomedical purposes if the crab quota was reached in season.

Horseshoe crabs are commonly caught and sold as by-catch in the bottom trawl fishery targeting fluke in Nantucket Sound. Due to quota reduction, Massachusetts had the shortest summer-time directed fluke fishery since the creation of quotas in the 1990's, with the fishery closed as of July 19th. This resulted in trawlers ceasing fishing and the supply of horseshoe crabs caught as bait crabs but being made available to the biomedical company being limited. A progressive commercial fisherman, working in cooperation with Associates of Cape Cod, invested in designing a trawl net that would minimize bycatch of finfish.

MarineFisheries does not yet have protocols for trawlers fishing for biomedical crabs regarding handling and returning crabs to harvest area. To date all trawler harvest in MA has been by vessels participating in the bait fishery.

Because there was ample quota of crabs remaining in late summer, these crabs were landed as bait crabs and counted against the commercial quota. The bio-medical firm obtained the crabs on an as needed basis before they were sold as bait. Work should continue on this net design this summer.

Table 1. Count of horseshoe crabs harvested by the bait fishery from Massachusetts Trip Level Reports and NMFS Vessel Trip Reports (* represents confidential numbers).

Month	Count
JAN	*
FEB	*
MAR	*
APR	4,893
MAY	48,402
JUN	31,027
JUL	11,581
AUG	6,774
SEP	4,693
OCT	6,602
NOV	5,224
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. In 2017, research permits were used to collect 6.5 clutches of eggs, and 72 juvenile crabs and one adult crab.

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 Rubbermaid barrels no more than approximately 2/3 full.

MarineFisheries issued 14 biomedical harvest permits, 5 of which were actively fished in 2017. This represents no change in the number of permits issued and an increase of one actively fished permit from 2016.

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). All data reported are from the surveys two shallowest depth strata (0-30' and 30-60', combined) because 98.3% of the horseshoe crabs caught in this survey since 1978 have come from these two strata.

Horseshoe crab mean number and weight per tow from the *MarineFisheries* bottom trawl survey met or exceeded survey median levels for both sexes, both regions, and both seasons again in 2017 (Figure 2 though Figure 5). While the male GOM spring survey 2017 data point was equal to the time series median, the median value is zero for this region, season and sex (Figure 4, Figure 5). The mean number of SNE male and female crabs collected in the spring of 2017 were higher than any other point in the time series (Figure 2, Figure 4), while the mean weight for both sexes in this region and season were the second highest recorded (Figure 3, Figure 5).   The percentages of tows containing horseshoe crabs (Figure 6 through Figure 13) were at or above time series medians for both sex, both regions, and both seasons, with the lone exception of fall, GOM male crabs which were slightly below the time series median. Nearly 20% of all spring SNE tows in the two shallowest depth strata contained male crabs. The previous high was just over 15% in 2016. Size distribution data is given in Figure 14 through Figure 21. Regardless of region or season of capture, nearly all male crabs were below 20 cm in 2017. SNE female crabs ranged from 15-30 cm PW, but most were below 25 cm PW. GOM females were all below 25 cm PW in the fall and below 20 cm PW in the spring.
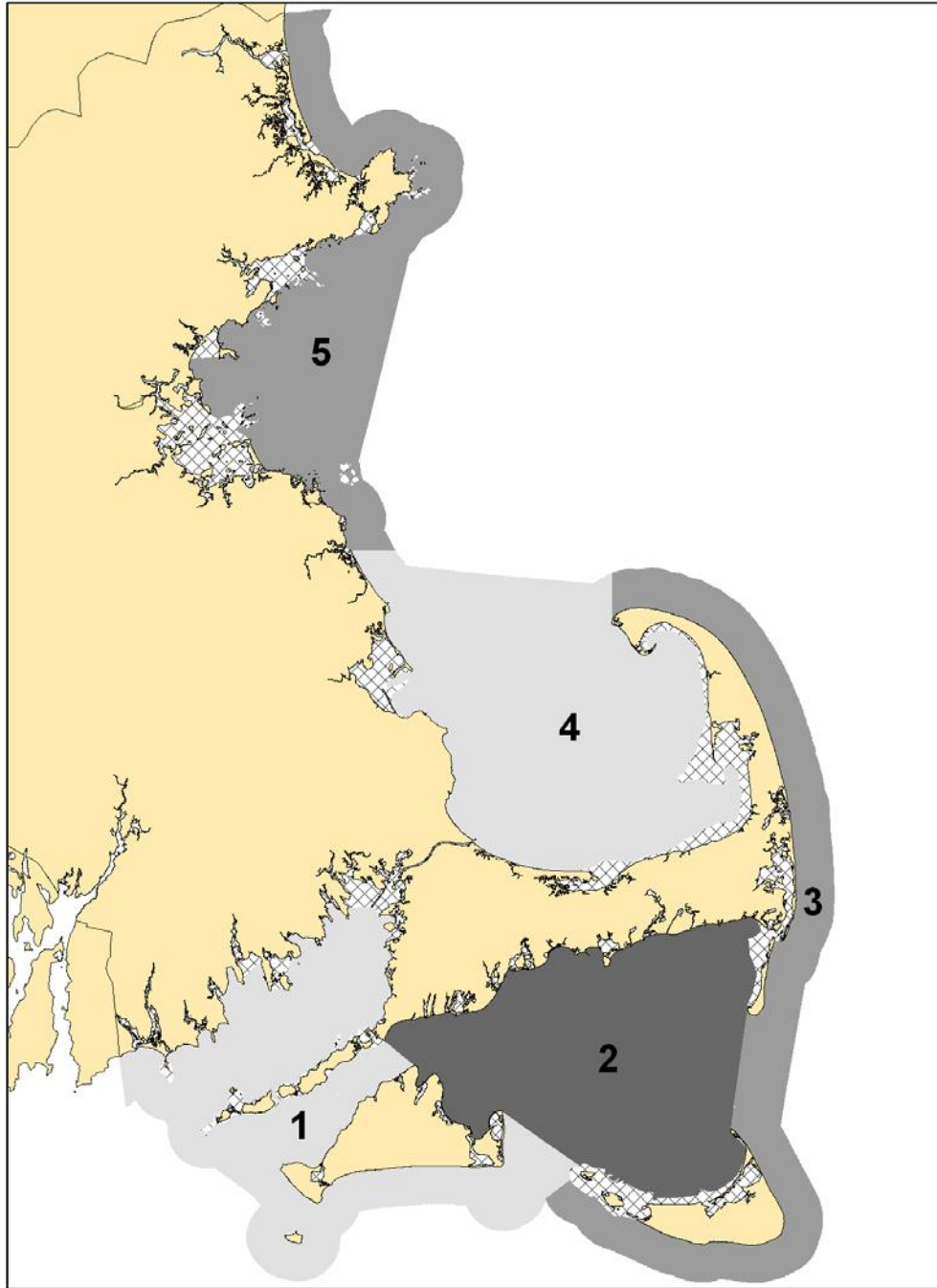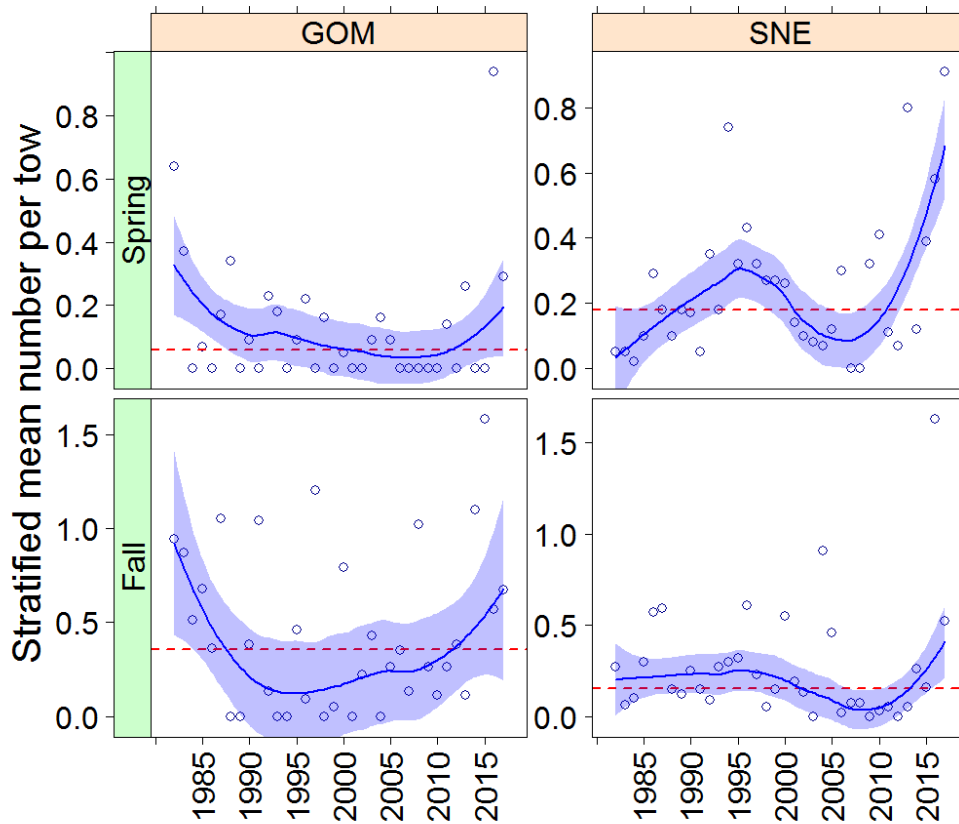
Figure 1. Map of *MarineFisheries* Resource Assessment Program trawl survey regions. For this report, regions 1-3 are considered Southern New England and regions 4 and 5 are Gulf of Maine. Figure supplied by *MarineFisheries'* Resource Assessment Program.
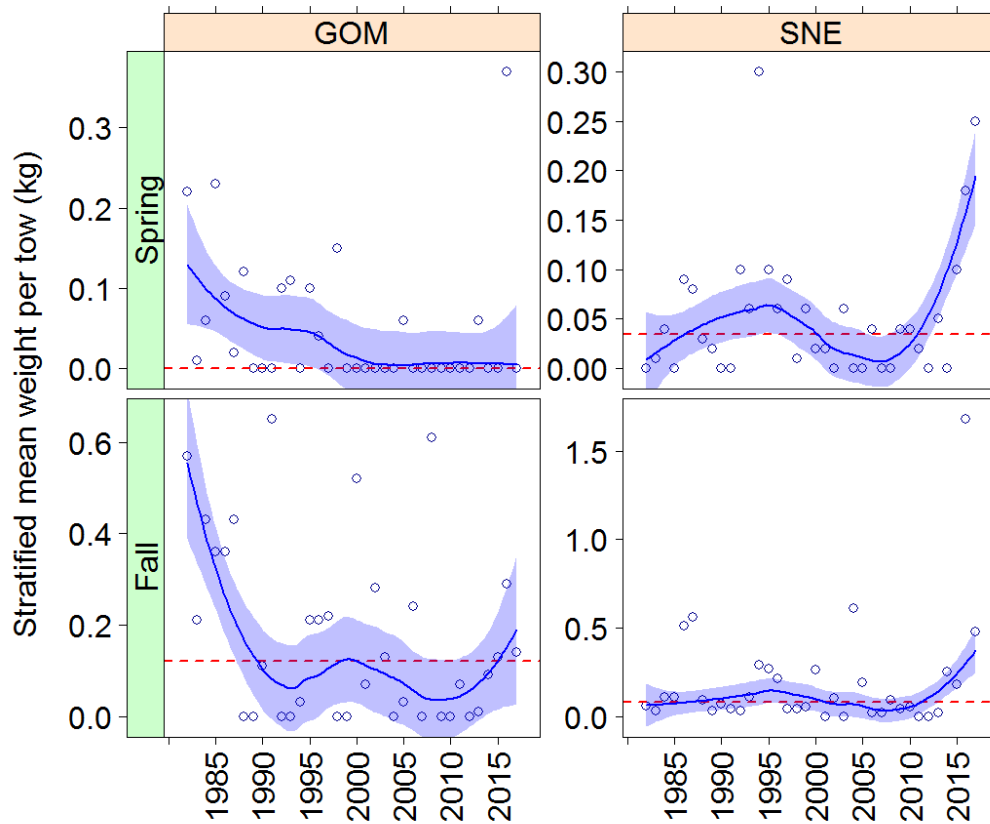
Figure 2. Bootstrapped female horseshoe crab mean number per tow from the two shallowest depth strata (0-30', 30-60') of the *MarineFisheries* trawl survey.   Upper boxes are from the spring survey, lower boxes are from the fall survey. Left side boxes are from the Gulf of Maine, right side boxes are 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.
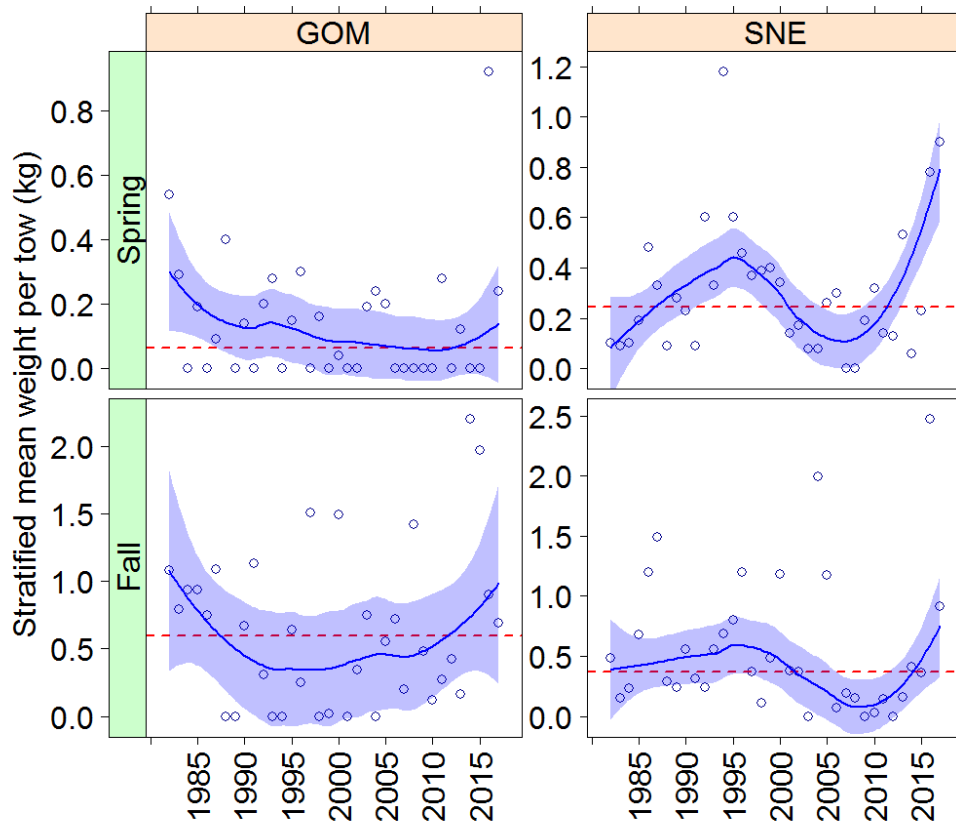
Figure 3. Bootstrapped female horseshoe crab mean weight (kg) per tow from the two shallowest depth strata (0-30', 30-60') of the *MarineFisheries* trawl survey. Upper boxes are from the spring survey, lower boxes are from the fall survey. Left side boxes are from the Gulf of Maine, right side boxes 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.
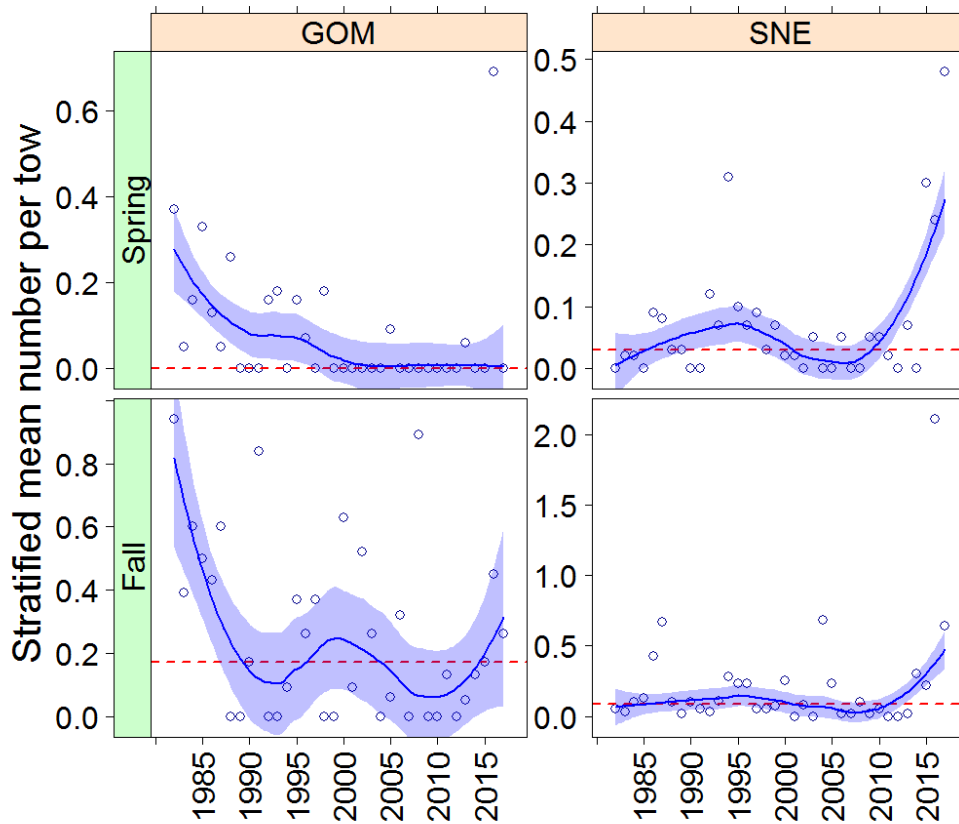
Figure 4. Bootstrapped male horseshoe crab mean number per tow from the two shallowest depth strata (0-30', 30-60') of the MarineFisheries trawl survey.   Upper boxes are from the spring survey, lower boxes are from the fall survey. Left side boxes are from the Gulf of Maine, right side boxes are from 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 the two shallowest depth strata (0-30', 30-60') of the 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.
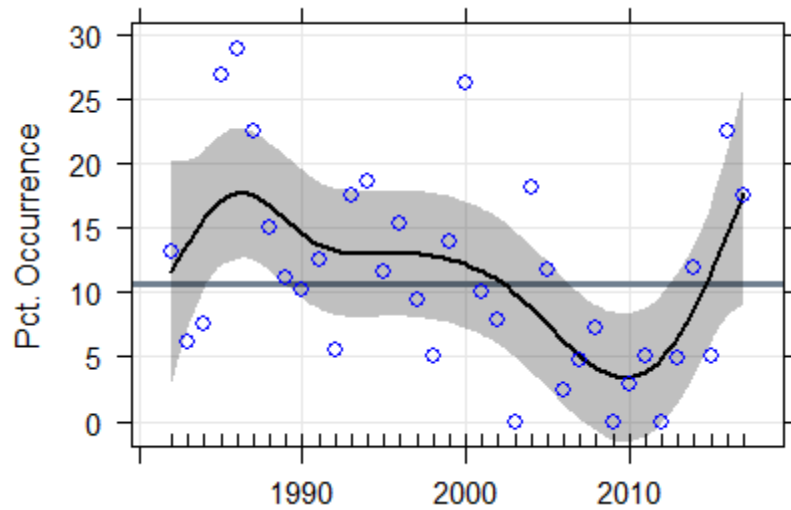
Figure 6. Percent of Southern New England tows that caught female horseshoe crabs from the two shallowest depth strata (0-30', 30-60') of the *MarineFisheries* fall trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.
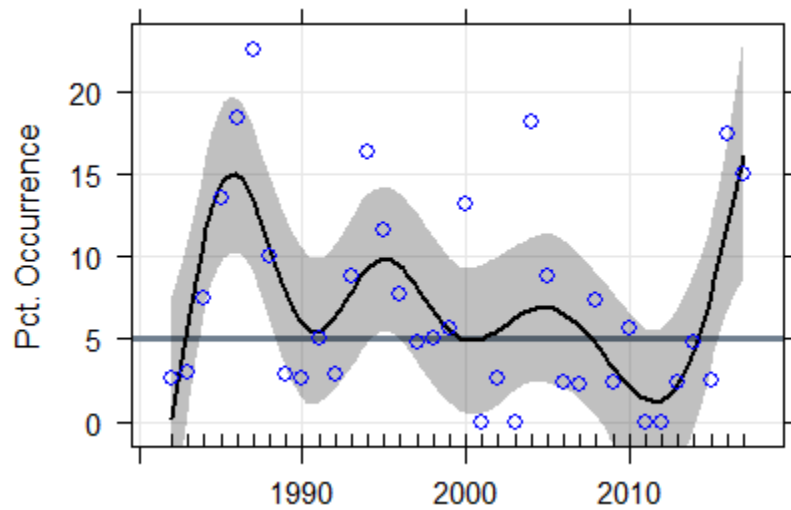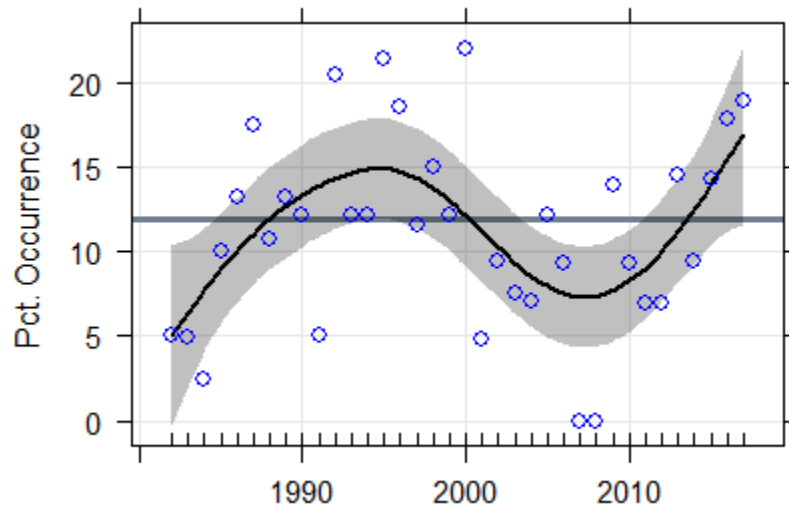

Figure 7. Percent of Southern New England tows that caught male horseshoe crabs from the two shallowest depth strata (0-30', 30-60') of the *MarineFisheries* fall trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.
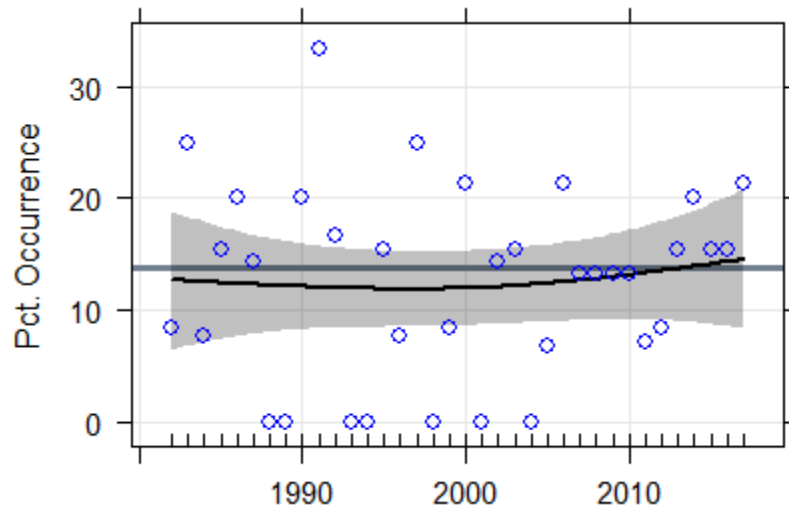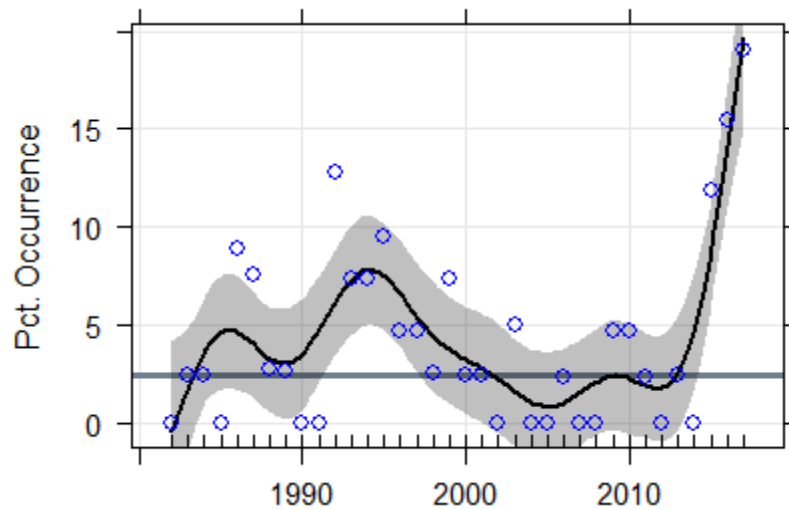
Figure 8. Percent of Gulf of Maine tows that caught female horseshoe crabs from the two shallowest depth strata (0-30', 30-60') of the MarineFisheries fall trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model fit, and the grey line is the time series median. Figure supplied by *MarineFisheries'* Resource Assessment Program.
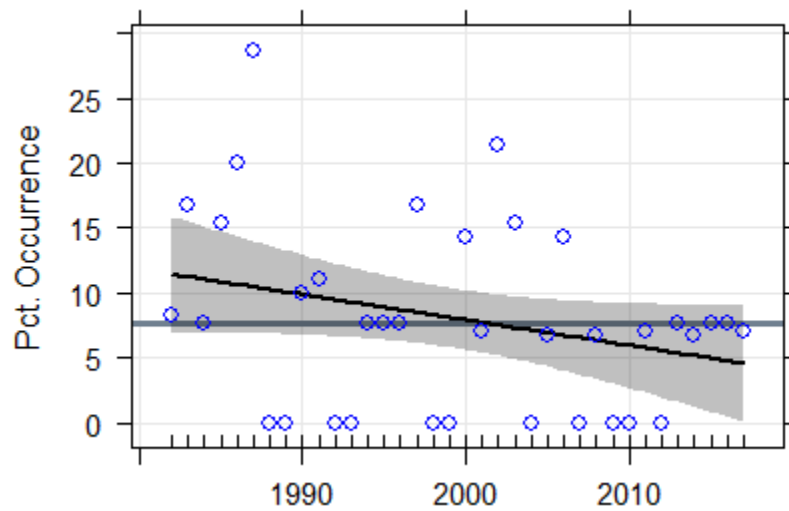
Figure 9. Percent of Gulf of Maine tows that caught male horseshoe crabs from the two shallowest depth strata (0-30', 30-60') of the MarineFisheries fall trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval of the model 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 the two shallowest depth strata (0-30', 30-60') of the *MarineFisheries* 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 the two shallowest depth strata (0-30', 30-60') of the *MarineFisheries* 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.

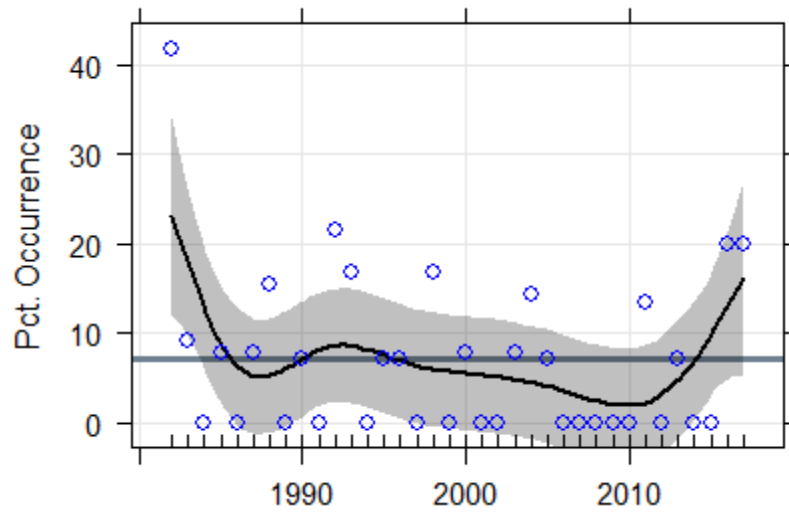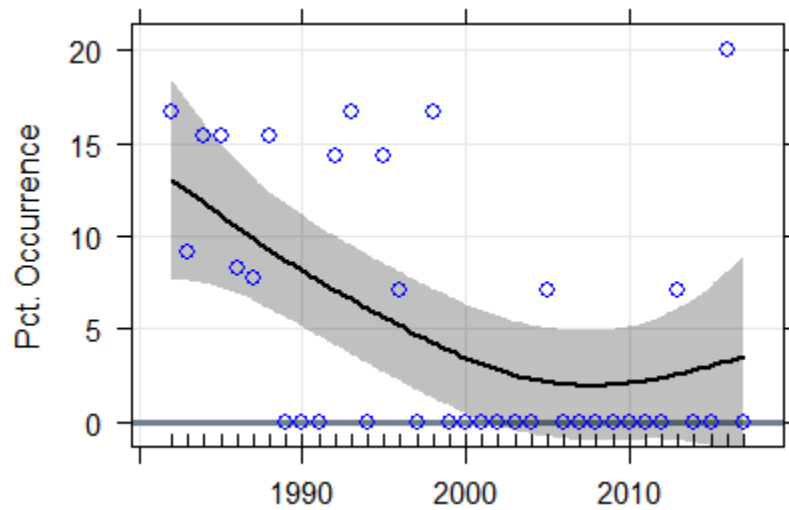**Figure 12. Percent of Gulf of Maine tows that caught female horseshoe crabs from the two shallowest depth strata (0-30', 30-60') of the *MarineFisheries* spring trawl survey. Blue circles are data points, black line is the general additive model fit, shaded grey area is the 95% confidence interval 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 the two shallowest depth strata (0-30', 30-60') of the *MarineFisheries* 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.
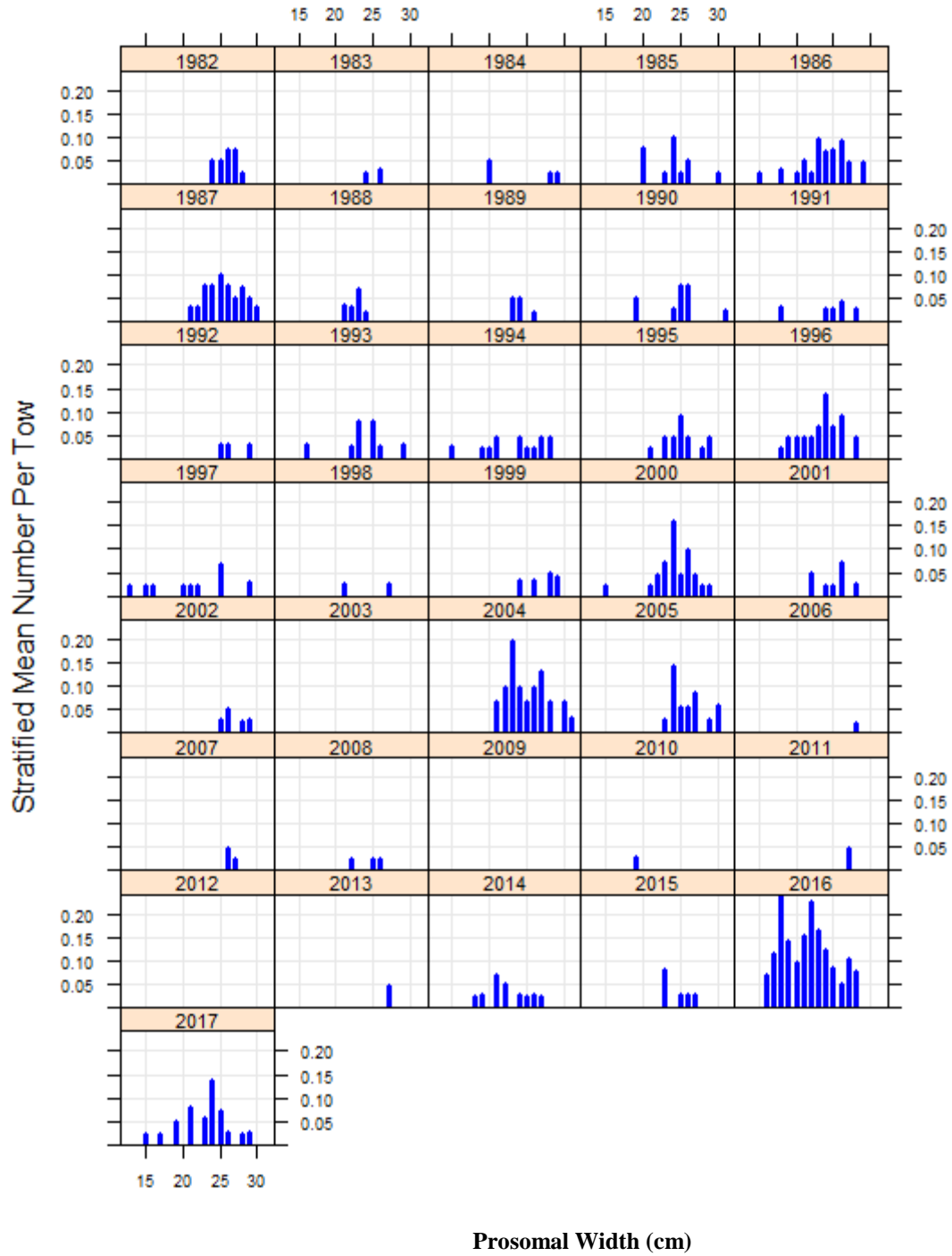
Figure 14. Southern New England female horseshoe crab size distribution (prosomal width (cm)) from the two shallowest strata (0-30', 30-60') of the *MarineFisheries* fall trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.
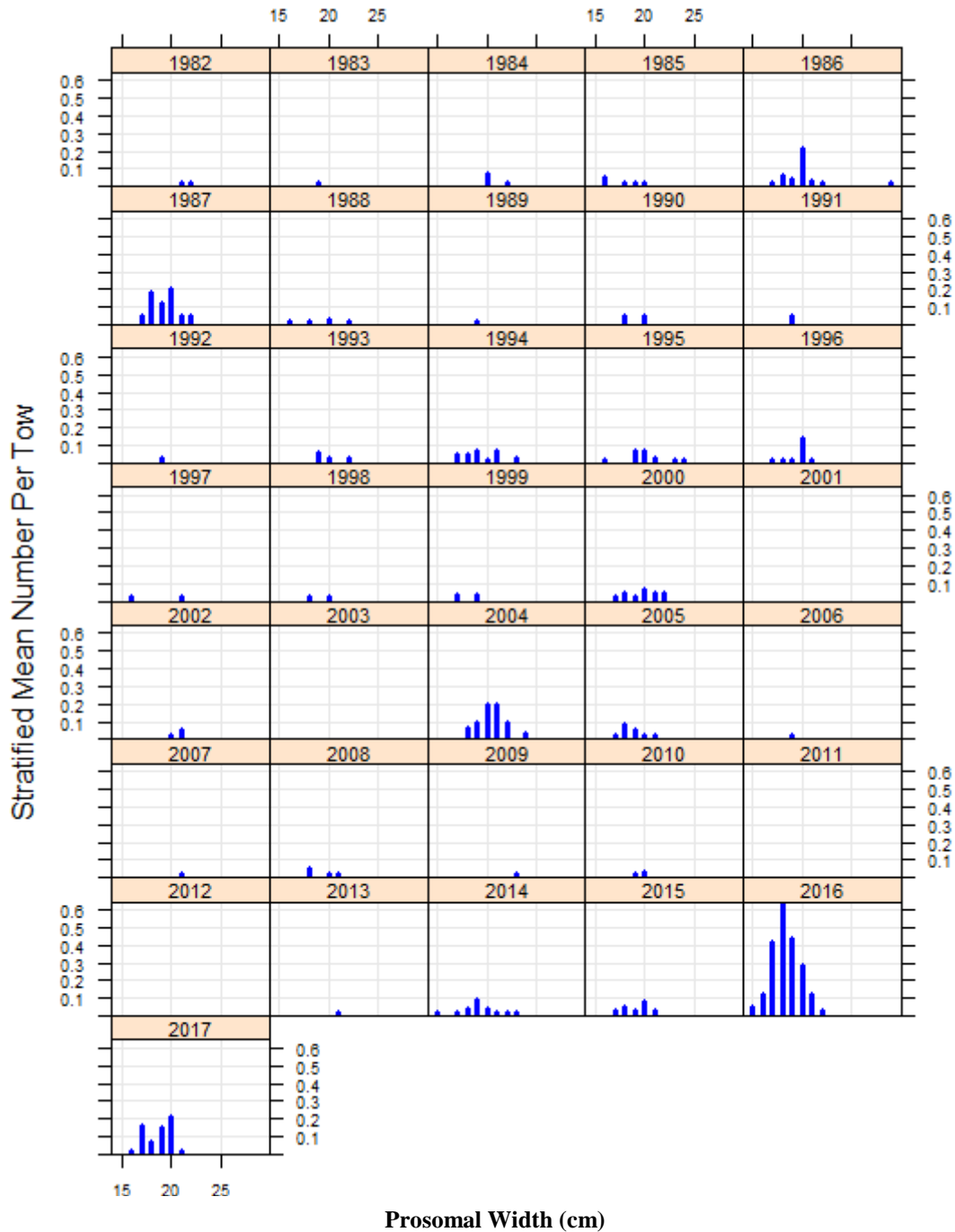
Figure 15. Southern New England male horseshoe crab size distribution (prosomal width (cm)) from the two shallowest strata (0-30', 30-60') of the *MarineFisheries* fall trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.
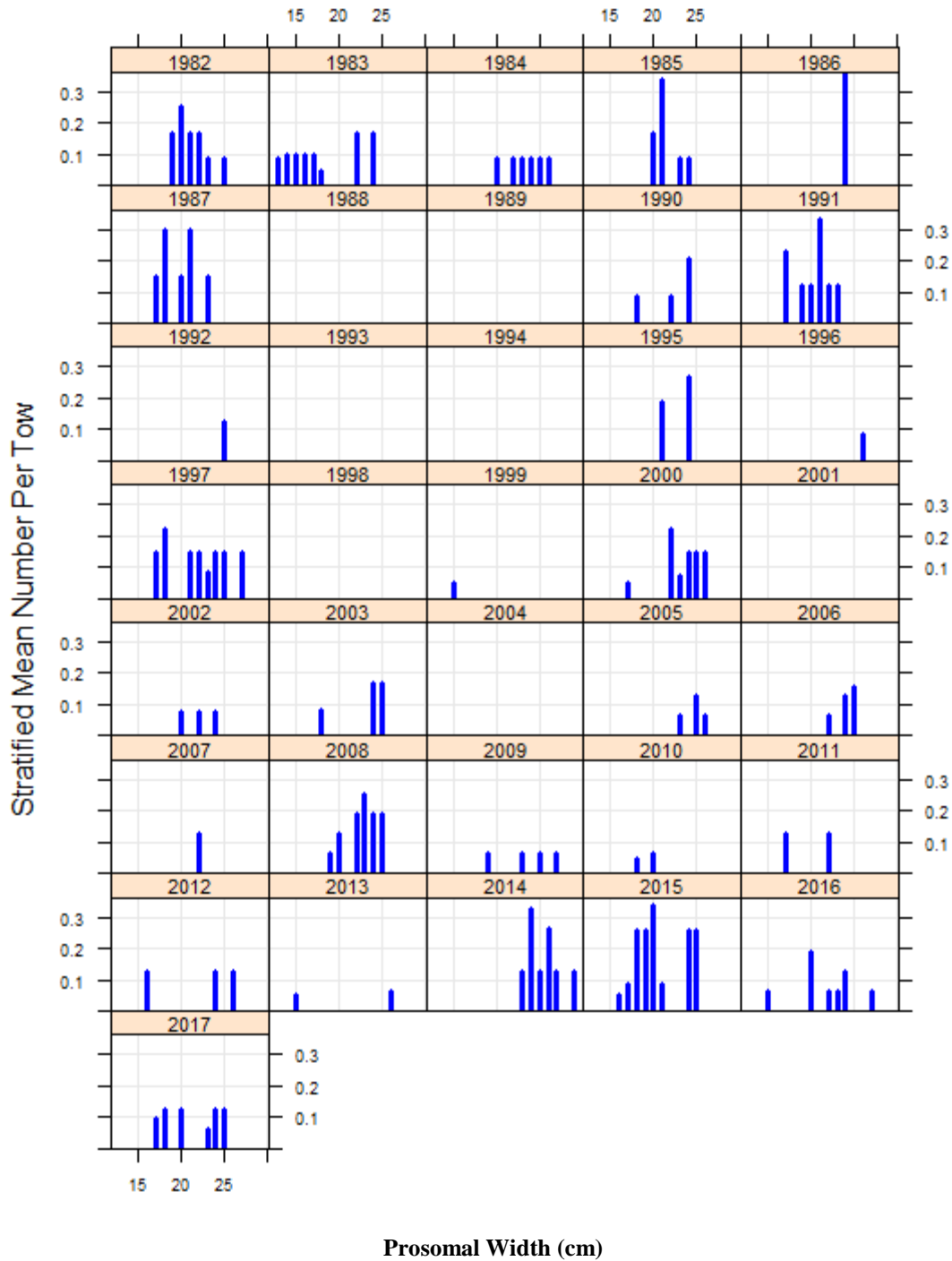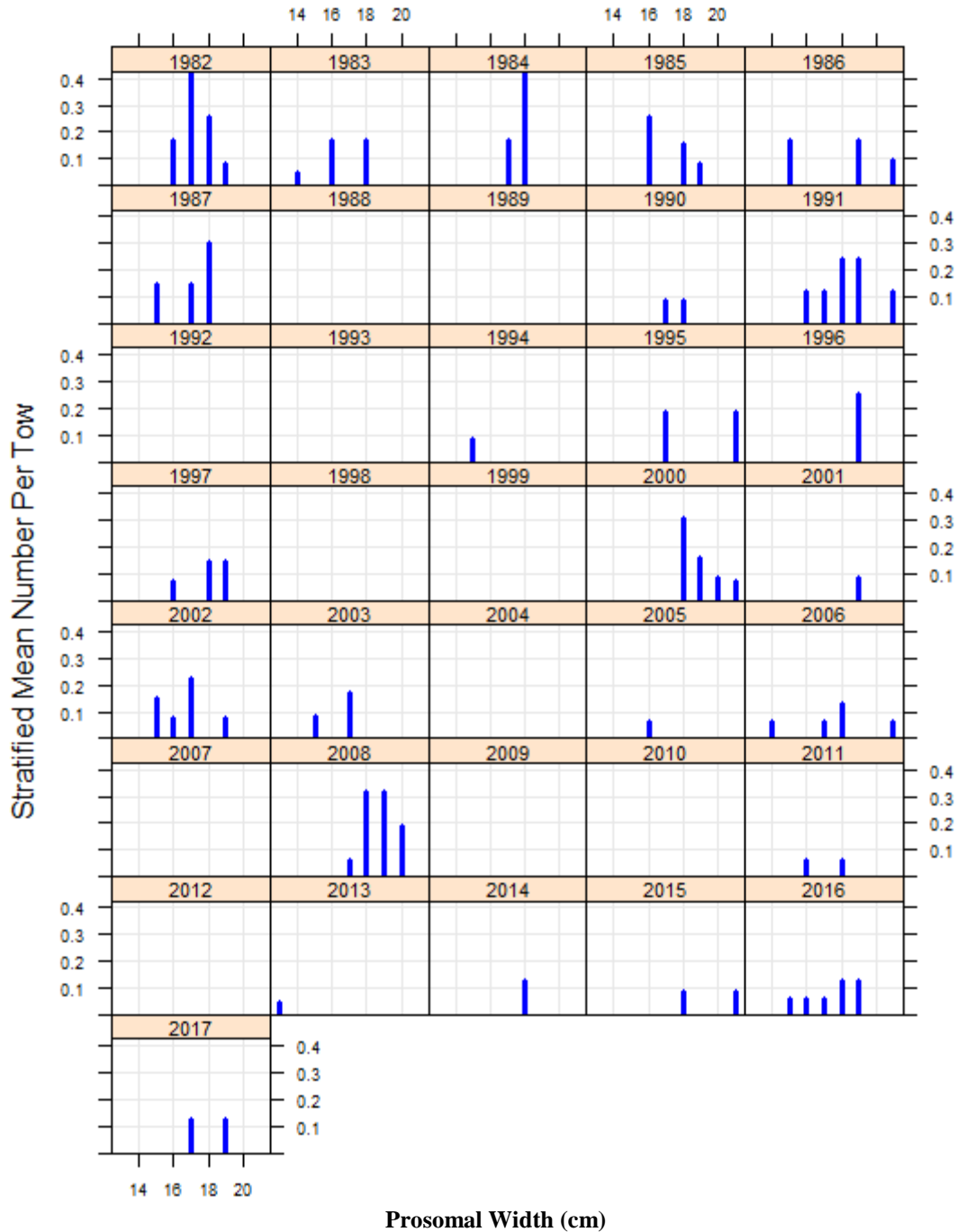
Figure 16. Gulf of Maine female horseshoe crab size distribution (prosomal width (cm)) from the two shallowest strata (0-30', 30-60') of the *MarineFisheries* fall trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.
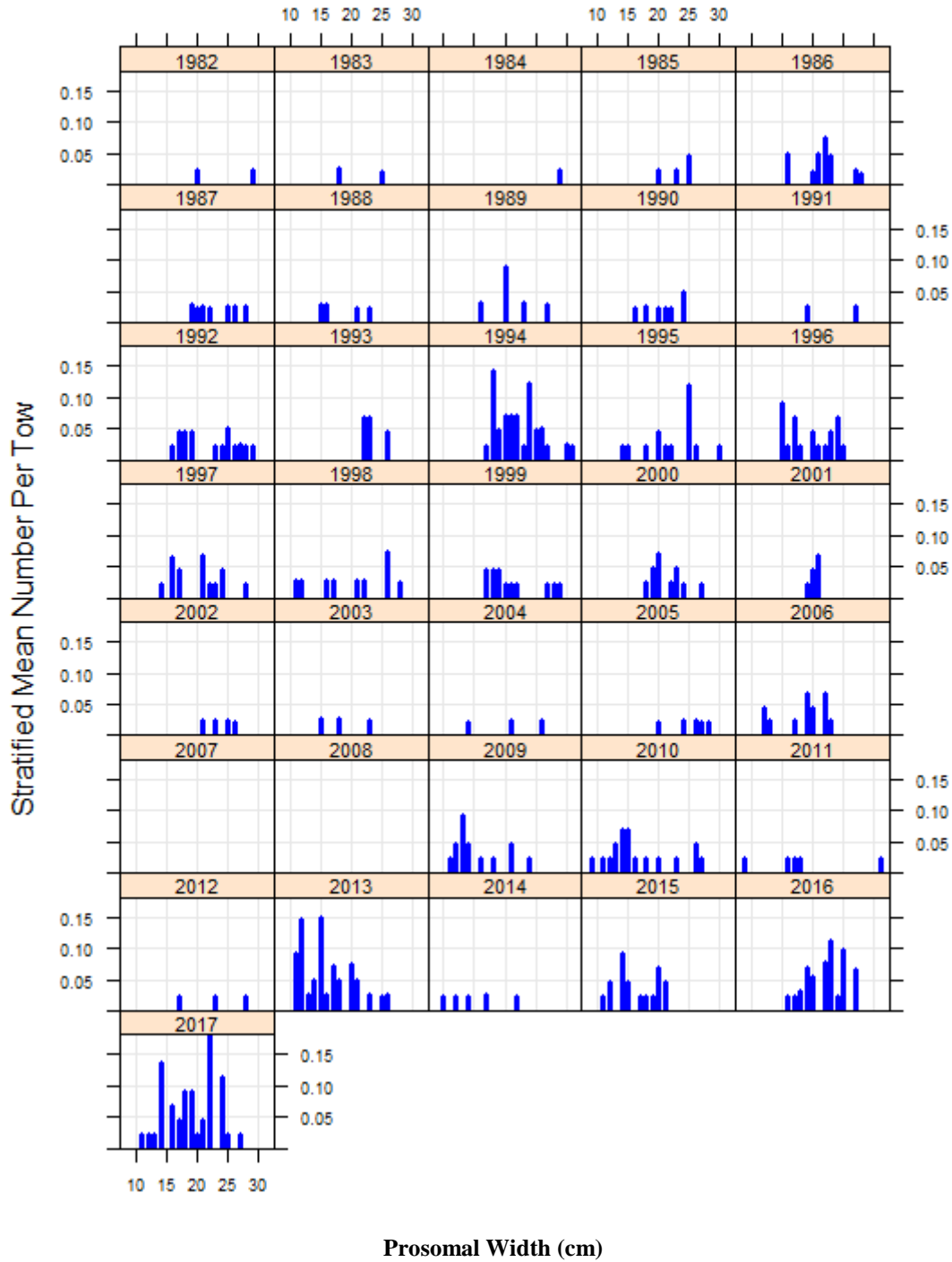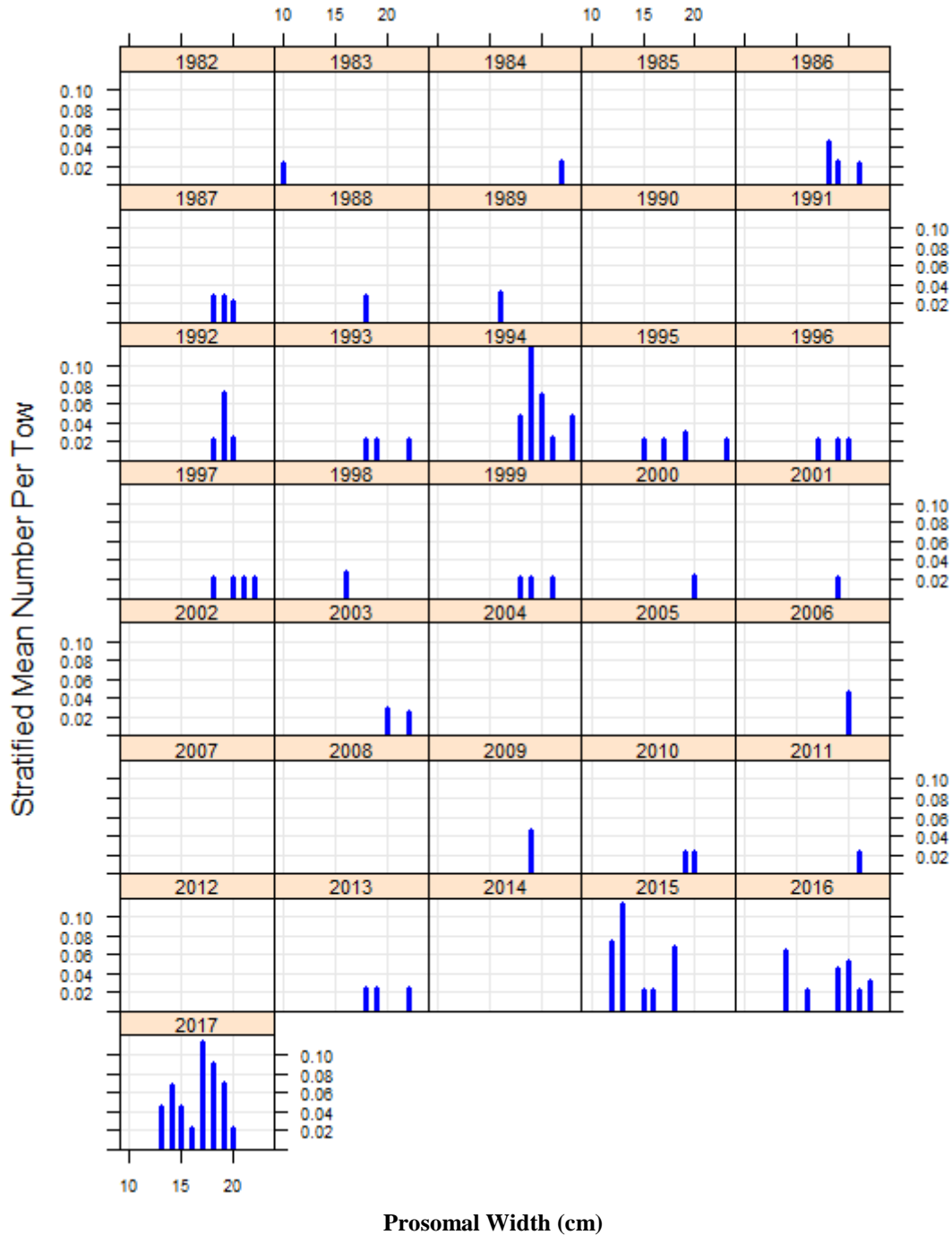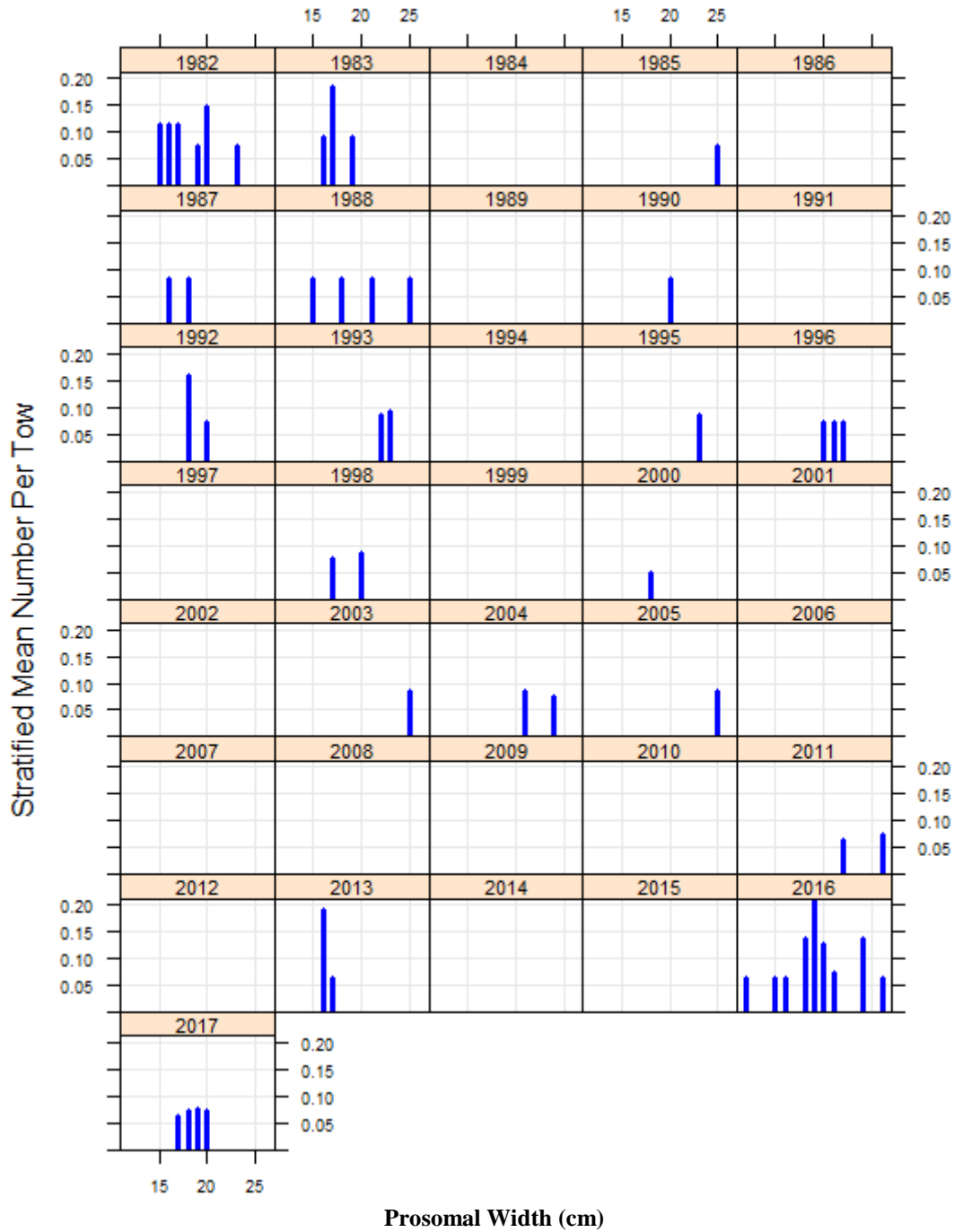
Figure 17. Gulf of Maine male horseshoe crab size distribution (prosomal width (cm)) from the two shallowest strata (0-30', 30-60') of the *MarineFisheries* fall trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

Figure 18. Southern New England female horseshoe crab size distribution (prosomal width (cm)) from the two shallowest strata (0-30', 30-60') of 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 two shallowest strata (0-30', 30-60') of 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 two shallowest strata (0-30', 30-60') of the *MarineFisheries* spring trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.
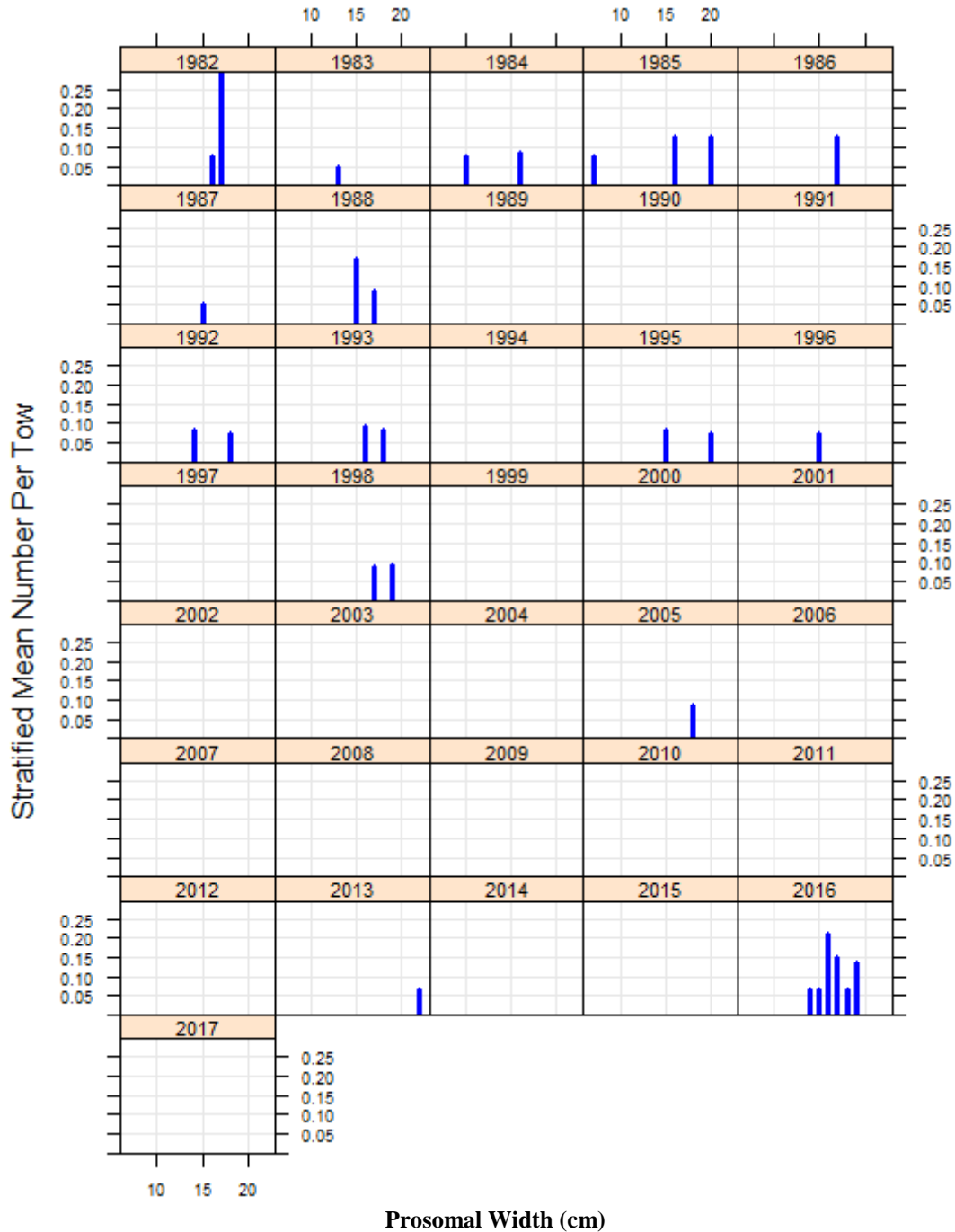
Figure 21. Gulf of Maine male horseshoe crab size distribution (prosomal width (cm)) from the two shallowest strata (0-30', 30-60') of the *MarineFisheries* spring trawl survey. Figure supplied by *MarineFisheries'* Resource Assessment Program.

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.
- *MarineFisheries* will continue to coordinate and support spawning beach surveys conducted in cooperation with various volunteer organizations.

V. Law Enforcement reporting requirements

    Law enforcement did not report any horseshoe crab related violations in 2017.