ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

For Jonah Crab
(*Cancer borealis*)

2022 FISHING YEAR

Prepared by the Plan Review Team

Approved November 2023

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

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REVIEW OF THE ATLANTIC STATES MARINE FISHERIES COMMISSION FISHERY MANAGEMENT PLAN FOR JONAH CRAB (*Cancer borealis*)

2022 FISHING YEAR

1.0 Status of the Fishery Management Plan

Year of ASMFC Plan's Adoption:	FMP (2015)
Framework Adjustments:	Addendum I (2016) Addendum II (2017) Addendum III (2018) Addendum IV (2022)
Management Unit:	Maine through North Carolina
States with a Declared Interest:	Maine through Virginia (Excluding Pennsylvania and DC)
Active Committees:	American Lobster Management Board, Technical Committee, Plan Review Team, Advisory Panel, Electronic Reporting Subcommittee, Electronic Tracking Subcommittee

2.0 Status of the Fishery

2.1 Commercial Fishery

Historically, Jonah crab was taken as bycatch in the lobster fishery; however, in recent years a directed fishery has emerged causing landings to rapidly increase. Throughout the 1990s, landings fluctuated between approximately 2 and 3 million pounds, and the overall value of the fishery was low. In the early 2000's landings began to increase, with over 7 million pounds landed in 2005. By 2014, landings had almost tripled to 17 million pounds and a value of nearly $13 million. This rapid increase in landings can be attributed to an increase in the price of other crab (such as Dungeness), creating a substitute market for Jonah crab, as well as a decrease in the abundance of lobsters in Southern New England, causing fishermen to redirect effort on Jonah crab. It should be noted that there is some uncertainty in the landings data—especially prior to 2008—due to species misidentification issues as well as underreporting of landings before the implementation of reporting requirements. Despite the uncertainty, the overall trend in landings is likely accurate.

Today, Jonah crab and lobster are harvested in a mixed crustacean fishery in which fishermen can target lobster or crab at different times of the year based on slight gear modifications and small shifts in the areas in which the traps are fished. While the majority of Jonah crab landings is harvested as whole crabs, fishermen from several states, including New York, Maryland and Virginia, land claws. Jonah crab claws are relatively large and can be an inexpensive substitute for stone crab claws. As a result, they can provide an important source of income for fishermen.

Along the Delmarva Peninsula, small boat fishermen have historically harvested Jonah crab claws because they do not have seawater storage tanks on board to store whole crabs.

In 2022, landings along the Atlantic Coast totaled approximately 14 million pounds of Jonah crab, representing $22.6 million in ex-vessel value. Landings increased 17% from 2021 landings of 11.9 million pounds, while ex-vessel value increased 76% from the 2021 value. The states of Massachusetts (55%), Maine (21%), and Rhode Island (17.5%) were the largest contributors to landings. Almost all coastwide landings came from trap gear.

2.2 Recreational Fishery

The magnitude of the Jonah crab recreational fishery is unknown at this time; however, it is believed to be quite small in comparison to the size of the commercial fishery.

3.0 Status of the Stock

Jonah crab are distributed in the waters of the Northwest Atlantic Ocean primarily from Newfoundland, Canada to Florida. The life cycle of Jonah crab is poorly described, and what is known is largely compiled from a patchwork of studies that have both targeted and incidentally documented the species. Based on tagging studies, male Jonah crab movements are generally limited to a few kilometers, though some individuals have been documented to travel over 100 km. Female movement patterns are poorly understood due to limited reported tag recaptures. Due to the lack of a widespread and well-developed aging method for crustaceans, Jonah crab size-at-age, and age-at-maturity are poorly described.

There is currently very limited information available on the status of the Jonah crab resource. The first range-wide stock assessment was completed and is scheduled for peer review in 2023. Massachusetts, Rhode Island, Maine, and New Hampshire conduct inshore state water trawl surveys, and NOAA Fisheries conducts a trawl survey in federal waters which collects data on Jonah crab abundance and distribution.

4.0 Status of Management Measures

Interstate Fishery Management Plan for Jonah Crab (2015)

Jonah crab is managed under the Interstate Fishery Management Plan (FMP) which was approved by the American Lobster Management Board in August 2015. The goal of the FMP is to promote conservation, reduce the possibility of recruitment failure, and allow for the full utilization of the resource by the industry. The FMP lays out specific management measures in the commercial fishery. These include a 4.75” minimum size and a prohibition on the retention of egg-bearing females. To prevent the fishery from being open access, the FMP states that participation in the directed trap fishery is limited to lobster permit holders or those who can prove a history of crab-only pot fishing. All others must obtain an incidental permit. In the recreational fishery, the FMP sets a possession limit of 50 whole crabs per person per day and prohibits the retention of egg-bearing females. Due to the lack of data on the Jonah crab fishery, the FMP implements a fishery-dependent data collection program. The FMP also requires harvester and dealer reporting along with port and/or sea sampling.

Addendum I (2016)

Addendum I establishes a bycatch limit of 1,000 crabs per trip for non-trap gear (e.g., otter trawls, gillnets) and non-lobster trap gear (e.g., fish, crab, and whelk pots). In doing so, the Addendum caps incidental landings of Jonah crab across all non-directed gear types with a uniform bycatch allowance. While the gear types in Addendum I make minimal contributions to total landings in the fishery, the 1,000 crab limit provides a cap to potential increases in effort and trap proliferation.

Addendum II (2017)

Addendum II establishes a coastwide standard for claw harvest. Specifically, it permits Jonah crab fishermen to detach and harvest claws at sea, with a required minimum claw length (measured along the forearm of the claw) of 2.75" if the volume of claws landed is greater than five gallons. Claw landings less than five gallons do not have to meet the minimum claw length standard. The Addendum also establishes a definition of bycatch in the Jonah crab fishery, whereby the total pounds of Jonah crab caught as bycatch must weigh less than the total amount of the targeted species at all times during a fishing trip. The intent of this definition is to address concerns regarding the expansion of a small-scale fishery under the bycatch limit.

Addendum III (2018)

Addendum III improves the collection of harvester and biological data in the Jonah crab fishery. Specifically, the Addendum improves the spatial resolution of harvester data collection by requiring fishermen to report via 10-minute squares. It also expands the required harvester reporting data elements to collect greater information on gear configurations and effort. In addition, the Addendum established a deadline that within five years, states are required to implement 100% harvester reporting, with the prioritization of electronic harvester reporting development during that time. Finally, the Addendum improves the biological sampling requirements by establishing a baseline of ten sampling trips/year, and encourages states with more than 10% of coastwide landings to conduct additional sampling trips.

Addendum IV (2022)

Addendum IV expands on reporting improvements by establishing electronic tracking requirements for federally-permitted vessels in the American lobster and Jonah crab fisheries. Specifically, electronic tracking devices will be required for vessels with commercial trap gear area permits for Lobster Conservation Management Areas (LCMAs) 1, 2, 3, 4, 5, and Outer Cape Cod to collect high resolution spatial and temporal effort data.

5.0 Fishery Monitoring

The provisions of Addendum III went into effect January 1, 2019. Specifically, Addendum III requires reporting of additional data elements, the implementation of 100% harvester reporting within five years, and the completion of a minimum of ten sea and/or port sampling trips per year for biological sampling of the lobster/Jonah crab fishery. The Addendum III requirement for commercial harvesters to report their fishing location by 10 minute longitudinal/latitudinal square was implemented in 2021. *De minimis* states are not required to conduct fishery-independent sampling or port/sea sampling.

Overviews of the states' port and sea sampling in 2022 are as follows:

- Maine: Maine conducted 163 sea sampling trips, 34 of which had Jonah crab measurements, for a total of 2,925 sampled Jonah crabs. Only 20 of the trips in 2022 measured more than 20 Jonah crabs. Types of information collected included: shell width, sex, discards, egg bearing status, cull status, shell hardness, and whether landings are whole crabs or parts. Maine's lobster port sampling program was suspended in 2011.
- New Hampshire: Staff sampled 29 Jonah crab on 14 sea sampling trips and collected information on sex, the presence of eggs, cull condition, molt stage, and carapace length. NH initiated a quarterly port sampling program in late 2016. Quarterly sampling took place at shellfish dealers, where an interview with the captain occurred and a biological sample was taken. A total of 426 Jonah crab were sampled (sexed, measured for carapace width, and weighed when feasible).
- Massachusetts: Massachusetts made 15 port sampling trips and sampled 7,103 Jonah crab from 8 different vessels. Data collected include carapace width, sex, egg bearing status, cull status, and shell hardness. No Jonah crab sea sampling trips were conducted.
- Rhode Island: Rhode Island did not conduct sea sampling for Jonah crab in 2022, due to funding and staff limitations. Five port sampling trips were conducted in 2022, measuring 971 Jonah crabs caught in four different Statistical Areas. Types of information collected included: carapace width, sex, egg bearing status, cull status, shell hardness, and shell disease condition.
- Connecticut: No sea sampling or port sampling trips were conducted for Jonah crab.
- New York: Staff conducted 7 market sampling trips, sampling 370 Jonah crab. No sea sampling trips were conducted for Jonah crab in 2022.
- New Jersey: No sea or port sampling trips were conducted for Jonah crab in 2022.
- Delaware: No sea or port sampling trips were conducted for Jonah crab in 2022.
- Maryland: No sea or port sampling trips were conducted for Jonah crab in 2022.
- Virginia: No sea or port sampling trips were conducted for Jonah crab in 2022.

6.0 Status of Surveys

The FMP for Jonah crab encourages states to expand current lobster surveys (i.e. trawl surveys, ventless trap surveys, settlement surveys) to collection biological information on Jonah crab. The following outlines the fishery-independent surveys conducted by each state.

Maine

A. Settlement Survey

The Maine settlement survey was primarily designed to quantify lobster young-of-year (YOY), but has also collected Jonah crab data from the sites throughout the survey. Jonah crab information collected includes carapace width, sex (when large enough), ovigerous condition, claw status, shell hardness, and location. The density of YOY Jonah crab increased over the past two decades with high values in 2012 and 2016, then declined slightly in recent years (Figure 1). In 2022, density of YOY Jonah crab increased from 2021 in Area 513 and 512, and decreased in 511.

B. State Trawl Survey

The ME/NH Inshore Trawl Survey began in 2000 and is conducted biannually (spring and fall) through a random stratified sampling scheme. Jonah crab data has been collected since 2003. The 2022 spring survey ran from May to June and completed 101 out of 120 scheduled tows. A total of 143 Jonah crabs were caught and sampled, with 54 females and 89 males caught and measured. The 2022 fall survey completed 87 out of 120 scheduled tows; a total of 115 Jonah crabs were caught and sampled, with 52 females, 62 males, and 1 unsexed crab caught and measured. Abundance indices for Jonah crab increased in 2022 after declining since 2016 (Tables 2 and 3).

C. Ventless Trap Survey

Maine began its Juvenile Lobster Ventless Trap Survey in 2006. Since the beginning of the survey, Jonah crab counts were recorded by the contracted fishermen, but the confidence in early years of this data is low because of the confusion between the two *Cancer* crabs (Jonah crab vs. rock crab) and similar common names. In 2016, the survey began collecting biological data for Jonah crab including carapace width, sex, ovigerous condition, claw status, shell hardness, and location. In 2022 Jonah crab catch in the survey decreased in all areas from 2021. Concentrations of Jonah crab were highest in Statistical Area 512 and lowest in 513 (Figure 2).

New Hampshire

A. Settlement Survey

Since 2009, species information has been collected on Jonah crab in the New Hampshire Fish and Game portion of the American Lobster Settlement Index. Figure 3 shows the CPUE (#/m^2) of Jonah crab for all NH sites combined, from 2009 through 2022. The time series shows a general upward trend with a time series high in 2022.

B. Ventless Trap Survey

Since 2009, New Hampshire Fish and Game has been conducting the coastwide Random Stratified Ventless Trap Survey in state waters (Statistical Area 513). A total of six sites were surveyed twice a month from June through September in 2022. Beginning in 2016, all Jonah crabs were evaluated for sex, carapace width (mm), cull condition, and molt stage. A total of 17 Jonah crab over 8 trips were measured during the 2022 sampling season.

Massachusetts

A. Settlement Survey

The Juvenile Lobster Suction Survey has consistently identified *Cancer* crabs to genus level since 1995, and Jonah crab have been consistently identified to species in the survey since 2011. The mean number of Jonah crab observed in the MA DMF Settlement Survey in the GOM region has been higher from 2016 through 2022 than it was from 2011 to 2015 (Figure 4).

B. Ventless Trap Survey

The Massachusetts Division of Marine Fisheries (MA DMF) Ventless Trap Survey is conducted in MA territorial waters of NMFS statistical areas 514 and 538. Stratified mean catch per trawl haul (CPUE) for the survey is standardized to a six-pot trawl with three vented and three

ventless traps. The index produced from the MA DMF Ventless Trap Survey has been increasing since 2012 and is approaching time series highs (Figure 5).

C. Trawl Survey

The aggregation of DMF trawl survey regions has changed compared to previous reports. Regions 1 and 2 are considered SNE, regions 3-5 are considered GOM. Previously, region 3, which extends southwards from the tip of Cape Cod along the eastern side of the outer Cape to south of Nantucket, was included with SNE. Except for the fall survey in the GOM region, Jonah crabs are infrequently caught in the MA DMF Trawl Survey. Since generally increasing in abundance since the mid-1990's, the last couple of years of the fall survey in the GOM have generally been near or below time series medians (Figure 6).

Rhode Island

A. Settlement Survey

The RI DEM lobster YOY Settlement Survey (Suction Sampling) intercepts Jonah crabs. Jonah crab catches in this survey are generally low. In 2022, the Jonah Crab Index was zero crabs per m^2, compared with the time series (1990-2022) mean of 0.18 crabs per m^2 (Figure 7).

B. Ventless Trap Survey

Since its inception in 2006, the RI Ventless Trap Survey (VTS) has recorded counts of Jonah crab per pot. Carapace width, sex, ovigerous condition, and location data have been collected for all Jonah crabs encountered in the survey since 2015; prior to this, only counts of Jonah crab were recorded. In 2022, the stratified abundance index of Jonah crabs was 2.40 crabs per ventless trap, higher than the time series mean of 1.40 crabs per ventless trap (Figure 8).

B. Trawl Survey

RI DEM has conducted spring and fall trawl surveys since 1979, and a monthly trawl survey since 1990. However, the survey did not begin counting Jonah crab specifically until 2015. Jonah crabs are rarely encountered in this survey, and abundance indices are variable yet low, averaging 0.04 crabs per tow over the time series.

Connecticut

A. Trawl Survey

Jonah crab abundance is monitored through the Long Island Sound Trawl Survey (LISTS) during the spring (April, May, June) and fall (September and October) cruises, all within NMFS statistical area 611. The survey documents the number of individuals caught and total weight per haul by survey site in Long Island Sound. The LISTS caught one Jonah crab in the fall 2007 survey and two in the fall 2008 survey. Both observations occurred in October at the same trawl site in eastern Long Island Sound. No trawl survey sampling was conducted in 2020 due to restrictions on field sampling caused by the global COVID-19 pandemic. No Jonah crabs were observed in the 2021 or 2022 spring or fall surveys.

New York

A. Trawl Survey

New York initiated a stratified random trawl survey in the near shore ocean waters off the south shore of Long Island in 2018 from the Rockaways to Montauk Point and the New York waters of Block Island Sound. Seven sampling cruises were conducted in 2022 during the winter (February), spring (April, May, June), summer (August) and fall (October, November). Twenty-one stations were sampled during the winter cruise in February. Thirteen, seventeen, and twenty-three stations were sampled during the spring cruises. Thirty stations were sampled during the summer cruise in August. During the fall, 20 stations were sampled in October and eight stations were sampled in November. A total of 256 Jonah crabs were caught. A total of 35 females were measured ranging from 18mm to 111mm with an average of 55mm; 58 males were measured ranging from 16mm to 141mm, with an average shell width of 84mm.

New Jersey

A. Trawl Survey

A fishery-independent Ocean Trawl Survey is conducted from Sandy Hook, NJ to Cape May, NJ each year. The survey stratifies sampling in three depth gradients, inshore (18'-30'), mid-shore (30'-60'), and offshore (60'-90'). The mean CPUE, which is calculated as the sum of the mean weight of Jonah crab collected in each sampling area weighted by the stratum area, has remained low throughout the time series, but increased slightly in 2019. A cruise was not conducted in April 2019. Due to the COVID-19 pandemic, 2020 and 2021 CPUE and indices were not obtained (Figure 9).

7.0 Recent and On-Going Research Projects

A. Declawing Study

NH F&G, Wells National Estuarine Research Reserve, and the University of New Hampshire have been conducting a variety of collaborative research on Jonah crabs since 2014. Two of those studies were published in 2021. Goldstein and Carloni (2021) assessed the implications of live claw removal, and Dorrance et al. (2021) conducted follow-up research on that study to better understand the sublethal effects of declawing. These manuscripts provide estimates of mortality for declawed animals, and information on the effects of claw removal on feeding, movement and mating.

In addition to the above-mentioned publications, an acoustic telemetry study was conducted in 2018 and 2019 by same collaborators to assess the movement patterns of both controls and declawed animals. These data are currently the basis for Maureen Madray's thesis (Furey lab-UNH) and will be finalized in the coming months.

B. Growth and Fishery Dependent Data

In 2019, two collaborative studies between the University of Rhode Island and Rhode Island DEM were published. The first of these was a growth study, which described molt increments for adult females and males and molting seasonality and molt probabilities for adult males in Rhode Island Sound. The second was an interview study in which fifteen in-person interviews

were conducted with Jonah crab fishermen to collect their knowledge concerning Jonah crab biology and fishery characteristics. The interviews provided insight into aspects of the species biology and life history that have not been characterized in the literature (e.g., seasonal distribution patterns); identified topics requiring further study (e.g., stock structure and spawning seasonality); and highlighted predominant concerns related to fishery management (e.g., inshore-offshore fleet dynamics).

New Hampshire Fish and Game, Wells National Estuarine Research Reserve and the University of New Hampshire conducted research on growth rates of crabs held at ambient and controlled temperatures for sizes ranging from 5 mm (YOY) to 100 mm. These data are currently being analyzed, and will be available for population assessment purposes.

C. CFRF Research Fleet

The Commercial Fisheries Research Foundation (CFRF) has expanded its lobster commercial research fleet to sample Jonah crab. Biological data collected include carapace width, sex, shell hardness, egg status, and disposition. As of July 31, 2023, 124,325 Jonah crabs have been sampled through the program.

8.0 State Compliance

All states except New York have implemented the provisions of the Jonah Crab FMP and associated addenda. The implementation deadline for the Jonah Crab FMP was June 1, 2016; the implementation deadline for Addendum I was January 1, 2017; the implementation deadline for Addendum II was January 1, 2018; and the implementation deadline for Addendum III was January 1, 2019 (with the exception of the 10 minute square reporting requirement).

- NY is in the process of implementing the full suite of management measures required under the Jonah Crab FMP or Addendum I and II. Specifically, NYSDEC has initiated a rulemaking which will limit participation in the Jonah crab directed trap fishery to those vessel and permit holders which already hold a lobster permit, or those who can prove prior participation in the crab fishery before the control date of June 2, 2015. This rulemaking will also establish a bycatch limit for Jonah crab of no more than 1,000 crabs per trip for non-trap gear and non-lobster trap gear. This rulemaking should be in effect before 2024.

9.0 *De Minimis* Requests

The states of Delaware, Maryland, and Virginia, have requested *de minimis* status. According to the Jonah crab FMP, states may qualify for *de minimis* status if, for the preceding three years for which data are available, their average commercial landings (by weight) constitute less than 1% of the average coastwide commercial catch. Delaware, Maryland, and Virginia meet the *de minimis* requirement.

10.0 Research Recommendations

A stock assessment for Jonah crab has been completed and is scheduled for peer review in 2023. Research recommendations will be made by the Stock Assessment Subcommittee and

Peer Review Panel.

11.0 Plan Review Team Recommendations

The following are recommendations and comments from the Plan Review Team:

- The PRT recommends the Board approve the *de minimis* requests of DE, MD, and VA.
- The PRT notes that MA has been unable to meet the August 1 deadline for compliance reports for the last several years.
- Rhode Island, Connecticut, New York, and New Jersey were not able to complete the sea and/or port sampling required by the FMP. These states have noted concerns with staff availability, funding, and lack of agreement by fishermen, which have contributed to the inability to complete the required sampling trips.

12.0 Tables

Table 1. Landings (in pounds) of Jonah crab by the states of Maine through Virginia. 2010-2021 landings were provided by ACCSP based on state data submissions. 2022 landings were submitted by the states as a part of the compliance reports and should be considered preliminary. *C= confidential data*

	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	Total
2010	1,093,962	C	5,689,431	3,720,440	C	968,122	30,441		17,845	C	11,690,787
2011	1,096,592	C	5,379,792	3,213,119	C	69,440	27,025		92,401	C	9,947,142
2012	556,675	C	7,540,510	3,774,300	2,349	410,349	68,606		C	C	12,552,537
2013	379,073	340,751	10,117,542	4,651,796	51,462	371,713	8,143		C	C	16,075,636
2014	348,295	404,703	11,904,611	4,435,934	49,998	83,060	33,156		153,714	C	17,413,503
2015	312,063	C	9,128,876	4,298,894	C	207,424	68,116	C	39,750	C	14,253,327
2016	602,206	150,341	10,660,653	4,224,092	C	165,427	261,287	C	14,656	C	16,084,217
2017	1,043,418	114,155	11,698,342	4,111,281	C	158,231	433,132	C	23,564	C	17,594,666
2018	1,054,795	22,434	13,250,803	4,665,701	C	231,642	880,192	C	60,628	C	20,175,488
2019	763,807	70,818	9,698,145	4,222,305	C	125,391	1,061,194	C	47,829	C	15,968,414
2020	696,309	31,658	8,605,007	3,319,652	C	105,841	975,522	C	35,606	C	13,744,904
2021	1,426,959	123,729	6,539,131	2,142,424	C	72,066	1,597,748	C	34,327	C	12,345,330
2022	2,956,697	295,529	7,765,545	2,458,416	C	34,550	526,680	C	C	C	14,037,417

Table 2. Jonah crab stratified mean weight (kg/tow) for the Spring Maine-New Hampshire Inshore Trawl Survey 2001-2022 (with no 2020)

Survey	StratMean_Weight	CV_Weight	SE_Weight
SP01	0.97	0.68	0.26
SP02	0.95	0.71	0.27
SP03	0.92	0.33	0.15
SP04	1.11	0.48	0.28
SP05	1.71	0.33	0.32
SP06	1.27	0.47	0.29
SP07	1.13	0.34	0.17
SP08	0.82	0.23	0.09
SP09	0.85	0.25	0.10
SP10	0.52	0.40	0.11
SP11	0.53	0.32	0.08
SP12	0.41	0.25	0.05
SP13	0.26	0.37	0.05
SP14	0.85	0.44	0.15
SP15	0.61	0.36	0.09
SP16	2.11	0.43	0.38
SP17	0.56	0.33	0.07
SP18	0.44	0.30	0.06
SP19	0.36	0.59	0.08
SP21	0.20	0.43	0.03
SP22	0.30	0.32	0.04

Table 3. Jonah crab stratified mean weight (kg/tow) for the Spring Maine-New Hampshire Inshore Trawl Survey 2001-2022 (with no 2020)

Survey	StratMean_Weight	CV_Weight	SE_Weight
FL00	0.45	0.47	0.09
FL01	2.23	0.27	0.32
FL02	1.37	0.66	0.40
FL03	0.63	0.22	0.08
FL04	1.11	0.36	0.23
FL05	0.69	0.34	0.16
FL06	0.69	0.38	0.13
FL07	0.94	0.28	0.15
FL08	1.29	0.17	0.12
FL09	0.38	0.30	0.06
FL10	0.46	0.43	0.09
FL11	0.34	0.35	0.07
FL12	0.29	0.30	0.04
FL13	0.29	0.26	0.04
FL14	0.16	0.36	0.02
FL15	2.52	0.42	0.48
FL16	2.01	0.27	0.28
FL17	1.14	0.24	0.13
FL18	0.75	0.46	0.14
FL19	0.68	0.20	0.06
FL20	0.15	0.62	0.05
FL21	0.13	0.36	0.02
FL22	0.19	0.46	0.04

13.0 Figures

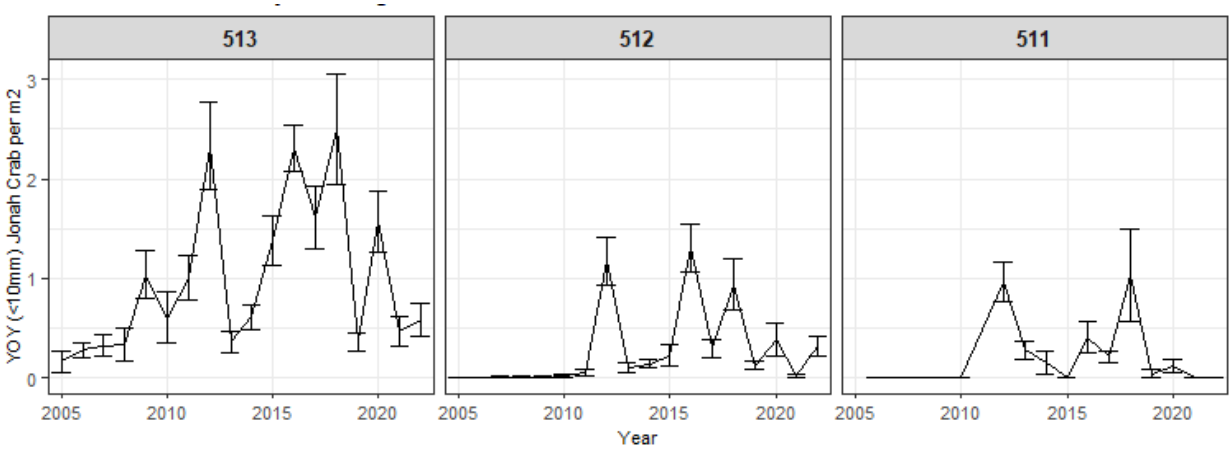

Figure 1. Density of YOY (<10mm carapace width) Jonah crab over time in the Maine Settlement Survey by statistical area.

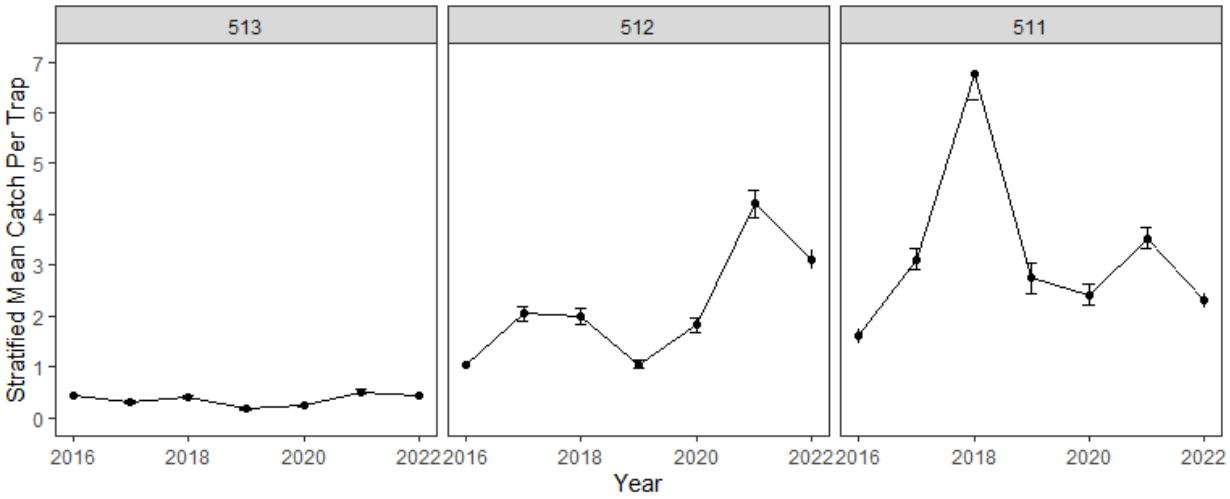

Figure 2. Stratified mean of Jonah crab from Maine Ventless Trap Survey 2016-2022. Standard error shown.

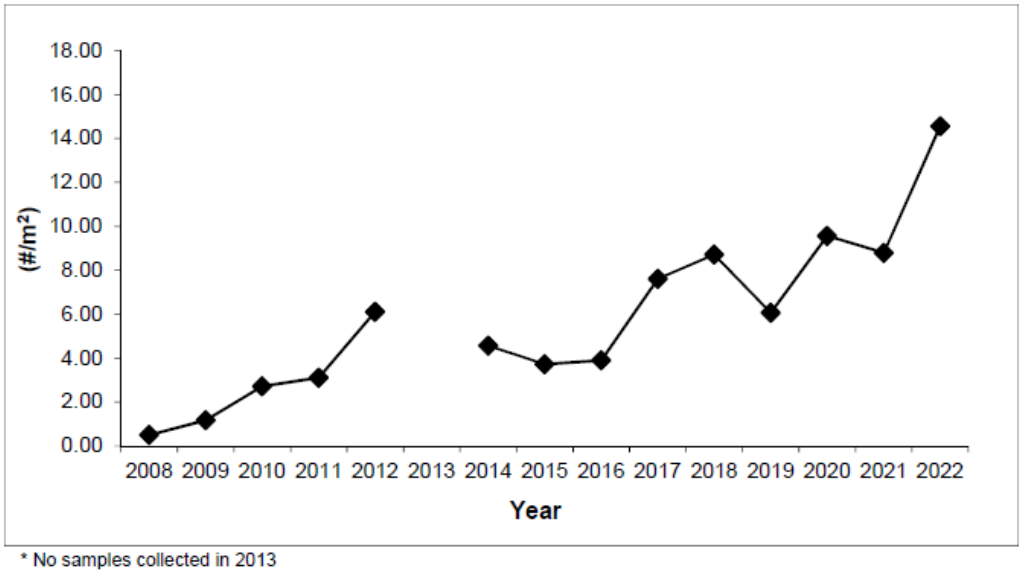

Figure 3. Catch per unit effort (#/m^2) of Jonah crab during the American Lobster Settlement Index Survey, in New Hampshire, from 2009 through 2022.

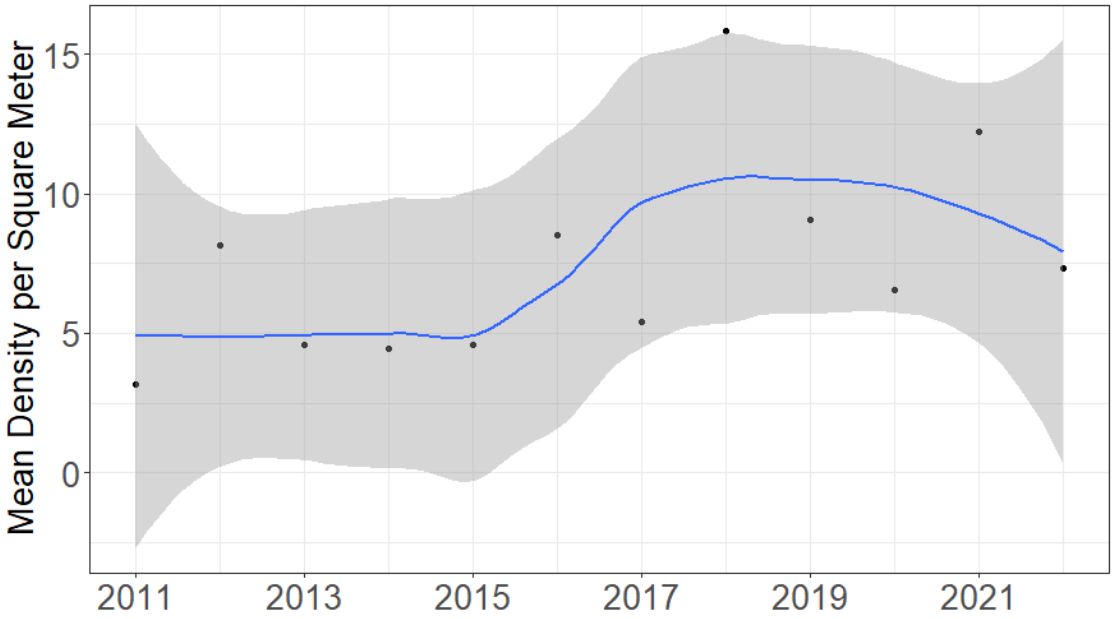

Figure 4. Mean number of Jonah crab per square meter from the MA DMF Settlement Survey from the Gulf of Maine (GOM) region. Black dots are annual means, blue line is a Loess soother, gray area is confidence interval around the Loess smoother.

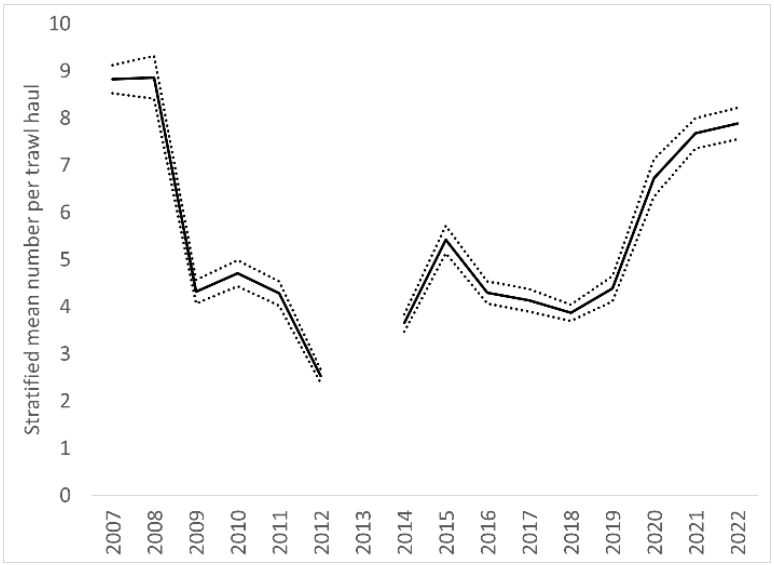

Figure 5. Mean number of Jonah crabs per trawl haul from ventless traps from GOM region of the MA DMF Ventless Trap Survey (standardized to a 6-pot trawl with three vented and three ventless traps). Error bars are two times the standard error. The survey was not conducted in 2013 due to a gap in funding.

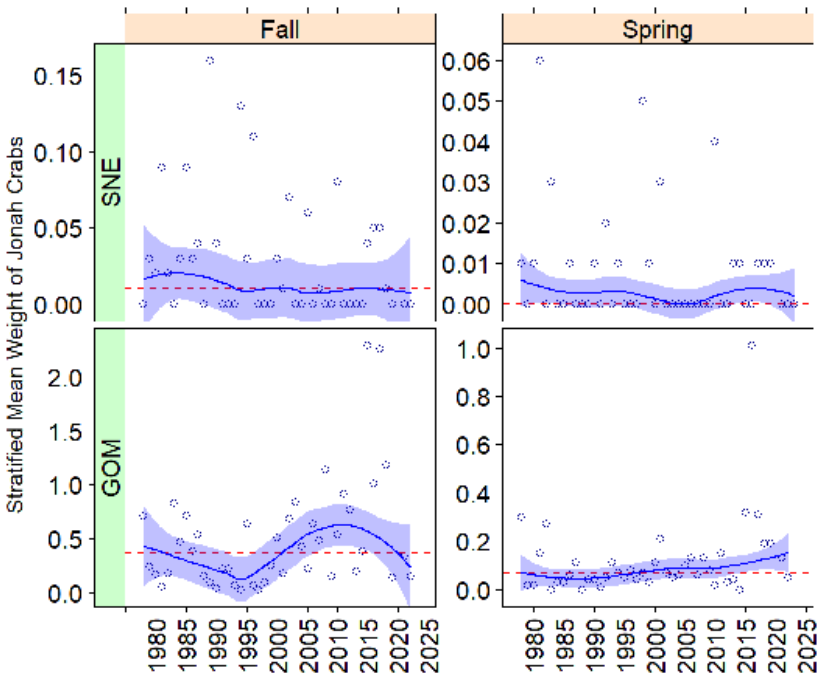

Figure 6. Stratified mean weight (kg) of Jonah crab from the MA DMF Trawl Survey. The left column shows the fall surveys, the right columns show the spring surveys. Southern New England (SNE) is on the top row, Gulf of Maine (GOM) is on the bottom. Red dashed line is the time series median. Blue line is a trend line (Loess smoother), and the blue shaded area is the confidence interval around the trend line. The survey was not conducted in 2020 due to the Covid-19 pandemic.

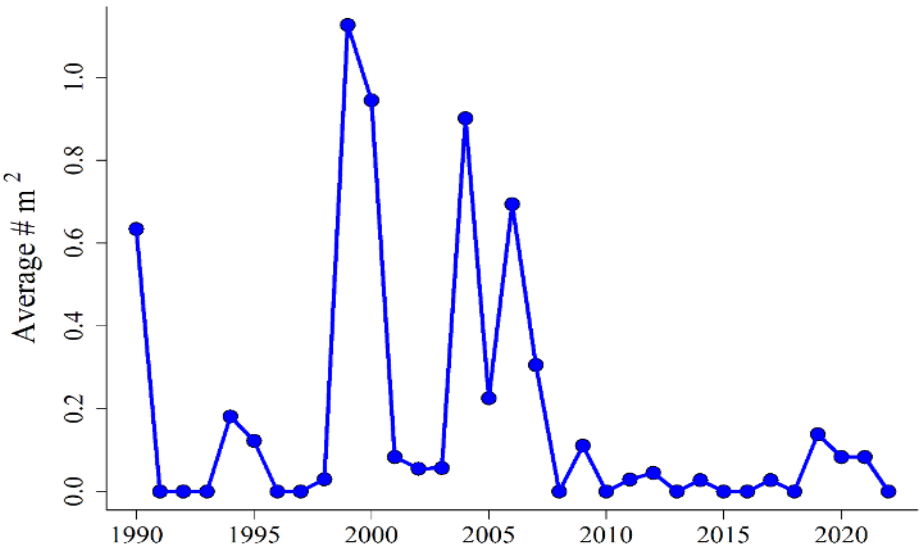

Figure 7. Rhode Island YOY Settlement Survey trend for all Jonah crabs caught per m^2, 1990-2022.

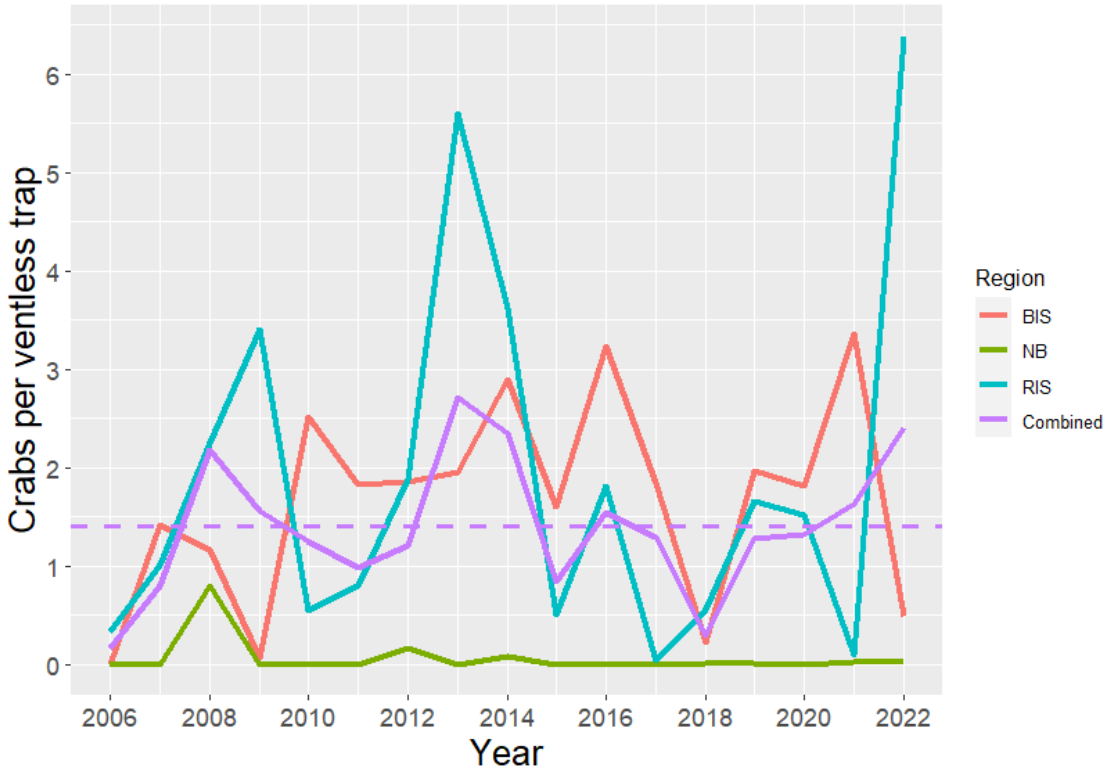

Figure 8. Rhode Island ventless trap survey index of Jonah crab abundance by region: Narragansett Bay (NB), Rhode Island Sound (RIS), and Block Island Sound (BIS). Time series mean for the combined region is presented as a dashed purple line.

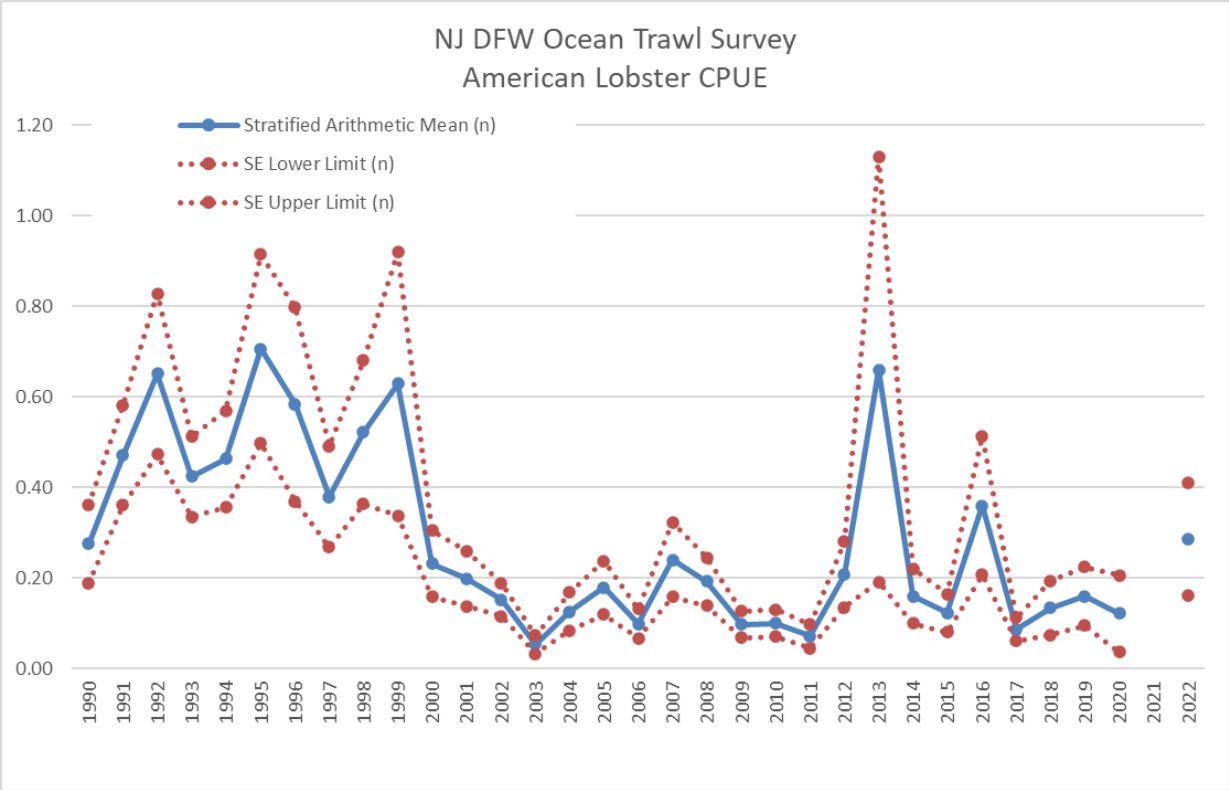

Figure 10. Stratified mean CPUE of all Jonah crab collected aboard the NJDFW Ocean Trawl Survey. The survey stratifies sampling in three depth gradients, inshore (18'-30'), mid-shore (30'-60'), offshore (60'-90'). The mean CPUE was calculated as the sum of the mean weight (in kg) of Jonah crab per size class collected in each sampling area weighted by the stratum area. ***NOTE: No April 2019 Survey was conducted due to Research vessel mechanical issues. Due to the COVID-19 pandemic, Apr-Oct 2020 and 2021 CPUE and indices were not obtained.**

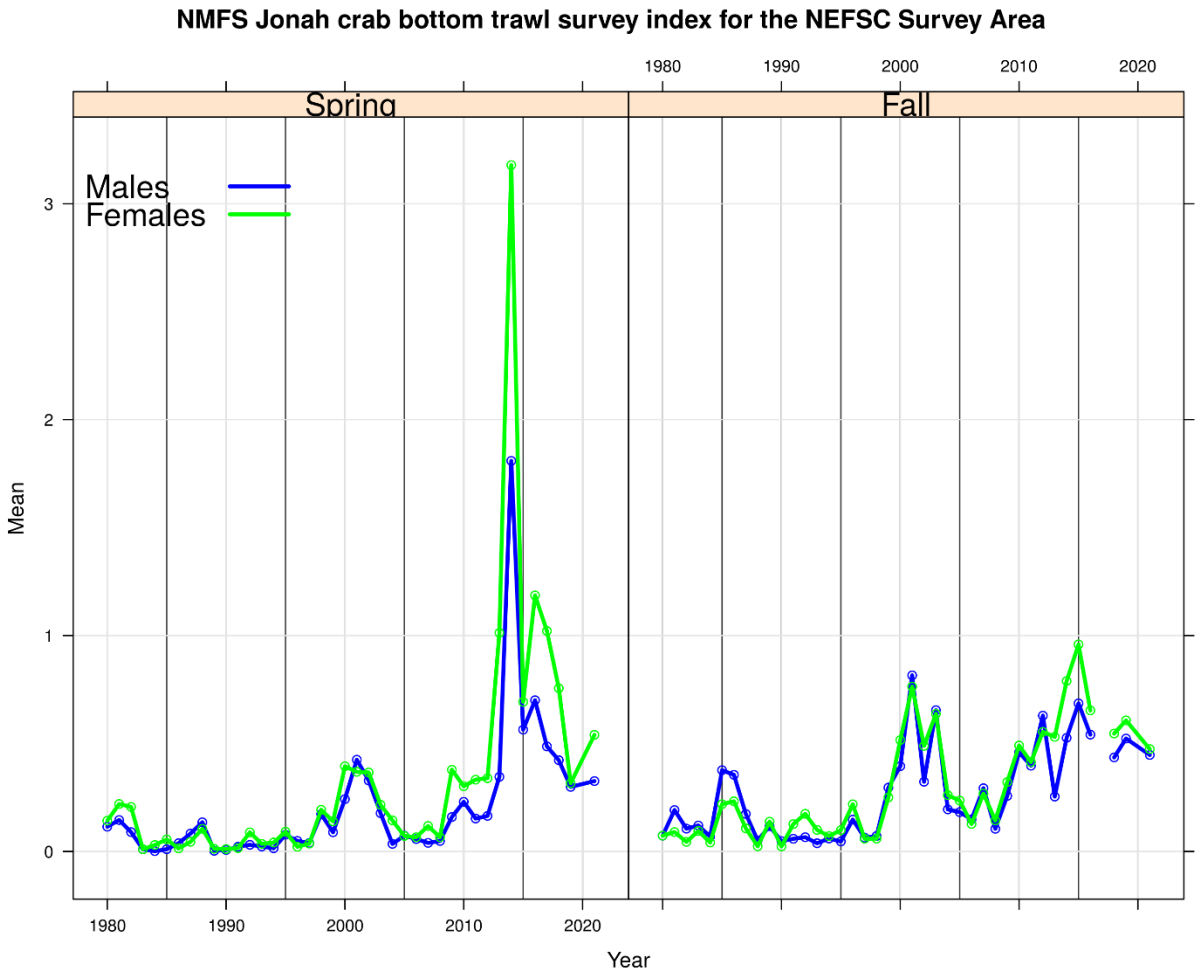

Figure 11. NMFS Jonah Crab index (mean number per tow) from the bottom trawl survey for the NEFSC Survey Area, through fall 2021 There was no survey conducted in 2020 due to the COVID-19 pandemic.