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**Massachusetts
Division of Marine Fisheries**



**Massachusetts 2021 Compliance Report to the
Atlantic States Marine Fisheries Commission –
Horseshoe Crab**

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I. Introduction

Massachusetts Division of Marine Fisheries (DMF) staff and numerous volunteer groups conducted spawning beach surveys at 15 beaches during the full and new moons of May and June. April spawning beach surveys were discontinued in 2021 because observations of April spawning activity have been low since the survey expanded in 2013 to include the second half of April. Prosomal widths were taken from 1,815 bait crabs and 904 biomedical crabs as part of our market sampling program. The bait fishery harvested 95% of the 2021 Massachusetts self-imposed quota. The number of crabs bled for biomedical purposes remains confidential due to the limited number of biomedical facilities in the state (one). A second biomedical firm is expected to open in 2022; Charles River Laboratories plans to open a bleeding facility in Harwich, Massachusetts.

II. Request for *de minimis* status – not applicable

III. Previous calendar year's fishery

a. Bait Harvest

In 2021, 44 of 210 horseshoe crab bait permits issued by DMF were actively fished, representing an increase of five active permits and a decrease of five issued bait permits from 2020. Nine fishermen with Coastal Access Permits also participated in the fishery in 2021. See Table 1 for the associated harvests. Based on dealer data, 47% of the quota issued by ASMFC to Massachusetts (330,377 crabs), and 95% of the more restrictive state quota voluntarily self-imposed by Massachusetts (165,000 crabs) was harvested. Dealers reported purchasing 11,080 more crabs than harvesters reported selling (Table 2). This is attributed to harvester trips where catch was not reported but was reported by the dealer. Bait crabs were harvested primarily by mobile gear (trawl or dredge; 62% of harvest) or by hand (including rakes, dipnets, and hand tongs; 36%), with 2% harvested by other means (gill net, weirs, pots, etc.) (Table 3). Bait crabs harvested in May and June accounted for 48% of all bait crabs landed in 2021 (Table 4).

Table 1. Number of permits issued, number of permits actively fished, and number of crabs fishermen reported harvesting by permit type (data source: Massachusetts Trip Level Reports and NMFS Vessel Trip Reports). Confidential data has been replaced with an asterisk.

Permit Type	# of Permits Issued	# of Permits Fished	# of Crabs Harvested
Biomedical	14	4	*
Commercial	210	44	119,239
Coastal Access	N/A	9	25,694

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Table 2. Number of bait crabs reported by bait harvesters (data sources: Massachusetts Trip Level Reports, NMFS Vessel Trip Reports).

	Female	Male	Unclassified	Total
Bait Harvest	29,458	7,433	108,042	144,933

Table 3. Number of bait crabs captured by method, as reported by harvesters (data source: Massachusetts Trip Level Reports and NMFS Vessel Trip Level Reports).

Harvest Method	# of Crabs	# of Total
Hand	52,546	36%
Mobile	89,603	62%
Other	2,784	2%

Table 4. Number of bait crabs harvested by month, as reported by harvesters (data sources: Massachusetts Trip Level Reports and NMFS Vessel Trip Reports). Confidential data has been replaced with an asterisk.

	# of Crabs
JAN	*
FEB	*
MAR	*
APR	1,990
MAY	42,338
JUN	26,948
JUL	18,552
AUG	27,994
SEP	13,684
OCT	4,840
NOV	2,886
DEC	2,508

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 2021, two research organizations applied for scientific permits to collect horseshoe crabs. Under these permits, 15 crabs were collected. Another organization released 46 age-1 crabs collected as eggs in 2020.

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c. Biomedical Fishery

In 2021, DMF issued 14 biomedical harvest permits, four of which were actively fished. This represents a decrease of one issued permit and no change to the number of active permits from 2020.

Associates of Cape Cod (ACC) was the only biomedical company producing *Limulus* Amebocyte Lysate (LAL) in Massachusetts in 2021. ACC filed monthly catch reports listing the dealers from whom they purchased crabs, location of harvest, the number and sex of crabs purchased, and the ultimate disposition of the crabs (released or returned to bait market). ACC also reported the number of crabs they rejected or received dead. Per the terms of the Letter of Authorization issued to ACC, they must adhere to the following conditions: 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.

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d. Shorebird monitoring- Not applicable

e. Benthic Sampling

Except for 2020, which was missed due to the Covid-19 pandemic, DMF's 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 4–5 are the Gulf of Maine (GOM). All data reported are from the survey's two shallowest depth strata (0–30' and 30–60', combined) because nearly all horseshoe crabs caught in this survey since 1978 have come from these two strata.

Horseshoe crab survey results from the 2021 DMF spring and fall trawl surveys were mixed (Figure 2 through Figure 5). South of Cape Cod, mean number and weight of spring caught males and females in SNE (Figure 2 and Figure 3) remain near their respective time series highs, but at or below time series medians in the fall. North of Cape Cod, 2021 mean number and weight data points were at or below their time series medians during the spring and fall surveys. Size distribution data are given in Figure 6 through Figure 13. Crabs south of Cape Cod are usually larger (and more numerous) than crabs north of Cape Cod.

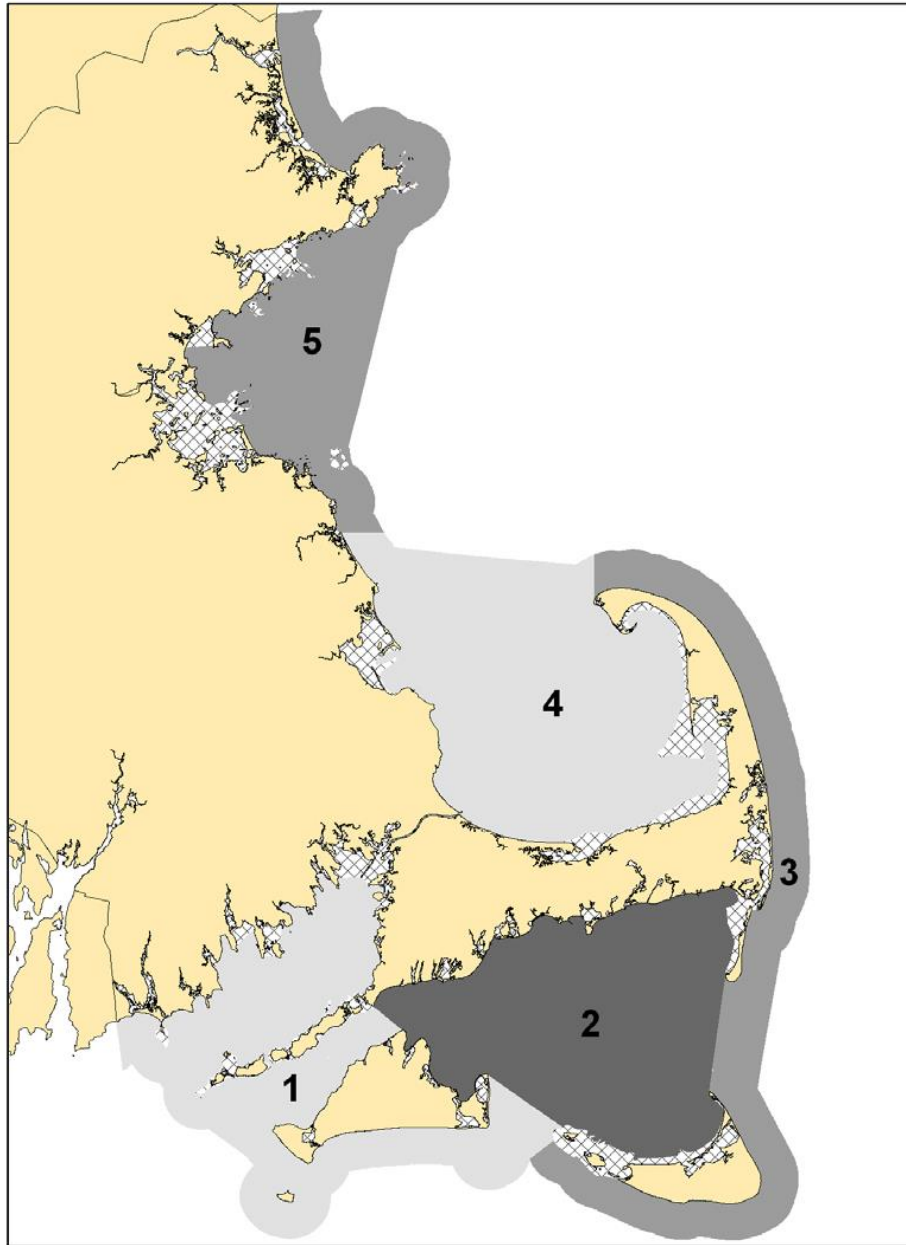


Figure 1. Map of regions for DMF's bottom trawl survey. For this report, regions 1–3 are considered Southern New England (SNE) and regions 4–5 are Gulf of Maine (GOM).

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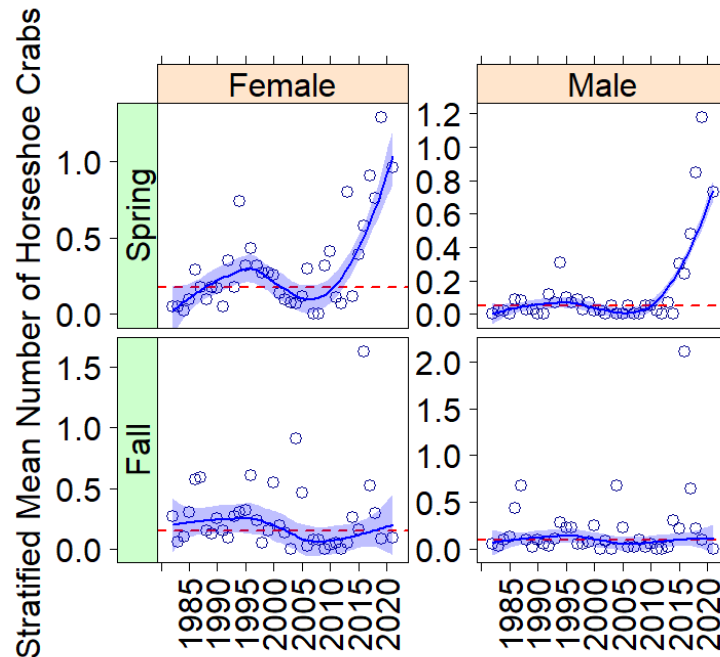


Figure 2. Bootstrapped mean number of horseshoe crabs per tow from the two shallowest depth strata (0–30' and 30–60' combined) of the DMF bottom trawl survey in SNE, by survey season and crab sex. The survey was not conducted in 2020 due to the Covid-19 pandemic. Red, dashed line is the time series median, 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 an approximate 95% confidence interval for the fit.

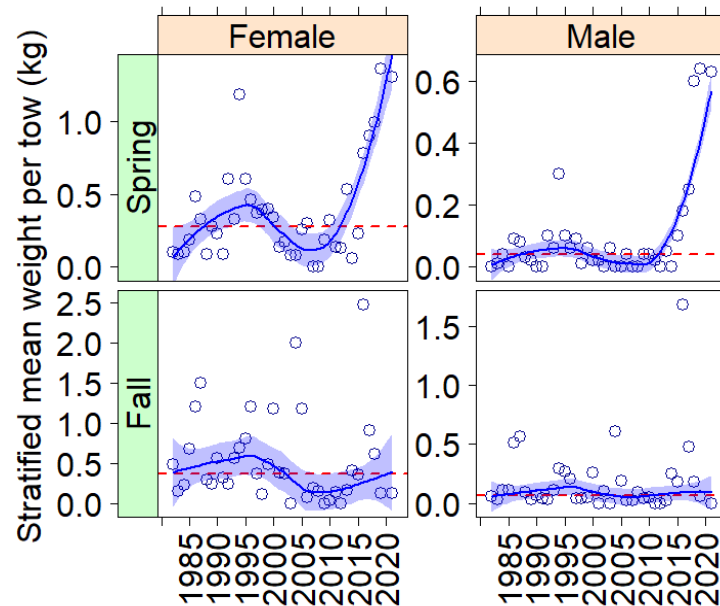


Figure 3. Bootstrapped horseshoe crab mean weight (kg) per tow from the two shallowest depth strata (0–30' and 30–60' combined) of the DMF bottom trawl survey in SNE, by survey season and crab sex. The survey was not conducted in 2020 due to the Covid-19 pandemic. Red, dashed line is the time series 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 an approximate 95% confidence interval for the fit.

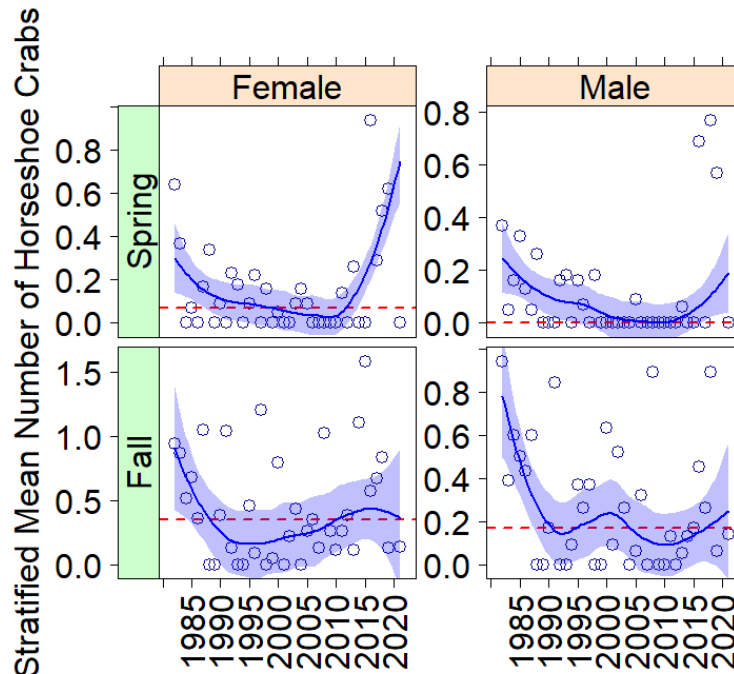


Figure 4. Bootstrapped mean number of horseshoe crabs per tow from the two shallowest depth strata (0–30' and 30–60' combined) of the DMF bottom trawl survey in GOM, by survey season and crab sex. The survey was not conducted in 2020 due to the Covid-19 pandemic. Red, dashed line is the time series median, 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 an approximate 95% confidence interval for the fit.

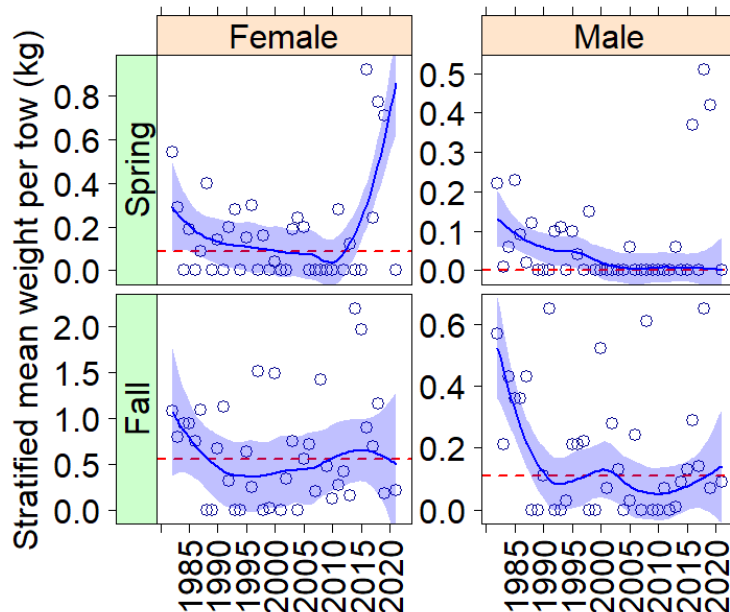


Figure 5. Bootstrapped horseshoe crab mean weight (kg) per tow from the two shallowest depth strata (0–30 and 30–60' combined) of the DMF bottom trawl survey in GOM, by survey season and crab sex. The survey was not conducted in 2020 due to the Covid-19 pandemic. Red, dashed line is the time series median, 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 an approximate 95% confidence interval for the fit.

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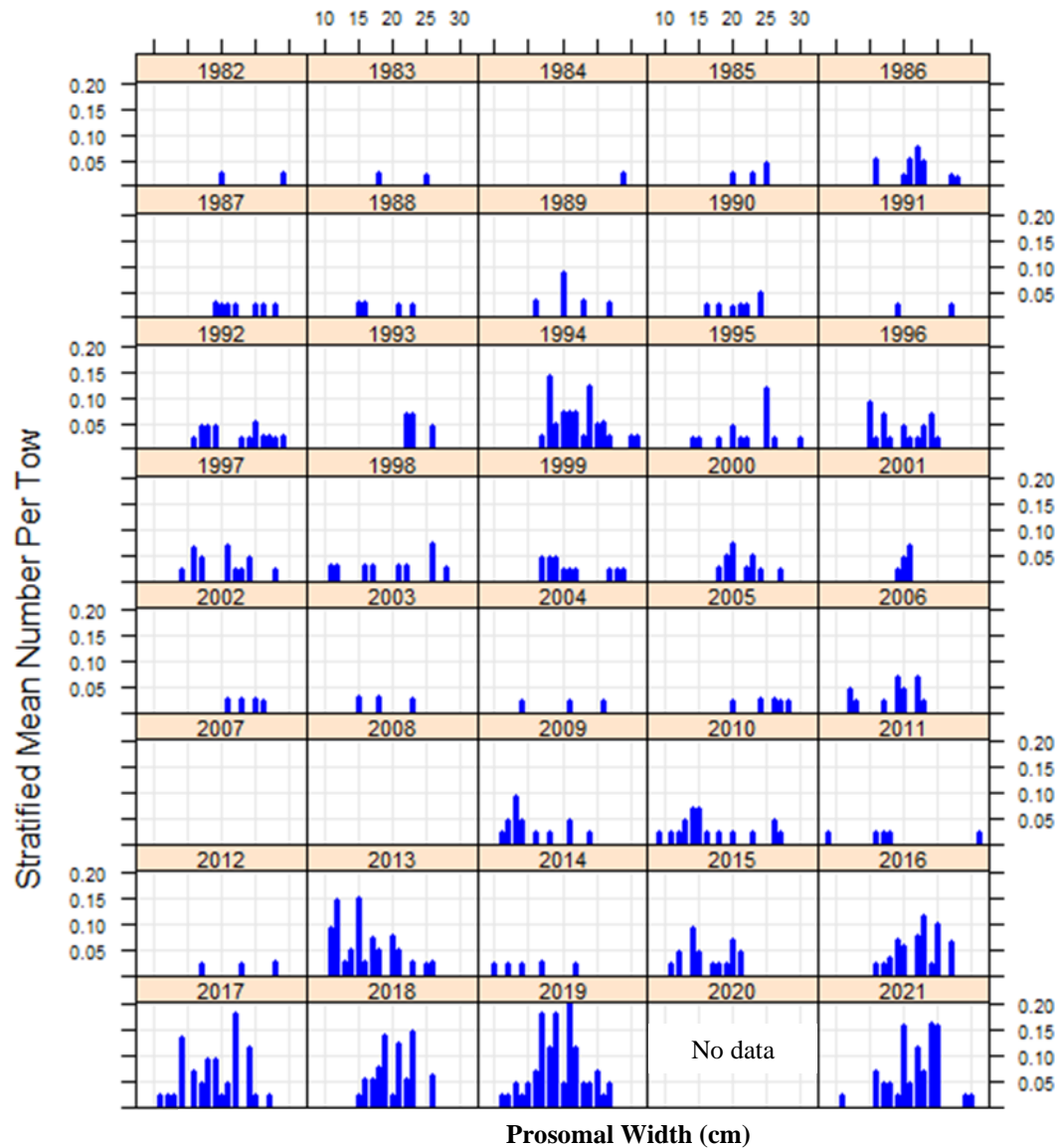


Figure 6. SNE female horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF spring bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.

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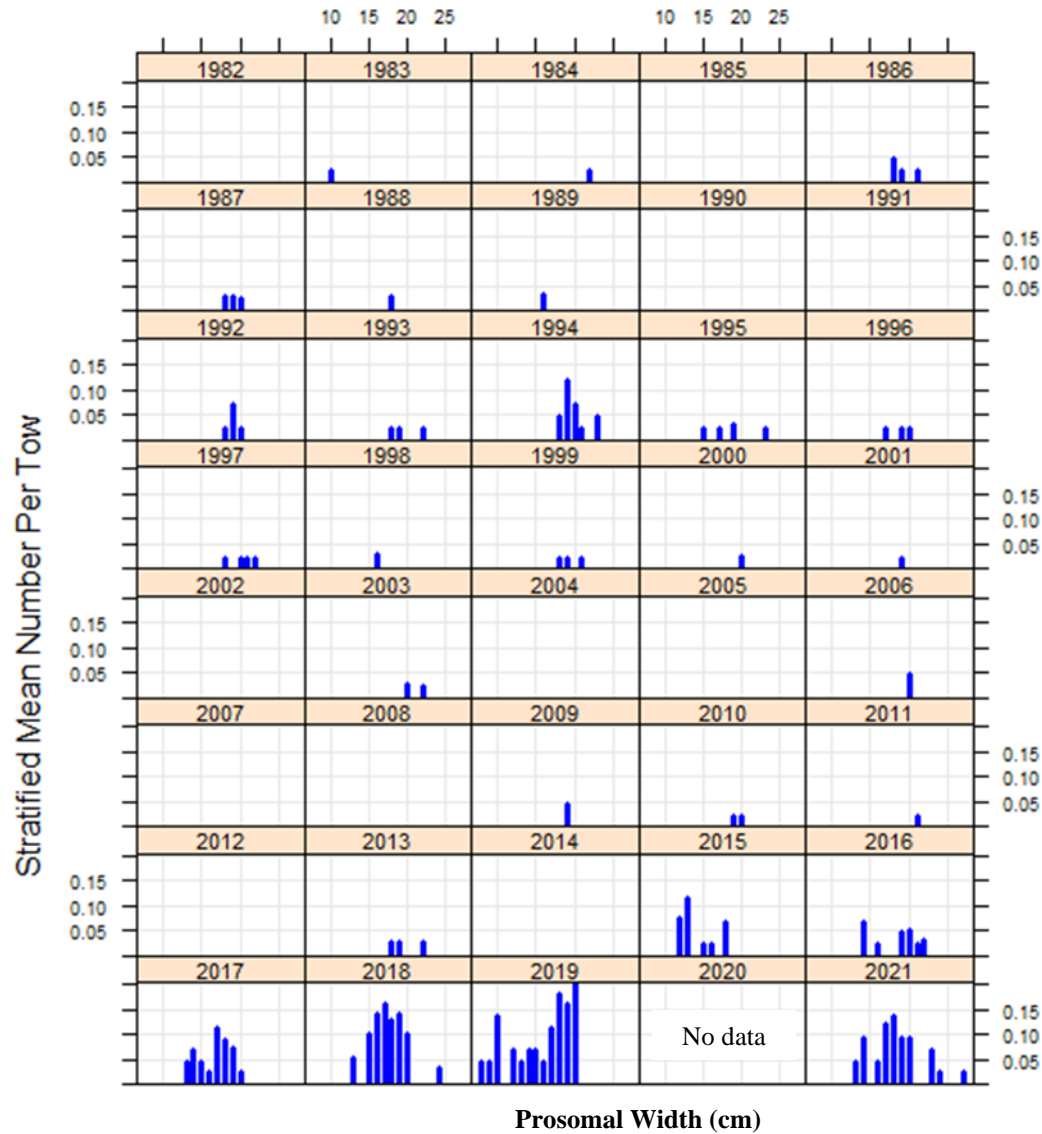


Figure 7. SNE male horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF spring bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.

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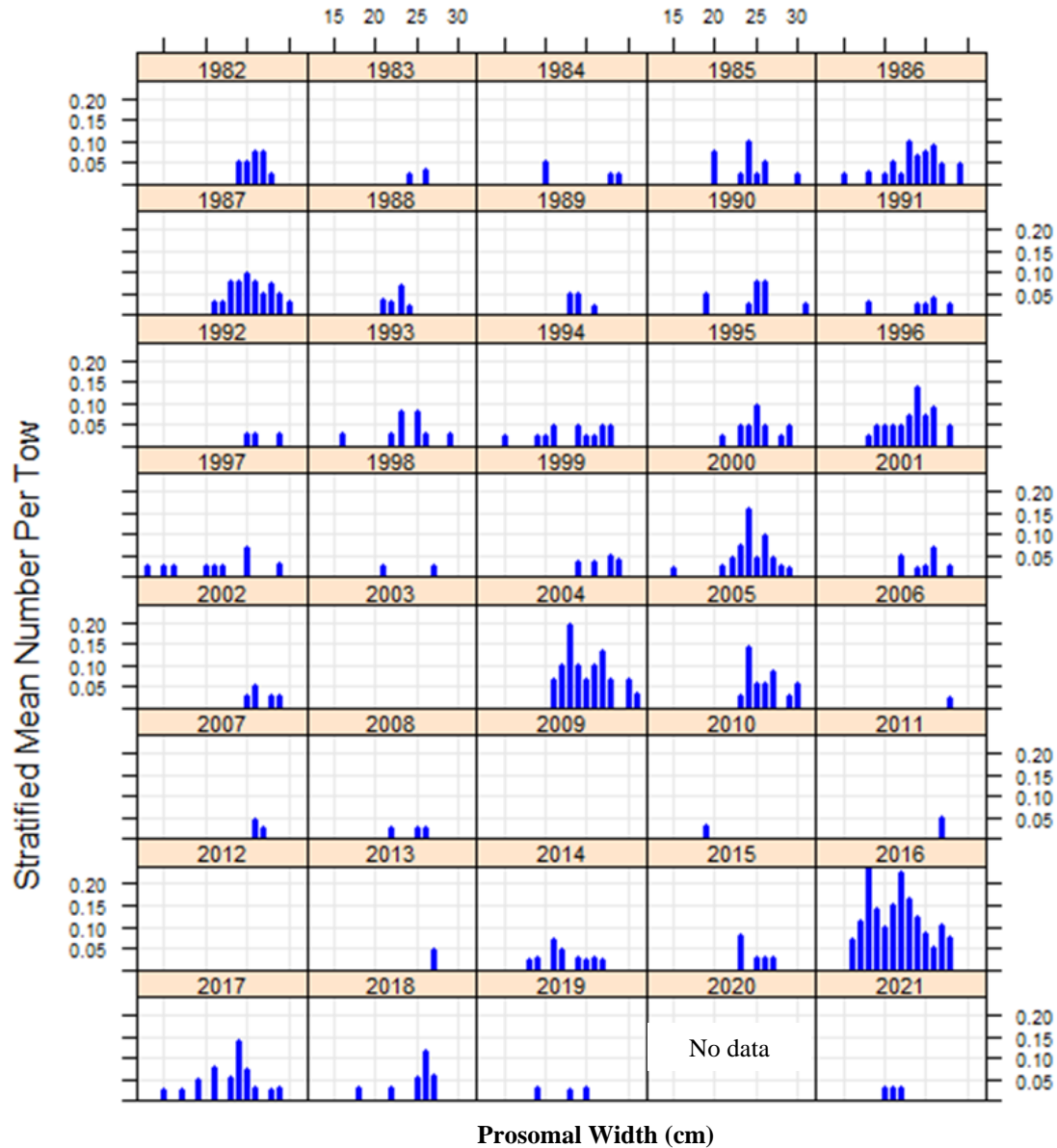


Figure 8. SNE female horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF fall bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.

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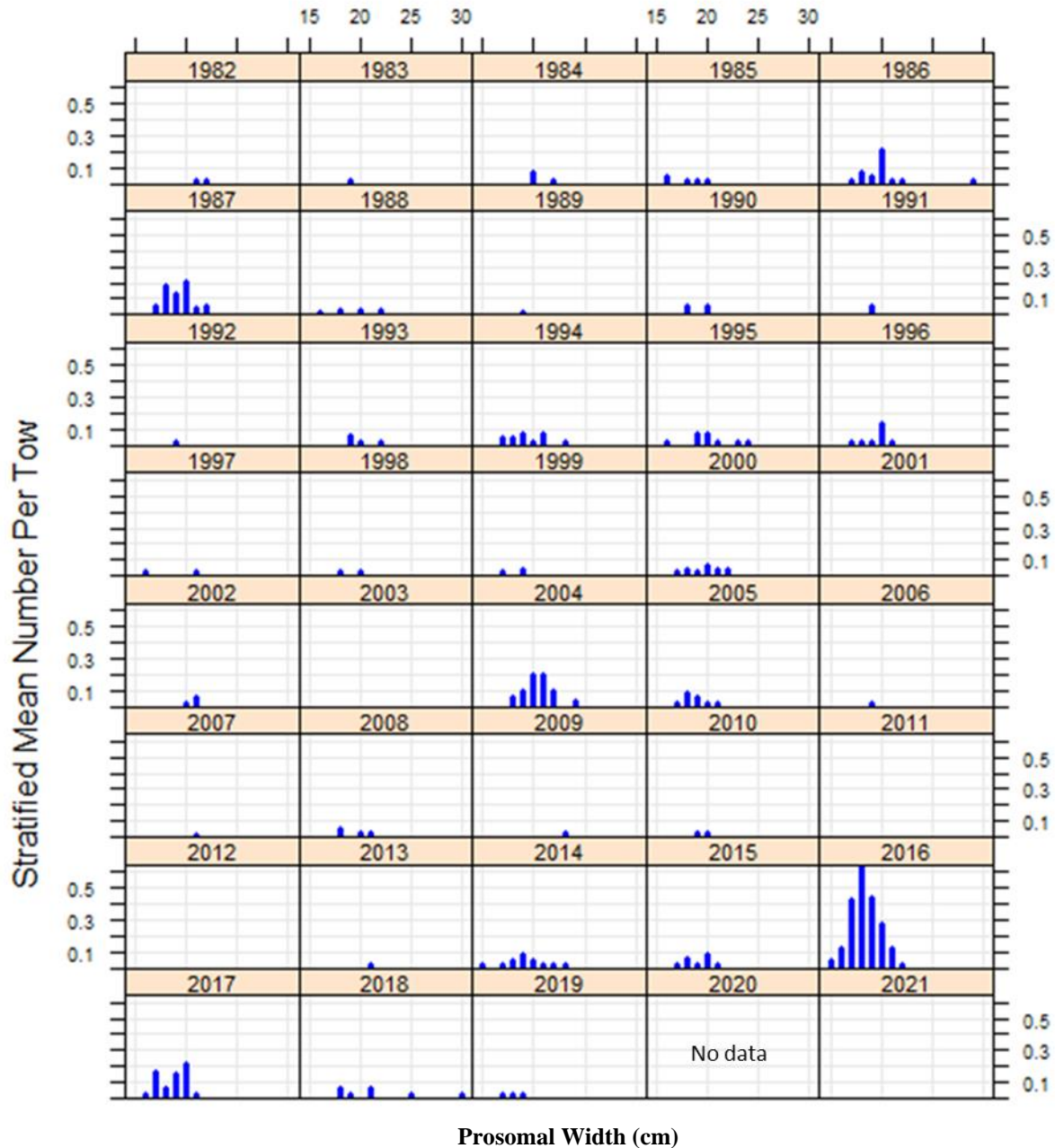


Figure 9. SNE male horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF fall bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.

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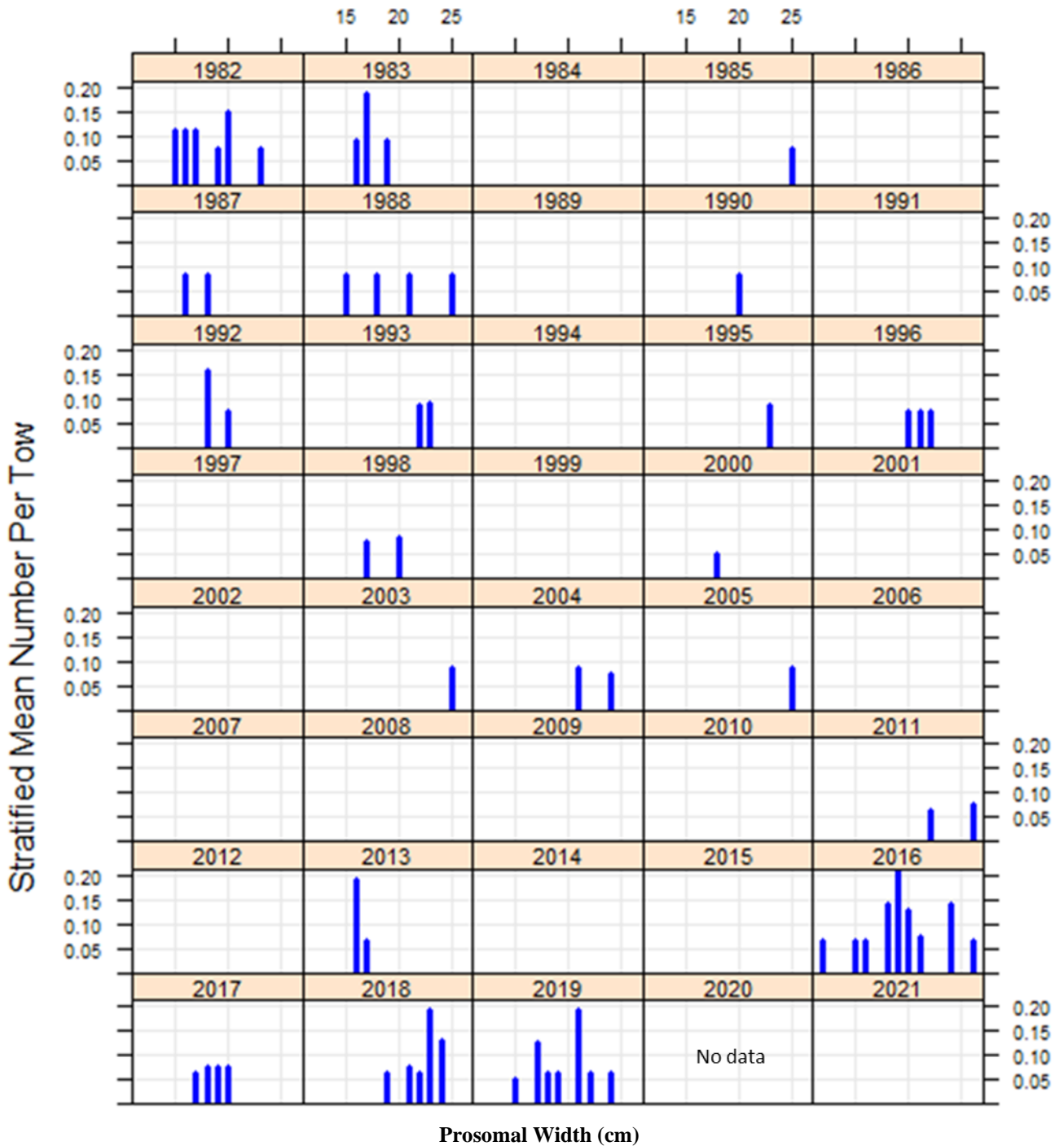


Figure 10. GOM female horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF spring bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.

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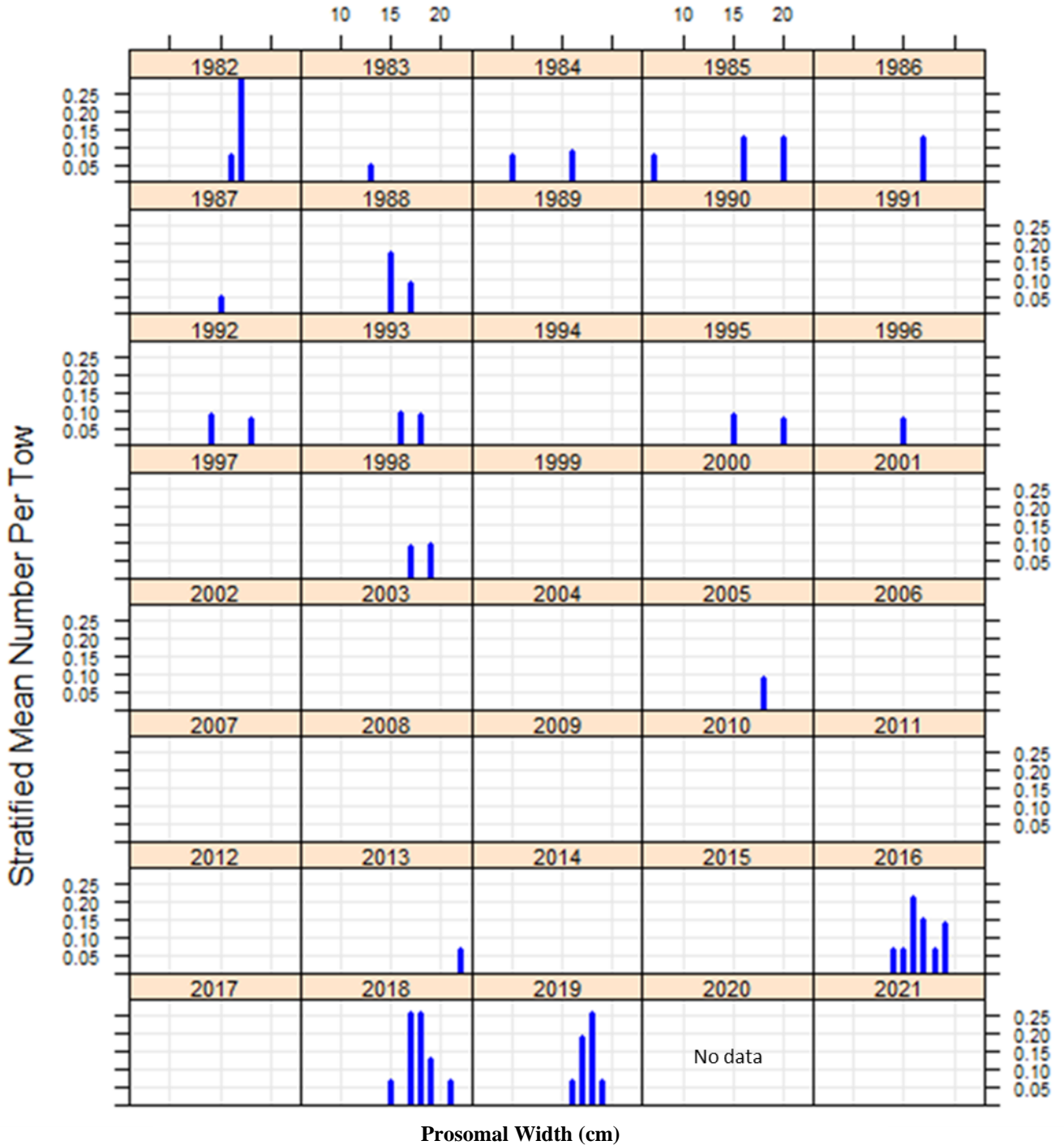


Figure 11. GOM male horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF spring bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.

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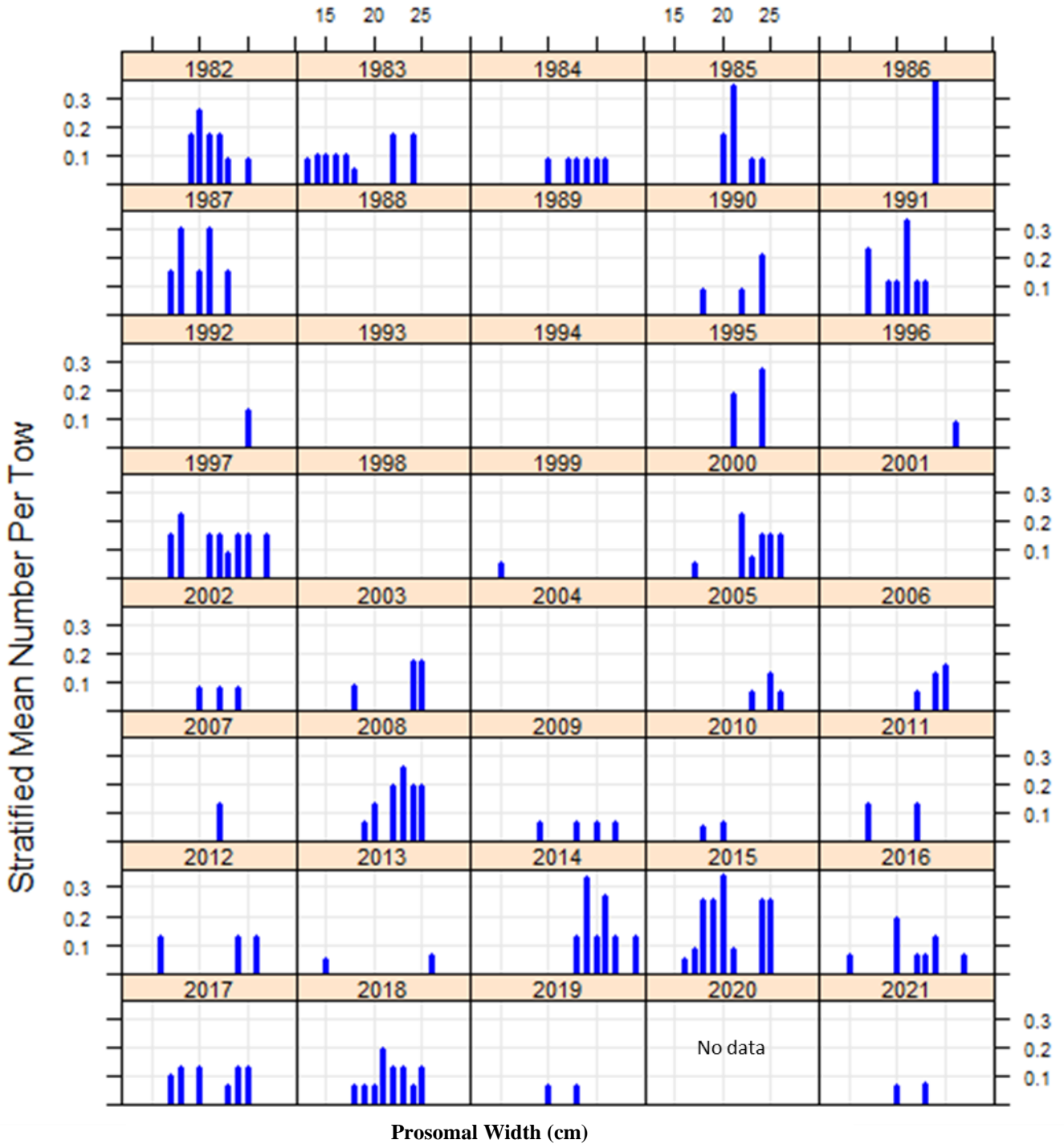


Figure 12. GOM female horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF fall bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.

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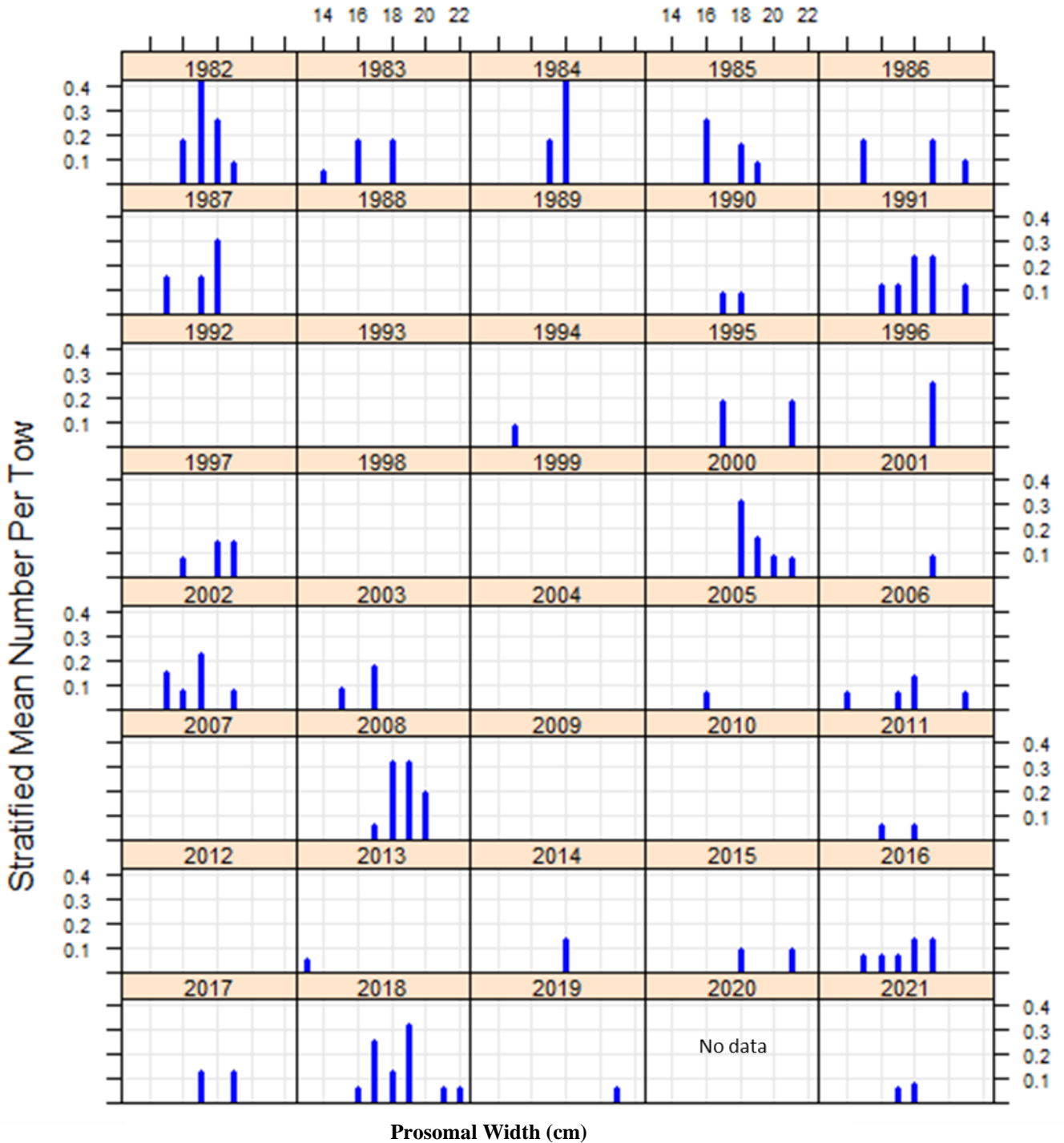


Figure 13. GOM male horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF fall bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.

IV. Planned management programs for the current calendar year

a. Summary of changes from previous years

There were no regulation changes from previous years directly related to horseshoe crabs.

b. Summary of monitoring programs that will occur

- DMF will continue collecting catch reports from all crab harvesters, dealers, and scientific permit holders.
- DMF will continue to collect monthly reports from the biomedical industry.
- DMF will also continue to characterize the commercial fishery through market sampling.
- DMF spring and fall trawl surveys will continue to monitor and record weight, number and prosomal width by sex of individuals collected.
- DMF will continue to coordinate and support spawning beach surveys conducted in cooperation with various volunteer organizations.

V. Law Enforcement reporting requirements

The Massachusetts Environmental Police did not report any horseshoe crab related violations in 2021.