

ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR JONAH CRAB
(Cancer borealis)

2017 FISHING YEAR



Prepared by the Plan Review Team

Approved by the American Lobster Board
October 2018

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**REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN FOR JONAH CRAB
(*Cancer borealis*)**

2017 FISHING YEAR

1.0 Status of the Fishery Management Plan

<u>Year of ASMFC Plan's Adoption:</u>	FMP (2015)
<u>Framework Adjustments:</u>	Addendum I (2016) Addendum II (2017) Addendum III (2018)
<u>Management Unit:</u>	Maine through North Carolina
<u>States with a Declared Interest:</u>	Maine through Virginia (Excluding Pennsylvania and DC)
<u>Active Committees:</u>	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 1990's, 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 dollars. 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.

Today, Jonah crab and lobster are considered 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 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. A historic claw fishery takes place along the Delmarva Peninsula where small boat fishermen harvest Jonah crab claws because they do not have a seawater storage tank on board to store whole crabs.

In 2017, 17.4 million pounds of Jonah crab were landed along the Atlantic Coast, representing \$16.3 million in ex-vessel value. The states of Massachusetts (66%) and Rhode Island (23%) were the largest contributors to landings in the fishery. Landings in descending order also occurred in Maine, New Jersey, New York, New Hampshire, Maryland, Delaware, Virginia, and Connecticut. 99% of coastwide landings in 2017 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 as compared 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. Female crab (and likely some males) are documented moving inshore during the late spring and summer. Motivations for this migration are unknown, but maturation, spawning, and molting have all been postulated. It is also generally accepted that these migrating crab move back offshore in the fall and winter. Due to the lack of a widespread and well-developed aging method for crustaceans, the age, growth, and maturity of Jonah crab is poorly described.

The status of the Jonah crab resource is relatively unknown and no range wide stock assessment has been conducted. 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. In addition, several studies are on-going (Section 7.0) to elucidate information on the species.

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 plan lays out specific management measures in the commercial fishery. These include a 4.75" minimum size with zero tolerance 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 Plan also requires harvester and dealer reporting along with port and sea sampling.

Addendum I (2016)

Addendum I establishes a bycatch limit of 1,000 pounds of crab/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.

5.0 Fishery Monitoring

The provisions of Addendum III did not impact fishery monitoring programs in 2017. As a result, language in the FMP sets the standard for fishery monitoring. Specifically, the FMP requires that *"at a minimum, state and federal agencies shall conduct port/sea sampling to collect the following types of information on landings, where possible: carapace width, sex, discards, egg-bearing status, cull status, shell hardness, and whether the landings are whole crabs or parts."* The Plan also establishes coastwide mandatory reporting and fishery dependent sampling with 100% dealer and harvester reporting. Jurisdictions which currently require less than 100% harvester reporting in the lobster fishery are required to maintain, at a minimum, their current programs and extend them to Jonah crab. *De minimis* states are not required to conduct fishery-independent sampling or port/sea sampling. These requirements for fishery monitoring will be amended in future years to reflect implementation of Addendum III.

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

- Maine: Maine conducted 8 sea sampling trips and sampled 523 Jonah crab. Sampling occurs through the Lobster Sea Sampling program, which has a sampling protocol for Jonah crab. Maine's lobster port sampling program was suspended in 2011.
- New Hampshire: Staff sampled 49 Jonah crab on 10 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. Sampling took place at shellfish dealers, where an interview with the captain occurred and a biological sample was taken. A total of 642 Jonah crab were sampled through this new program, of which a maximum of 250 crabs were sexed, measured for carapace length, and (when feasible) weighed.
- Massachusetts: Staff conducted 10 sea sampling trips and sampled 2,419 Jonah crab. Types of information collected include shell width, sex, egg bearing status, cull status, shell hardness, and whole crabs vs. parts. Massachusetts also inspected 19 vessels at port and sampled 11,707 Jonah crab.
- Rhode Island: Through a collaboration with URI-GSO and the state, 5 sea sampling trips measuring 3,684 Jonah crab were conducted in 2017. Due to staff and budget constraints, RI DFW did not conduct its own sea or port sampling but it hopes to continue this collaboration with URI-GSO in the future.
- Connecticut: No sea sampling or port sampling trips were conducted for Jonah crab.
- New York: Staff conducted two market sampling trips, collecting information on 25 Jonah crab. No sea sampling trips were conducted for Jonah crab.
- New Jersey: No sea or port sampling trips were conducted for Jonah crab.
- Delaware: No sea or port sampling trips were conducted for Jonah crab.
- Maryland: No sea or port sampling trips were conducted for Jonah crab.
- Virginia: No sea or port sampling trips were conducted for Jonah crab.

6.0 Status of Surveys

The Interstate Fishery Management Plan 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 Jonah crab has increased over the past two decades with high values in 2013 and 2016 (Figure 1). Similarly, the density of all Jonah crab noticeably increased in the early 2000's and has remained high since (Figure 1).

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 throughout the history of this survey. The 2017 spring survey completed 122 tows and sampled a total of 339 Jonah crab. The spring abundance indices for Jonah crab have significantly increased since 2013, but noticeably decline in 2017 (Figure 2). The 2017 fall survey completed 101 tows and sampled 526 Jonah crab. Abundance indices for Jonah crab have declined in 2016 and 2017 (Figure 2).

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 this data in the early years 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. Figure 3 shows the catch of Jonah crab per trap in 2017.

D. Sea Urchin Survey

Maine DMR conducts an annual dive survey of the sea urchin stock within state waters. Beginning in May and working through June, divers evaluated approximately 60 1-meter square quadrats at each site they visited. Beginning in 2004, the data collected on crabs was expanded to include carapace width and sex. A total of 117,337 quadrats have been evaluated for Jonah crab through 2016. Counts of Jonah crab from this survey show a marked increase from 2005-2008 (Figure 4).

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 5 depicts the CPUE (#/m²) of Jonah crab for all NH sites combined, from 2009 through 2017. This time series shows a general upward trend to a time series high in 2017.

B. Ventless Trap Survey

Since 2009, NHF&G 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 2017. Beginning in 2016 all Jonah crab were evaluated for sex and carapace length. A total of 23 Jonah crab over 8 trips were measured during the 2017 sampling season.

Massachusetts

A. Settlement Survey

The Juvenile Lobster Suction Survey has consistently identified Jonah crab since 2011, and has identified the *Cancer* crabs to genus since 1995. Figure 6 shows that Jonah crab are generally absent from the two sampled locations in stat area 538 (Buzzards Bay and Vineyard Sound) but

are present at other sampled locations. The number of Jonah crab per square mile in Cape Ann decreased from 2016 to 2017 but remained fairly stable in Beverly/Salem, Boston Harbor, South Shore, and Cape Cod Bay.

B. Ventless Trap Survey

CPUE of Jonah crab from the MA DMF Ventless Trap Survey within NMFS statistical areas 538 and 537 has been trending downward (Figure 7). Though the survey started in 2005, Figure 7 only shows data from 2011 through 2017 due to changes in areas surveyed prior to 2011. The 2017 data point is the lowest in the time series. The MA DMF Ventless Trap Survey catches fewer Jonah crab in NMFS statistical area 514 (Figure 8) compared to 538/537. Area 514 has been on an overall downward trend, but has been fairly stable since 2009.

C. Trawl Survey

The MA DMF Trawl Survey has seen a recent increase in the number of Jonah crab in the fall survey south and east of Cape Cod (Figure 9), and in the spring and fall surveys north of Cape Cod (Figure 9). All 2017 data points were above time series medians and trending upward based on a fitted generalized additive model.

Rhode Island

A. Ventless Trap Survey

Since its inception in 2006, the RI Ventless Trap Survey (VTS) has recorded counts of Jonah crab in each pot. In 2014, carapace width and sex were also recorded for all individuals. In 2017, the VTS was conducted during the months of June-August and over 18 sampling trips. A total of 314 Jonah crab were sampled. All sampling was conducted in LMA 2, NMFS Statistical Area 539. The stratified mean catch per ventless trap on a six pot (three ventless, three vented) trawl was 0.75 Jonah crab (Figure 10).

B. Trawl Survey

RIDEM has conducted Spring and Fall trawl surveys since 1979, and a monthly trawl survey since 1990. However, invertebrates (other than lobsters) have not been counted for much of these time series. In 2015, the survey began counting Jonah crab specifically. Given the short time series of Jonah crab data available and few Jonah crab observations by the surveys, the information is not available at this time. As the datasets for Jonah crab from these trawl surveys grow, these data will be provided as abundance indices.

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 Long Island Sound Trawl Survey 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 Jonah crab have been observed in the survey since 2008.

New Jersey

A. Trawl Survey

An 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'), offshore (60'-90'). The mean CPUE, which is calculated as the sum of the mean number of Jonah crab collected in each sampling area weighted by the stratum area, has remained low throughout the time series (Figure 11).

7.0 Recent and On-Going Research Projects

A. Maturity Study

MA DMF, in collaboration with CFRF, has conducted a Jonah crab maturity study. Results suggests that females mature at a smaller size than males (~88-94mm carapace width vs. ~103-117mm carapace width, depending on region sampled). Importantly, the sizes at maturity for both sexes are below the current minimum legal size for harvest (121 mm).

In addition, a graduate student at the University of Maryland Eastern Shore completed a master's thesis on the size at sexual maturity and reproductive biology of Jonah crabs in the Mid-Atlantic Bight in the spring of 2018. Jonah crabs were collected as bycatch in black sea bass and lobster pots from December 2015 to September 2017 as well as from the 2016 and 2017 Virginia Institute of Marine Science Mid-Atlantic Sea Scallop dredge survey. Measurements included: sex, weight, length, width, chela length and height, abdomen width (females), molt condition, presence/absence of egg clutches, and presence/absence of external sperm plugs. A gonadosomatic index was created for female Jonah crabs.

B. Tagging Study

MA DMF, in collaboration with AOLA, NH F&G, and ME DMR, is conducting a tagging study in the Jonah crab fishery. Preliminary data suggests that most Jonah crab are not migrating far; however, four tagged Jonah crab were recorded traveling over 100 km between Georges Bank and Southern New England. As of August 2018, 15,026 clinch tags and 17,037 t-bar tags have been deployed, and there is an overall tag return rate of 2.4%.

C. Declawing Study

NH F&G conducted a laboratory study to investigate the mortality associated with declawing of Jonah crab. 5 trials were completed over 3 seasons. Results indicate a 15% mortality rate for control crabs, a 56% mortality rate for crabs with one claw removed, and a 75% mortality rate for crabs with both claws removed. A field-based declawing study is being conducted in 2018 to see if the results are similar to those conducted in the lab.

D. Growth and Fishery Dependent Data

A graduate student at URI is completing a Master's Thesis on Jonah crab, focusing on fishery-dependent data collection and growth. From June 2016 to August 2017, a pilot sea sampling program was implemented to collect information on size distributions, length-weight relationships, sex ratios, molting condition, and shell disease levels. In addition, a laboratory study was conducted in 2016-2017 to describe the growth of Jonah crab in RI Sound. Results

include quantification of growth-per-molt in male and female Jonah crab, and a description of molting seasonality and molt probabilities in male Jonah crab. Finally, the Master's Thesis includes fifteen in-person interviews with Jonah crab fishermen to collect their knowledge concerning Jonah crab biology and fishery characteristics. Results of the interviews are anticipated to be submitted for publication this fall.

E. CFRF Research Fleet

The Commercial Fisheries Research Foundation (CFRF) has expanded their lobster commercial research fleet to sample Jonah crab. Biological data collected include carapace width, sex, shell hardness, egg status, and disposition. As of September 2018, 56,301 Jonah crab have been sampled through the program.

8.0 State Compliance

Two states have not implemented 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; and the implementation deadline for Addendum II was January 1, 2018.

- New York has not yet implemented the full suite of management measures required under the Jonah Crab FMP or Addendum I and II. New York crab legislation currently prohibits the harvest of female crabs with eggs and recreational harvest is limited to 50 crabs. The 4.75" minimum carapace width, the 1000 crab bycatch limit, and commercial rules regarding crab part retention have not been implemented. In last year's compliance report it was expected that regulations would be implemented by early 2018.
- Delaware has not yet implemented the management measures required under the Jonah Crab FMP or Addendum I and II. Promulgation of Delaware's Jonah Crab regulations have to go through the state legislature and this has yet to occur. In last year's compliance report it was expected that regulations would be implemented by early 2018.

9.0 De Minimis Requests.

The states of Virginia, Maryland, and Delaware have requested *de minimis* status. According to the Interstate Fishery Management Plan for Jonah crab, 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

The following research questions were compiled by the Jonah Crab TC and need to be answered in order to complete a coastwide stock assessment.

- **Growth Rates** – While there has been some research on Jonah crab growth rates, more studies are needed to determine growth rates along the entire coast. In particular, it is necessary to determine the molt frequency, molt increment, and if there is a terminal molt.
- **Maturity and Reproduction** – Studies are needed to determine the size at maturity of crabs in different regions, the size ratio of mating crabs, and sperm limitations.

- **Migration** – There are several tagging studies on-going in the Jonah crab fishery. Hopefully these studies will elucidate the migrations of Jonah crab as well as seasonal habitat preferences.
- **Natural Mortality** – An estimate of natural mortality must be developed for Jonah crab in order to carry out a stock assessment. In particular, it will be critical to determine the natural mortality of the adult size crabs.

11.0 Plan Review Team Recommendations

The following are recommendations from the Plan Review Team:

- The PRT recommends the Board approve the *de minimis* requests of DE, MD, and VA.
- The PRT raises concerns about the lack of Jonah crab regulations in NY and DE, particularly in regard to the lack of minimum carapace width and commercial bycatch limit. Similar issues were raised in the 2017 compliance reports and have not been addressed within the last year.
- The PRT recommends that jurisdictions with crab-only fishermen report on the number of these fishermen, their collective number of traps fished, and the rules governing their fishing activity.
- The PRT recommends continued research of the Jonah crab species so that a coastwide stock assessment can be completed in the near future.
- The PRT recommends the LEC review compliance in the Jonah crab fishery, given it is a fairly new fishery management plan and lessons may be learned.

12.0 Tables

Table 1. Landings (in pounds) of Jonah crab by the states of Maine through Virginia. 2010-2016 landings were provided by ACCSP based on state data submissions. 2017 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	2,922,404	C	968,122	28,400		18,045	C	10,890,910
2011	1,096,592	C	5,379,792	2,540,337	C	69,440	26,286		92,401	C	9,273,622
2012	556,675	C	7,540,510	3,286,569	2,349	410,349	68,252		C	C	12,072,452
2013	379,073	340,751	10,087,443	4,397,734	51,462	C	7,803		C	C	15,798,919
2014	344,290	404,703	11,858,702	4,123,040	49,998	C	33,104	C	153,714	C	17,050,643
2015	309,715	C	9,096,374	3,861,260	C	207,437	68,116	C	39,750	C	13,780,846
2016	604,023	150,342	10,657,785	3,669,939	C	165,427	260,856	C	C	C	15,527,171
2017	1,167,833	114,155	11,425,083	4,082,252	C	158,179	432,754	C	C	C	17,403,526

13.0 Figures

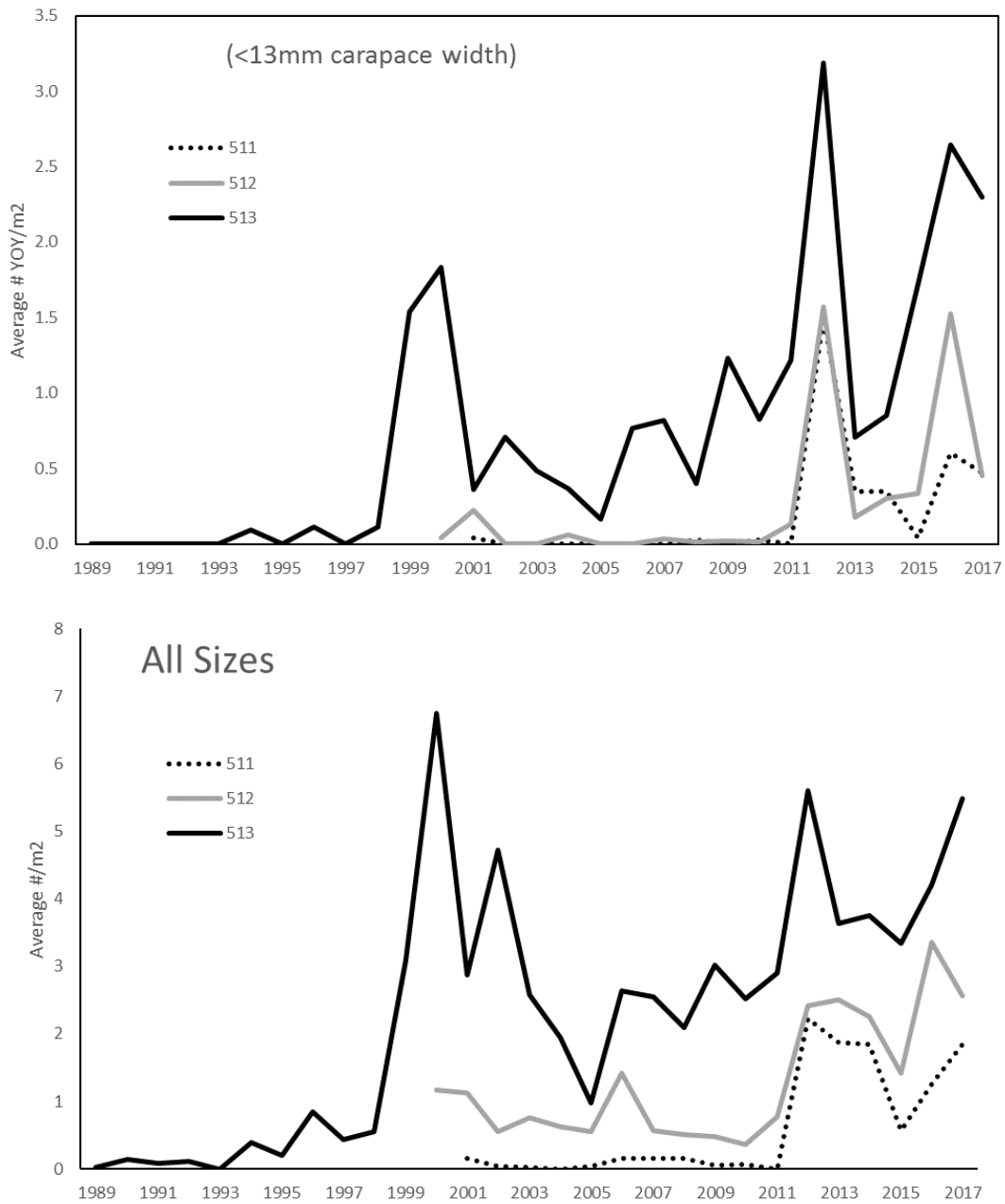


Figure 1: The density of Jonah crab measured over time in the Maine Settlement Survey by statistical area. The top graph shows the density of Jonah crab less than 13mm in carapace width and the bottom graph shows the density of all Jonah crab.

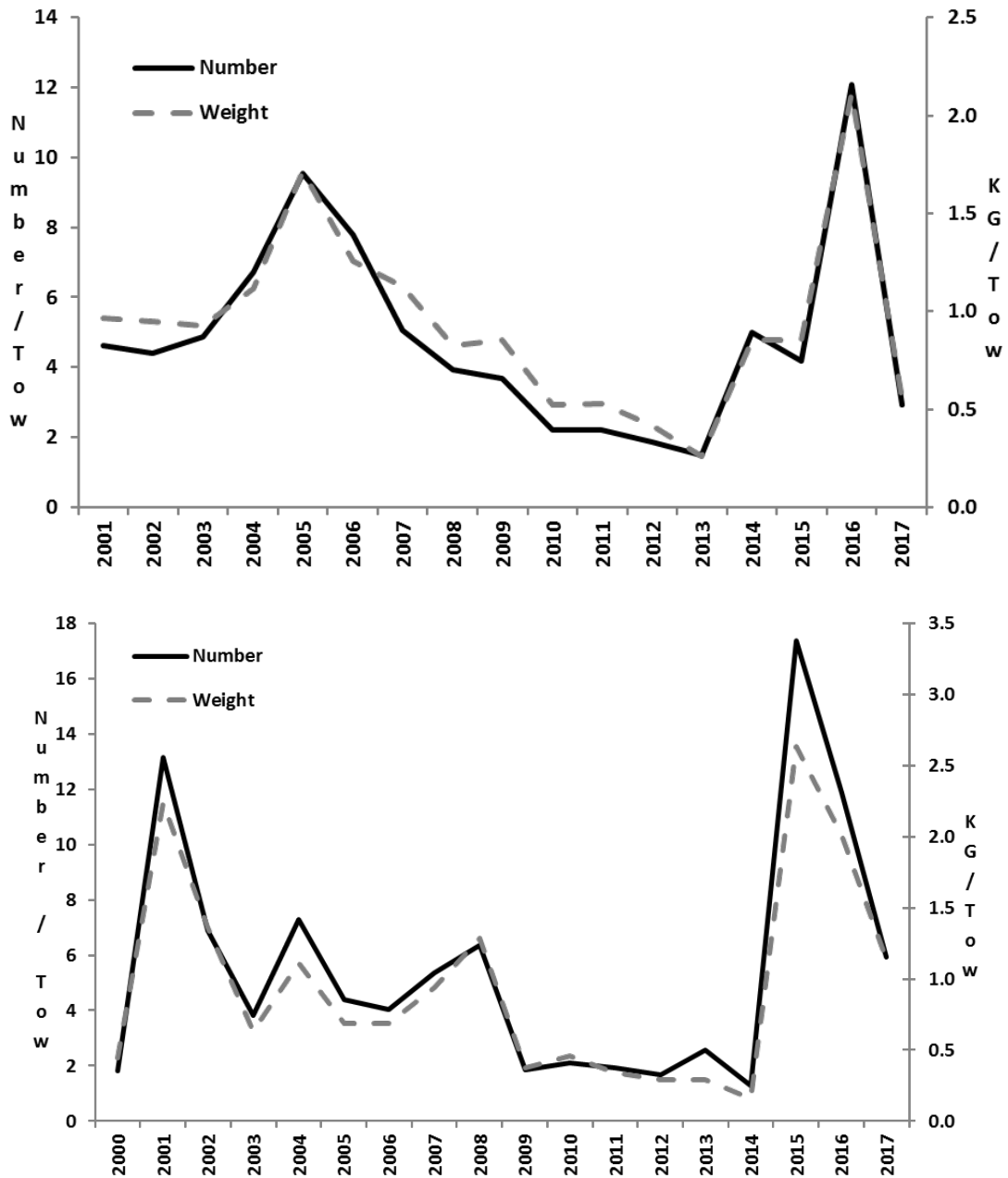


Figure 2: Maine-New Hampshire survey abundance indices for Jonah crab, 2001-2017. Results of the spring survey are on the top and results from the fall survey are on the bottom.

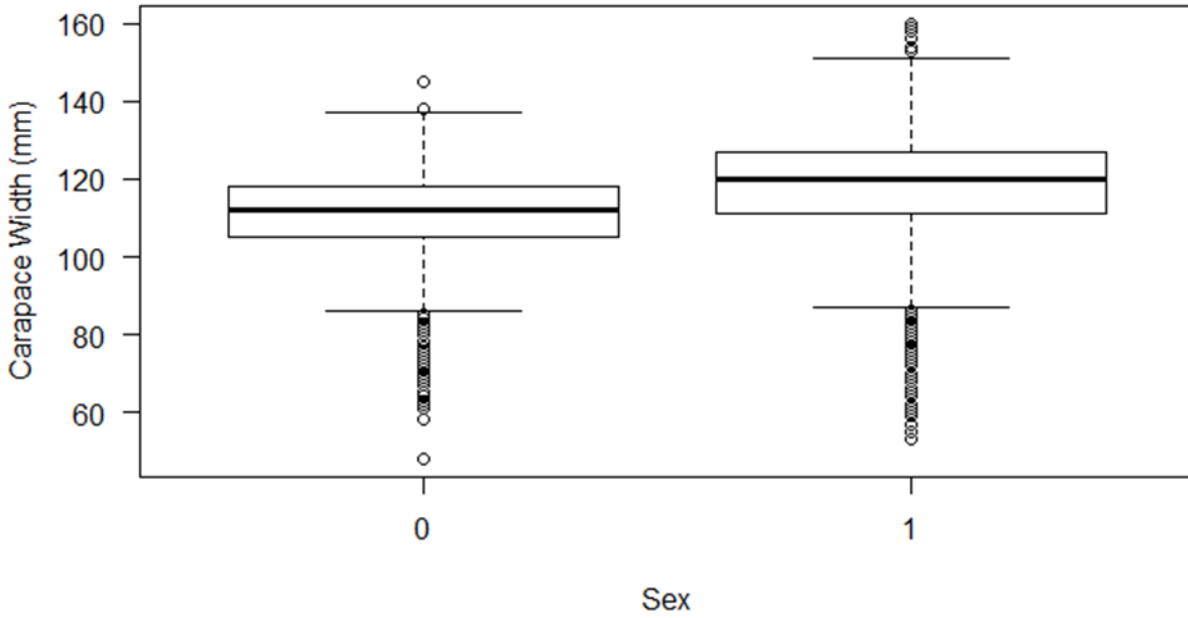


Figure 3: Female (0) and male (1) Jonah crab size from the 2017 Maine Ventless Trap Survey.

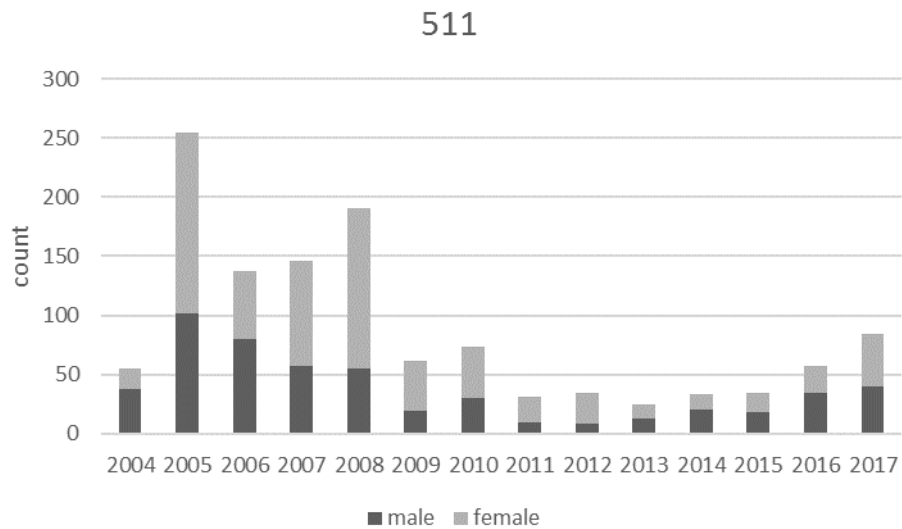


Figure 4: Observed crab from the Maine Sea Urchin Survey (statistical area 511).

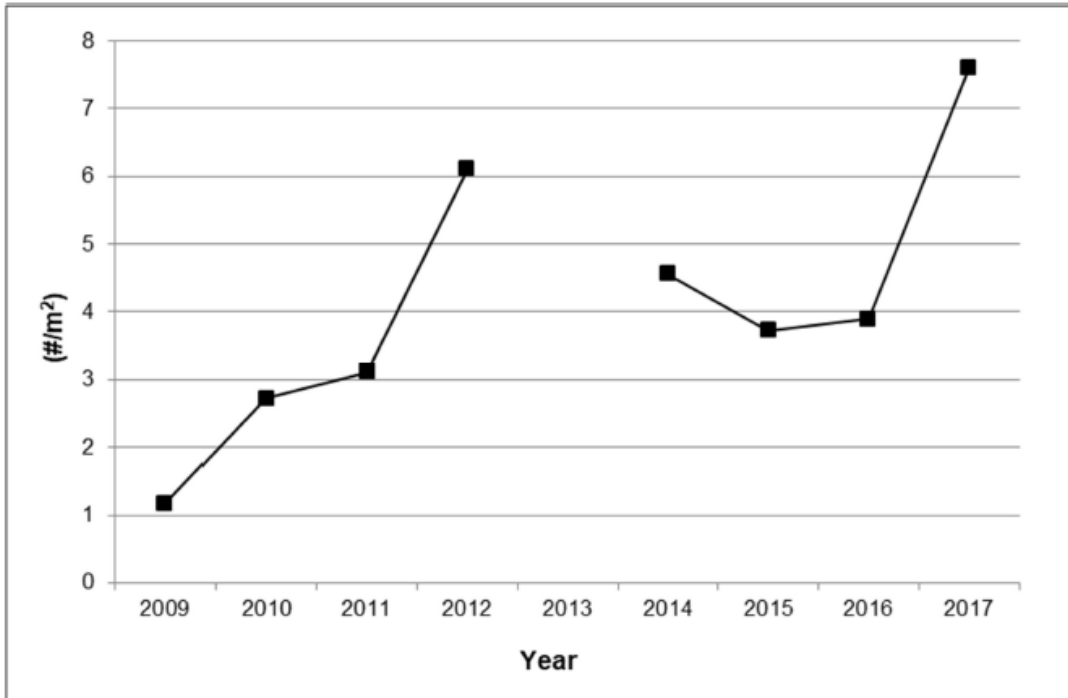


Figure 5: Catch per unit effort (#/m²) of Jonah crab during the American Lobster Settlement Index Survey, in New Hampshire, from 2009 through 2017.

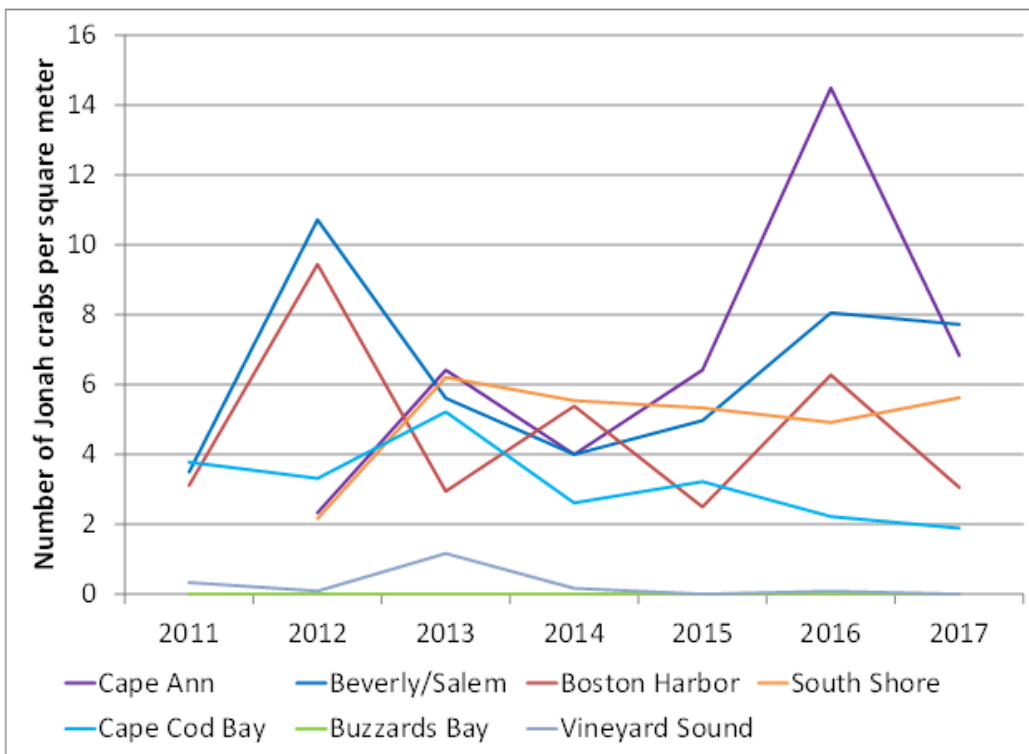


Figure 6: Number of Jonah crab per square meter from the MA DMF juvenile lobster suction survey. Cape Ann, Beverly/Salem, Boston Harbor, South Shore, and Cape Cod Bay are in NMFS statistical area 514; Buzzards Bay and Vineyard Sound are in statistical area 538.

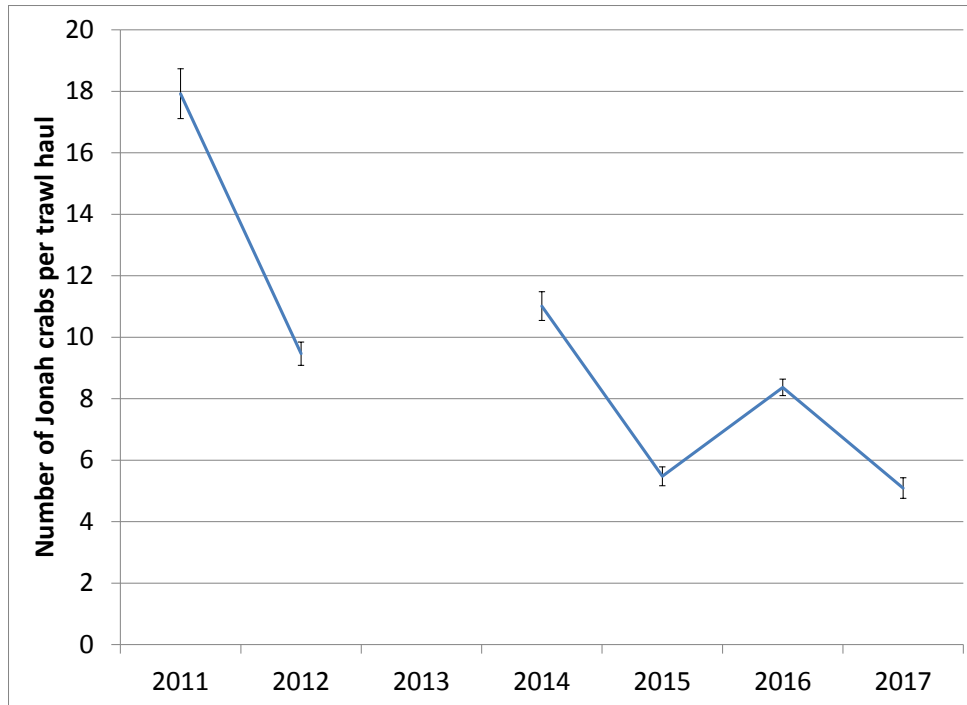


Figure 7. Number of Jonah crab per trawl haul from NMFS stat area 538 and 537 from the MA DMF Ventless Trap Survey. CPUE is standardized to a 6 pot trawl with three vented and three ventless traps. Error bars are \pm two times the standard error. The survey did not occur in 2013.

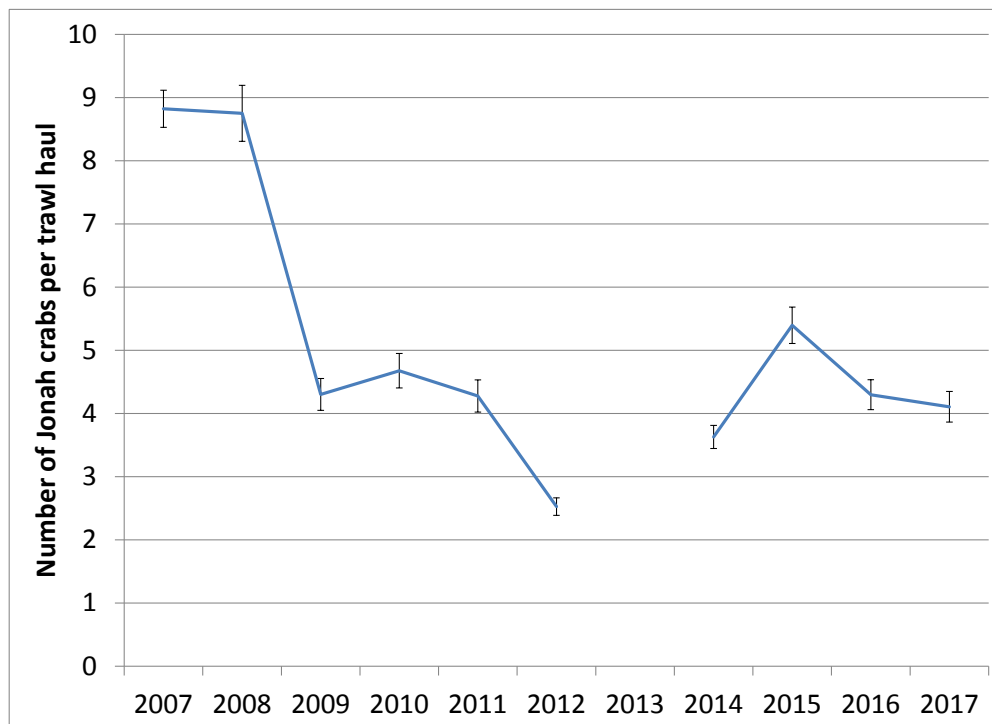


Figure 8. Number of Jonah crab per trawl haul from NMFS stat area 514 from the MA DMF Ventless Trap Survey. CPUE is standardized to a 6 pot trawl with three vented and three ventless traps. Error bars are \pm two times the standard error. The survey did not occur in 2013.

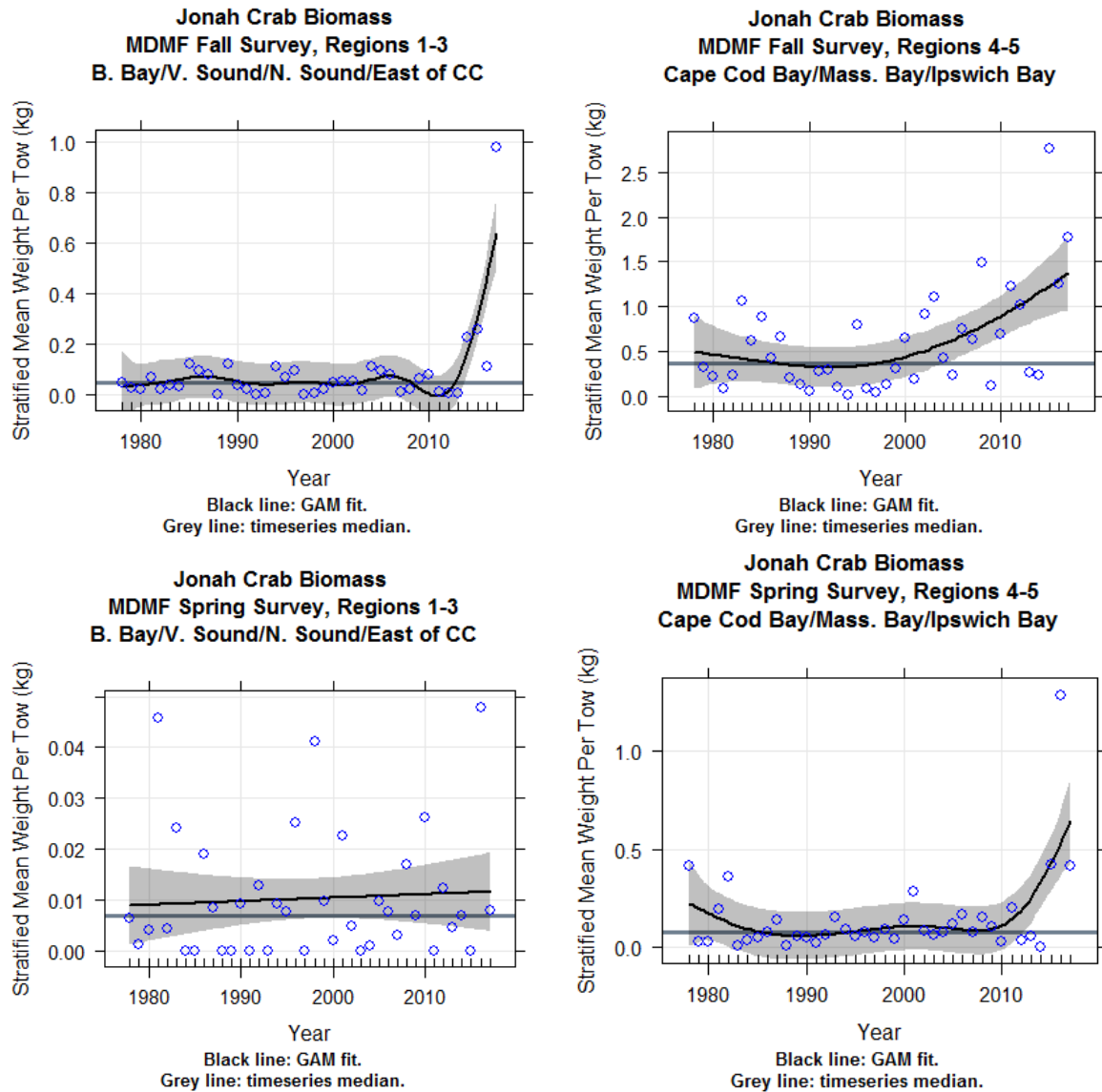


Figure 9. Jonah crab (sexes combined) stratified mean weight per tow from the MA DMF fall (top) and spring (bottom) trawl survey for regions 1–3 (south and east of Cape Cod, left) and regions 4 and 5 (north of Cape Cod, right). Black line is the generalized additive model fit, grey line is the time series median, shaded area is \pm two times the standard error of the predicted value.

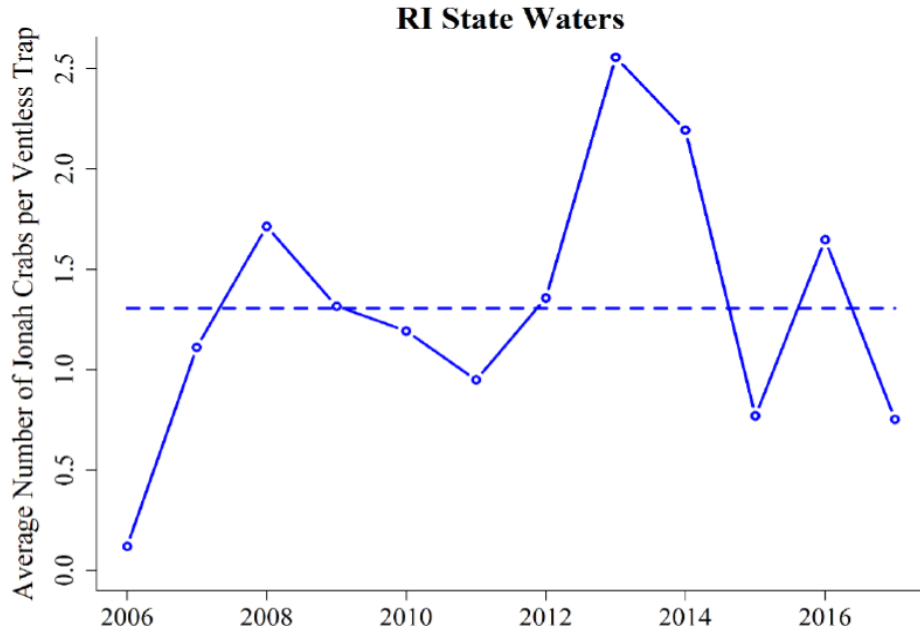


Figure 10: Stratified mean catch (#) per ventless trap in a VTS haul for Jonah crab. Dashed line indicates time series mean. (Source: RI DEM)

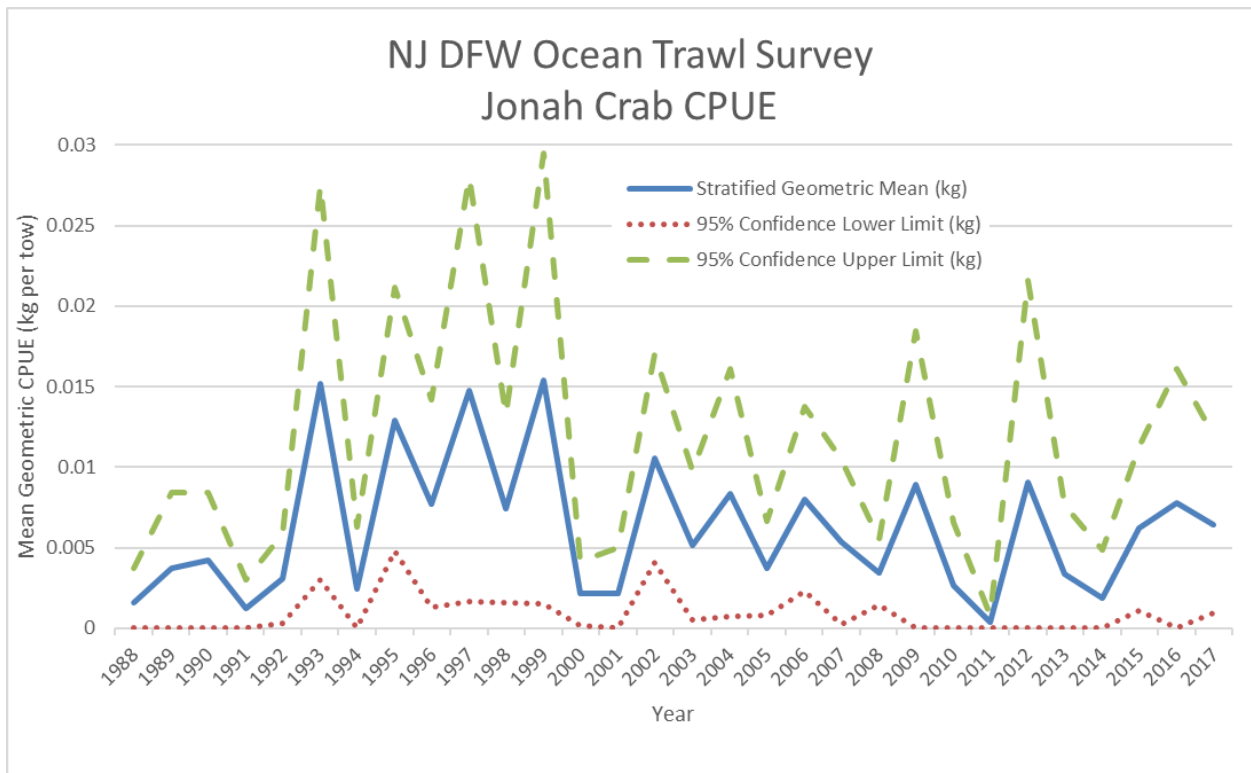


Figure 11: Stratified mean CPUE of all Jonah crab collected aboard the NJDFW Ocean Trawl Survey. The survey stratifies sampling in three depth gradients, inshore (18'-30'), mid-shore (30'-60'), offshore (60'-90'). The mean CPUE was calculated as the sum of the mean weight (in kg) of Jonah crab per size class collected in each sampling area weighted by the stratum area.

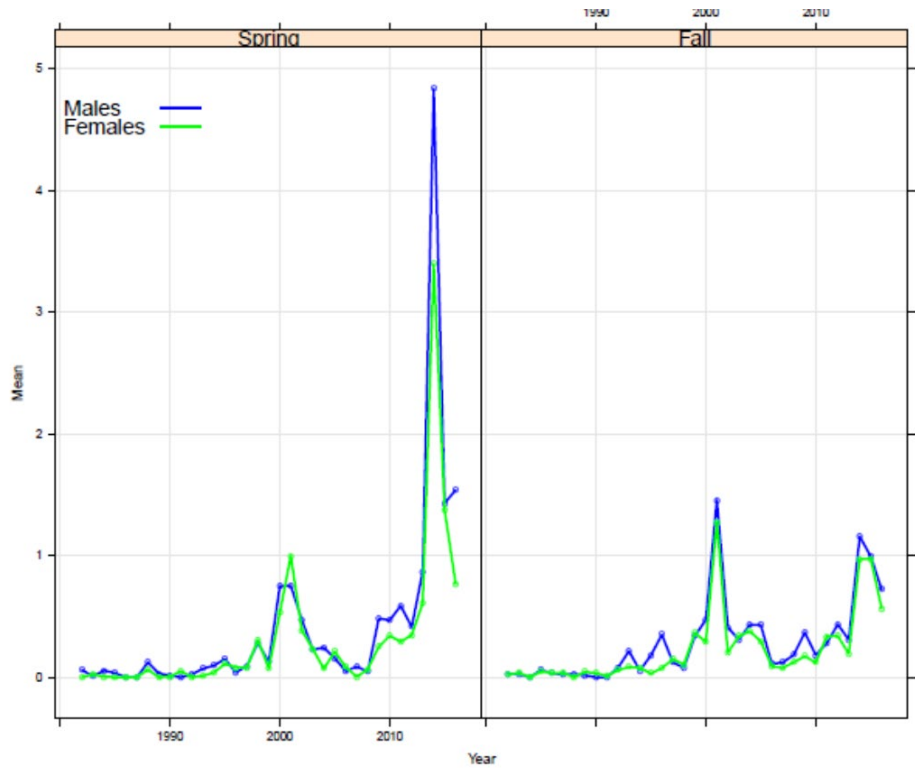


Figure 12: NMFS Jonah Crab index from the bottom trawl survey in the Gulf of Maine, through 2016.

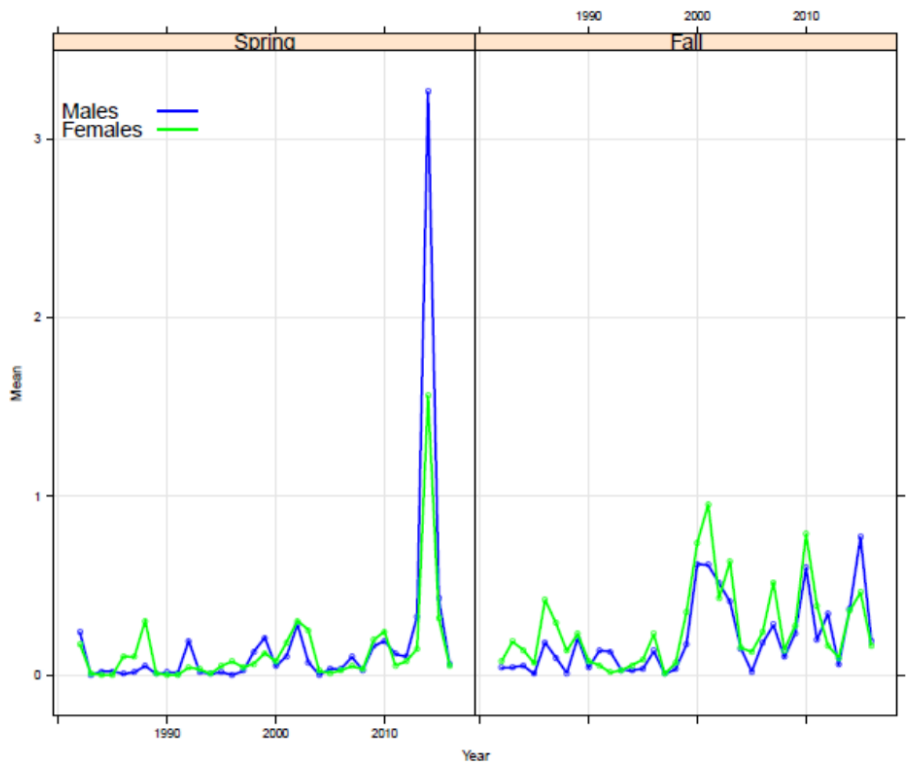


Figure 13: NMFS Jonah crab index from the bottom trawl survey in Georges Bank, through 2016.

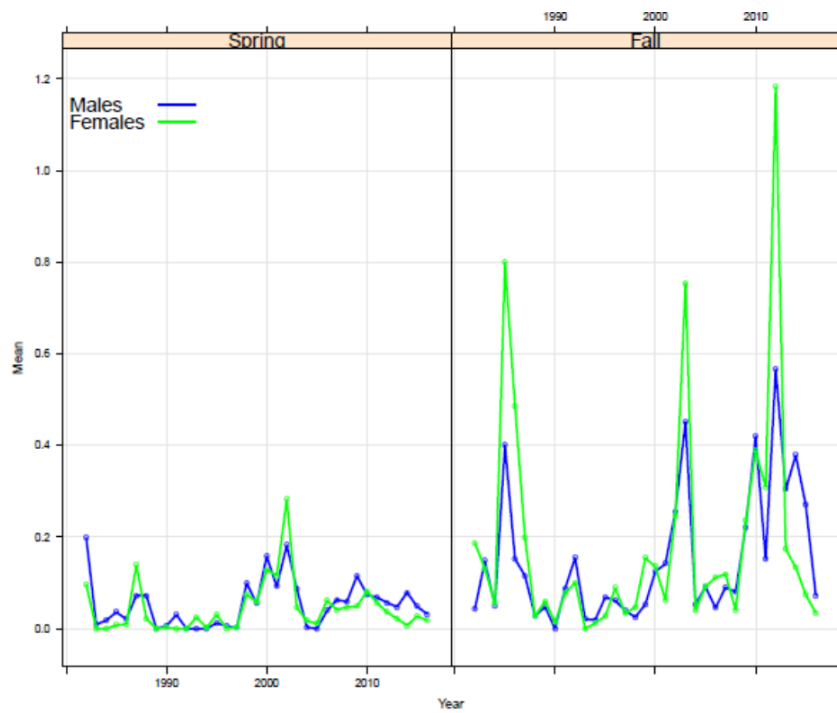


Figure 14: NMFS Jonah crab index from the bottom trawl survey in Southern New England, through 2016.