

# Massachusetts Horseshoe Crabs

Horseshoe Crab Biology, Status in Massachusetts, and How Recent Regulation Changes May Impact Buzzards Bay



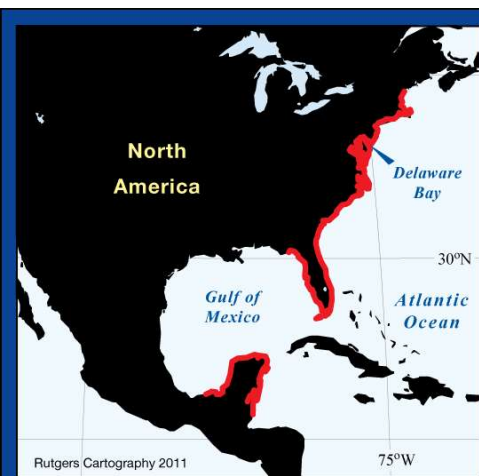
Derek Perry, Massachusetts Division of Marine Fisheries

# Who is this guy?

- DMF Biologist for 20 years
- Last 18 years with Invertebrate Fisheries Program
  - Lead biologist for
    - Crabs (real crabs)
    - Horseshoe crabs
      - Run MA horseshoe crab FD and FI monitoring programs
      - MA rep on ASMFC Horseshoe Crab Technical Committee
      - Member of ASMFC Horseshoe Crab Stock Assessment Committee
- Lived most of my life around Buzzards Bay
  - Falmouth, Bourne, Wareham, New Bedford

# Biology

- Living fossil (350-450 million years)
- Marine chelicerate
- Live ~30 years
- Reach maturity late
- Fairly limited movements
- Most abundant around Delaware Bay



## Primary Range of the Horseshoe Crab

- *Limulus polyphemus*
- *Tachypleus tridentatus*
- *Tachypleus gigas*\*
- *Carcinoscorpius rotundicauda*\*

\*These two species share the same habitat



# Biology



# Prey



## 1960 Chatham Shellfish Department Annual Report

In the continuing fight against the predators we destroyed over one hundred bushels of conchs, over fifty thousand Horseshoe Crabs and several bushel of round winkle spawn.

## 1962 Duxbury Shellfish Department Annual Report

Late in June four cents was paid for each live horseshoe crab delivered to me. The response was so great that in three days over 14,000 crabs were received and the money set aside for this program was spent.

## 1998 Yarmouth Shellfish Regulations

G. No starfish, horseshoe crabs, green crabs, conch, moon snails or oyster drills shall be returned to the water. They shall be placed above the high water mark or some suitable place out of the water.

# Predators



# Shorebirds

- Eggs consumed by many species of shorebirds
  - Energetic food source
  - Eggs consumed are generally non-viable
- Rufa red knot
  - Sub-species of red knot
  - Threatened under U.S. ESA
  - >50% of population stops in DB in May
  - Red knots spend ~ two weeks in DB
  - Double their weight during stopover
  - Some travel >20,000 miles round trip in 1 year
  - Literature says they are “unusual” in MA during their northward migration\*
    - But common in the fall
  - Recent observations of spring birds in MA
  - DB crab harvest tied to red knot counts

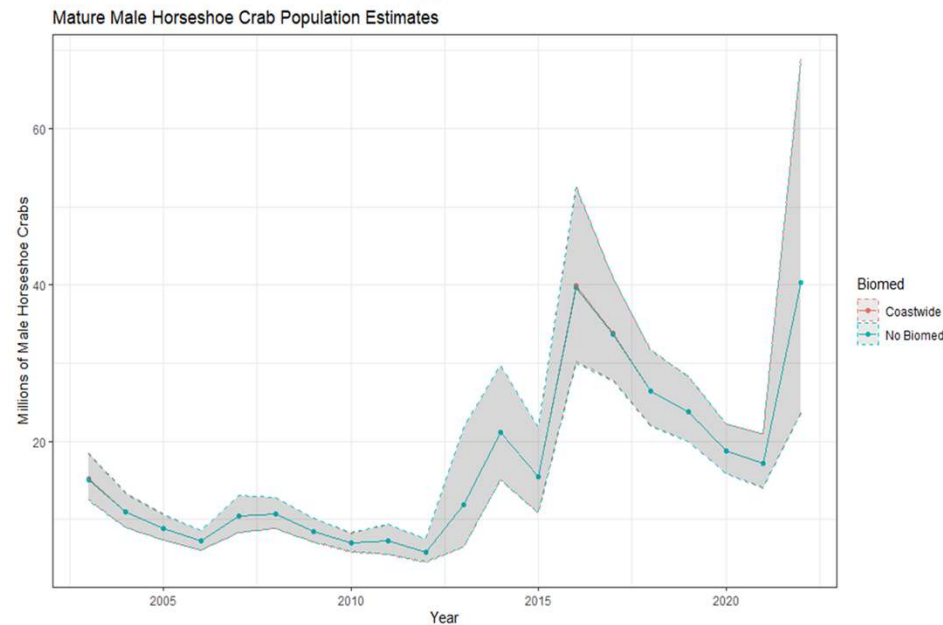
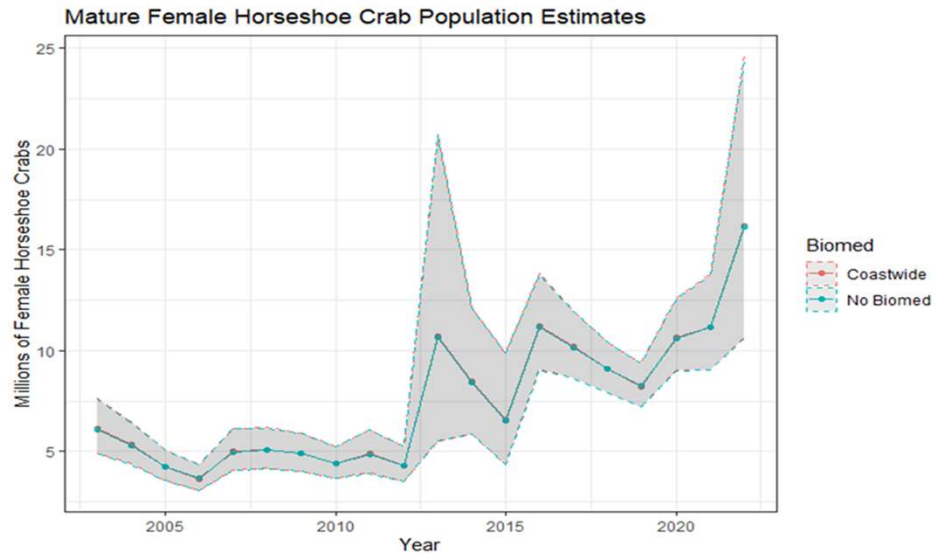
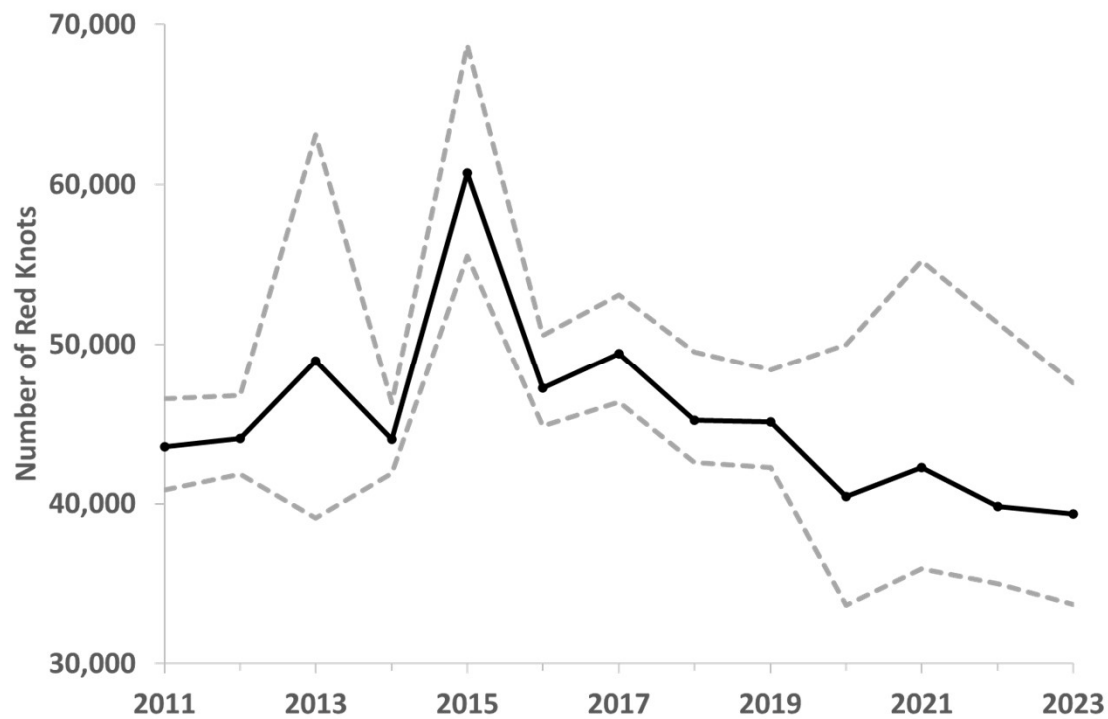
\*Harrington et al. 2010



DE DNR figure

# Shorebirds

- Figures from ASMFC annual ARM report
- ARM used for management of Delaware Bay crabs
  - Red knot abundance remains low
  - Horseshoe crab abundance increasing







## Limulus amebocyte lysate

- Used to test products that contact circulatory system
  - Vaccines, IV's, implants, medical devices, antibiotics, etc.
- FDA approved test
  - Used since the 1970's
  - Replaced rabbit test
- Commercial production started in Falmouth
  - ~50-year history of biomedical harvest from Pleasant Bay
  - Provides opportunity to look at long-term population impacts from biomedical
  - Crabs returned to water
    - Estimated 15% mortality rate

# Horseshoe Crab Fishery

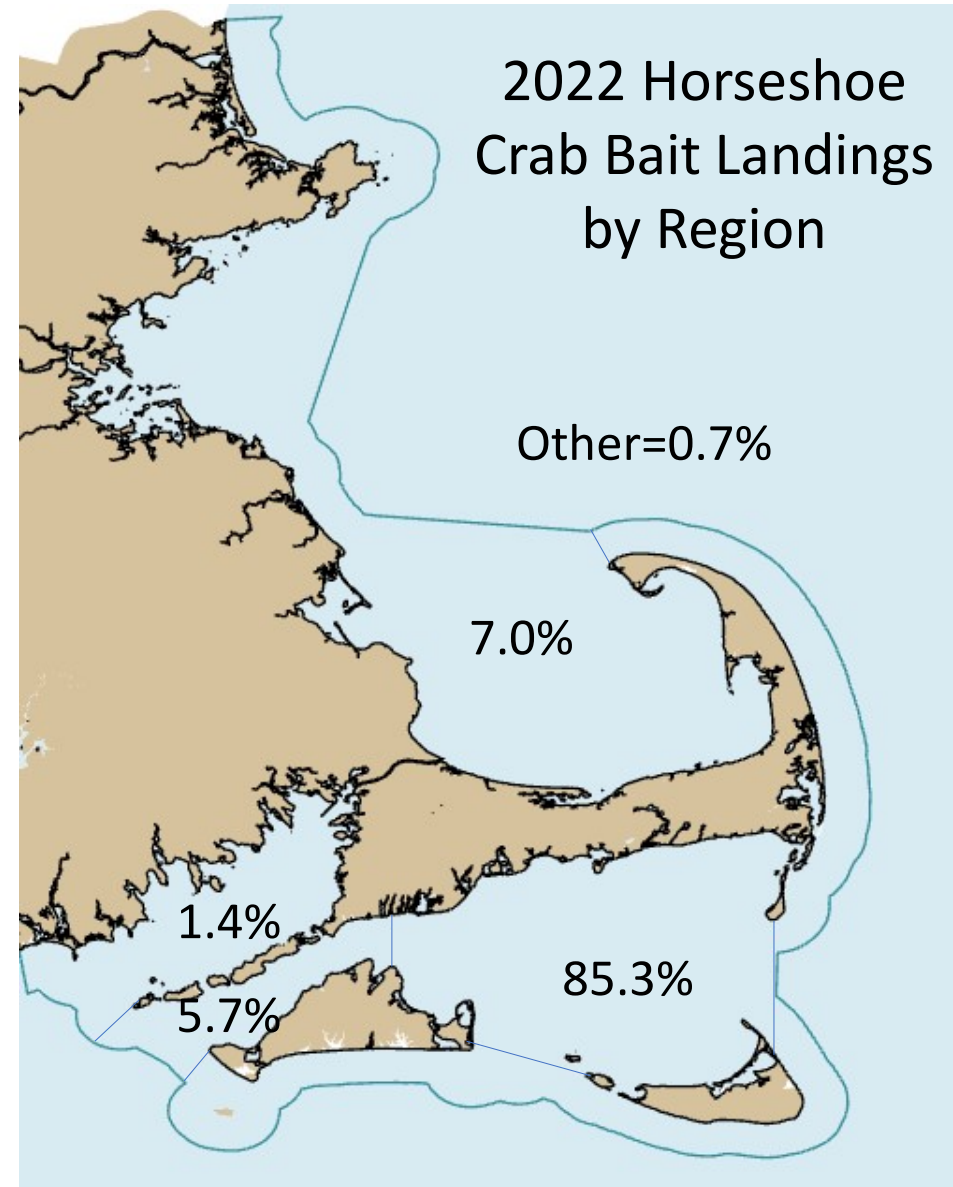


# Massachusetts Fisheries Dependent Data

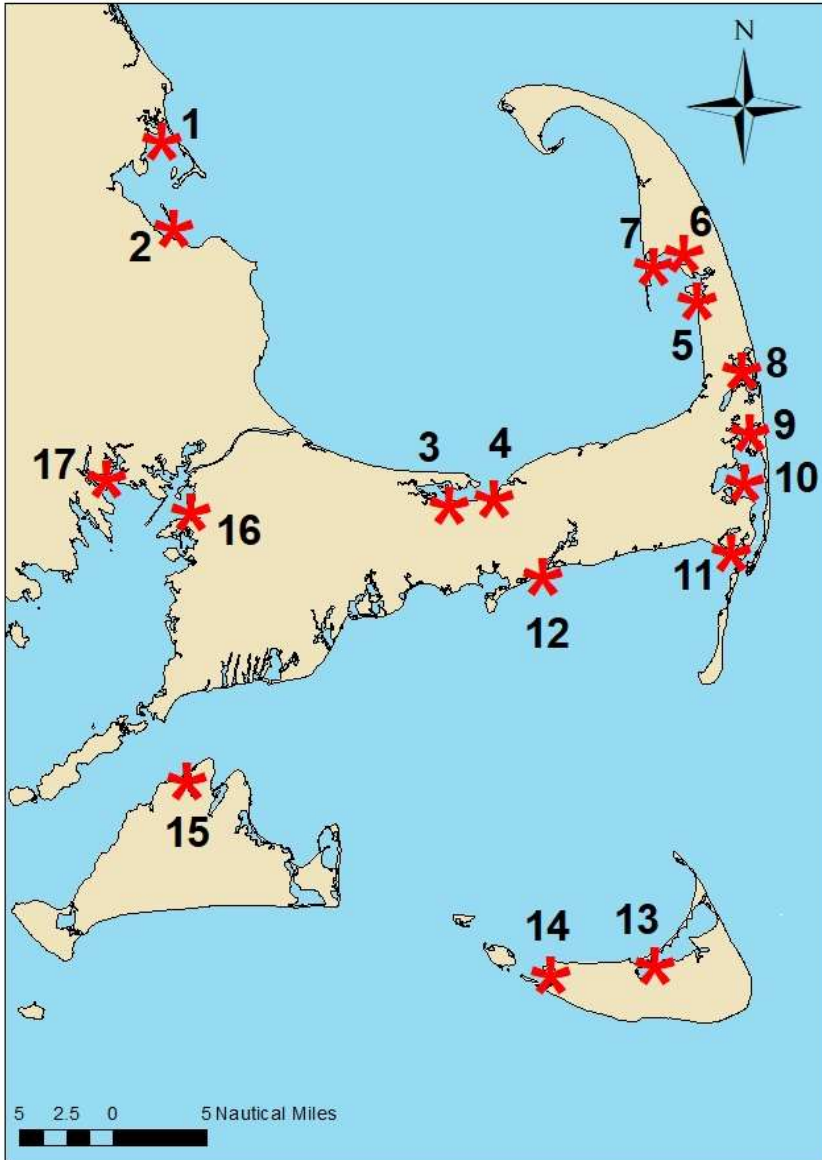
## 2022 MA Monthly HSC Bait Landings

Month	Landings	% Hand
JAN	C	0%
FEB	C	0%
MAR	C	0%
APR	3,027	C
MAY	30,448	98%
JUN	21,194	48%
JUL	28,311	0%
AUG	24,129	0%
SEP	8,716	0%
OCT	12,334	0%
NOV	3,726	0%
DEC	C	0%

Data source: MATL Reports and NOAA VTRs

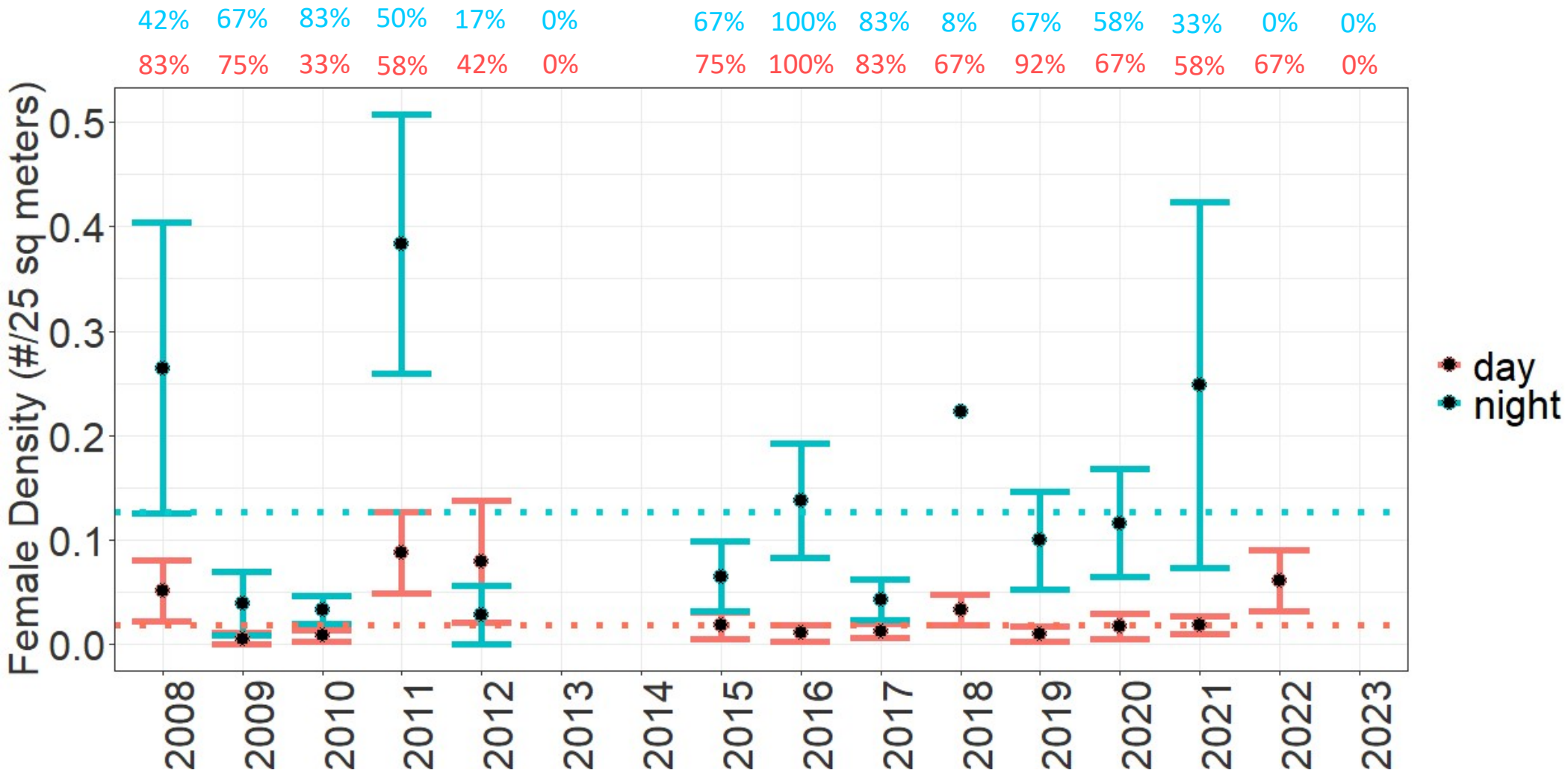


# MA Spawning Beach Survey



Beach	Organization	
1 Duxbury	NSRWA	
2 Long Beach	SEMPBA	
3 Millway	Mass Audubon- LP	
4 Long Pasture	Mass Audubon- LP	
5 Sanctuary Beach	Mass Audubon-Wellfleet	
6 Indian Neck	Mass Audubon-Wellfleet	
7 Great Island	Mass Audubon-Wellfleet	
8 Priscilla's Landing	Mass Audubon-Wellfleet	
9 Marsh 2-3	Mass Audubon-Wellfleet	
10 Erica's Beach	Mass Audubon-Wellfleet	
11 Stage Harbor	USFWS	
12 Bass River	Erik Hunter	
13 Monomoy Beach	Maria Mitchell Assoc.	
14 Warren's Landing	Nantucket Cons. Fnd.	
15 Tashmoo	Mass Audubon-Felix Neck	
16 Tahanto	ESCCI	1% of 2022
17 Swifts Beach	MADMF	bait harvest

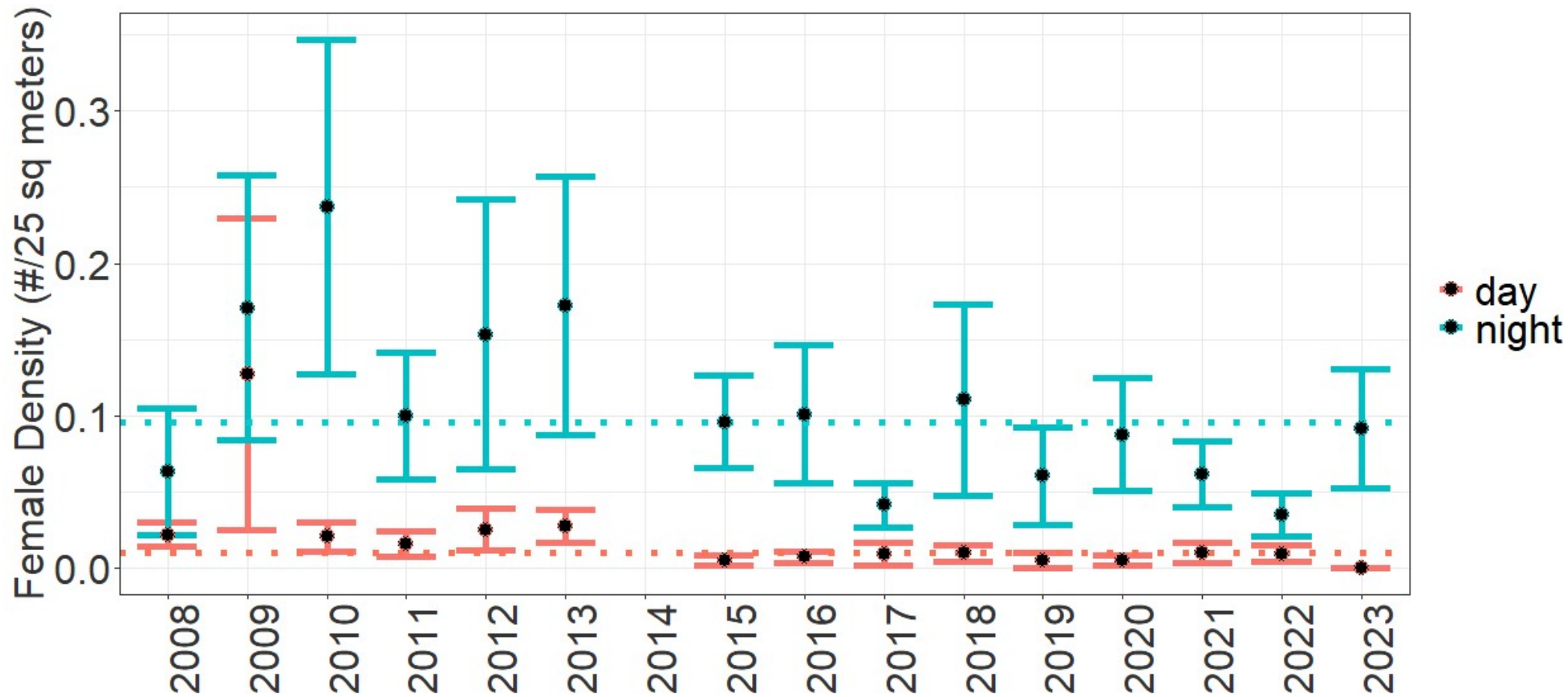
# Tahanto – Elder Services of Cape Cod and the Islands



# Swifts Beach – MA Division of Marine Fisheries

92% 58% 83% 92% 75% 92%      92% 100% 92% 100% 100% 100% 100% 100% 92%

75% 92% 92% 100% 83% 92%      100% 100% 100% 100% 100% 100% 100% 100% 100%



# 2023 Spawning Survey Summary

Region	5- Year Mean % of Bait Landings	Beach	Time of Day	2023 vs Median	10-year trend	5-year trend
Cape Cod Bay	8%	Duxbury	Day	below	decreasing	increasing
		Duxbury	Night	above	decreasing	increasing
		Long Beach	Day	below	NA	decreasing
		Long Beach	Night	below	NA	increasing
		Millway	Day	below	increasing	increasing
		Millway	Night	above	increasing	increasing
		Long Pasture	Day	above	increasing	increasing
		Sanctuary Beach	Day	below	increasing	increasing
		Indian Neck	Day	below	decreasing	decreasing
		Indian Neck	Night	below	increasing	decreasing
Great Island	Day	below	increasing	increasing		
Outer Cape Cod	0% *Also Has Biomed	Priscillas Landing	Day	above	increasing	decreasing
		Marsh 2-3	Day	above	increasing	increasing
		Erica's Beach	Day	below	increasing	decreasing
Nantucket Sound	84% *Also Has Biomed	Stage Harbor	Day	NA	NA	NA
		Stage Harbor	Night	NA	NA	NA
		Bass River	Day	below	NA	increasing
		Bass River	Night	above	NA	increasing
		Monomoy	Day	equal	increasing	NA
		Monomoy	Night	below	increasing	NA
		Warrens Landing	Day	above	increasing	increasing
		Warrens Landing	Night	above	increasing	increasing
		Tashmoo	Day	NA	increasing	NA
Tashmoo	Night	NA	increasing	NA		
Buzzards Bay	2%	Tahanto	Day	NA	increasing	increasing
		Tahanto	Night	NA	increasing	NA
		Swifts Beach	Day	below	decreasing	decreasing
		Swifts Beach	Night	below	decreasing	increasing

## 2023 vs Median

- 36% above, 5% equal, 59% below

## 10-year trend

- 77% increasing, 23% decreasing

## 5-year trend

- 71% increasing, 29% decreasing

## Record highs

- Millway (night, 16 years)
- Warrens Landing (day, 13 years)

## Record lows

- Long Beach (both, 5 years)
- Great Island (day, 12 years)
- Swifts (day, 16 years)

# Spawning Survey Records- Most Crabs

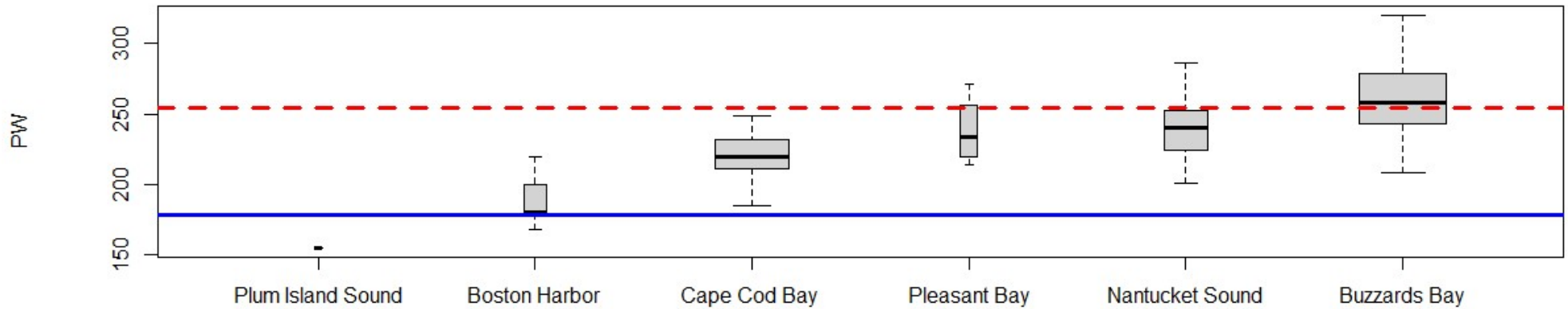
Rank	Region	Beach	Date of record	Total crabs	Total crab density	# of surveys completed
1	Outer Cape Cod	Marsh 2-3	5/13/2021	2982	74.55	118
2	Outer Cape Cod	Priscilla Landing	5/22/2020	1399	16.27	126
3	Nantucket Sound	Stage Harbor	5/31/2022	894	50.47 *	13
4	Outer Cape Cod	Erica's Beach	5/15/2010	878	26.14	190
5	Nantucket Sound	Bass River	5/31/2022	640	8.21	47
6	Cape Cod Bay	Duxbury	5/21/2016	542	11.78	252
7	Nantucket Sound	Warrens Landing	6/1/2023	469	11.44	264
8	Nantucket Sound	Tashmoo	6/5/2019	192	4.27	183
9	Cape Cod Bay	Long Pasture	6/17/2022	141	5.22	159
10	Nantucket Sound	Monomoy	5/19/2016	138	3.83	233
11	Cape Cod Bay	Indian Neck	5/20/2019	107	1.70	304
12	Cape Cod Bay	Sanctuary Beach	5/16/2022	99	2.06	162
13	Buzzards Bay	Swifts Beach	5/21/2009	93	2.74	336
14	Cape Cod Bay	Millway	5/16/2022	67	5.15	224
15	Buzzards Bay	Tahanto	6/13/2011	58	2.00*	180
16	Cape Cod Bay	Long Beach	5/14/2022	57	0.76	98
17	Cape Cod Bay	Great Island	5/14/2022	15	0.26*	118

\* Indicates highest density was on a day other than record number of crabs counted (difference in survey distance)

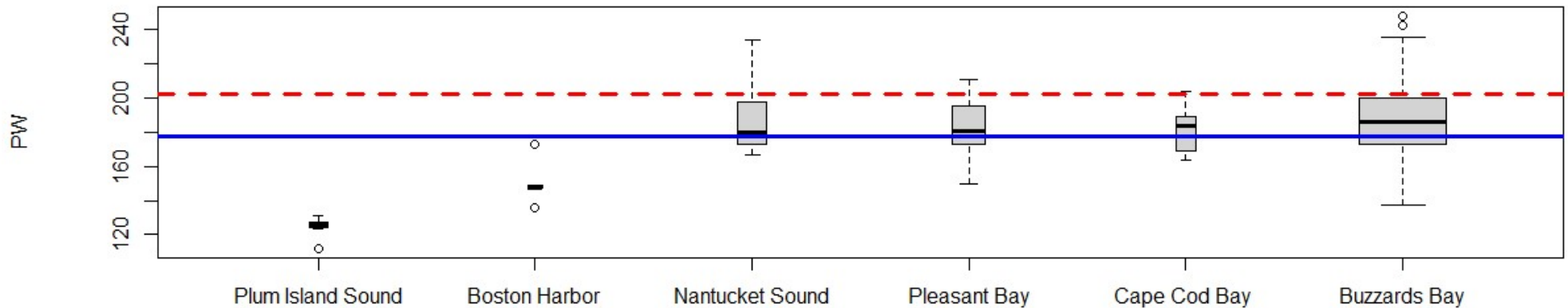


# Size of Massachusetts Spawning Crabs

## Female

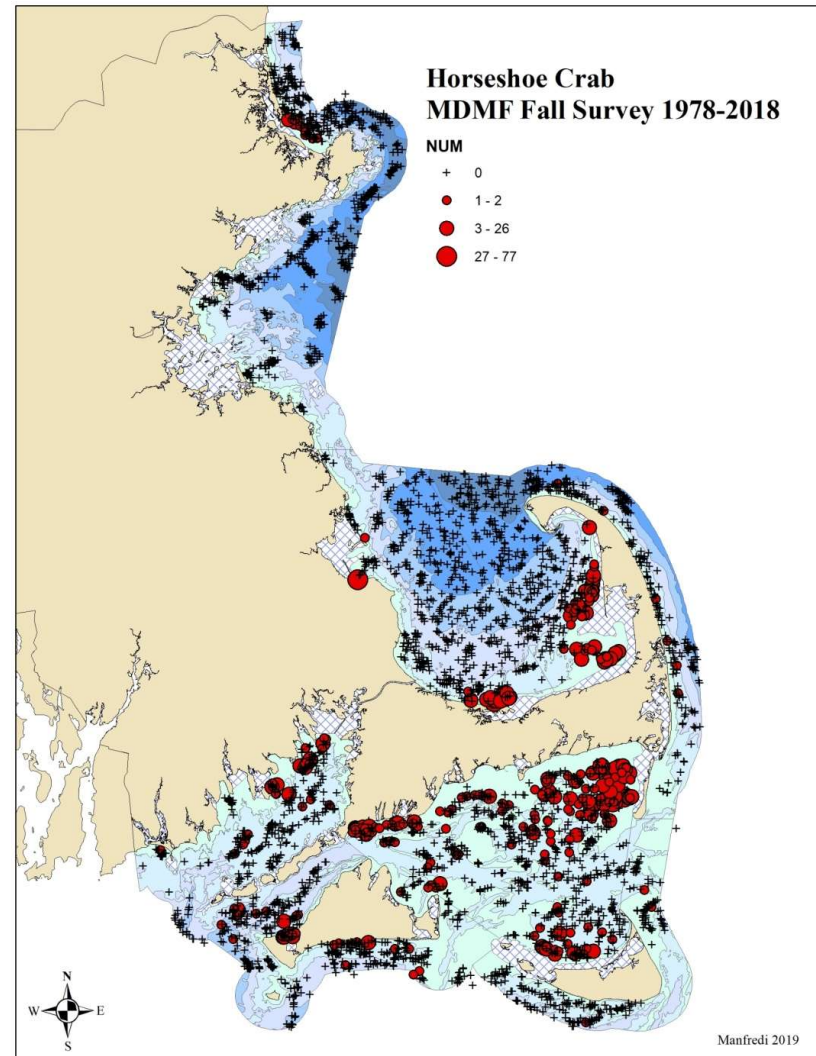
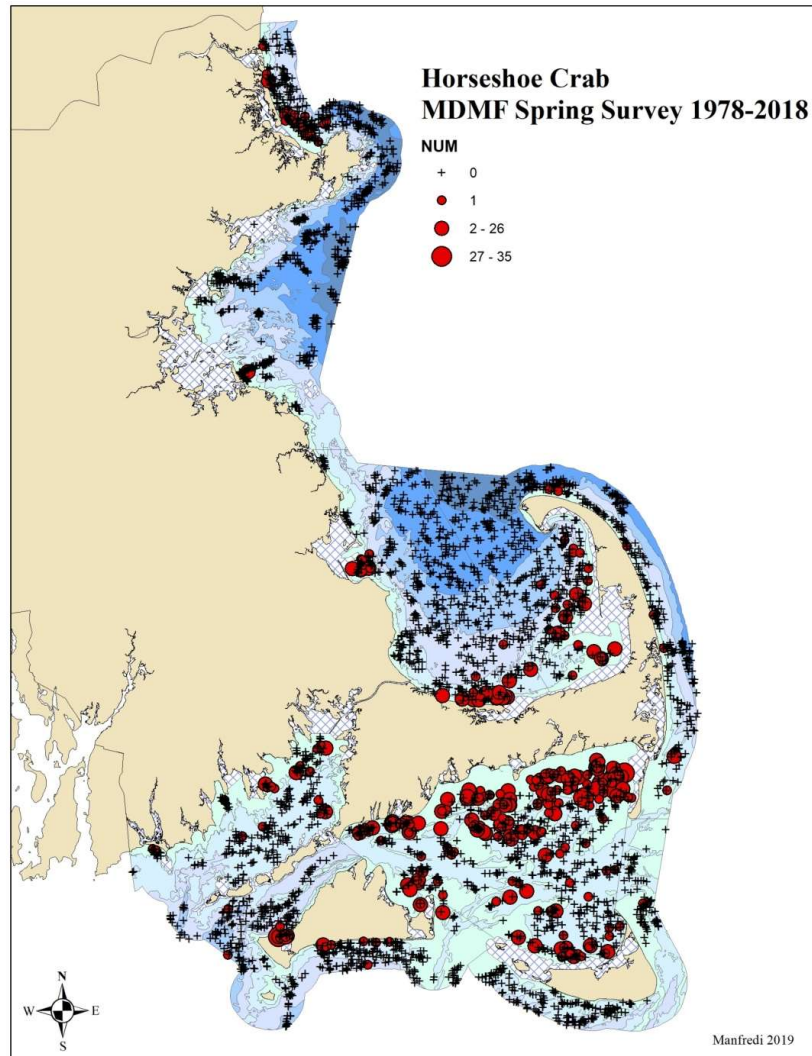


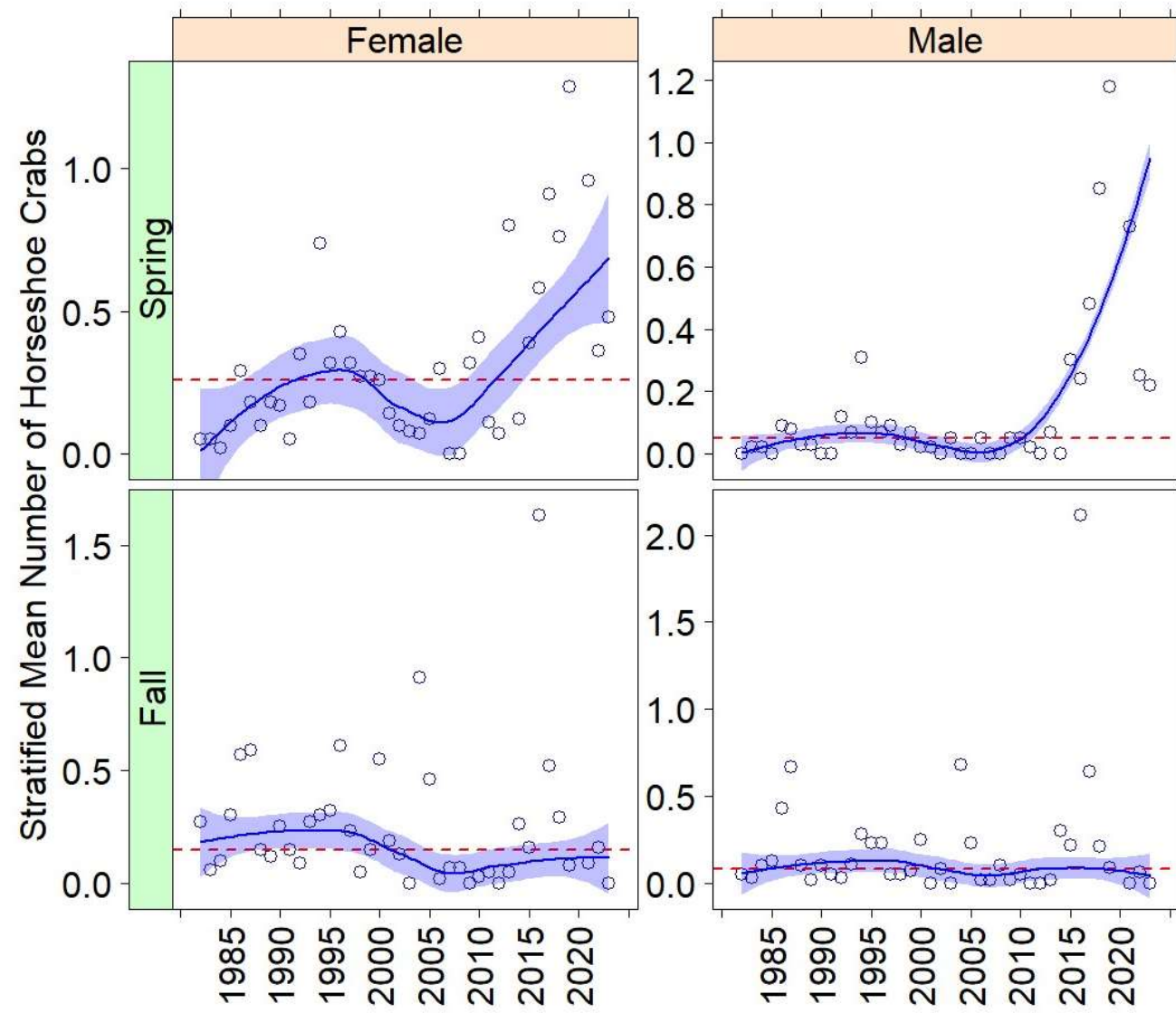
## Male



Blue line is MA MLS, dashed red lines are estimates of size at maturity from NJ (Botton and Loveland 1992)

# MA DMF Resource Assessment Trawl Survey





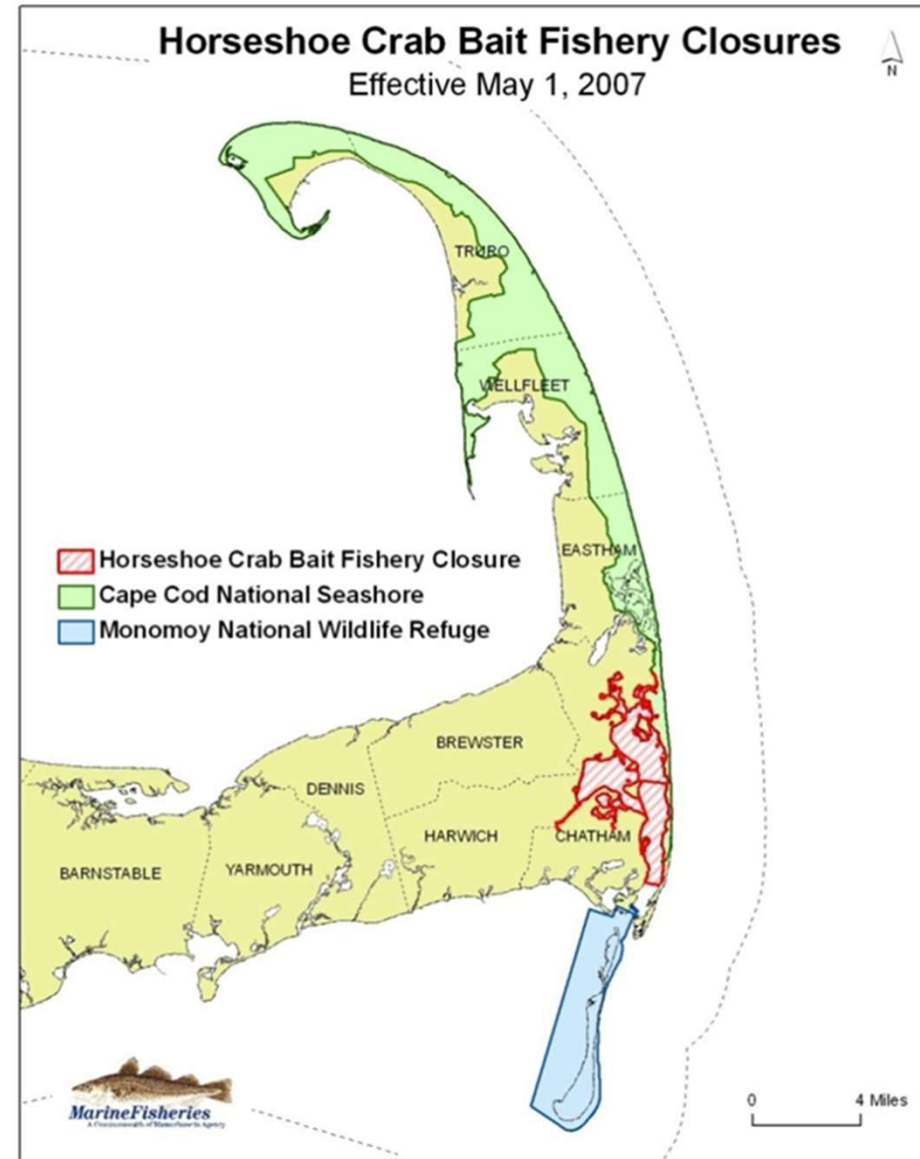
MA DMF Trawl  
Survey- Southern  
New England



Population Concerns

# Massachusetts Horseshoe Crab Regulations

Regulatory Description	Effective Date
Harvest closed on Saturday and Sunday	1990's
Federal area closures	Pre-2007
Pleasant Bay closed to bait harvest	2007
Bait permit moratorium (capped)	2008
Bait quota reduced from 330,377 to 165,000	2008
Bait possession limit reduced from 1,000 to 400 crabs	2008
7" min prosomal width	2010
May-June lunar closures	2010
Mobile gear bait harvest daily limit increased (400 to 600) /24-hour period starting July 1	2010
Lunar closure extended to include to mid-April	2013
Reduced mobile gear daily bait trip limit to 300/day	2014
Asian crabs prohibited	2014
Bait quota reduced from 165,000 to 140,000	2023
Biomedical quota initiated (200,000 crabs)	2023

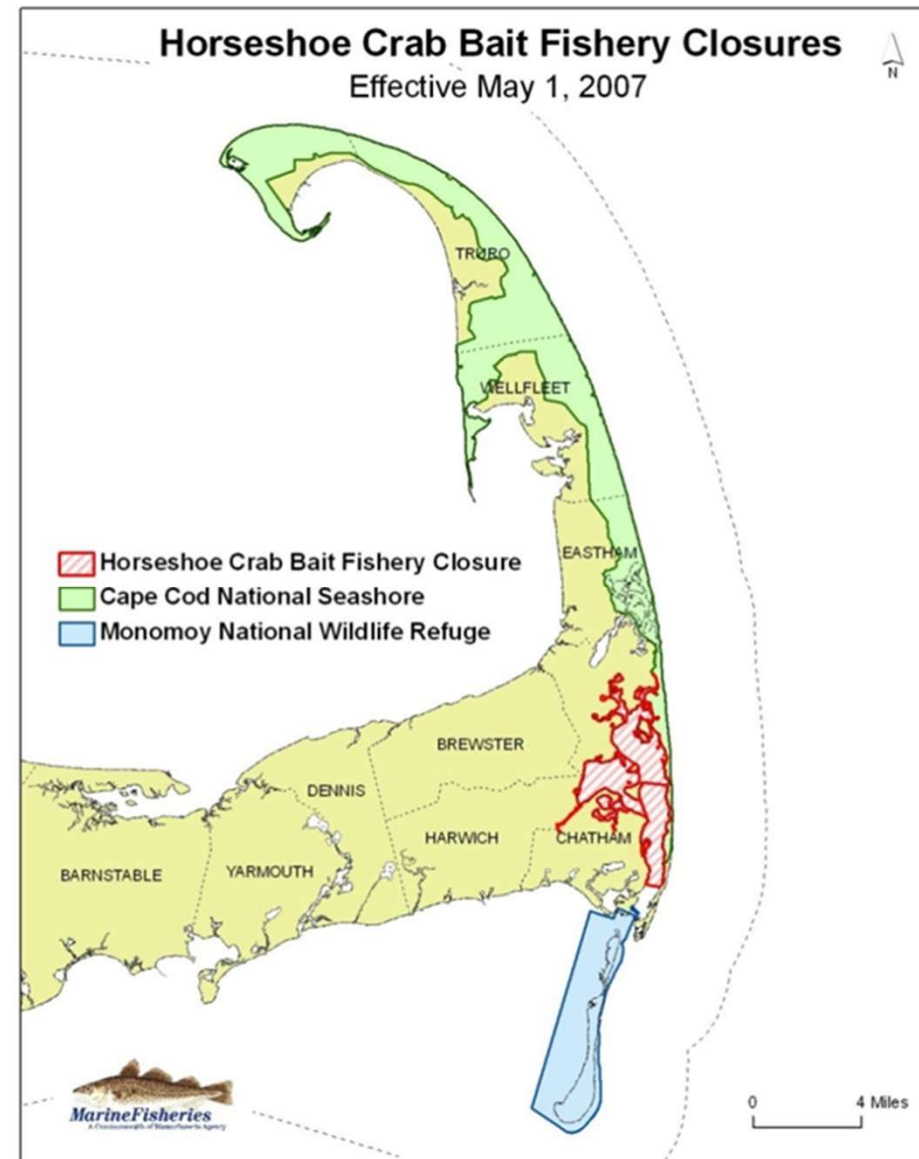


# Massachusetts Horseshoe Crab Regulations

## 2024 Regulation Changes

**Compliment existing federal closed areas  
(Cape Cod National Seashore and  
Monomoy National Wildlife Refuge)**

- Allows MA Environmental Police to enforce regulation



# Massachusetts Horseshoe Crab Regulations

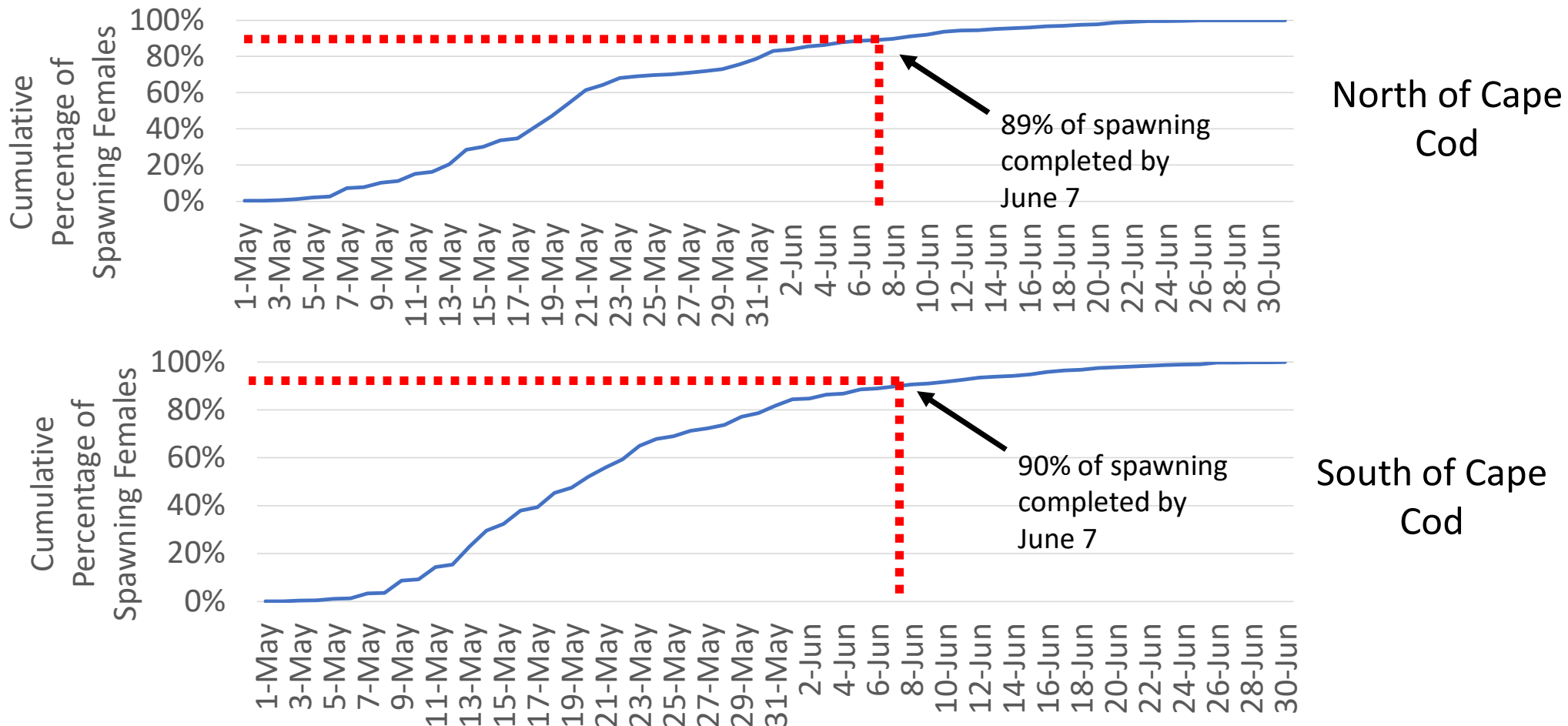
## 2024 Proposed Regulation Changes

### **April 15<sup>th</sup> to June 7<sup>th</sup> harvest prohibition (bait and biomedical)**

- Large public demand (thousands of comment letters)
- Replaces current lunar closures (25 closed days -> 54 days)
- Closes period when ~90% of spawning activity is observed in MA
- Includes closure of period when crabs aggregate and stage for spawning
- Similar closure periods to states in Delaware Bay region
  - June 7<sup>th</sup> used there because most red knots have left DB by that date
- Lunar closures don't necessarily capture peaks in spawning
  - Moon is only one factor that drives spawning
    - Barlow et al. 1986
    - Cheng et al. 2016

# Massachusetts Horseshoe Crab Regulations

## Expected Impacts from Newly Proposed Regulations





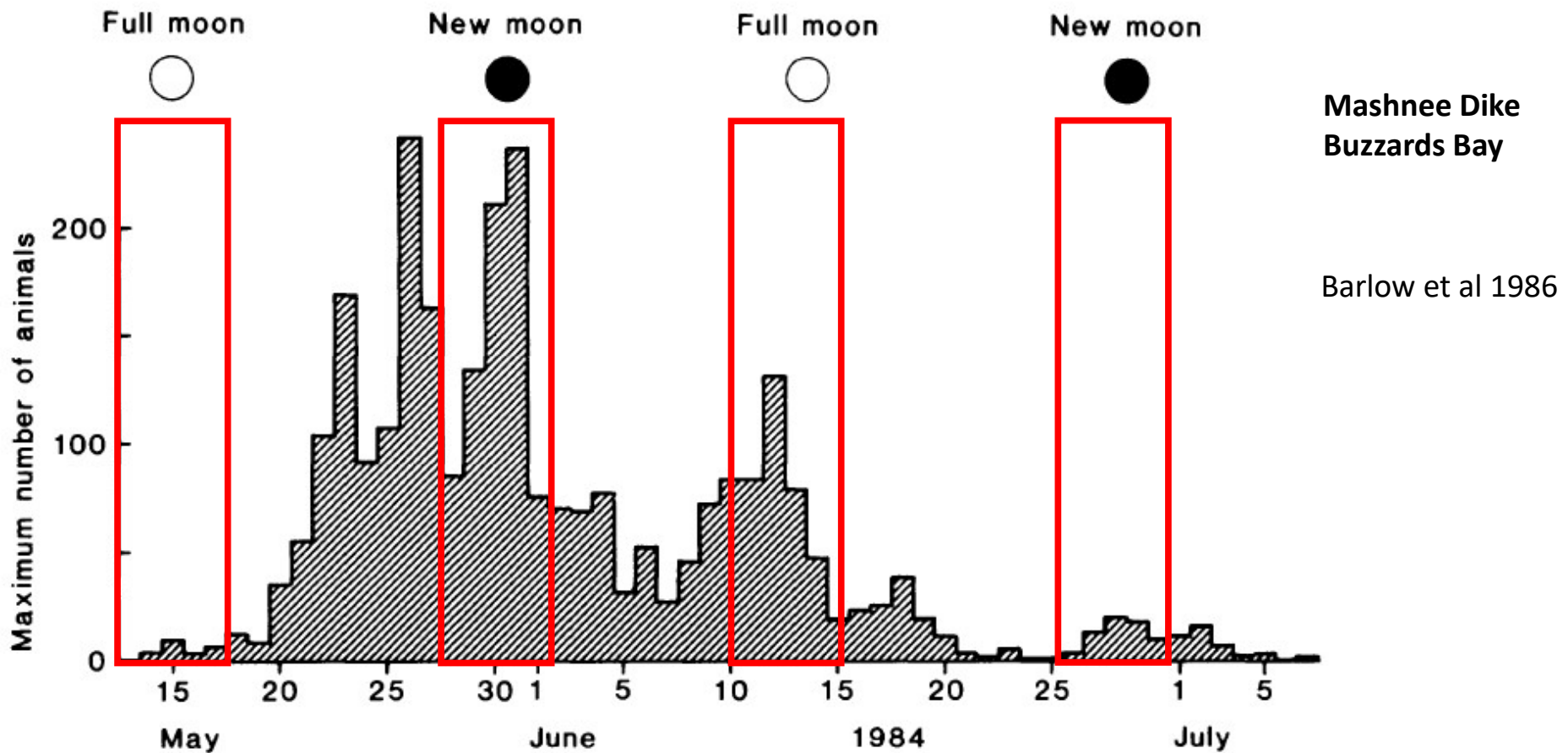


FIGURE 3. Maximum number of *Limulus* counted in the transects each day of the 1984 mating season at Mashnee Dike. The height of each bar shows the largest total number of males and females recorded in a single half-hourly counting session during the solar day. The open and filled circles indicate the full and new moons of 14 and 30 May and 13 and 28 June (Eldridge, 1984).

# Massachusetts Horseshoe Crab Regulations

## 2024 Regulation Changes

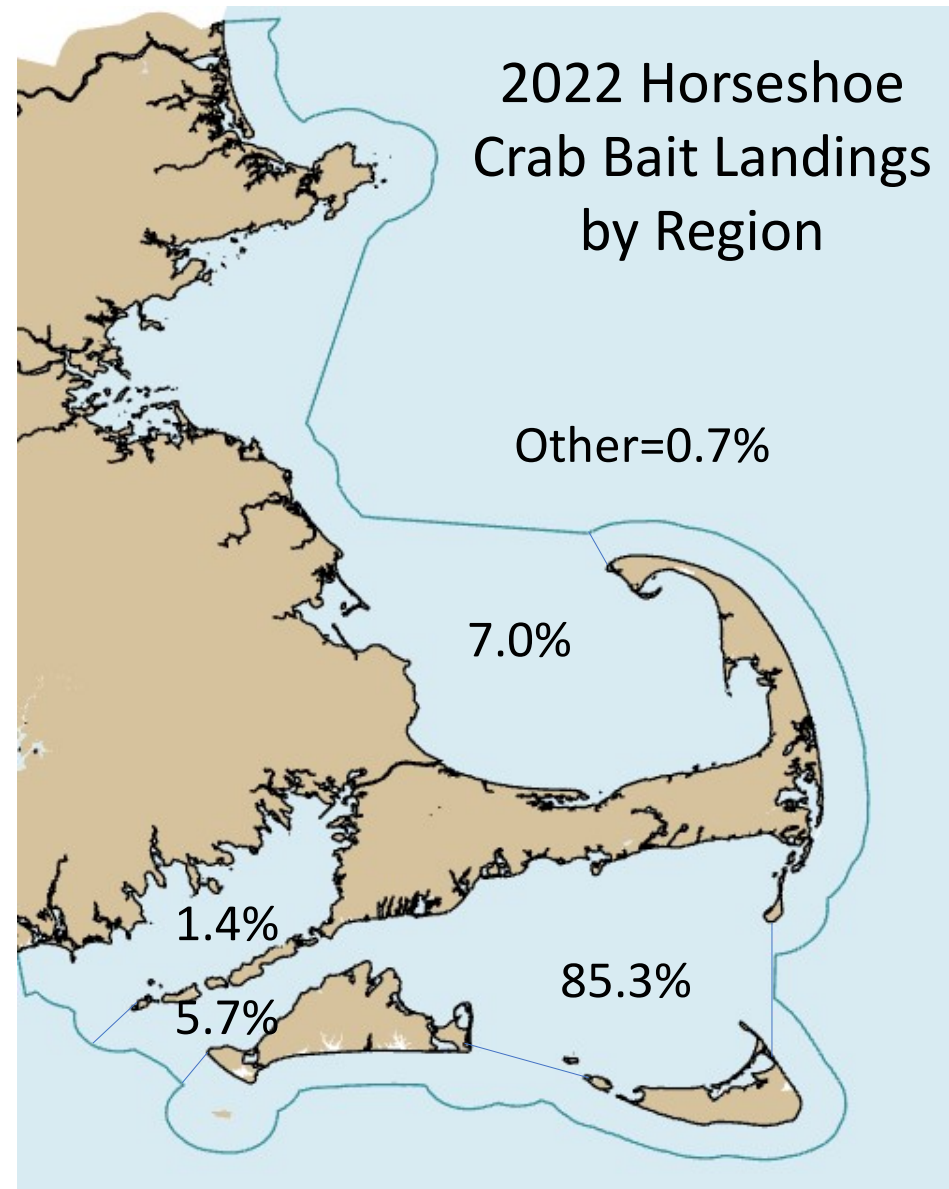
### **Reduce hand harvest trip limit from 400 crabs/day to 300/day**

- Creates consistent trip limit across methods (hand and mobile gear)
- Slows rate of landings (less likely to have market gluts as seen in 2023)

# Massachusetts Horseshoe Crab Regulations

## Expected Impacts from New Regulations

- Areas with most harvest will see the greatest benefit (e.g., Nantucket Sound)
- Areas with little to no harvest will see little to no impact
- Landings will be more concentrated
  - More in Nantucket Sound
  - Less in Cape Cod Bay
  - Harvest from Buzzards Bay will cease
    - Mobile gear prohibited in BBay

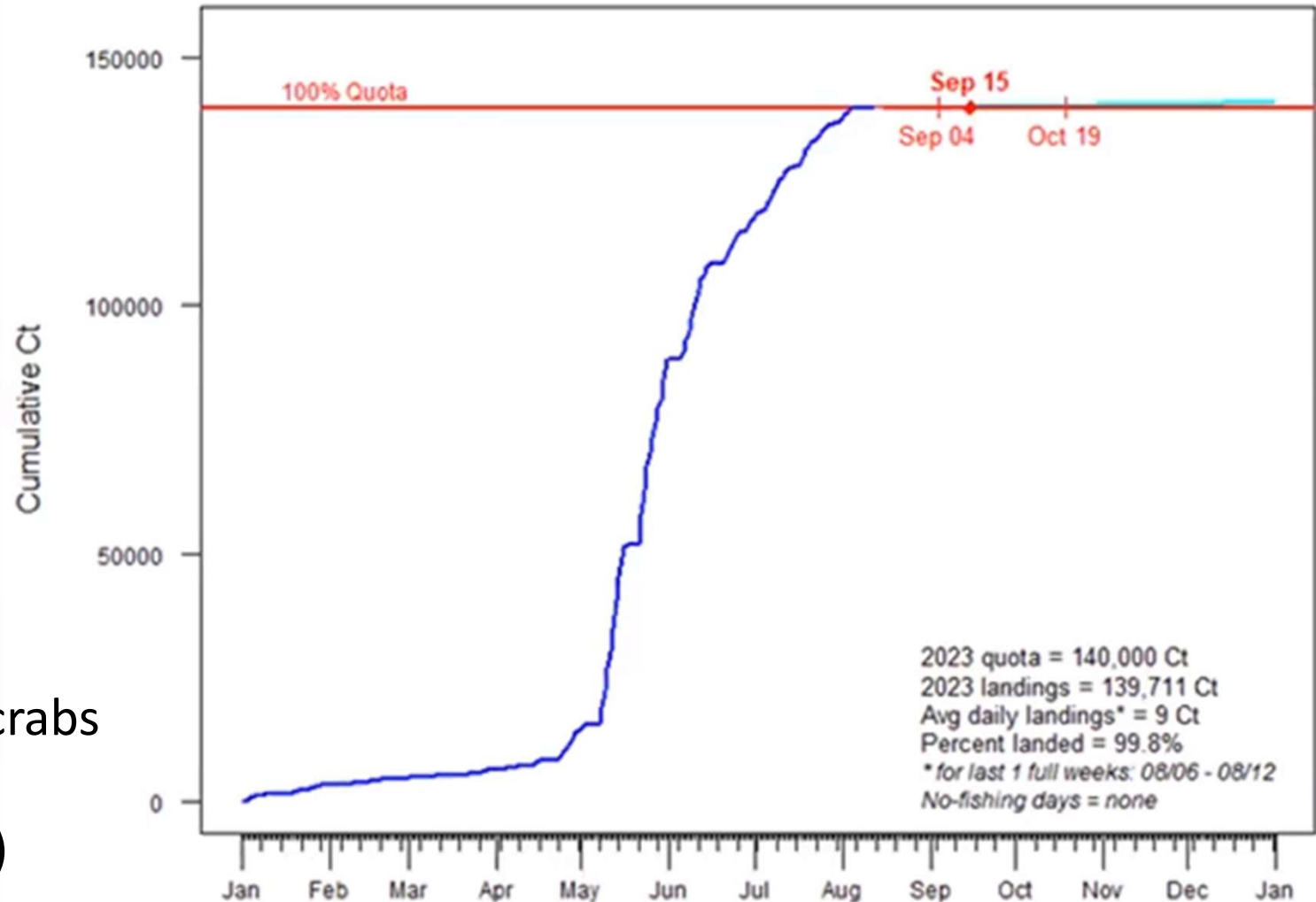


# Massachusetts Horseshoe Crab Regulations

## Expected Impacts from New Regulations

- Will likely see more crabs in spawning surveys (location dependent)

2023 CRAB, HORSESHOE Quota Monitoring  
as of August 16, 2023 09:09 AM



# Massachusetts Horseshoe Crab Regulations

## Expected Impacts from New Regulations

- Hand harvest effort will be greatly reduced
  - Peak period of hand harvest will be eliminated
  - Loss of income for ~30 harvesters
    - Loss of peak season will convince some fishers to seek other sources of income and not fish during post-June 7 period
  - Landings will be more skewed towards mobile gear fleet
- Greatest benefit will be through recruitment
  - Fishery can still catch same number of crabs
  - But nearly all crabs will have a chance to spawn first
  - Increased recruitment will be observed on spawning beaches in ~10 years

# Informational Resources

MA DMF Annual Reports- regulation changes, brief fisheries independent/dependent summaries

<https://www.mass.gov/service-details/dmf-annual-reports>

MA Horseshoe Crab Compliance Reports to ASMFC

<https://www.mass.gov/service-details/horseshoe-crab-monitoring>

MA Fisheries Regulations (section 6.34 for horseshoe crabs)

<https://www.mass.gov/doc/322-cmr-6-regulation-of-catches/download>

MA Quota Monitoring Page

<https://www.mass.gov/service-details/current-commercial-fishing-quotas-and-landings>

MA DMF Resource Assessment Project reports and information (trawl survey, seine survey)

<https://www.mass.gov/orgs/division-of-marine-fisheries> and search “Resource Assessment”

ASMFC Horseshoe Crab Page- FMP, FMP reviews, Biomed BMPs, stock assessments

<http://www.asmfc.org/species/horseshoe-crab>