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# Massachusetts
# Division of Marine Fisheries


# Massachusetts 2022 Compliance Report to the Atlantic States Marine Fisheries Commission – Horseshoe Crab

Submitted by:
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## I. Introduction

Massachusetts Division of Marine Fisheries (DMF) staff and numerous volunteer groups conducted spawning beach surveys at 17 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. The bait fishery harvested 82% (135,731 crabs) of the 2022 Massachusetts self-imposed quota (165,000 crabs). Prosomal widths were taken from 1,572 bait crabs and 2,054 biomedical crabs as part of our market sampling program. Sampling intensity of the biomedical fishery was increased due to the addition of a second biomedical firm, which opened in July 2022. The number of crabs collected and released by the biomedical fishery was 175,427 (based on harvester reports). This is the first time the number of biomedical crabs harvested in Massachusetts and collected by harvesters with biomedical permits has been released because more than 3 biomedical dealers reported landings. Massachusetts biomedical horseshoe crab landings were considerably higher than past years due to the addition of a second biomedical firm in 2022.

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

## III. Previous calendar year's fishery

### a. Bait Harvest

In 2022, 35 of 204 horseshoe crab bait permits issued by DMF were actively fished, representing a decrease of nine active permits and six issued bait permits from 2021. Six fishermen with Coastal Access Permits also participated in the fishery in 2022, which is a decrease of three from 2021. See Table 1 for the associated harvests. Based on dealer data, 41% of the quota issued by ASMFC to Massachusetts (330,377 crabs), and 82% of the more restrictive state quota voluntarily self-imposed by Massachusetts (165,000 crabs) was harvested. Dealers reported purchasing 978 fewer crabs than harvesters reported selling (Table 2). This could be due to crabs being retained by harvesters for personal use. Bait crabs were harvested primarily by mobile gear (trawl or dredge; 65% of harvest) or by hand (including rakes, dipnets, and hand tongs; 30%), with 6% harvested by other means (gill net, weirs, pots, etc.) (Table 3). Bait crabs harvested in May and June accounted for 38% of all bait crabs landed in 2022(Table 4), which is a decrease from 2021 when 48% of the harvest was from May and June

**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).**

| Permit Type | # of Permits Issued | # of Permits Fished | # of Crabs Harvested |
|---|---|---|---|
| Biomedical | 26 | 14 | 175,427 |
| Commercial | 204 | 35 | 123,442 |
| Coastal Access | N/A | 6 | 12,289 |

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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 | 12,056 | 4,862 | 118,812 | 135,731 |

**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 | 40,411 | 30% |
| Mobile | 87,601 | 65% |
| Other | 7,719 | 6% |

**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 (fewer than three individuals reporting landings) are marked with an asterisk.**

| | # of Crabs |
|---|---|
| JAN | * |
| FEB | * |
| MAR | * |
| APR | 3,027 |
| MAY | 30,448 |
| JUN | 21,194 |
| JUL | 28,311 |
| AUG | 24,129 |
| SEP | 8,716 |
| OCT | 12,334 |
| NOV | 3,726 |
| 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. Scientific collection data is currently not available for 2022.

**c. Biomedical Fishery**

In 2022, DMF issued 26 biomedical harvest permits, 14 of which were actively fished. This represents an increase of eight issued permits and 10 active permits from 2021. These increases are largely due to the addition of a second biomedical firm in the state.

Two Massachusetts biomedical companies bled horseshoe crabs to produce *Limulus*

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Amebocyte Lysate (LAL) in 2022, Associates of Cape Cod (ACC) and Charles River Laboratories (CRL). Both companies 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 (harvested with biomedical permit then released, or harvested with a bait permit and returned to the bait market). They also reported the number of crabs they rejected or received dead.

Per the terms of the Letter of Authorization issued by the Commonwealth to both biomedical firms, they must adhere to the following conditions: cannot accept more than 1,000 crabs per permitted biomedical harvester per day, crabs must be separated by source (e.g., location of harvest), crabs cannot be held out of water more than 36 hours, crabs must be returned to harvester/dealer in good condition, crabs must be released in same embayment where they were originally collected, crabs must be kept moist during transport and storage, crabs must be transported in a temperature-controlled environment 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. DMF also requires that every bled crab harvested using a biomedical permit must be marked to indicate the crab was bled and that crab cannot be bled a second time in a calendar year. DMF assigns the mark annually, which is applied on the underside of the crab, and each company uses a waterproof paint color specific to that company.

In 2022, Massachusetts biomedical firms bled bait crabs from Massachusetts, and biomedical crabs from Massachusetts and Rhode Island (Table 5 - redacted). ACC and CRL reported purchasing (redacted) crabs (all sources combined), which is an increase of (redacted) crabs over 2021. The bait market contributed (redacted) of the crabs bled (Table 6 - redacted). Bait dealers sold (redacted) crabs to ACC, which ACC bled and returned to the bait market. CRL did not participate in the rent-a-crab program. No bait crabs from other states were bled in Massachusetts in 2022. Massachusetts biomedical firms bled (redacted) crabs from Massachusetts and (redacted) crabs from Rhode Island collected solely for LAL production. Data reported by the two companies resulted in a combined mortality rate of 2.49% for males, and 2.37% for female crabs from the time of capture to the time of release for Massachusetts biomedical-only crabs. ACC reported equal mortality rates (0.81% each) for male and female Rhode Island biomedical crabs (CRL did not bleed crabs from Rhode Island).

**Table 5. Number of crabs bled, rejected, and dead by month from 2022 biomedical facility reports (confidential).**

**Table redacted**

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**Table 6. Number of purchased, rejected, and dead crabs from 2022 biomedical facility reports (confidential).**

**Table redacted**

**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.

Though not the time series highs observed in recent years, data points (stratified mean number per tow and stratified mean weight per tow) from the 2022 DMF Spring Trawl Survey for both sexes and both regions were all above their time series medians (Figure 2 though Figure 5). Fall surveys for both sexes in SNE were around time series medians. The 2022 data point for GOM fall males was also around its time series median. GOM fall females, however, were below their time series median. Size distribution data are given in Figure 6 through Figure 13. Crabs south of Cape Cod (SNE) are usually larger (and more numerous) than crabs north of Cape Cod (GOM).

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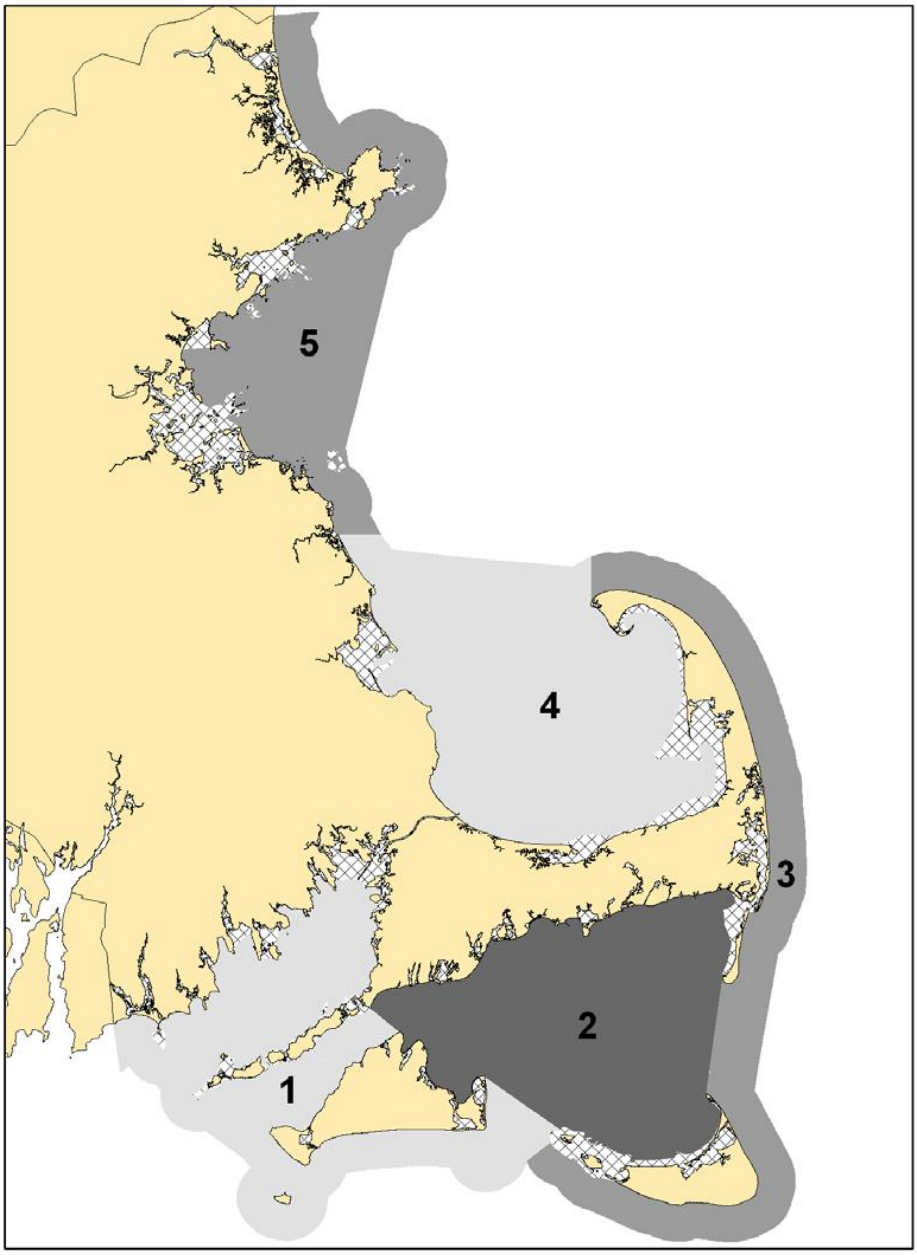


**Figure 1. Map of regions for DMF's bottom trawl survey. For this report, regions 1–3 are considered Southern New England (SNE) and regions 4–5 are Gulf of Maine (GOM).**

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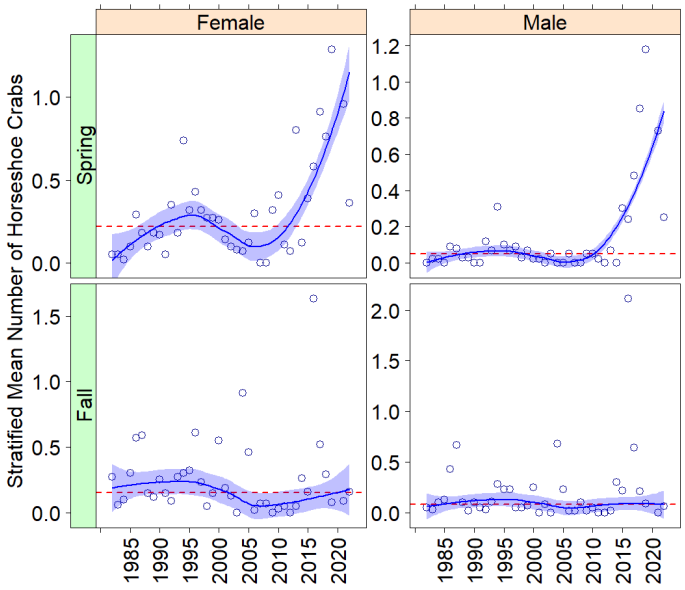


**Figure 2. Bootstrapped mean number of horseshoe crabs per tow from the two shallowest depth strata (0–30' and 30–60' combined) of the DMF bottom trawl survey in SNE, by survey season and crab sex. The survey was not conducted in 2020 due to the Covid-19 pandemic. Red, dashed line is the time series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

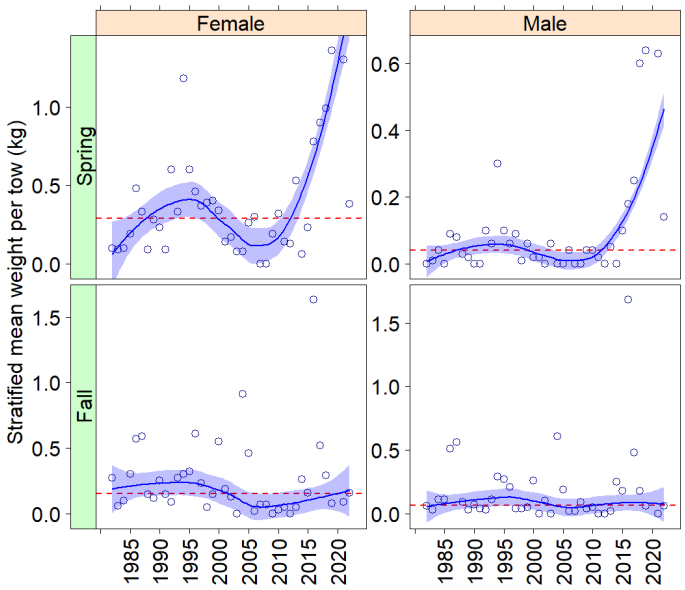


**Figure 3. Bootstrapped horseshoe crab mean weight (kg) per tow from the two shallowest depth strata (0–30' and 30–60' combined) of the DMF bottom trawl survey in SNE, by survey season and crab sex. The survey was not conducted in 2020 due to the Covid-19 pandemic. Red, dashed line is the time series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

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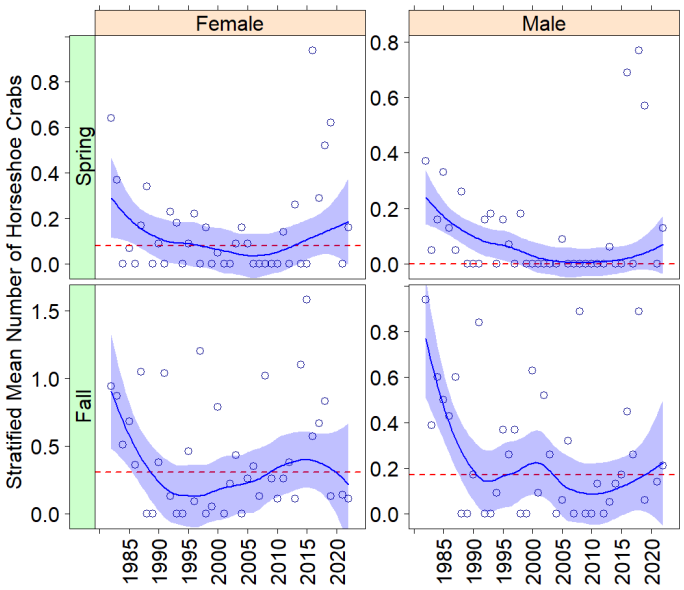


**Figure 4. Bootstrapped mean number of horseshoe crabs per tow from the two shallowest depth strata (0–30' and 30–60' combined) of the DMF bottom trawl survey in GOM, by survey season and crab sex. The survey was not conducted in 2020 due to the Covid-19 pandemic. Red, dashed line is the time series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

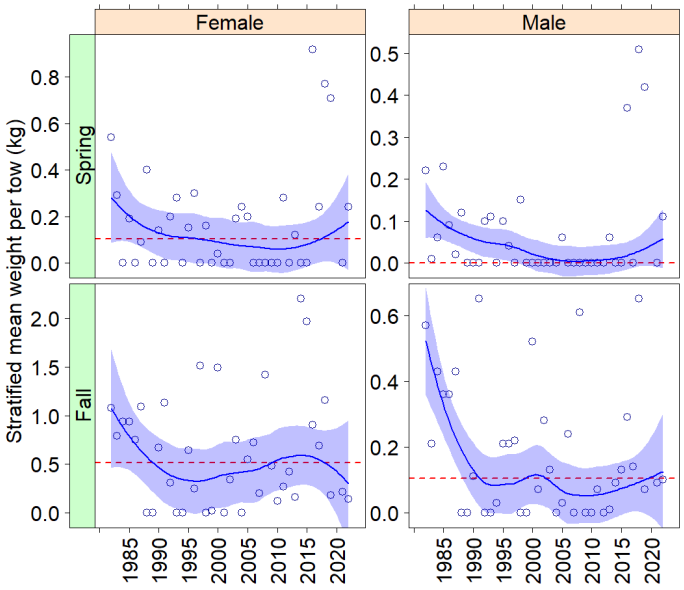


**Figure 5. Bootstrapped horseshoe crab mean weight (kg) per tow from the two shallowest depth strata (0–30 and 30–60' combined) of the DMF bottom trawl survey in GOM, by survey season and crab sex. The survey was not conducted in 2020 due to the Covid-19 pandemic. Red, dashed line is the time series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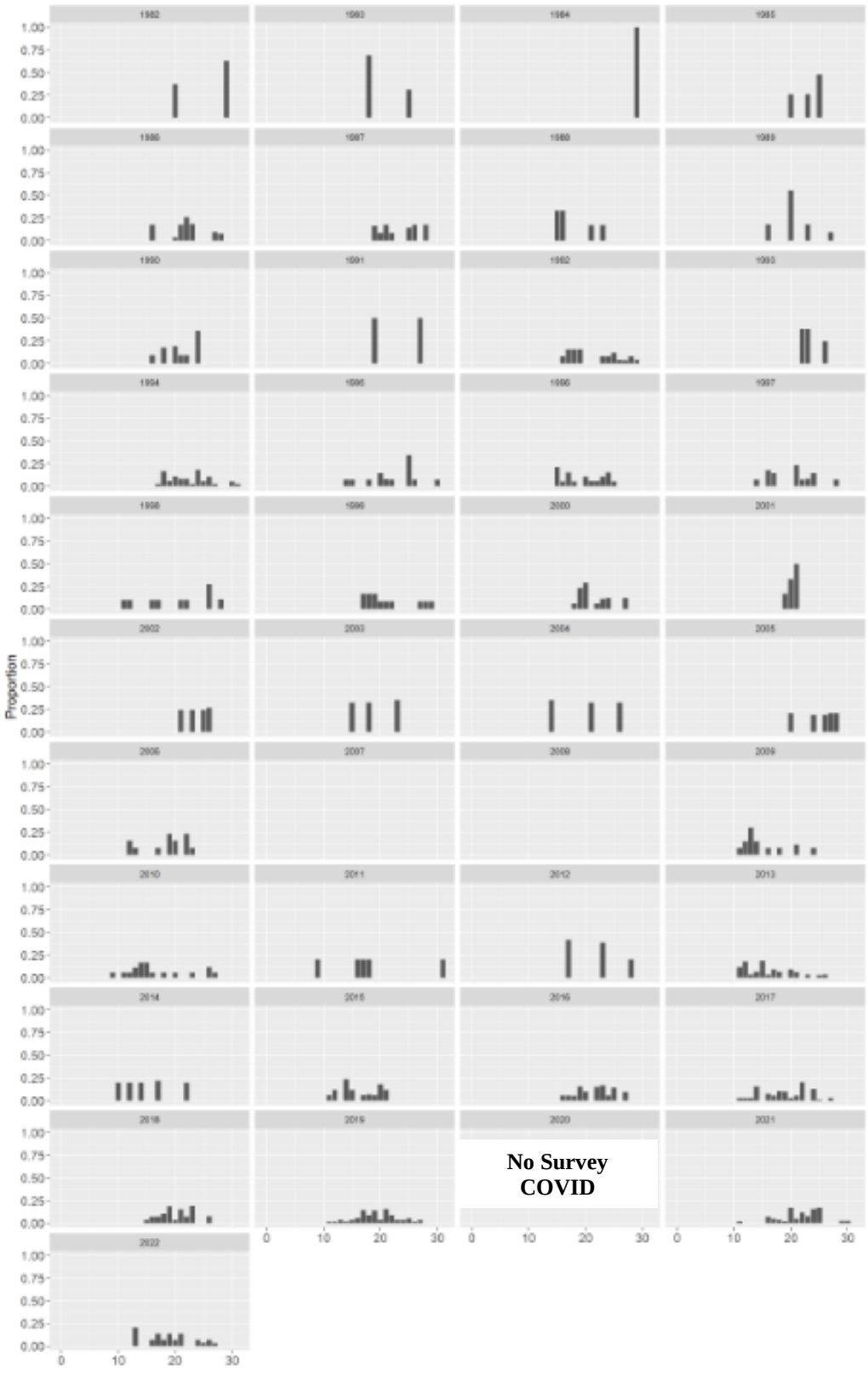


**Figure 6. Proportion of SNE female horseshoe crab by size (prosomal width) from the two shallowest strata (0–30' and 30–60' combined) of the DMF spring bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.**

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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.**

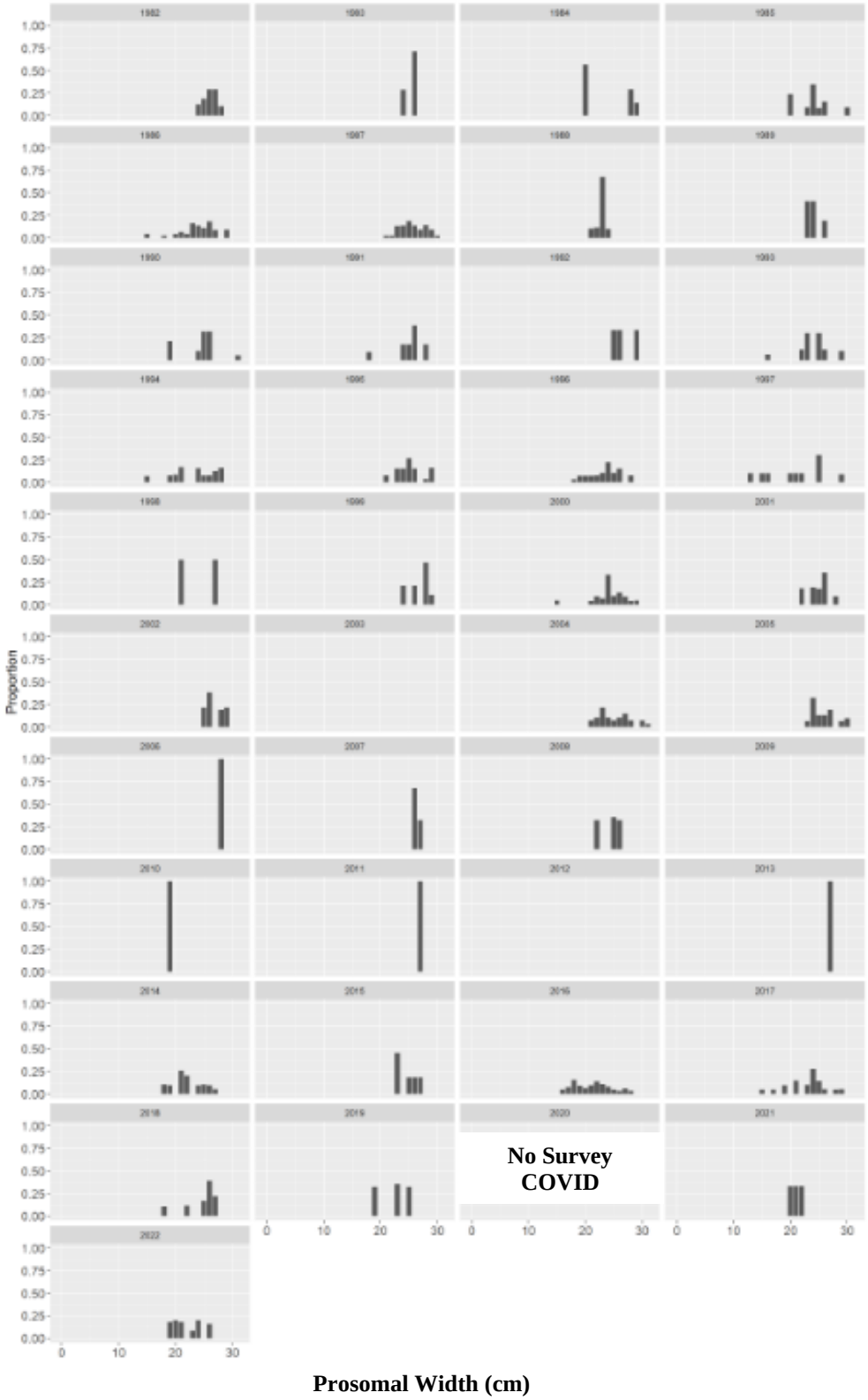


**Figure 8. SNE female horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF fall bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.**

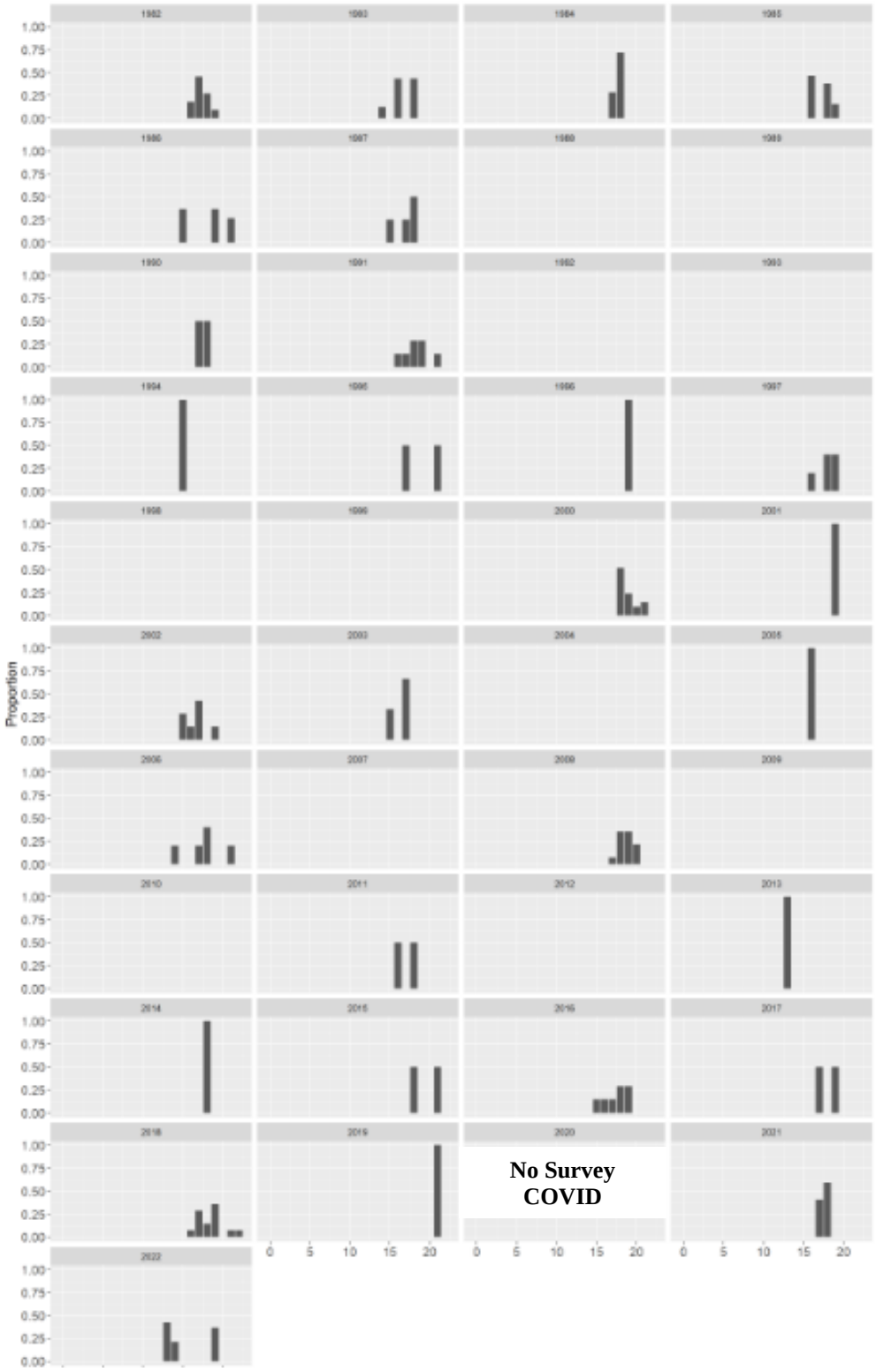


**Figure 9. SNE male horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF fall bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.**

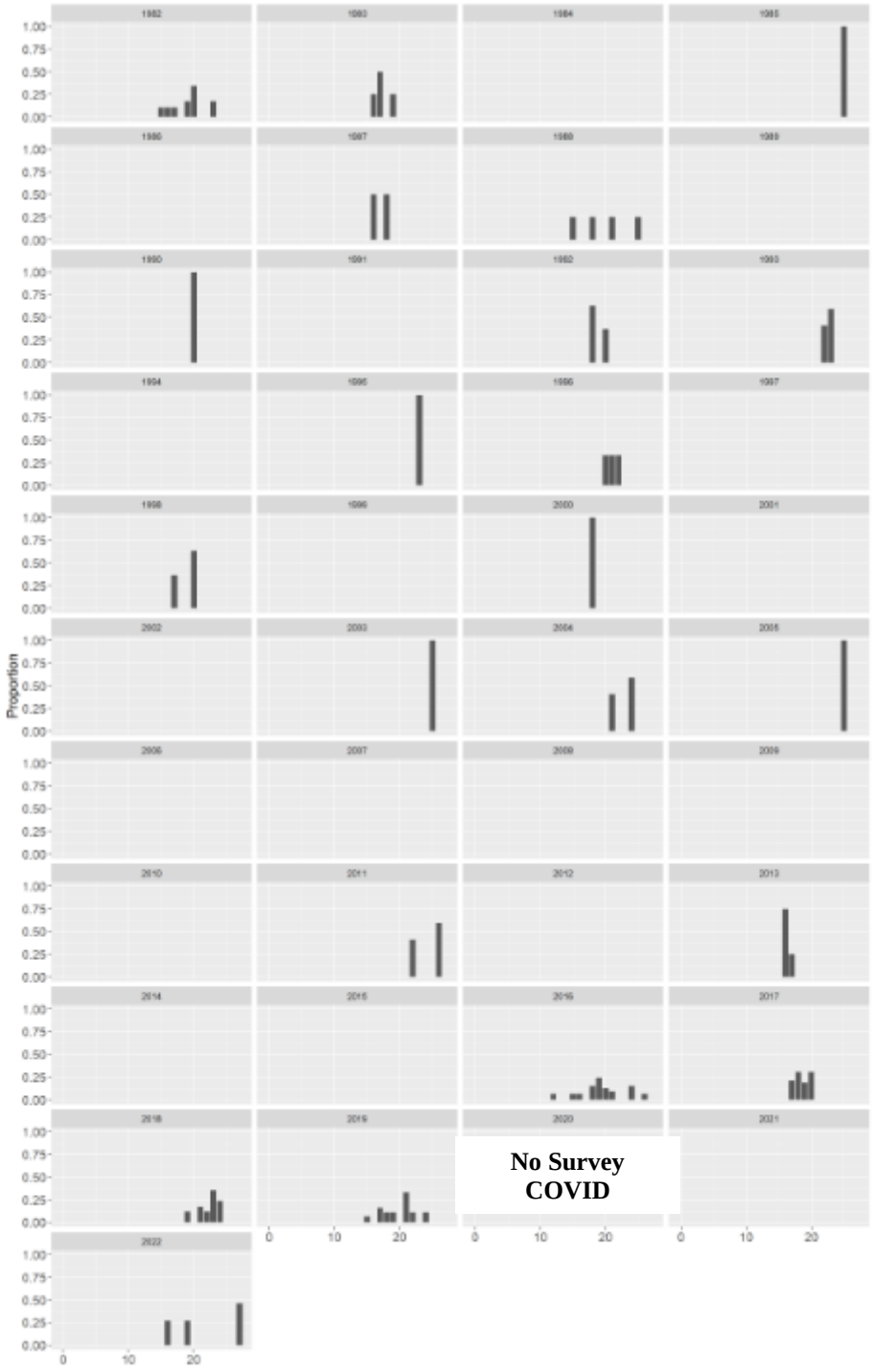


**Figure 10. GOM female horseshoe crab size distribution from the two shallowest strata (0–30’ and 30–60’ combined) of the DMF spring bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.**

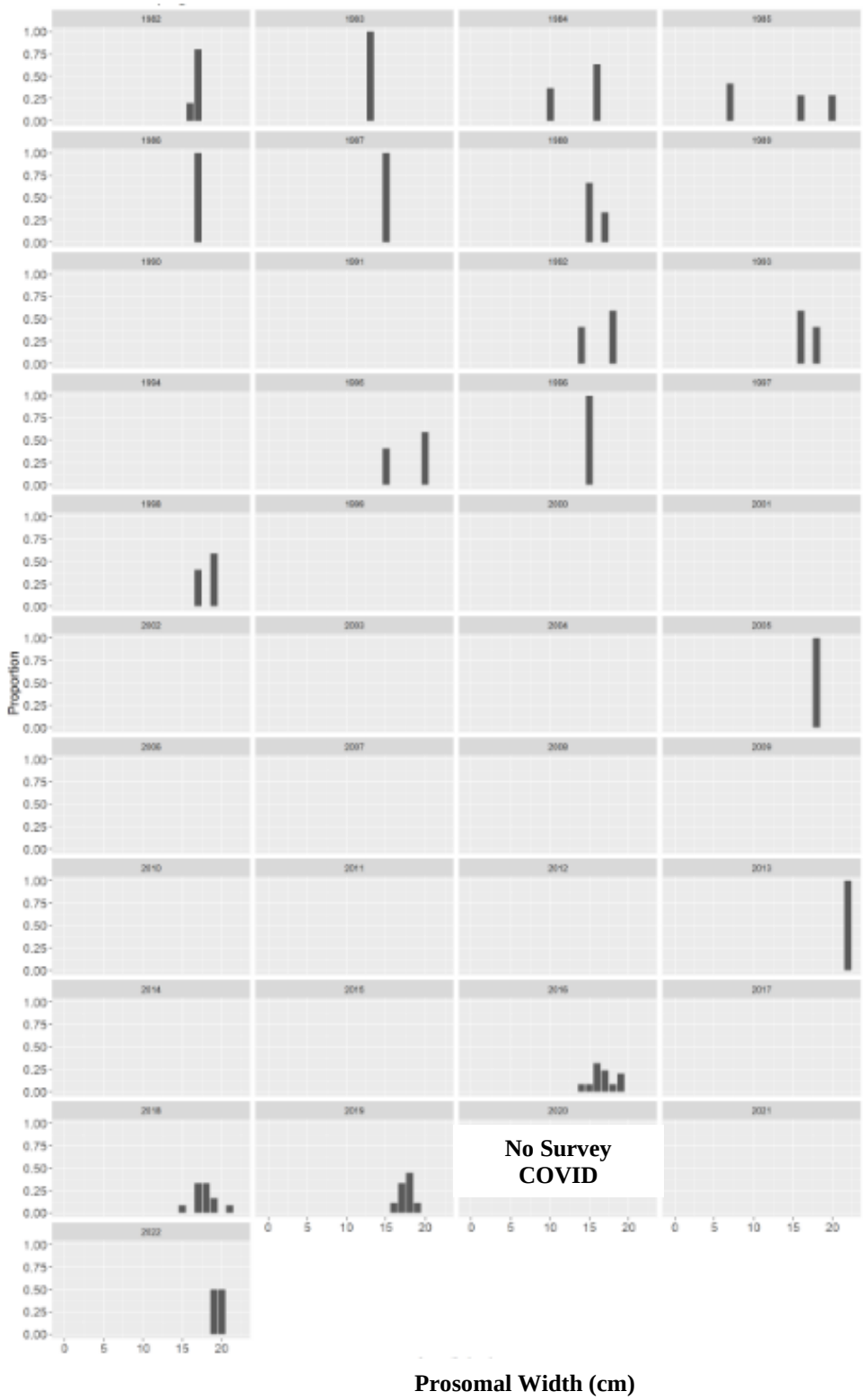


**Figure 11. GOM male horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF spring bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.**

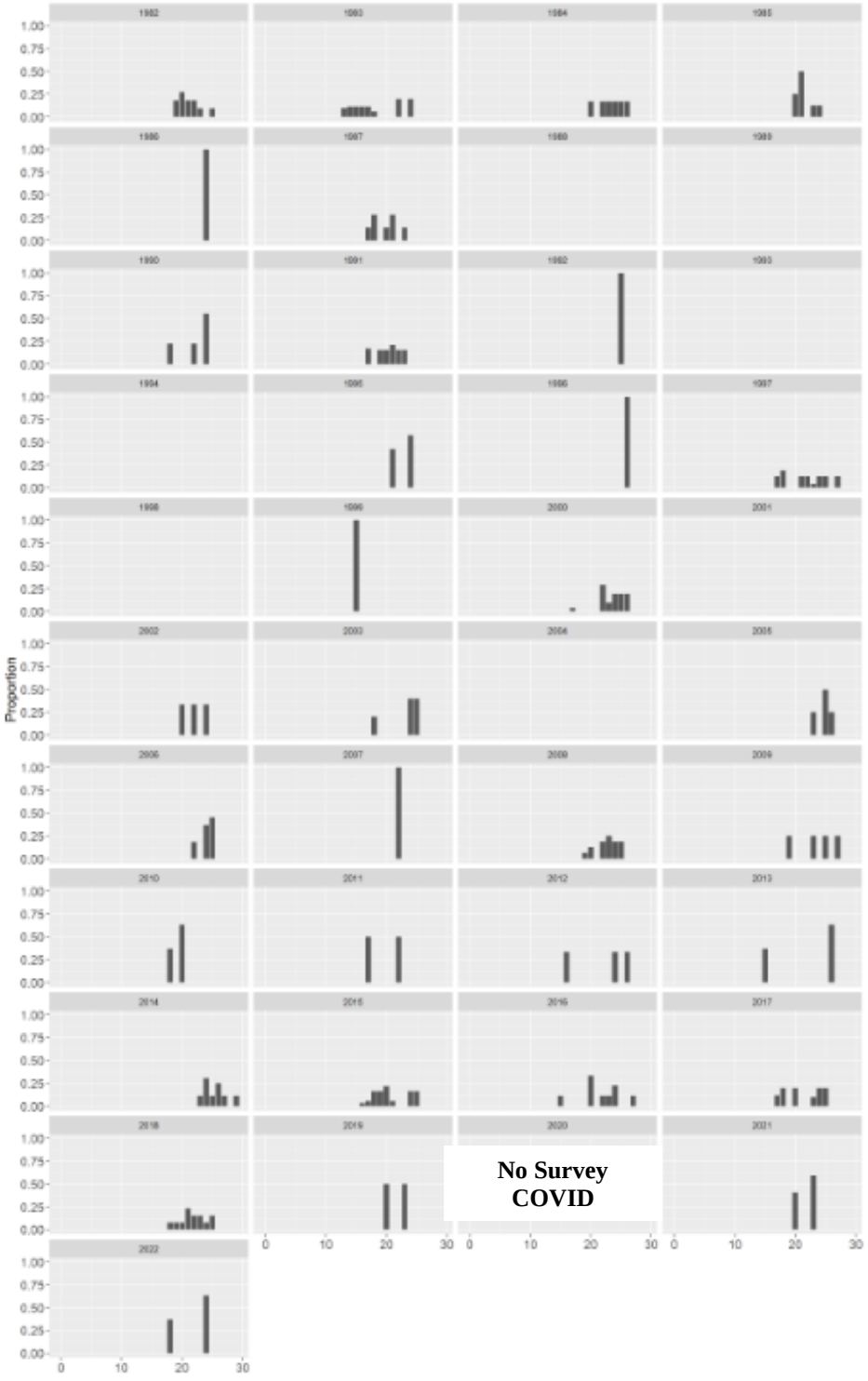


**Figure 12. GOM female horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF fall bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.**

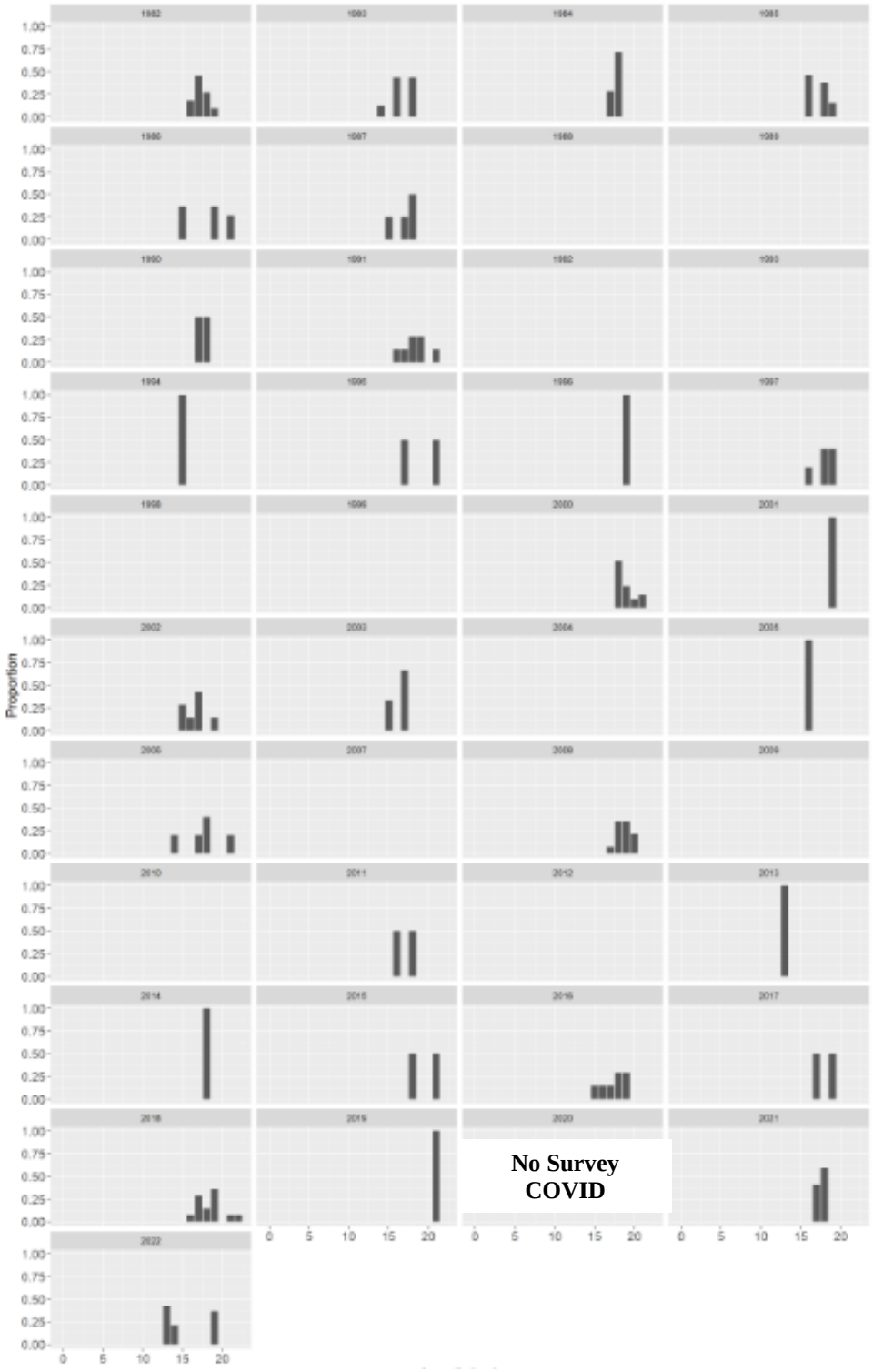


**Figure 13. GOM male horseshoe crab size distribution from the two shallowest strata (0–30' and 30–60' combined) of the DMF fall bottom trawl survey. The survey was not conducted in 2020 due to the Covid-19 pandemic.**

## IV. Planned management programs for the current calendar year (2023)

### a. Summary of changes from previous years

- The bait quota will be reduced from 165,000 to 140,000
- A biomedical quota will be implemented at 200,000 crabs, split evenly between the two biomedical firms
- Biomedical Best Management Practices that were formerly included as permit conditions will become regulations in 2023
- Full list of regulations can be found at https://www.mass.gov/doc/322-cmr-6-regulation-of-catches/download in section 6.34

### 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 bait and biomedical fisheries through market sampling and sea sampling and will expand sampling of the biomedical industry to include direct observations by DMF staff of biomedical holding conditions (pens and other holding systems) and release trips.
- 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 collaboration with various volunteer organizations.

## V. Law Enforcement reporting requirements

The Massachusetts Environmental Police did not report any horseshoe crab related violations in 2022. One hand harvester was given a written warning by the U.S. Fish and Wildlife Service for possessing horseshoe crabs on refuge property (Monomoy National Wildlife Refuge). The harvester was not observed harvesting on refuge property.