Massachusetts
Division of Marine Fisheries

Massachusetts 2008 Compliance Report to the Atlantic States Marine Fisheries Commission– Horseshoe Crab

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I. Introduction

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

On March 31, 2008 *MarineFisheries*, with the approval of the Marine Fisheries Advisory Commission, instituted new regulations for the harvest of bait crabs (Code of Massachusetts Regulations 322(CMR) 6.34). Provisions included:

- No new entry in to the fishery after March 28, 2008
- Reduction in annual quota from 330,377 to 165,000
- Reduction in daily limit from 1000 to 400
- Temporary closure of the fishery on July 7 to allow accounting of landings to determine catch levels (this was not necessary in 2008 because catch levels were significantly below the quota)

Reported bait harvest to date is 103,506 crabs. Only 5 fishermen harvested close to 400 crabs/day, 4 on only 1 or 2 occasions.

Spawning surveys were begun following the protocol of Delaware Bay surveys, except that larger quadrats (5 x 5 m) were used because of much smaller populations in MA. Twenty-four beaches in MA were surveyed by almost 200 volunteers. Surveys were coordinated among 13 agencies and institutions. Efforts were coordinated with RI and CT; NY joined the regional effort at the end of the season. It is anticipated that this will be an annual survey.

II. de minimis status – not applicable

III. Previous calendar year's fishery and management program

a. Activity and results of fishery dependent monitoring.

Massachusetts requires any person harvesting more than six crabs per day to have a regulated fishery permit and to report landings monthly. New monthly catch reports were developed to more closely fit forms for other fisheries that are entered in to an Oracle database. New reports must include the date of harvest, trip start time and duration, port, gear type, disposition, the gender of the crabs, harvest location, and harvest method. If the crabs are sold, the harvester must identify the dealer or person purchasing the crabs. All scientific and research institutes and the single biomedical company must file monthly catch reports listing the names of individuals they purchased crabs from, in-state and out-of-state, the number of crabs purchased and how the crabs were used. Bait dealers are required to file electronic reports weekly under the SAFIS (Standard Atlantic Fisheries Information System) system. The biomedical company, Associates of Cape Cod (ACC), must also report the number of crabs received dead or rejected and the number of dead crabs returned to the biomedical vendor. (The vendor is a fisherman who delivers crabs he, his brother, and one other fisherman harvested, all with biomedical permits, to ACC). The biomedical vendor must report monthly the number of dead crabs from the time of harvest to the time the crabs were returned to the water.

In 2008, Massachusetts issued 279 horseshoe crabs bait and 21 horseshoe crabs biomedical harvest permits. With most reporting complete at this time, 94 bait permit holders reported harvesting 103,963 horseshoe crabs (Fig. 1). Breakdown by sex was as follows:

Bait:
Female: 53,764 (52%)
Male: 48,046 (46%)
Unclassified 2,153 (2%) unclassified.

Biomedical:
Female: 64%
Male: 34%
Unclassified: 1.5% (numbers cannot be provided due to confidentiality)

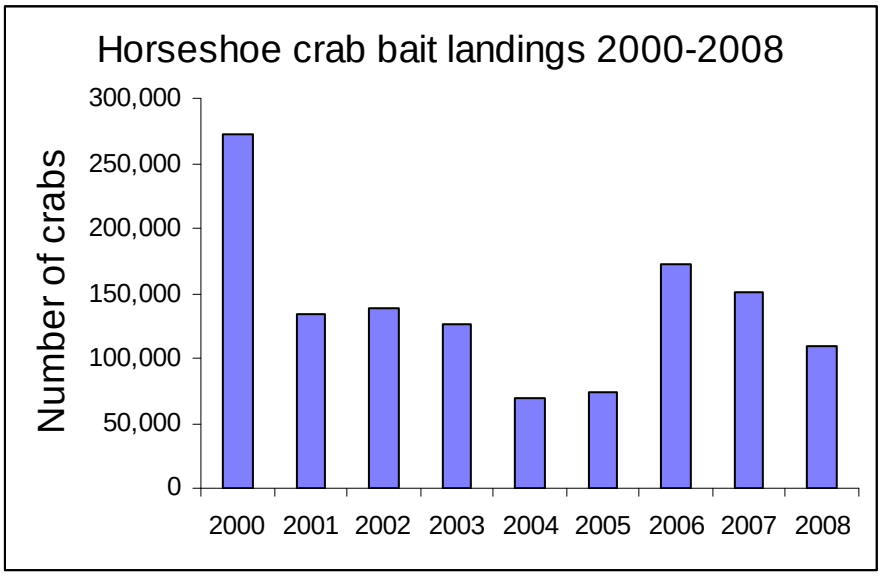


Fig. 1. Massachusetts Horseshoe Crab Landings 2000-2008 (2008 is year-to-date)

Approximately 76% (79,443) of the crabs were reportedly taken off spawning beaches by hand or rake harvest while draggers and dredge boats landed approximately 20% (20,765). Four percent (3,755) of the crabs were reported with UNKNOWN gear type. The following reporting discrepancies exist to date and are being investigated:

Total sold from Dealer Reporting: 137,036 crabs
Total sold from Fisher Reporting: 151,231 crabs
Discrepancy: 14,195 more reported by fishermen

The breakdown by disposition is as follows:

Bait Not Sold from Fisher Reporting (personal use): 15,199
Total crabs used for bait: 103,963

Bait Sold from Fisher Reporting: 88,764
Bait from Dealer Reporting: 80,708
Unknown disposition from Dealer Reporting: 3,297

Scientific and research facilities reported purchasing under 1000 male horseshoe crabs from fishermen. None of these crabs were returned to water.

Because the three biomedical permit holders who collected crabs in 2008 were working for the Commonwealth's single biomedical dealer, their harvest numbers cannot be released. Massachusetts General Laws, Chapter 130, section 21 protects the confidentiality of any person or business who submits such statistics.

MarineFisheries surveyed beaches along the Commonwealth's 1800 mile coastline to identify horseshoe crab spawning and nursery habitat, but effort was limited because of spawning surveys. All crab harvesters are required to identify beaches and embayments on the monthly catch reports. In 2009, a number of shorebird biologists will assist in the effort to identify spawning beaches by reporting presence/absence of spawning horseshoe crabs during their regular beach surveys for shorebirds. As in the past, catch reports showed that harvest was limited to the beaches on Cape Cod, Buzzards Bay, Mount Hope Bay and Martha's Vineyard. With the exception of 363 crabs landed in Duxbury Bay, no crabs were reported harvested north of the Cape Cod Canal to the Massachusetts/New Hampshire state line.

MarineFisheries continues to characterize the commercial harvest of the crabs. Horseshoe crabs at local dealers were sampled to collect information on sex composition and prosomal width. Results are detailed in Section V.

b. Activity and results of fishery independent monitoring.

Resource Assessment Project

The *MarineFisheries*' Resource Assessment Project has conducted seasonal spring (May) and fall (September) coastal bottom trawl surveys of state waters since 1978. Approximately 100 tows are made in five bio-geographic areas, each survey using a stratified random sampling design, with 22 total strata. Because of the net's design, a ¾ size two seam 39' x 51' otter trawl with 3 ½" cookies on a chain sweep, relatively few horseshoe crabs are caught during these surveys. However, as a result of the long timeline the data are useful in showing trends over time (Figs. 2 & 3).

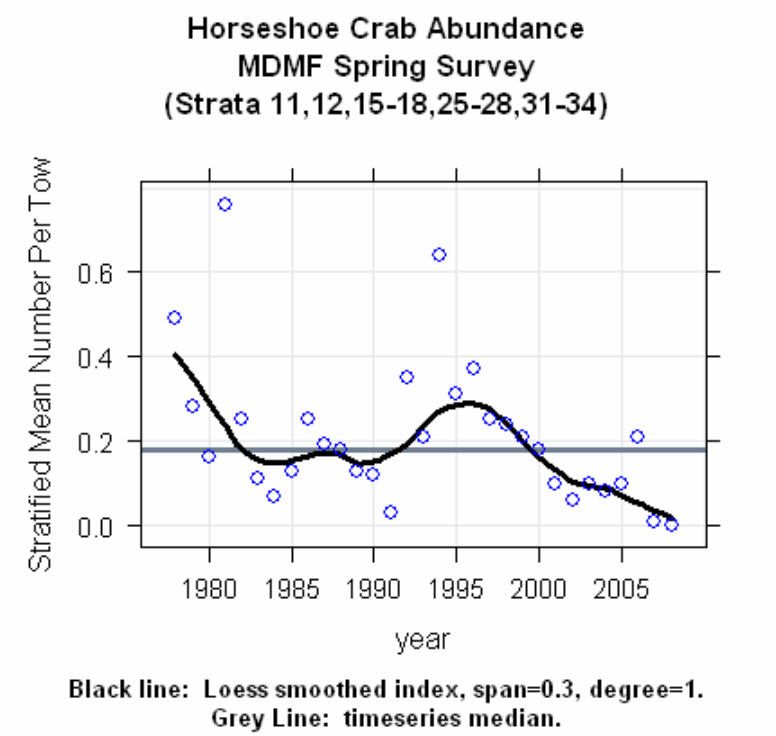


Fig. 2. Results of the Massachusetts' Resource Assessment spring bottom trawl surveys for Massachusetts, 1978-2008. Strata where no crabs were ever caught are eliminated from the dataset.

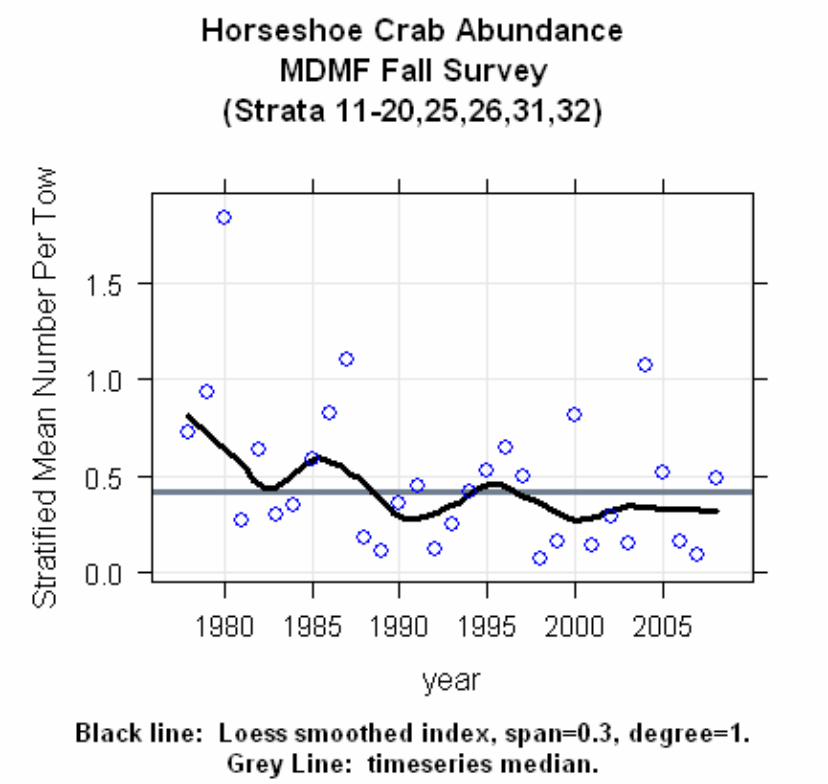


Fig. 3. Results of the Massachusetts' Resource Assessment fall bottom trawl surveys Massachusetts 1978-2008. Strata where no crabs were ever caught are eliminated from the dataset.

Note that the survey vessel does not generally enter water <20', so estuaries, intertidal areas, and shallow coastal waters are not surveyed. Nevertheless, Loess smoothed index of stratified mean number crabs per tow for both spring and fall surveys shows a trend of decreasing abundance over time. Seven of the last eight years were below the time-series median in spring, and 5 of the 8 in fall. The spring results are of particular concern because the last two years approach, and then equal, zero – i.e. no crabs were captured in 2008 spring trawls, the first time in the entire time series that happened. In the fall survey, the uptick in mean from 2007 to 2008 was driven by one stratum with high numbers in Cape Cod Bay. Only 3 other strata had any crabs, the rest had zero.

Plots of crab distribution from the trawl surveys showed relatively large concentrations in shallow water (<30') off the largest spawning beaches in the spring and fall, as well as in Nantucket Sound (Fig. 4).

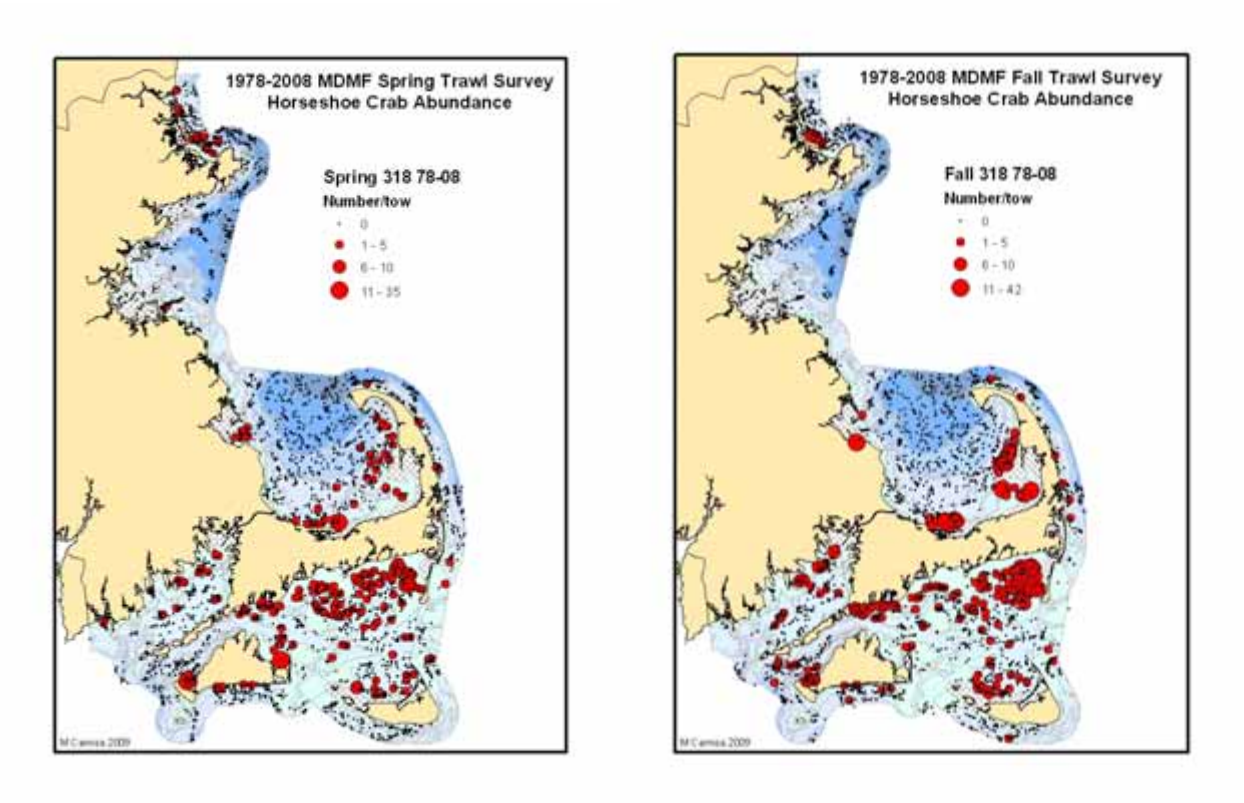


Fig. 4. Horseshoe Crab Capture Locations, *MarineFisheries* Trawl Survey, 1978-2008.

It may be useful to look at the first 5 years vs. the last 5 years of the survey to see where changes in catch rates have occurred. Between the two time periods, fall surveys show disappearance of catches (or only 1 trawl with low catch) north of Cape Cod, in Buzzards Bay, and around Martha's Vineyard. Nantucket Sound catches are down significantly and are now much more

concentrated around Monomoy Island (Fig. 5). Since there is virtually no harvest north of Cape Cod, overharvest is not a likely explanation for reduction in numbers in that region.

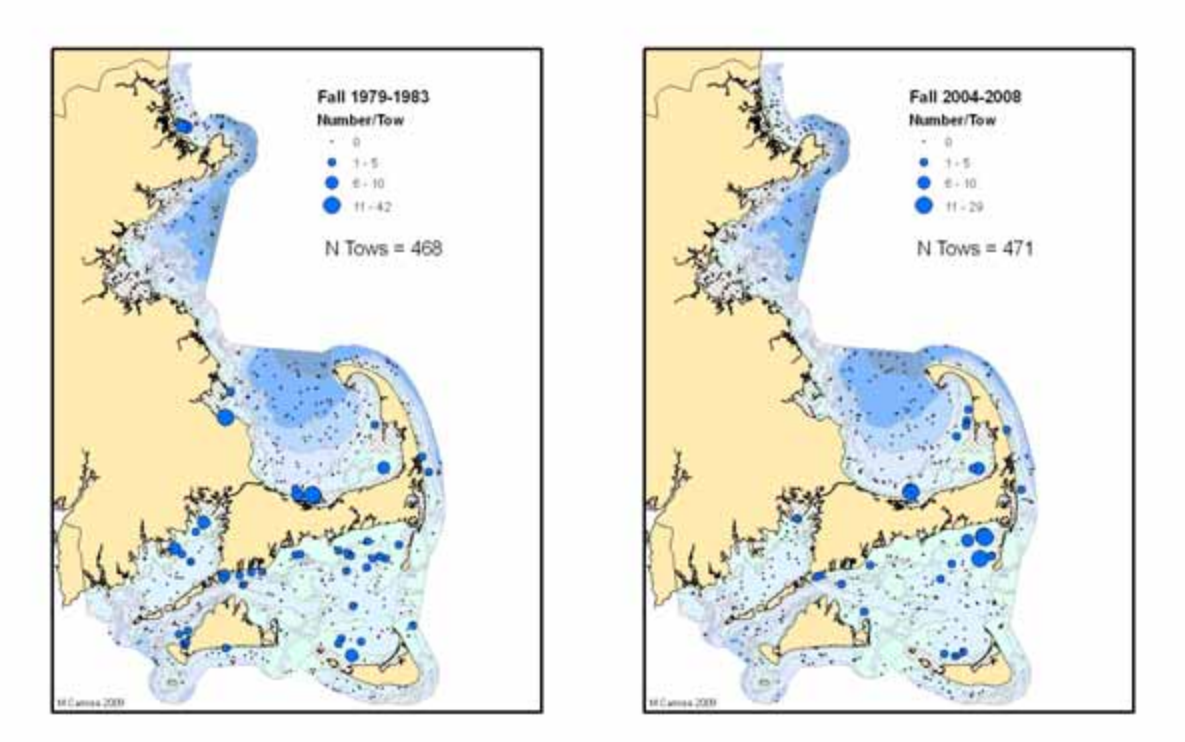


Fig. 5. Mean number of horseshoe crabs per tow over the first five years (1979-1983) of the fall survey and the last five years (2004-2008). 1978 data were not included to keep time periods within each group equal.

Spring surveys showed a similar but even more dramatic trend than the fall north of Cape Cod, in Buzzards Bay and around Martha's Vineyard (Fig. 6). Cape Cod Bay saw more of a decrease than in the recent fall surveys, and no crabs were caught on the outside (east side) of the Cape. Note that the 2004-2008 map includes the all-zero 2008 data. Spring surveys may be affected by crab movement into estuaries to spawn. Variation in water temperature and survey dates within May from year to year may influence catches. In the fall, temperatures are relatively stable, and crabs would have finished spawning and moved out of the estuaries if they were going to do so, so conditions are likely more stable than in the spring.

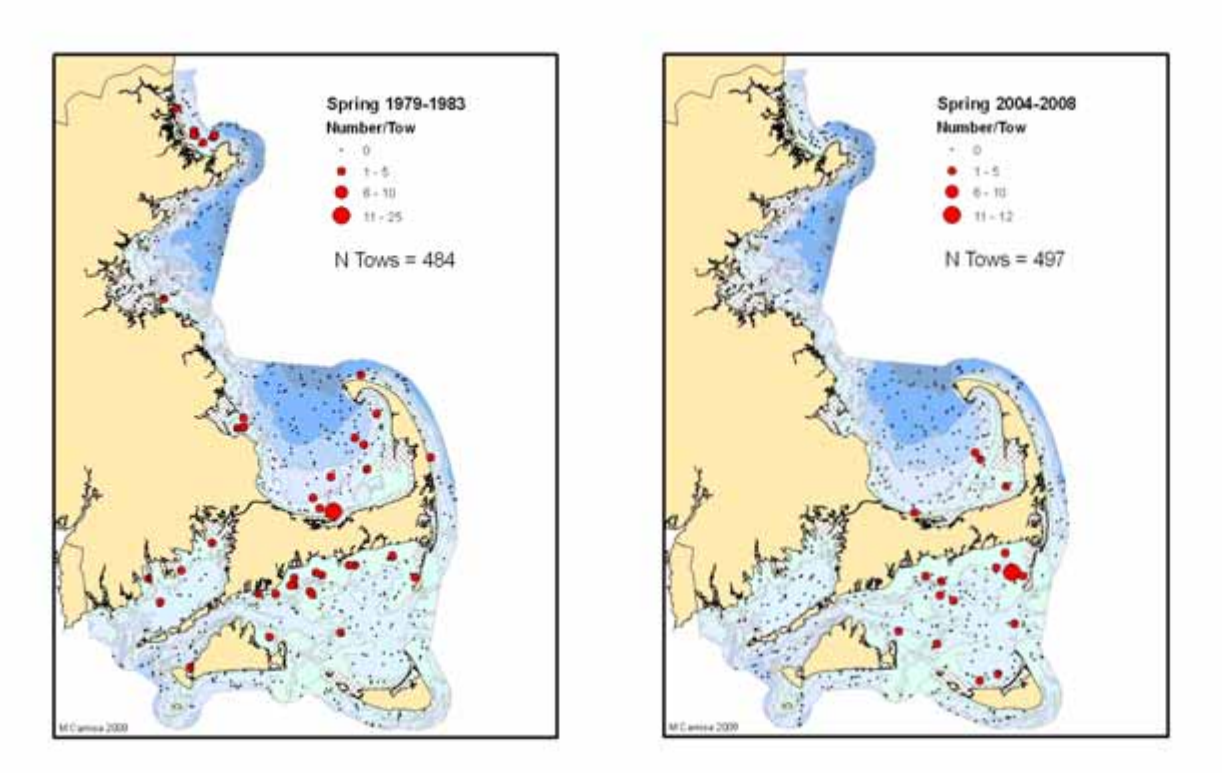


Fig. 6. Mean number of horseshoe crabs per tow over the first five years (1979-1983) and the last five years (2004-2008) of the spring survey. 1978 data were not included to keep time periods within each group equal.

Spawning surveys

Spawning indices (number of females per 25 m^2) were low in all areas (Fig. 7) compared to catch landings and anecdotal reports.

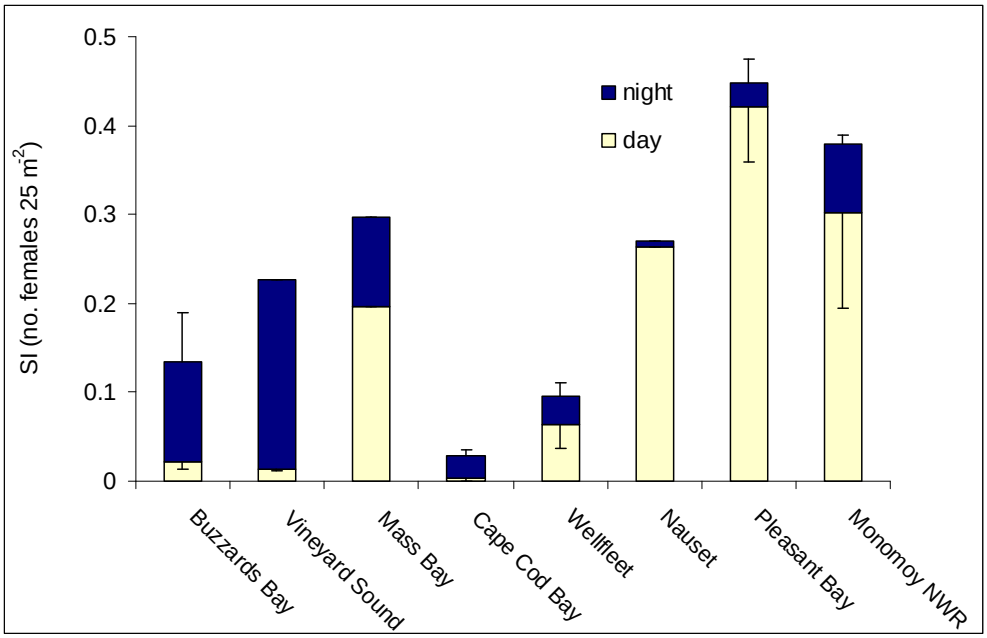


Fig. 7. Spawning index (number females per 25 m^2 quadrat) in MA areas. Data are combined from all beaches in each area, averaged across all moons. Upward facing error bars are SE for night; downward facing bars are SE for day. SEs cannot be calculated where only one beach in an area was surveyed in any given year.

Forty-eight percent of all surveys recorded no female crabs. Only 12% of surveys had more than 10 females. We have historical data from several areas from 2000-2002 (James-Pirri et al. 2005 and unpublished 2008 data) (Fig. 8). All areas except Nauset Estuary (NE) and Pleasant Bay (PB) show downward trends, although the differences are not statistically significant. The large drop at Monomoy may be due to significant physical restructuring of the area due to currents and sand movement, so that former spawning areas are no longer suitable.

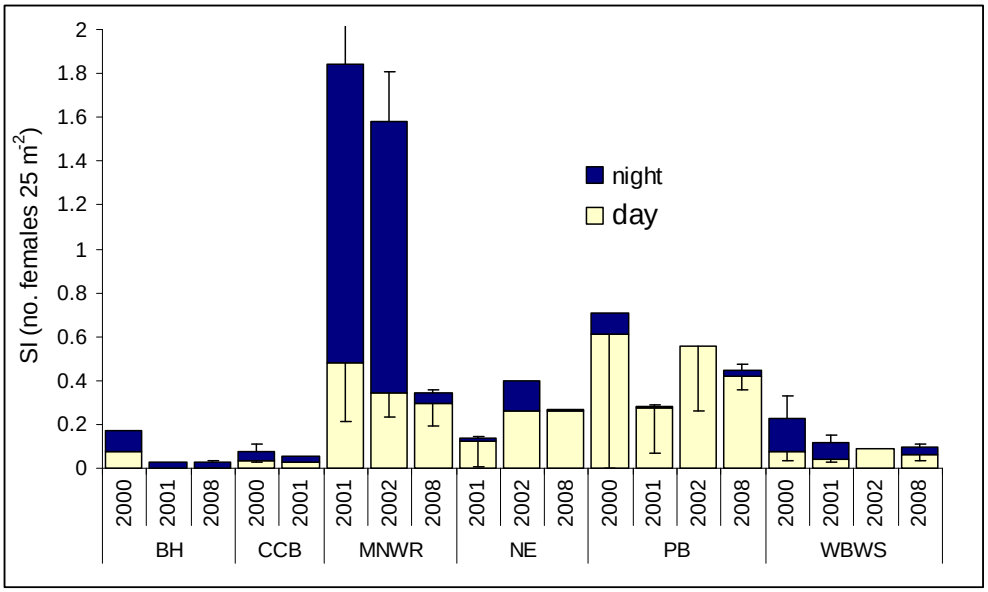


Fig. 8. 2008 and historical spawning indices in MA estuaries where data are available. **Night and day indices denoted by color. SE bars going upward are for night indices, error bars going downward are for day indices. SE cannot be calculated where only one beach was surveyed in an area in a given year. Note scale differs from Fig. 8.**

Sex ratios in Pleasant Bay are becoming increasingly male-skewed, while ratios in other Cape Cod estuaries remain unchanged (James-Pirri et al. 2005 and unpublished 2008 data) (Table 1).

Table 1. Sex ratios in Cape Cod estuaries from 1950s to 2008.

	Historic sex ratios (F:M)		
Site	**Historic (1950s)***	**2000-2002****	**2008*****
Cape Cod Bay	**1:2.4**	**1:2.9**	**1:1.7**
Nauset	**NA**	**1:1.6**	**1:1.3**
Monomoy NWR	**NA**	**1:1.9**	**1:2.2**
Pleasant Bay	***1:2.5***	***1:5.8***	***1:9.5***

*Shuster 1979

** James Pirri et al. 2005

*** James-Pirri, unpublished data

Pleasant Bay has been harvested for biomedical purposes for 30 years. These sex ratios raise concerns about whether bleeding may be having a sub-lethal effect on spawning behavior of females. More study is needed.

c. Regulations in effect for 2008.

The Code of Massachusetts Regulations 322(CMR) 6.34 Horseshoe Crab Management

(1) Permit. It shall be unlawful for any person to take, land or possess more than six horseshoe crabs (*Limulus polyphemus*) per day for any purpose without a regulated fishery permit for horseshoe crabs issued by the Director. Licensed pot fishermen using

horseshoe crabs as bait may possess more than six horseshoe crabs without a regulated permit, provided their documented source is a wholesale or bait dealer.

(a) Moratorium. As of March 28, 2008, the Director may not issue any new regulated fishery permit endorsements for horseshoe crabs. Failure to renew the horseshoe crab regulated fishery endorsement in any calendar year shall result in permit forfeiture to the Division.

(2) Reporting. Each holder of a regulated fishery permit for horseshoe crabs or a scientific collecting permit shall file a monthly catch report on forms supplied by the Division. Failure to report by the fifth day of each successive month shall be grounds for suspension or non-renewal of the permit.

(3) Dealers. Wholesale Dealers and Bait Dealers who purchase horseshoe crabs from licensed fishermen shall register with the Division and record purchases on forms supplied by the Division. Failure to report purchases shall be grounds for administrative action.

(4) Minimum Size. (reserved)

(5) Quotas. The annual Horseshoe Crab Quota shall be 165,000 crabs.

(6) Notice. When 100% of the annual quota is reached, a notice of fishery closure shall be filed with the Massachusetts Register and made available to all horseshoe crab regulated fishery permit holders.

(7) Daily Limit.

(a) Bait crab harvesters It shall be unlawful for any horseshoe crab harvester permitted to take crabs for bait purposes to take, land or possess more than 400 horseshoe crabs during any 24 hour period beginning at 12:00 P.M (noon).

(b) Biomedical crab harvesters It shall be unlawful for any horseshoe crab harvester permitted to take crabs for biomedical purposes to take, land or possess more than 1,000 horseshoe crabs during any 24 hour period beginning at 12:00 P.M (noon).

(c) The possession limit shall be vessel limits and shall apply regardless of the number of persons or permit holders aboard a vessel or working in conjunction with a vessel. It shall be unlawful for any person to harvest more than the possession limit in a day regardless of the number of permits held.

(d) The limit shall not apply to lawfully harvested horseshoe crabs held in frozen or cold storage by licensed conch or eel fishermen or bait dealers.

(8) Closed Days. No horseshoe crabs may be taken for any purpose at any time on Saturday or Sunday.

(9) Summer Closed Period. It shall be unlawful for any horseshoe crab harvester permitted to take crabs for bait purposes to take, land or possess horseshoe crabs after June 30. The Director may re-open the fishery after sufficiently compiling catch records to estimate the proportion of the annual quota taken. Upon re-opening the Director may adjust the daily limit.

(10~~9~~) Closed Areas. The Director may close any area to the taking of horseshoe crabs provided:

(a) A majority of the members of the Massachusetts Marine Fisheries Commission approve, and;
(b) A notice of closure has been filed with the Massachusetts Register stating the rationale for the closure, the duration of the closure and a description of the area to be closed, and;
(c) All permit holders and dealers are notified.

(11~~10~~) Biomedical/Research.

(a) Harvesters collecting horseshoe crabs exclusively for use by the biomedical industry for the manufacture of limulus lysate or sale to a permitted scientific institution for research purposes must obtain a special permit limited to that purpose.
(b) The holder of the biomedical special permit shall not be allowed to obtain a permit for bait harvest. Biomedical permit holders must sell horseshoe crabs directly to the biomedical company or to a biomedical crab dealer. It shall be unlawful for biomedical permit holders to sell horseshoe crabs to bait dealers including those bait dealers that supply horseshoe crabs to the biomedical company.
(c) Horseshoe crabs harvested for biomedical or research purposes by harvesters licensed under 322 CMR 6.34 (11)(a) which are bled and released alive in the area of capture or used for display or research shall not be counted against the annual quota established by the Atlantic States Marine Fisheries Commission, but must be reported to the Division by the harvester and the company or institution.
(d) If a biomedical company or permitted scientific institution chooses to purchase horseshoe crabs from persons licensed to harvest horseshoe crabs for bait, or from bait dealers, the company or institution shall keep records sufficient to show the number and source(s) of said horseshoe crabs, including the harvester or dealer and harvest area. Horseshoe crabs purchased from bait harvesters or bait dealers must be reported to the Division of Marine Fisheries by the harvesters or dealers and counted against the annual quota if harvested in Massachusetts.
(e) Horseshoe crabs purchased by a biomedical company from bait harvesters or bait dealers may be returned to the harvesters for use or sale as bait, or returned or sold to a bait dealer, at the discretion of the biomedical company.
(f) Horseshoe crabs which are imported from other states for biomedical purposes shall be counted against the quota of the producing state or returned to the producing state for release, according to established rules and regulations of the state of origin.

(12) Fishery Limit Adjustments.

(a) The Director may, by declaration, adjust the manner and times of taking horseshoe crabs, and the legal size limits, numbers and/or quantities of horseshoe crabs to be taken as prescribed by M.G.L. c. 130, § 17A and specified by the Atlantic States Marine Fisheries Commission (ASMFC).

(b) Declaration Process

1. a two-week comment period has been conducted by the Division;

2. it has been approved by a majority of the members of the Massachusetts Marine Fisheries Advisory Commission;

3. a notice has been filed with the Massachusetts Register;

4. a notice has been published by at least one local newspaper; and

5. a copy of the notice has been emailed via the Marine Fisheries Listserv and posted on the Division's website.

Closed areas

In addition to the above regulations, Monomoy National Wildlife Refuge (federal closure) and the National Season (NPS - federal) remain closed to all HSC harvest, and Pleasant Bay (state closure) remains closed to bait fishing only (Fig. 9).

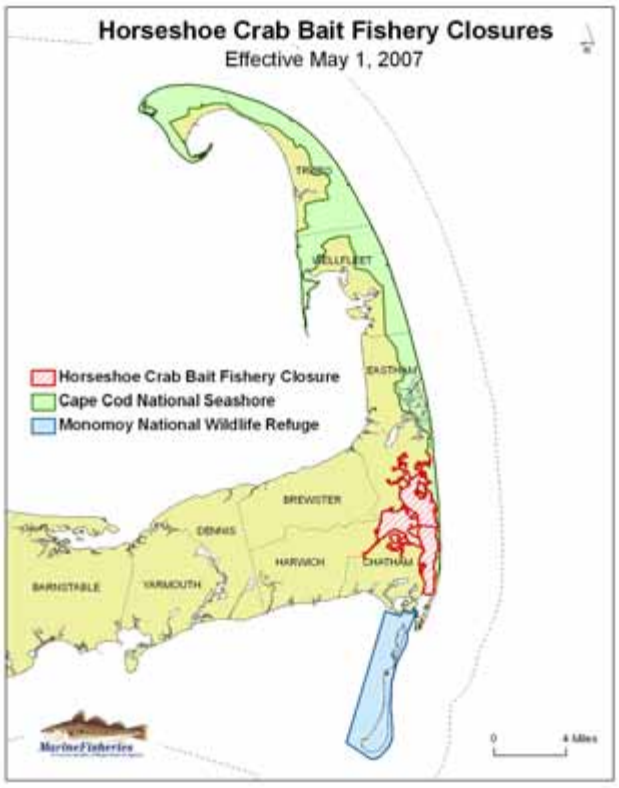


Fig. 9. Areas closed to bait and/or biomedical harvest.

d. 2008 Horseshoe Crab Harvest Reported by Fishermen (as of 1/31/09)

2008 PERMITS	
Bait Permits Issued	279
Fished	94
Did Not Fish	169
Did Not Report	16
Biomedical Permits Issued	21
Fished	8
Did Not Fish	13
Did Not Report	0

2008 HORSESHOE CRAB BAIT HARVEST	**103,963**

e. Review of progress in implementing habitat recommendations.

In an effort to conserve and maintain spawning and nursery habitat, *MarineFisheries* annually sends a letter to the Department of Environmental Protection, Coastal Zone Management and the Department of Environmental Management reminding them of the importance of protecting crab habitat.

The *MarineFisheries*' Environmental Review Project recommends on state and federal coastal alteration permits to protect horseshoe crab spawning and nursery areas. Recommendations are made to limit certain activities during the crab's May – July spawning season. Known spawning beaches have been entered into a GIS database to facilitate Environmental Review. This database will be updated annually.

IV. Planned management programs for 2008

a. Summarize regulations that will be in effect (copy of current regulations if different from III c).

The 2008 regulations are the same as those found in Section III (C). We are currently meeting with stakeholder groups - ACC (the biomedical company), conch fishermen, bait dealers, and HSC harvesters - to maximize efficiency of crab use and possibly reduce harvest of spawners. New regulations may result from this process.

b. Summarize monitoring program that will be performed.

We plan to continue spawning surveys and expand them into new areas (Martha's Vineyard, Nantucket, etc.). In addition *MarineFisheries* plans to carry out development of gear and methods for population surveys to the extent possible given current staffing and financial constraints. It is felt that future effective fisheries management of this species in Massachusetts will depend on more comprehensive data on local populations than is currently available.

We began some tagging in Pleasant Bay in 2008, in conjunction with the National Park Service and USFWS coast-wide tagging program. We plan to continue and coordinate tagging between NPS, Mass Audubon, Waquoit Bay NERR, and possibly other groups. Management strategies may be different depending on scale and patterns of movement of crabs. We hope that recapture results will begin to elucidate how localized populations of horseshoe crabs are in this region.

The closing of Pleasant Bay has increased pressure on other estuaries in Massachusetts, raising concern about sustainability of harvest levels in those areas. Results of spawning surveys showed low spawning indices in all areas. To address these concerns, in addition to population assessment plans discussed above, we will be examining management strategies such as minimum/maximum size limit, delayed harvest or more closed days to allow some spawning to occur, male-only harvest, and further closures.

MarineFisheries will continue collecting catch reports from all crab harvesters, dealers, and scientific permit holders. The biomedical company will submit monthly reports and an annual questionnaire. *MarineFisheries* will also continue to identify horseshoe crab spawning and nursery habitat and to characterize the commercial fishery. 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 working on methods to reduce the number of crabs needed by the fishermen by encouraging the use of bait bags and bait cups as well as alternative baits. If alternative bait companies can prepare product before the next harvest season, *MarineFisheries* is prepared to test these products against horseshoe crabs as bait in the field.

c. Highlight changes from previous year.

The primary changes from last year were new regulations described above, and implementation of Delaware Bay-style spawning surveys conducted on 24 beaches from Cape Cod south to the RI border, as well as one site in Duxbury. We plan to continue these surveys on an annual basis as long as staffing allows.

V. Monitoring Program Requirements – Including Addendums I-III

Component A_1: Addendum III requires monthly reporting of all harvest of horseshoe crabs (bait fisheries, biomedical, industry, by-catch, educational and scientific research) by number landed, by sex and harvest method. Continue characterization of the commercial catch based on prosomal width by sex. States will be required to characterize a portion of the commercial catch based on maturity once an appropriate technique is developed and approved by the Technical Committee.

Massachusetts' existing regulations comply with Addendum III of the FMP. The Code of Massachusetts Regulations 322(CMR) 6.34 requires any person harvesting, taking or landing more than six horseshoe crabs per day for any purpose to have a regulated fishery permit from the Director of the Division of Marine Fisheries. Permit holders are required to report monthly the number of crabs harvested daily by gender, the beach or embayment of harvest, type of gear used and the intended use of the harvested crabs. If the crabs are sold, as a directed fishery or as by-catch, the fisherman must identify the dealer or individual buying the crabs. Failure to report shall be ground for suspension of the permit and non-renewal.

Wholesale or bait dealers purchasing horseshoe crabs from licensed fishermen are now required to submit weekly electronic SAFIS reports. Biomedical, research and educational research facilities must report the name of the harvester, number of crabs and the use of horseshoe crabs monthly.

Commercial horseshoe crab landings were sub-sampled during the hand harvest season by *MarineFisheries* biologists at bait dealer facilities. Approximately 745 horseshoe crabs (379 female & 367 male crabs) were identified by sex and measured to determine prosomal width. Mean prosomal width for female crabs was 25.02 cm and 19.81 cm for male crabs (Fig. 10). Box plots of PW from 2000-2008 show that mean PW of surveyed crabs has not changed over time (Attachment 1). Ratio of F:M was 1.03:1.

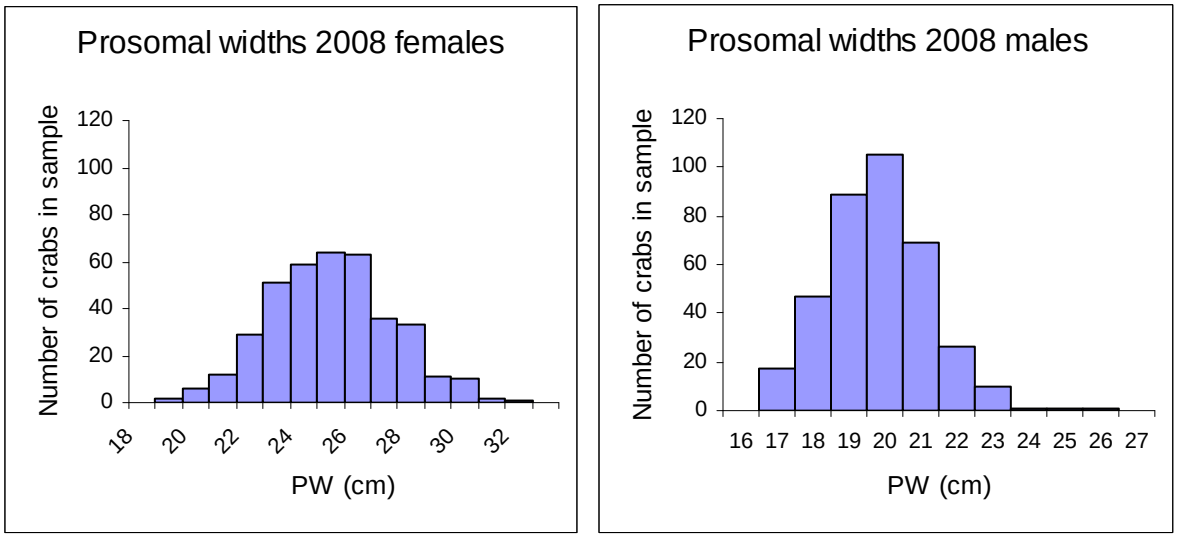


Fig. 10. Prosomal widths (cm) for female and male horseshoe crabs sampled during market surveys.

Component A_2: To comply with Addendum III, states where horseshoe crabs are captured for biomedical use must monitor and report monthly and annual harvest of horseshoe crabs by biomedical facilities. All states must identify percent mortality from the point of harvest to release. States are required to use the HSC TC biomedical survey or some other means to obtain the required information.

The Massachusetts biomedical company, Associates of Cape Cod (ACC) obtains crabs from a single biomedical dealer, three licensed bait dealers, and one fisherman. Massachusetts regulations allow the biomedical company to purchase bait crabs for bleeding. Once bled, the crabs are returned to the bait dealers for sale as bait or to the biomedical dealer to be released at the site of capture. As a large percentage of the crabs used by the biomedical company came from the bait dealers, the number of crabs harvested by biomedical permit holders is reduced. This significantly reduces the total number of crabs harvested in the Commonwealth.

In an effort to comply with Addendum III, the biomedical company is required to file monthly reports noting the number of crabs received from each dealer, the number of dead or rejected crabs and the number of dead crabs returned to the dealers.

Dealers selling crabs to the biomedical company must submit the ASMFC biomedical questionnaire annually detailing the year's activities. Review of the questionnaires showed biomedical harvest was limited to three fishermen with biomedical permits harvesting crabs May – October in one bay, and new biomedical fisherman harvesting in a different bay. The biomedical company reported the rejection rate of approximately 5.3% for both the biomedical and bait dealers. Crabs from the biomedical dealer rejected by the biomedical company because

of injury, size, etc. were returned to the water near the harvest site. Crabs rejected from the bait dealers were sold as bait.

State law does not allow *MarineFisheries* to release the biomedical harvest numbers by the dealer. Therefore, the completed questionnaires are not attached to this report and have been sent separately to the Biomedical Subcommittee.

Component A_3: States must identify spawning and nursery habitat. States that have completed this work must report changes in spawning and nursery habitat over time. States must actively intervene to the extent of their authority to ensure that spawning and nursery habitat is conserved and the quality and productivity is maintained.

A survey of horseshoe crab spawning and nursery habitat along the Commonwealth's 1,800 miles of coastline was completed in 2004. This will be updated in the coming years as staffing allows. All crab harvesters are required to identify beaches and embayments on the monthly catch reports. Normally beaches identified as harvest sites during the spawning season are investigated to determine if the beaches are spawning habitat. This year because of spawning survey start-up and staff limitations, this was only done in a few locations.

MarineFisheries annually solicits public assistance by issuing a press release to newspapers, postings on the website and in the *MarineFisheries* newsletter. Anyone observing spawning horseshoe crabs is asked to contact *MarineFisheries*. This coming year shorebird biologists will also be looking out for spawning horseshoe crabs while they patrol the beaches.

In an effort to conserve and maintain spawning and nursery habitat, *MarineFisheries* annually sends a letter to the Department of Environmental Protection, Coastal Zone Management and the Department of Environmental Management reminding them of the importance of protecting crab habitat. *MarineFisheries'* Environmental Review Project also recommends conditions to all coastal alteration projects to protect horseshoe crab habitat and requests time-of-year restriction on any activities on known horseshoe crab spawning beaches.

Monitoring Program Recommendations – Including Addendums I-III

<u>Monitoring of Horseshoe Crab Populations and Habitat</u>

Component B_1: Continue working towards expanding the annual coastwide benthic trawl survey following methods described in Hata and Berkson (2003).

MarineFisheries continues working towards expanding the annual coastwide trawl survey. However, due to fiscal and manpower limits, the Commonwealth is unable to participate in a coastwide trawl survey at this time. *MarineFisheries*' Coastal Resource Assessment Project currently records the number, and prosomal width by sex of all horseshoe crabs collected during the annual spring and fall bottom trawl surveys. Survey data is forwarded to the Stock Assessment Committee.

Component B_2: Continue existing benthic sampling programs.

As noted in Component B_1, *MarineFisheries*' Resource Assessment Project currently records the number, and prosomal width by sex of all horseshoe crabs collected during the annual spring and fall bottom trawl surveys. Survey data is forwarded to the Stock Assessment Committee.

Component B_3: Continue monitoring spawning populations based upon standardized and statistically robust methodologies.

Massachusetts started annual spawning surveys modeled after Delaware Bay's (which modification of quadrat size to 5 x 5 m^2) due to much lower populations in MA.

Component B_4 A coordinated tagging program should be implemented by the Tagging Subcommittee based upon the draft coast-wide framework developed in 2003.

MarineFisheries did limited tagging in Pleasant Bay in 2008, and hopes to expand efforts to other areas in 2009. We are working with USFWS to develop a smaller tag more suited to our smaller crabs.

Joint Monitoring of Delaware Bay Horseshoe Crabs and Shorebirds

Component B_5 Continue existing state egg abundance surveys, particularly in the Delaware Bay region.

MarineFisheries is exploring funding and implementation options to implement a crab egg abundance surveys.

Component B_6 Continue existing state shorebird monitoring programs.

Shorebird monitoring in Massachusetts is conducted by other agencies and organizations.

Component E: Evaluate the post-release mortality of horseshoe crabs used by the biomedical industry by initiating a tagging program.

MarineFisheries conducted preliminary in-tank studies examining mortality in bled and unbled crabs. We are exploring funding options to scale these studies up in 2009. We also tagged bled and unbled crabs in Pleasant Bay and will be comparing re-sight data over time.

Component F: Identify potential horseshoe crab spawning and nursery habitats.

See Component A_3.

Changes to Research Needs Section.

Section 6.1 Develop an effective and efficient field protocol to identify critical life history stages. At a minimum, the protocol should identify horseshoe crabs that have spawned previously, those that are within one year of spawning for the first time and those that are more than one year from spawning for the first time.

Once developed, Massachusetts will incorporate the protocol into the sampling design.

Section 6.2 In addition to investigating, encouraging and funding alternative bait sources, the Committee suggested focusing on alternative trap design (i.e. traps with bait bags).
In 2004, *MarineFisheries* in concert with several fishermen began trial use of bait cups and alternative baits. Preliminary results indicated that the use of the cups and bait bags reduced the amount of horseshoe crab required to bait a pot and extended the time between re-baiting. Over

the course of the year quite a few conch fishermen began using modifications of the bait cups and bags. Almost all reported a significant reduction in the number of crabs needed per trip.

In 2005 fishermen continued modifying bait cups and bags. Several new modifications were tested. All appeared to work well, allowing for smaller pieces of horseshoe crabs and other baits such as herring, skate or green crabs to be added to the containers. Based upon returns of a questionnaire sent to conch pot fishermen, nearly all are using some form of bait bag or bait cup.

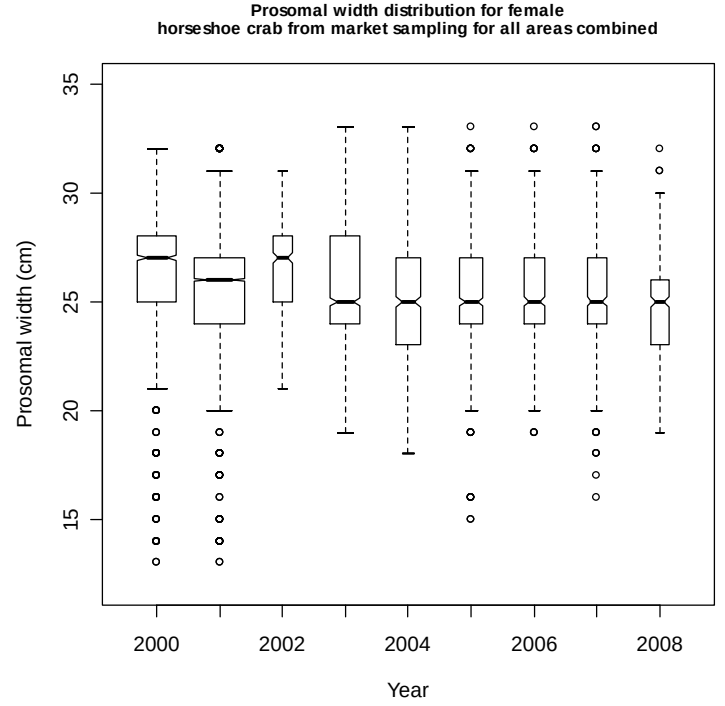
At a recent meeting with conch fishermen, we learned there is a wide variety of techniques and number of pots/crab that people use. We hope to gather more information from the most efficient users of crabs, and share this information with other fishermen to potentially cut down on the need for crabs.

VI. Law enforcement reporting requirement: Horseshoe Crabs

b. Interstate Fishery Management Plan for Horseshoe Crabs

The Massachusetts Office of Environmental Law Enforcement (OLE) in the Executive Office of Environmental Affairs was sent the ASMFC Law Enforcement Report form. OLE was instructed to submit the form to the ASMFC Law Enforcement Committee.

ATTACHMENT 1
HORSESHOE CRAB PROSOMAL WIDTHS
2000 - 2008



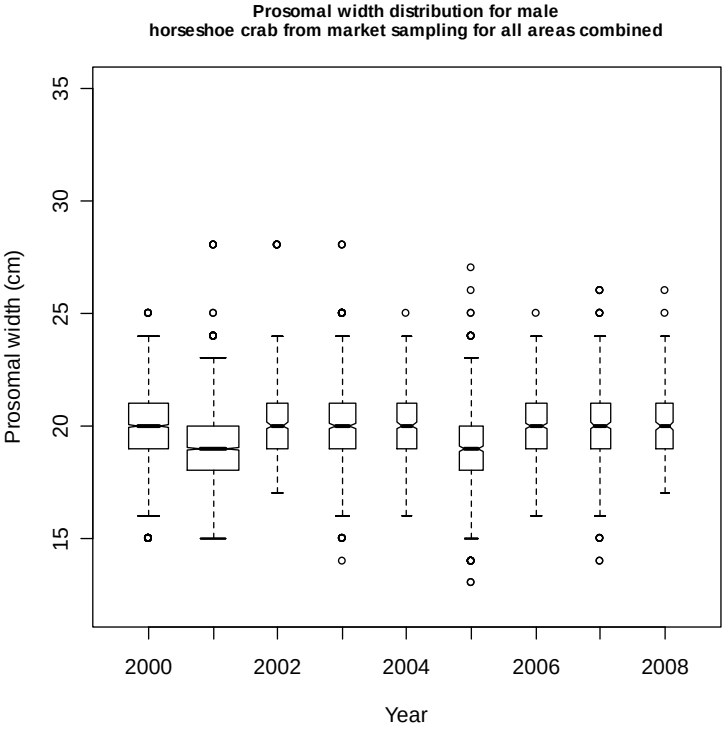


Figure 1. Boxplots of prosomal widths taken in market sampling of horseshoe crabs for all areas combined (2000-2008). Top panel: female horseshoe crabs. Bottom panel: male horseshoe crabs. Width of box is proportional to the square root of sample size.

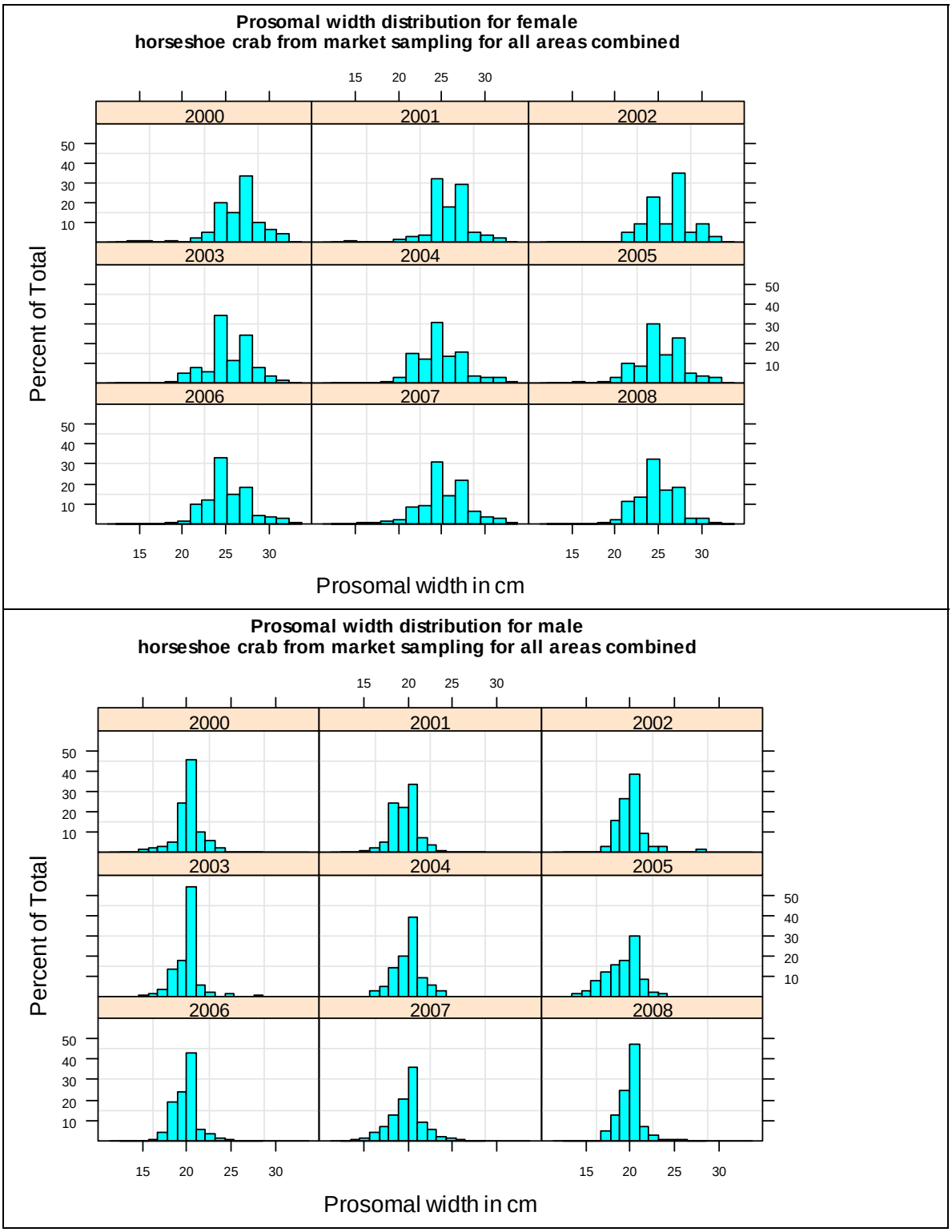


Figure 2. Prosomal width frequency from market sampling for horseshoe crabs (2000-2008). Top panel: female horseshoe crabs. Bottom panel: male horseshoe crabs.