

ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR JONAH CRAB
(Cancer borealis)

2016 FISHING YEAR



Prepared by the Plan Review Team

Approved by the American Lobster Board
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REVIEW OF THE A FISHERY MANAGEMENT PLAN FOR JONAH CRAB (*Cancer borealis*)

2016 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)
<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 Development Team, Plan Review Team, Advisory Panel

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 supplement their income with 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 2016, 15.0 million pounds of Jonah crab were landed along the Atlantic Coast, representing \$11.9 million in ex-vessel value. The states of Massachusetts (68%) and Rhode Island (24%) are

the largest contributors to landings in the fishery. Landings in descending order, also occurred in Maine, New Jersey, New York, New Hampshire, Maryland, Virginia, Connecticut, and Delaware. Over 545 individuals participate in the commercial Jonah crab fishery coastwide.

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. 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

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

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) effective January 1, 2017. 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

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 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. *The implementation deadline for Addendum II is January 1, 2018.*

5.0 Fishery Monitoring

The Interstate Fishery Management Plan for Jonah Crab states 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 that 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.

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

- **Maine:** A sea sampling protocol for Jonah crab has been established to collect data on shell width, sex, egg bearing status, cull status, and shell hardness. No Jonah crab were sampled during lobster sea sampling trips in 2016. Maine's lobster port sampling program was suspended in 2011.
- **New Hampshire:** Staff sampled 183 Jonah crabs on 7 sea sampling trips and collected information on sex, 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 172 Jonah crab were sampled through this new program.
- **Massachusetts:** Staff conducted 6 sea sampling trips and sampled 6,213 Jonah crab. Types of information collected include shell width, sex, egg bearing status, cull status, shell hardness, and whole crabs vs. parts. 14 port sampling trips from 11 vessels were also conducted, with a total of 9,449 Jonah crab sampled. Catch was 99.9% male.
- **Rhode Island:** Through a collaboration with URI-GSO and the state, 8 sea sampling trips measuring 5,788 Jonah crab were conducted as part of a Masters student's thesis project. Due to staff and budget constraints, RI DFW did not conduct its own sea or port sampling.

- Connecticut: No sea sampling or port sampling trips were conducted for Jonah crab.
- New York: Staff made 13 attempts to obtain trips with Jonah crab fishermen but no trips were conducted. Staff conducted 1 port sampling trip and sampled 10 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 crabs. The following outlines the fishery-independent surveys conducted by each state. Figures 11-13 also show the results of the NMFS Bottom Trawl survey for the Gulf of Maine, Georges Bank, and Southern New England.

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 has increased over the past two decades with high values in 2013 and 2016 (Figure 1). Similarly, the density of all Jonah crabs 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 2016 spring survey completed 122 tows and sampled a total of 1,378 Jonah crabs. The spring abundance indices for Jonah crab have significantly increased since 2013 (Figure 2). The 2016 fall survey completed 83 tows and sampled 996 Jonah crab. Abundance indices for Jonah crab were slightly less than 2015 but were still well above the time-series average (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 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 crabs per trap in 2016. The majority of traps caught less than 5 crabs; however, a handful of traps had upwards of 50 crabs.

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 crabs in the New Hampshire Fish and Game portion of the American Lobster Settlement Index. Figure 5 depicts the CPUE (#/m²) of Jonah crabs for all NH sites combined, from 2009 through 2016. This time series shows an upward trend to a time series high in 2012, followed by relatively high levels from 2014 through 2016.

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 2016. Beginning in 2016 all Jonah crabs were evaluated for sex and carapace length. A total of 39 Jonah crabs over 8 trips were measured during the 2016 sampling season.

Massachusetts

A. Settlement Survey

The MA DMF Lobster Settlement Survey began measuring Jonah crabs and making a greater effort to identify small *Cancer* crabs to species in 2016. Appropriate analyses are being developed to properly explore these data as numerous stations have been added and/or removed and the level of identification of *Cancer* crabs has varied since the survey began in 1995. Figure 6 is a length frequency plot of all crabs caught during the 2016 survey. Most crabs are below 25 mm CW. Though Jonah crab size-at-age is not very well known, these are likely age-0 crabs.

B. Ventless Trap Survey

The MA DMF Ventless Trap Survey collects information on the distribution of Jonah crabs. Figure 7 shows the distribution of Jonah crab in 2016. The largest catches of crabs are caught in the deep survey stratum (41-60 m) in the federal waters portion of the survey, southwest of Buzzards Bay. MA DMF began collecting Jonah crab carapace width data in the ventless trap survey in 2015. The size structure of the catch was similar in 2015 and 2016 (Figure 8).

C. Trawl Survey

The MA DMF spring and fall trawl surveys collect biological information on Jonah crab. There is an upward trend in relative abundance in both seasons, particularly in the Spring survey, since 2010 (Figure 9).

Rhode Island

A. Ventless Trap Survey

Since its inception in 2006, the RI Ventless Trap Survey (VTS) has recorded counts of Jonah crabs in each pot. In 2014, carapace width and sex were also recorded for all individuals. In 2016, the VTS was conducted during the months of June-August and over 18 sampling trips. A total of 1,302 Jonah crabs were sampled. All sampling was conducted in LMA 2, NMFS Statistical Area 539. The stratified mean catch per trap on a six pot (three ventless, three vented) trawl was 0.55 Jonah crabs, the highest of the time series (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 crabs 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 crabs have been observed in the survey since 2008.

7.0 On-Going Research Projects

A. Maturity Study

MA DMF, in collaboration with CFRF, is finishing a Jonah crab maturity study. The study suggests that females mature at a smaller size than males (~88mm carapace width vs. ~117mm carapace width); however, the gonadal maturity of small crabs still needs to be determined. A graduate student from UMES is also conducting a thesis on Jonah crab maturity and fecundity and it is expected that this work will be completed within the year.

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 Jonah crab are not migrating far; however, this could mask seasonal migrations to and from the same location. Through the project, 40,000 t-bar tags and 200,000 zip-tie tags will be deployed. It is expected that the project will finish in 2018.

C. Declawing Study

NH F&G has conducted an in-lab study to investigate the mortality associated with declawing of Jonah crabs. To date, 5 trials have been 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. The next step is to replicate this study in the ocean to see if results are similar.

D. Growth and Fishery Dependent Data

A graduate student at URI is completing a Master's Thesis on Jonah crab, focusing on growth data and biological sea sampling in statistical areas 537 and 529. To complete the growth study, morphometric analysis as well as calculation of growth per molt are being conducted. Preliminary results suggest that the growth rates between males and females are statistically different.

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. Currently, 17 vessels participate in the Jonah crab sampling program.

8.0 State Compliance

- New York has not yet implemented the full suite of management measures required under the Jonah Crab FMP or Addendum I. 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 but are included in a current regulatory proposal and are expected to be adopted in early 2018.
- Delaware has not yet implemented the management measures required under the Jonah Crab FMP or Addendum I. Delaware delayed implementation of the regulations anticipating a change in the lobster regulations due to Addendum XXV. Given the regulatory process is costly and the lobster/Jonah crab fishery is quite small in Delaware, the state hoped to do these regulatory actions together. Given that lobster regulatory changes are not required at this time, the state is moving forward with implementation of the Jonah crab regulations and they are expected to be completed 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 Regulatory Changes

- Maine DMR adopted regulations to expand the existing lobster and crab harvesting closure in the Penobscot River in order to protect public health due to the risk of mercury contamination.

11.0 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.
- **Mortality Rates in the Claw Fishery** – An in-lab study investigating mortality associated with the claw fishery has been conducted; however, this mortality study should be replicated in the field and in different regions along the coast. It is also unclear how long it takes to regenerate a claw.
- **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.

12.0 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 recommends the Jonah Crab TC evaluate the sea sampling needs of the fishery, particularly given some states did not conduct sea/port sampling in 2016 and a large portion of landings occur in two states.
- The PRT also recommends that the Jonah Crab TC discuss standard methods for reporting survey data in compliance reports. This includes a common unit of measure as well as a standard definition for young-of-year.
- The PRT highlights the importance of all states implementing the 4.75” minimum carapace width in the Jonah crab fishery, especially in regards to issues of interstate commerce.
- As states implement Addendum 2, which addresses claw landings in the Jonah crab fishery, the PRT highlights the importance of disposition reporting.
- The PRT recommends continued research of the Jonah crab species so that a coastwide stock assessment can be completed in the near future.

12.0 Tables

Table 1. Landings (in pounds) of Jonah crab by the states of Maine through Virginia. 2010-2015 landings were provided by ACCSP. 2016 landings were submitted by the states as a part of the compliance reports. *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	C	609	68,252		C	C	11,662,713
2013	379,073	340,751	10,087,443	4,397,734	51,462	C	7,803		C	C	15,474,240
2014	344,290	404,703	11,858,702	4,123,040	50,070	C	33,104	C	153,714	C	16,974,364
2015	309,715	C	9,096,374	3,861,260	7,989	C	68,116	C	30,244	C	13,565,974
2016	620,950	150,342	10,130,257	3,650,760	C	170,996	246,090	C	C	C	14,990,066

13.0 Figures

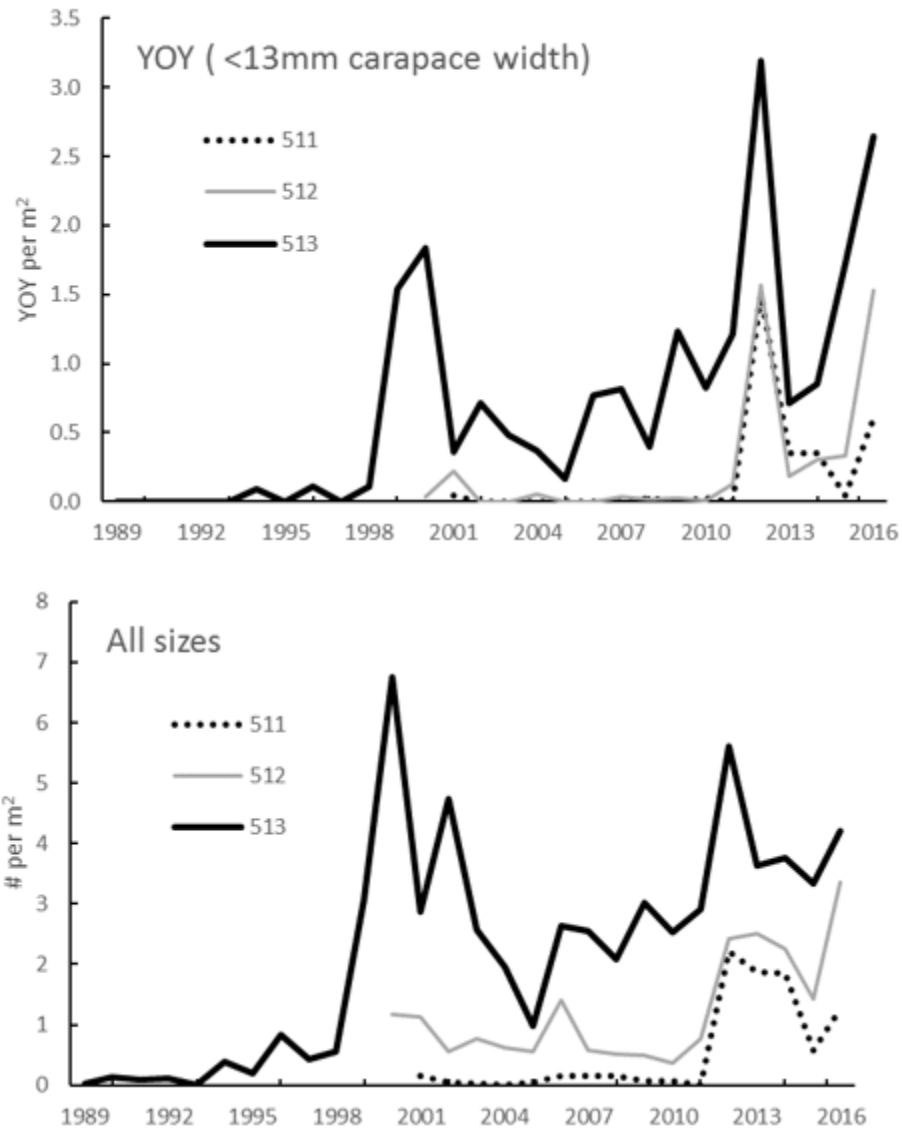


Figure 1: The density of Jonah crabs measured over time in the Maine Settlement Survey by statistical area. The top graph shows the density of young of year Jonah crab and the bottom graph shows the density of all Jonah crabs.

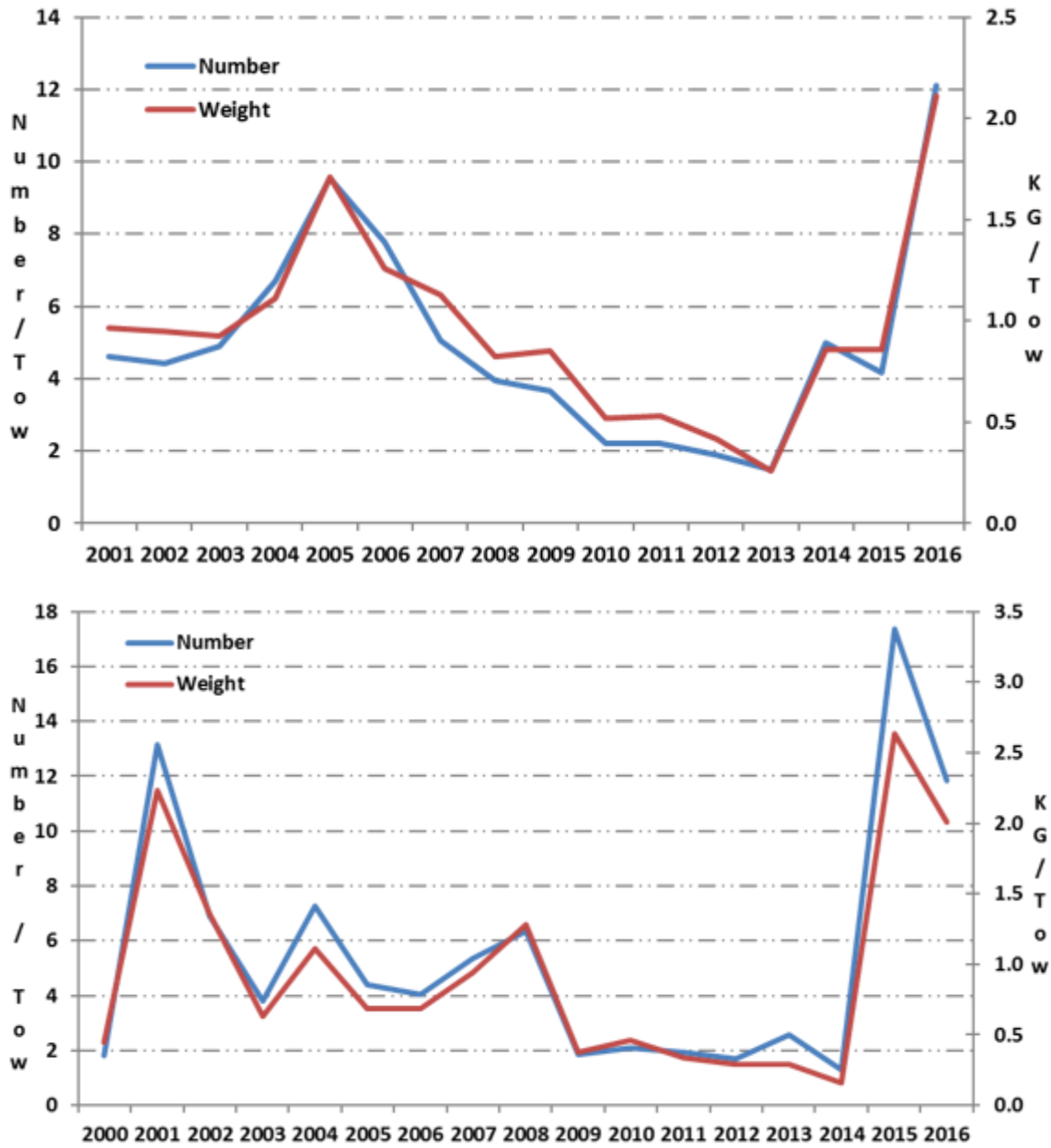


Figure 2: Maine-New Hampshire survey abundance indices for Jonah crab, 2001-2016. Results of the spring survey are on the top and results from the fall survey are on the bottom.

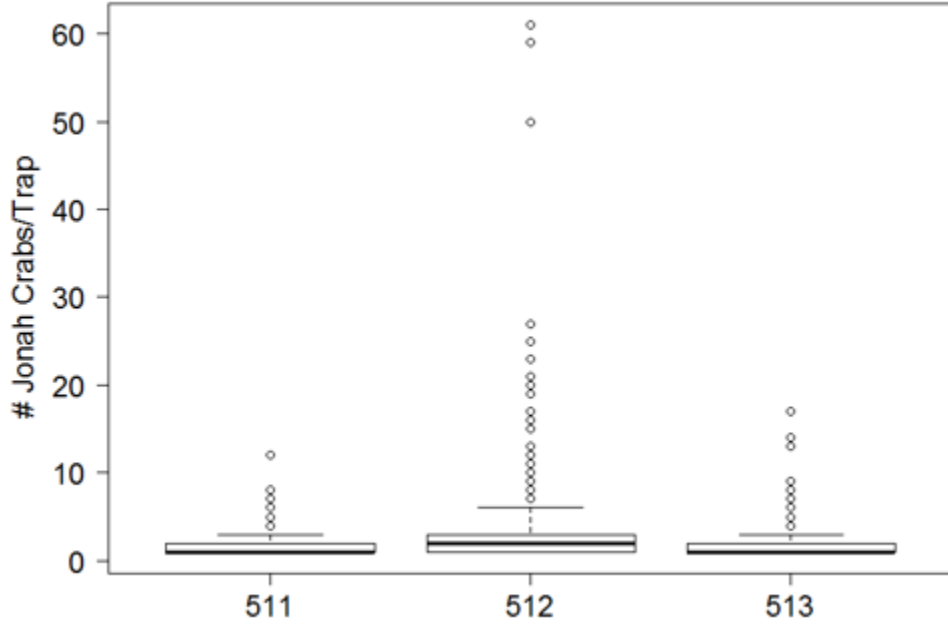


Figure 3: Catch per trap of Jonah crabs in the 2016 Maine Ventless Trap Survey by statistical area.

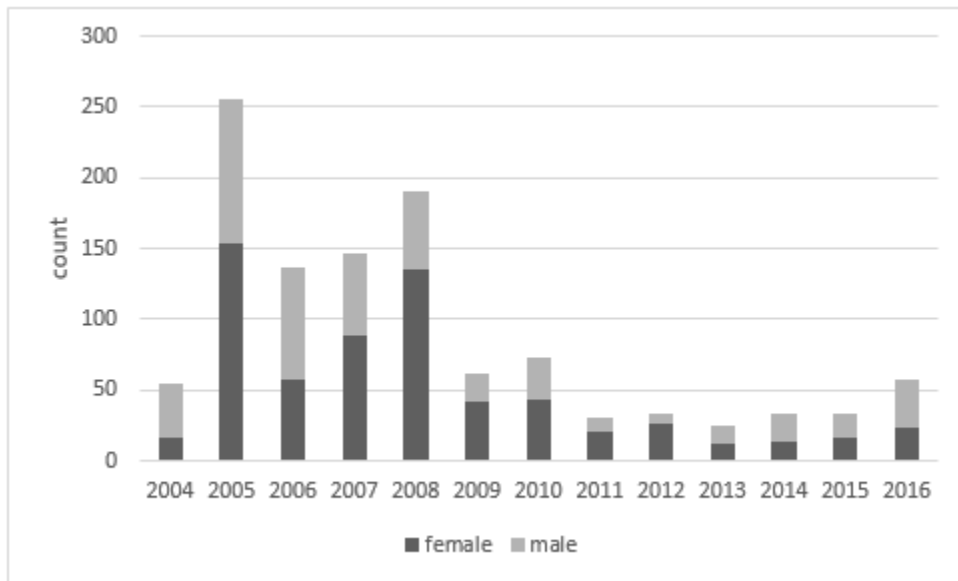


Figure 4: Observed crabs from the Maine Sea Urchin Survey (statistical area 511).

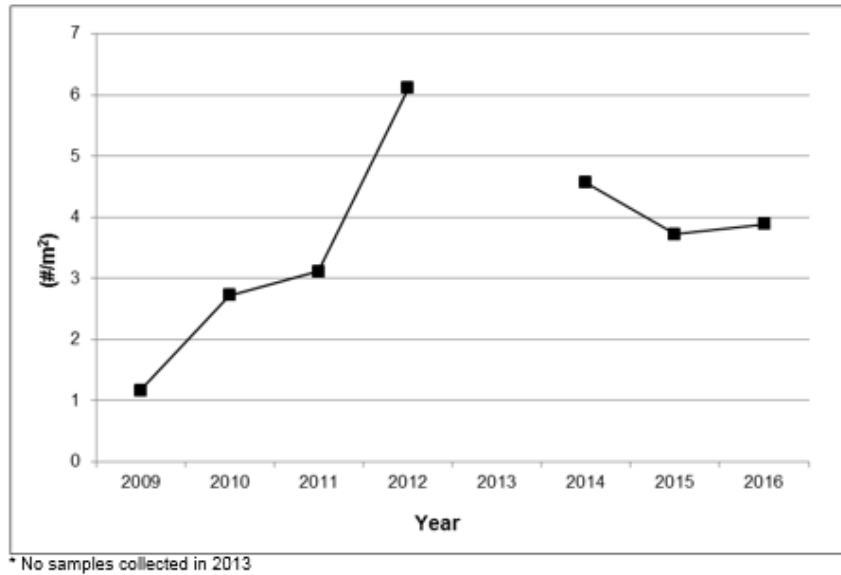


Figure 5: Catch per unit effort (#/m²) of Jonah crabs during the American Lobster Settlement Index Survey, in New Hampshire, from 2009 through 2016.

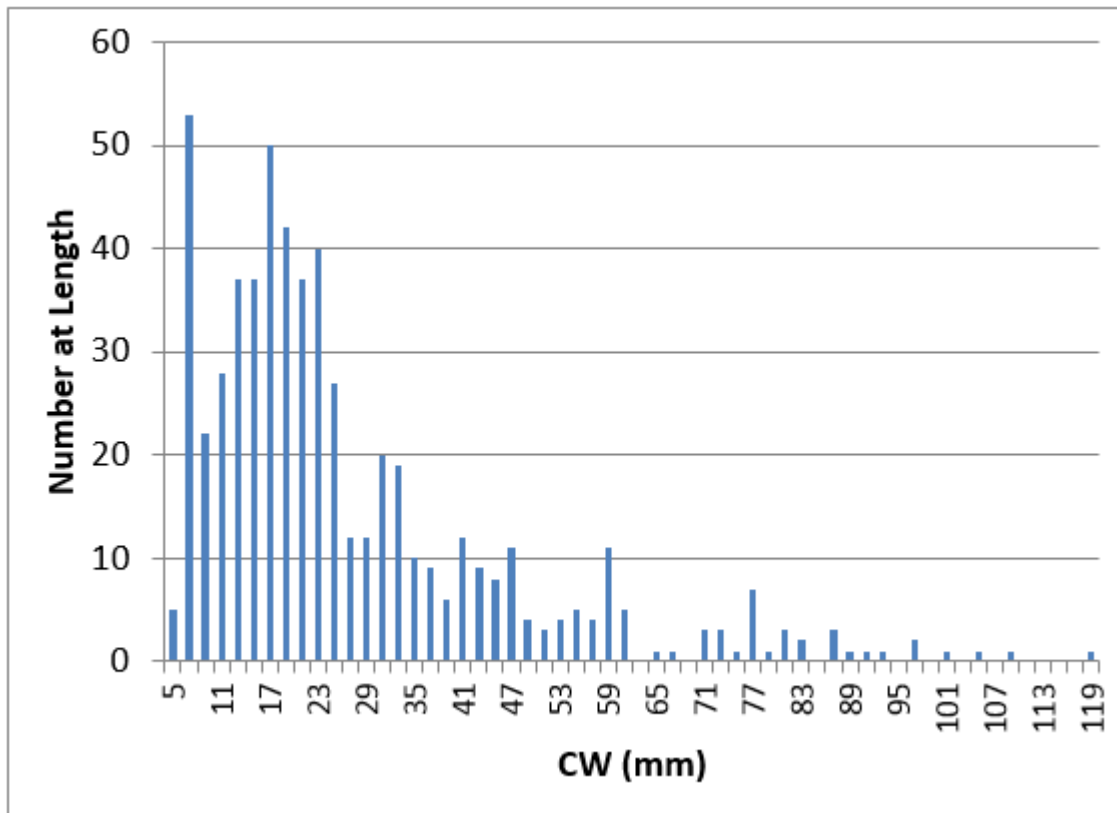


Figure 6: Size frequency of all Jonah crabs caught in the 2016 MA DMF Lobster Settlement Survey.

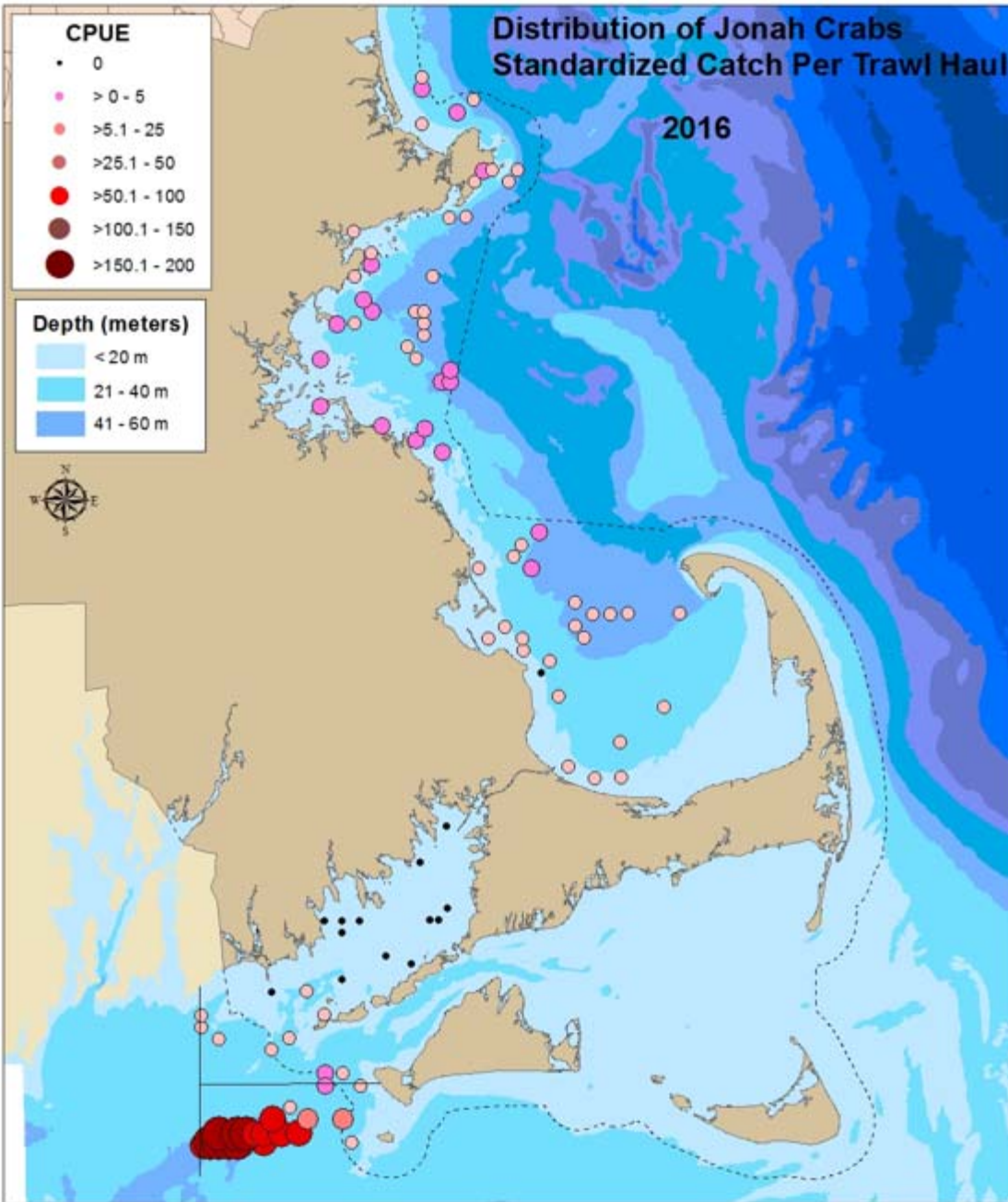


Figure 7. 2016 Catch per unit of effort (CPUE) from MA DMF Ventless Trap Survey. Catch is standardized to a six pot trawl consisting of three vented traps and three ventless traps.

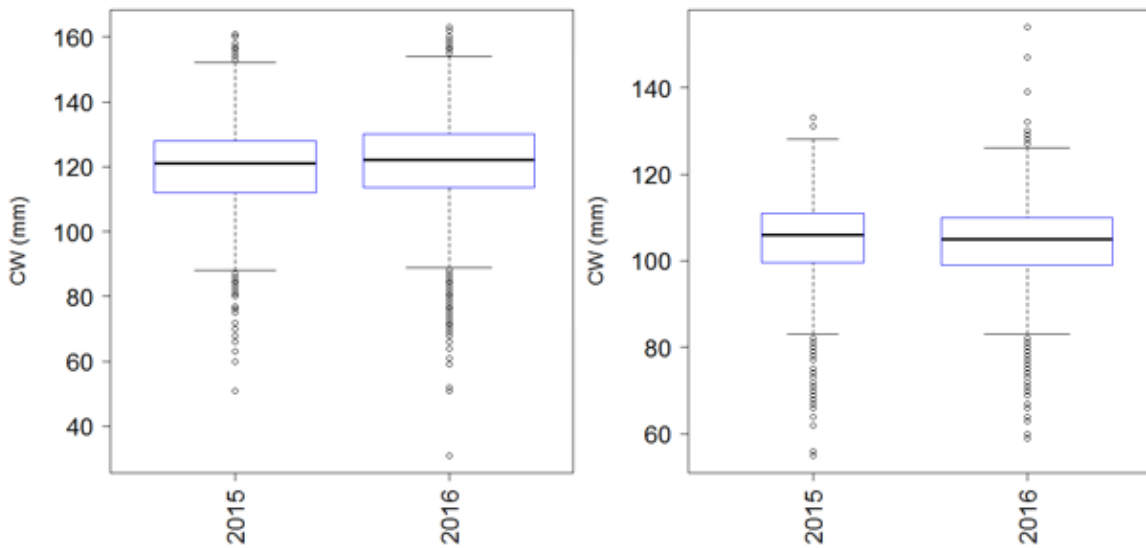


Figure 8. Male (left) and female (right) size distribution from MA DMF Ventless Trap Survey. The survey started measuring Jonah crabs in 2015. Black line is monthly median, top of the blue box is the 75th quartile, the bottom of the blue box is the 25th quartile, dashed lines are 1.5 times the interquartile range, circles are outliers, and box width is representative of sample size.

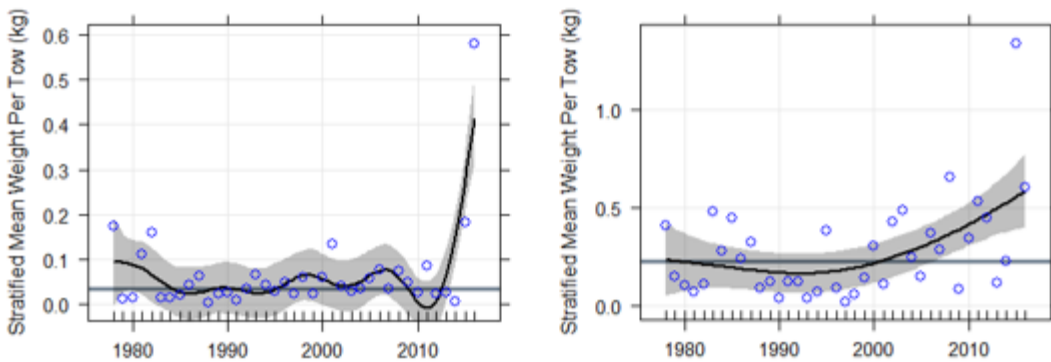


Figure 9. Jonah crab (sexes combined) stratified mean weight per tow from all regions of the MA DMF Spring (left) and Fall (right) Trawl Survey. Black line is the generalized additive model fit, grey line is the time series median, shaded area is \pm two times the standard error of the predicted value.

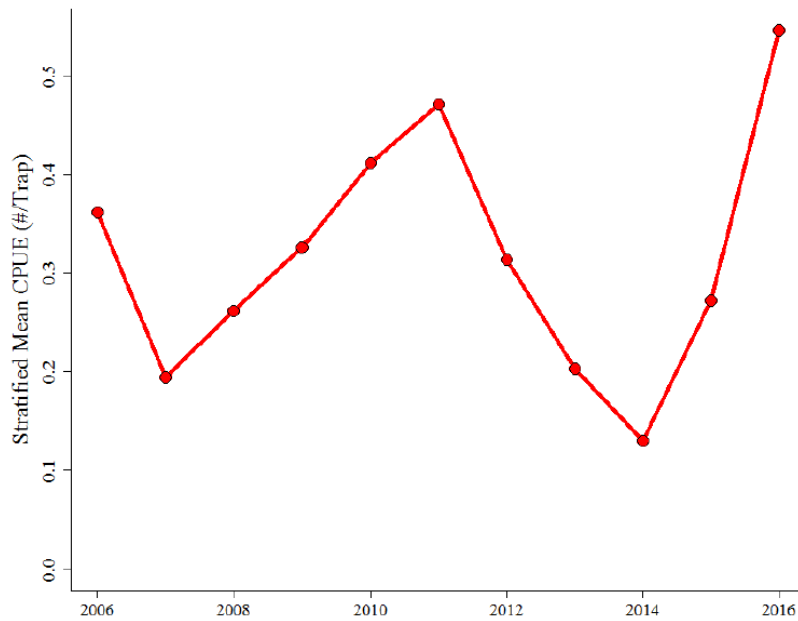


Figure 10: Stratified mean catch (#) per trap in a VTS haul for Jonah crabs (Source: RI DEM).

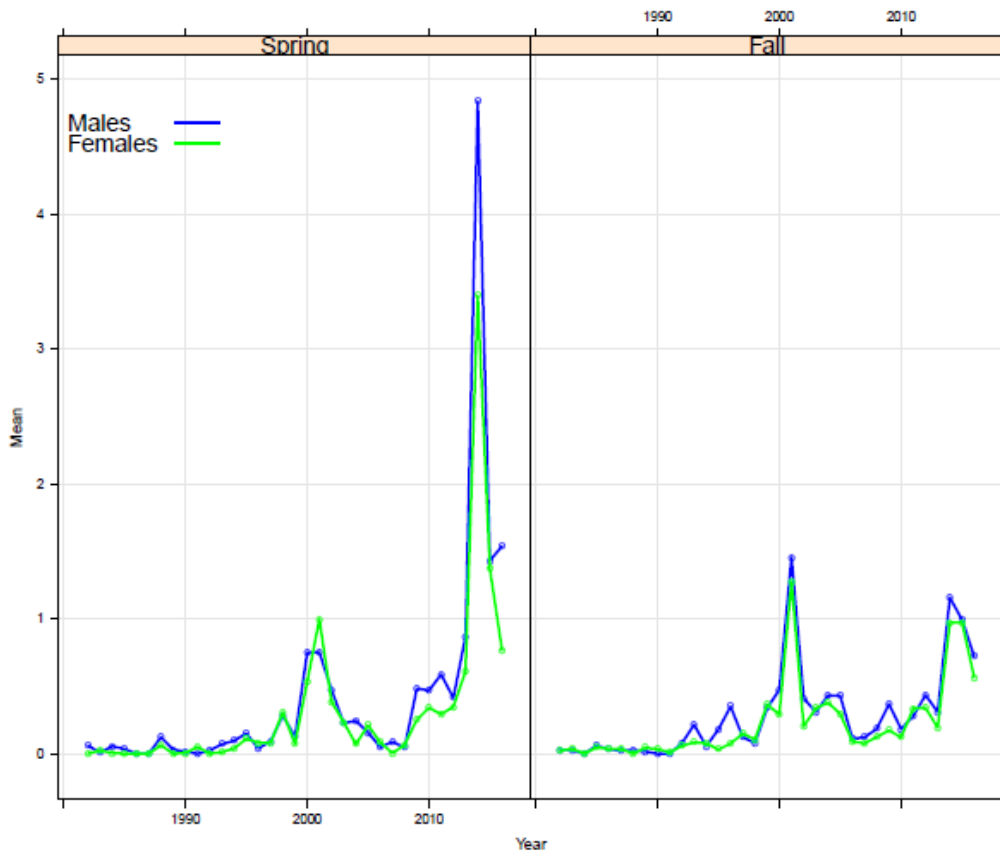


Figure 11: NMFS Jonah crab index from the bottom trawl survey in the Gulf of Maine.

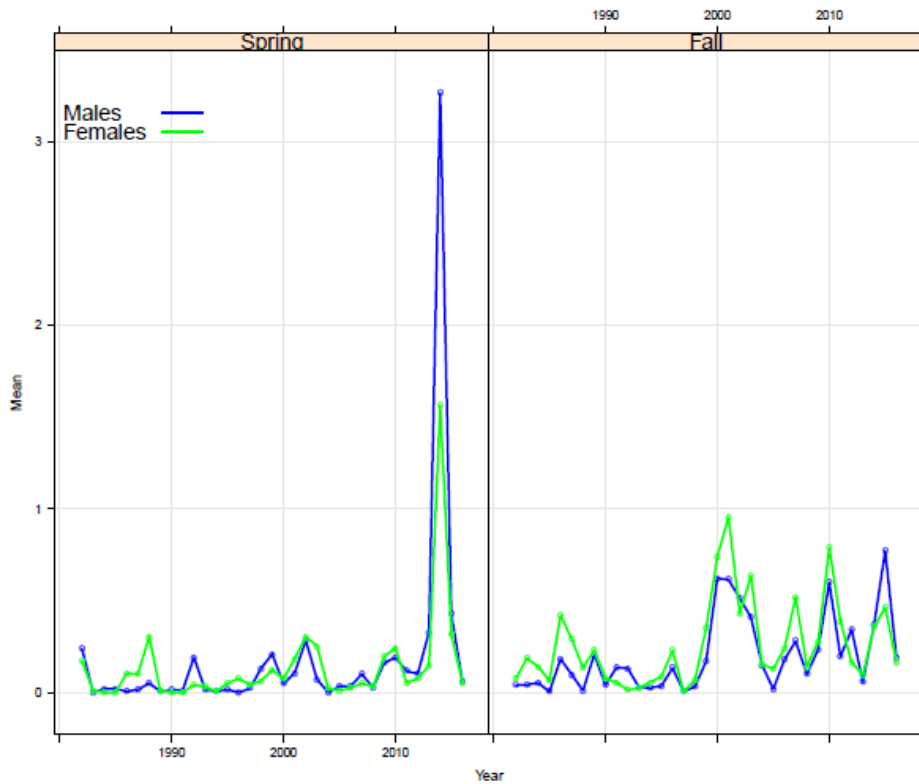


Figure 12: NMFS Jonah crab index from the bottom trawl survey in Georges Bank.

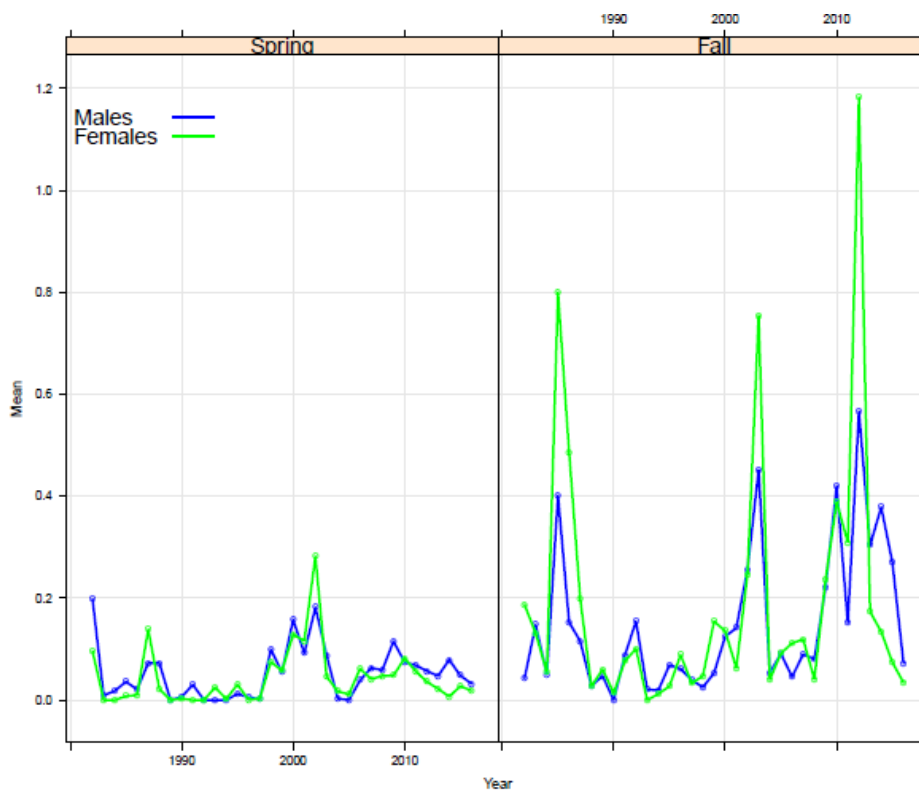


Figure 13: NMFS Jonah crab bottom trawl survey index for Southern New England.