New England Fishery Management Council
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MEMORANDUM

DATE: July 26, 2019

TO: Dr. Jason McNamee, Chair, Science and Statistical Committee

FROM: Jessica Gribbon Joyce, Chair, Deep-Sea Red Crab Plan Development Team

SUBJECT: PDT Memo - Deep-Sea Red Crab Specifications Package for Fishing Years 2020- 2022

The purpose of the of the Deep-sea Red Crab Specification Package is to set appropriate specifications for fishing years (FY) 2020 - 2022 and to ensure that landings do not exceed sustainable levels, including the Acceptable Biological Catch (ABC) recommended by the Science and Statistical Committee (SSC).

Background Information

The current ABC for the red crab fishery is based on the outputs of a depletion-corrected average catch (DCAC) model employed during the 2008 Northeast Data Poor Stocks Working Group (DPSWG) meeting. DCAC estimates a sustainable yield based on the average catch in a fishery (average landings used for red crab), adjusted by fishery-independent estimates of the degree of stock depletion since inception of the fishery.

For red crab, the depletion estimate is based on two surveys (1974 & 2003-2005) that showed comparable biomass, meaning minimal stock depletion seems to have occurred between those surveys. No surveys have been conducted since 2005. In its report to the Council on April 28, 2010, the SSC agreed that "the PDT demonstrated that the DCAC model developed by the DPSWG provides an estimate of sustainable yield that underestimates maximum sustainable yield (MSY)". Therefore, the SSC concluded that "the information available for red crab is insufficient to estimate MSY or an overfishing limit (OFL)". In lieu of an OFL estimate, the SSC recommended an interim ABC based on the long-term average landings of male red crab. The DCAC model output in 2008 was a sustainable yield of 1,775 metric tons (mt).

While OFL is currently unknown, the SSC concluded that "an interim ABC based on long-term average landings is safely below an overfishing threshold and adequately accounts for scientific uncertainty" in the April 28, 2010 report to the Council.

While NMFS had already published red crab specifications for FY 2010 in May 2010[1] (based on recommendations from a September 2009 SSC meeting), the Council requested the SSC reconsider their ABC recommendation based on findings from this April 2010 report. The SSC then recommended an interim ABC of 1,775 mt, and on August 13, 2010, NMFS published a rule implementing the SSC's revised TAC of 1,775 mt with a corresponding fleet allocation of 665 DAS.

Amendment 3 to the Red Crab FMP[2] established the current method for specifying an ACL and AMs, and set the Total Allowable Landings (TAL) for red crab for FY 2011–2013. The TAL equaled the sustainable yield derived from the DCAC model, which is also equivalent to the ABC. Specifications since Amendment 3 have used this method. Thus, the TAL has remained at 1,775 mt since FY 2011 (notwithstanding the similar specifications adjusted in-season in FY2010).

The Deep-Sea Red Crab PDT (PDT) met (via webinar) on June 18, 2019 to discuss previous specifications, review updated fishery information, and discuss the availability of new information and regulations. Specifically, the PDT reviewed the previous specifications (FY 2017-2019)[3], including SSC recommendations in 2016 for the red crab ABC and TAL.

The SSC made the following recommendations at the last meeting where red crab specifications were discussed on August 20, 2016:

1. The DCAC-based approach to developing catch advice for the Atlantic red crab fishery should remain in place at present. OFL remains unknown and ABC should not exceed 1,775 mt for fishing years 2017-2019.
2. Additional information, including the outcomes of industry-funded research, could potentially be incorporated into a revised control rule.[4] New approaches should be evaluated, perhaps as a Council research priority.

This memo includes a limited number of figures and tables at the end of the document to support the updated data. Additional figures and tables are included in the PPT presentation to the SSC (#2).

[1] TAC of 1,615 mt and 582 fleet DAS.

[2] 76 FR 60379; September 29, 2011 and NEFMC. 2011. Amendment 3 to the Fishery Management Plan for Deep-Sea Red Crab, Incorporating Specifications for FY 2011 through 2013 and Including an EA, RIR, and IRFA.

[3] NEFMC. 2016. Atlantic Deep-Sea Red Crab Specifications for Fishing Years 2017-2019, Including a Regulatory Flexibility Analysis. Final rule: 82 FR 11322; February 22, 2017.

[4] While not specified, it is assumed the SSC is referring to a new ABC control rule verses the current interim ABC.

Red Crab Landings, LPUE, Port Samples, and Observer Data

The PDT reviewed updated red crab fishery information on landings, landings per unit effort (LPUE), port samples and observer data compiled by the Northeast Fisheries Science Center (NEFSC). The updated information indicate landings have remained relatively stable since 2016, with a slight increase in 2018, and have all been below the TAL (Figure 1). Landings from VTR and CFDBS data are closely aligned, thus validating the accuracy of the datasets. The PDT discussed that landings are indicative of good market conditions, as this is a market-driven fishery.

Based on VTR-reported statistical area fished, landings are attributed to one of three fishing regions: Georges Bank/southern New England (Region 1), NY, NJ, DE, MD (Region 2), and VA and NC (Region 3) (Figure 2). Annual landings by region are one measure of the spatial extent of the fishery over time. Recent data indicate landings have been increasing in Region 2, and decreasing in Region 1 where most of the landings were concentrated in the early years of the fishery (2002-2007) (Figure 3). Landings in Region 3 are stable, but lower than the other regions. Industry members indicate this is due to shorter trips in Region 3 that target crabs for the live market.

Average LPUE, estimated using VTR-reported haul and gear data, has fluctuated between 15 to ~25 pounds per trap hauled since 2002, generally increasing from 2007, with a peak in 2016. However, there has been a slight decrease in LPUE across all regions in 2017 and 2018 (Figure 4). Average values of LPUE by region are similar for regions 1 and 2 but more variable in Region 3, perhaps due to different market conditions, and therefore trip types, in that region (Figure 5).

Two vessels take different types of trips in Region 3: one vessel takes longer trips catching crabs to be processed, and another vessel takes shorter trips to catch crabs for the live market. LPUE for the longer trips is described in the preceding paragraph. A separate LPUE was calculated for the shorter trips catching crabs for the live market in Region 3. These trips started in 2016, and have a slightly lower average LPUE than other trips (see orange bars in Figure 5).

There are some caveats with LPUE estimates due to variability in VTR reports; however, the method used to estimate LPUE is consistent over all years and regions, and has been used since 2006.

Using port sampling data, length frequencies and average size by year and across all regions indicate that the fishery has targeted larger crabs since 2013 (Figure 6). The largest crabs are being caught in Region 3.

Since 2016, the Northeast Fisheries Observer Program (NEFOP) has increased its allocation of observers to red crab trips. Observer data provide information there is no other way to get, since there is no regular survey that includes red crab, and fishery-dependent data are limited. Analyses of NEFOP data presented here are considered preliminary, but they can provide excellent insight on several aspects of the fishery. For example, observer data from 48 directed red crab trips during 2016-

2019 indicate smaller males (small enough to be discarded) are caught consistently in red crab traps, which suggests there is a supply of younger crabs to recruit to the fishery in the future (Figure 7). Also, length frequency data from 2016-2019 suggest females (which are minimally impacted by the fishery and are more likely to retain their natural length distributions) in regions 2 and 3 are larger than those in Region 1, which may be evidence for a latitudinal gradient in size (Figure 8). We can also use observer data from red crab trips to examine egg-bearing female length frequencies, estimate discards of undersized and female red crabs, and assess the level of bycatch of other species in the red crab fishery.

Based on the landings, LPUE, port sampling, and observer data from recent fishing years, there is no evidence of a decline in the overall red crab stock size. While recent observer data shed light on evidence of recruitment, the data available (all fishery-dependent) do not allow for a quantitative measure of recruitment, so there is no way to estimate this variable.

Discards in the Red Crab Fishery

The PDT reviewed VTR-reported red crab discard rates by the red crab fishery (culled crabs – females and small males) and noted that there is a high level of uncertainty and variability in the amount of discards. Recent discard information from at-sea observers confirms this variability. Variability is caused by culling for females and preferred market sizes for males, the depth and location of the gear, the time of year, and amount of attention given to discard estimation as the traps are handled on deck.

In 2013, the SSC concluded that the available monitoring data on discards and research on discard mortality were inadequate to reliably estimate dead discards and the best scientific information available for deriving ABC was the time series of landings. Aside from the recently observed trips that provide estimates of the volume of discards, there have been no new sources of information on discard mortality since 2013.

Discards of other species in the red crab fishery are minimal.

Discards of Red Crab in Other Fisheries

Discards of red crabs in other fisheries are estimated annually using the NEFSC Standardized Bycatch Reporting Methodology (SBRM), which is based on discard data gathered by at-sea observers from a variety of fleets. While variable, the results from July 2011 through June 2018 suggest otter trawl fleets are typically responsible for most red crab discards in both the New England and mid-Atlantic regions, although there was a recent increase in discards from the lobster pot/trap fleet in 2017-2018.

The total number of red crab discards from all fisheries from July 2017-June 2018 were 152 mt, down from a high of 334 mt in July 2012 – June 2013 (Table 1). From July 2017-June 2018, the majority of red crab discards (70%) were observed on

crab pots and traps in the Northeast region, followed by other fleets (24%), and then lobster pots and traps in the Mid-Atlantic region (6%). Of the 'other fleets' discarding red crab, otter trawl fleets are responsible for the majority discards, followed by scallop dredge.[5]

Social, Economic, and Market Information

From FY 2009-2018, total red crab landings (live lbs) for limited-access red crab vessels have generally increased, with the most recent 3-years above the 10-year landings average (DMIS data) (Table 2). While dealer revenue has generally increased over the same 10-year period, including the most recent 3-years being above the 10-year average of $2.96 million, the inflation-adjusted price per pound has decreased over this period (Figure 9).

Red crab is sold for human consumption. Red crab landed in New Bedford, MA is processed and primarily sold domestically, with a small portion sent overseas for additional processing. The Virginia red crab landings are primarily live (i.e., no processing) and > 60% is trucked directly to Chinatown in New York City where a price premium is received. The remaining Virginia landings are sold locally but cannot compete with the local blue crab market when blue crab is available.

Availability of New Information and Regulations

Recent Red Crab Research

Bradley Stevens, Ph.D. (University of Maryland) and a student (Stephanie Martinez Rivera) conducted recent research on reproductive biology in female red crabs. Key findings from Dr. Martinez Rivera's PhD dissertation (Document #6) are summarized in this memo. Other ongoing research by Dr. Stevens is in preparation for publication.

- Size at sexual maturity (SM_{50}) indicate differences in SM_{50} of females by location (i.e., decreasing with higher latitude) and by season (i.e., larger carapace length [CL] in summer and fall than winter and spring).
- A positive correlation between fecundity and female size was observed.
- Results implied asynchrony between morphological and physiological sexual maturity, suggesting that mating occurs prior to completion of ovarian development.
- Results support earlier evidence (Stevens and Guida, 2016) that the female red crab reproductive cycle is at least two years, and hatching is seasonal but semi-continuous.
    - Red crabs can mate when they reach morphometric maturity, but may take up to a year to produce their first brood mass.

[5] Wigley, S. and Tholke, C. 2019. Discard Estimation, Precision, and Sample Size Analyses for 14 Federally Managed Species Groups in the waters off the northeastern United States. Northeast Fisheries Science Center.

Right Whales

In response to a recent decline in the North Atlantic right whale population, NMFS is taking actions under the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA):

- NMFS reinitiated Section 7 consultation (ESA) to assess whether federal fisheries, including red crab, may affect the right whale population. The draft Biological Opinion resulting from this consultation is expected to be released in late 2019 or early 2020.
- The Atlantic Large Whale Take Reduction Team (ALWTRT) met in April 2019 and recommended a suite of measures aiming at a 60% reduction in risk of serious injury and mortality to North Atlantic right whales. NMFS is working with states to develop specific measures. The proposed rule is expected to be published late in 2019 or early 2020, so final action is unlikely before the red crab final rule is published.
    - While the ALWTRT has primary focused on lobster pot/trap gear, it is possible that the regulations could extend to other pot/trap fisheries, including red crab.

Coral Management Areas

- The Mid-Atlantic Fishery Management Council (MAFMC) coral management zone went into effect on January 13, 2017, which did not include any restrictions for the red crab fishery. However, the MAFMC may reconsider the red crab exemption from fishing regulations in discrete zones (canyons), but not the entire slope, which would affect the fishery if it were closed. Discrete zones are listed at 50 CFR §648.372.
- The New England Fishery Management Council (NEFMC) is proposing a coral management zone that starts at, or deeper than 600m, which is slightly shallower than where the red crab fishery occurs. These regulations include an indefinite exemption for the red crab fishery. The final rule should be in effect by the time there is final action on the red crab specifications.

Northeast Canyons and Seamounts Marine National Monument

- Regarding the Northeast Canyons and Seamounts Marine National Monument, there is a possibility that red crab and lobster pots will be prohibited from the Monument before September 2023, when the 7-year exemption sunsets. However, at this time, there is no movement on lifting the exemption prior to this initial sunset date.

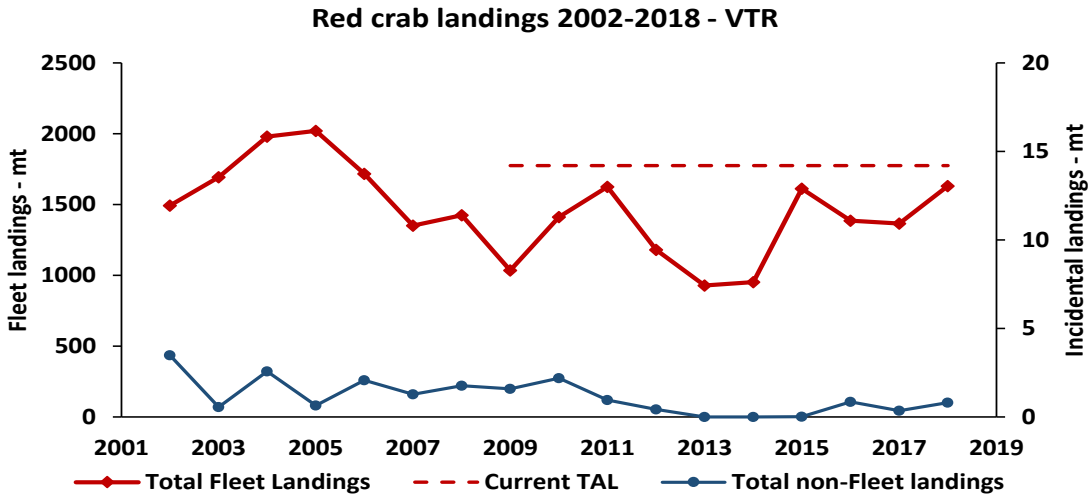


Figure 1. Red crab landings from 2002-2018

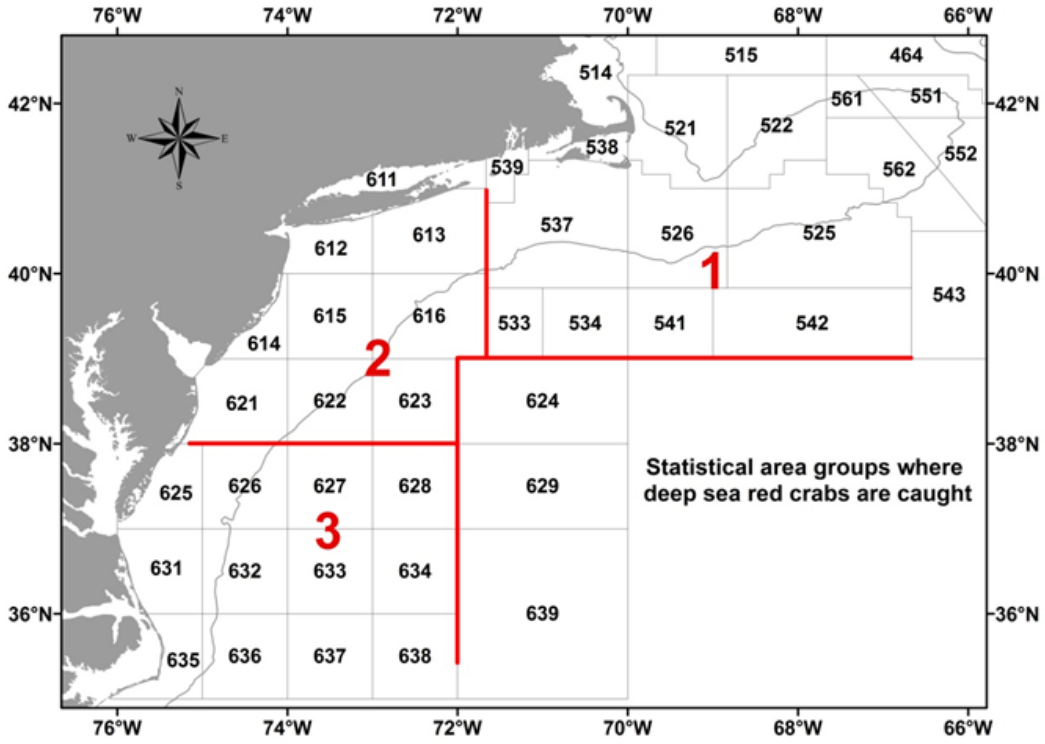


Figure 2. Red crab regions

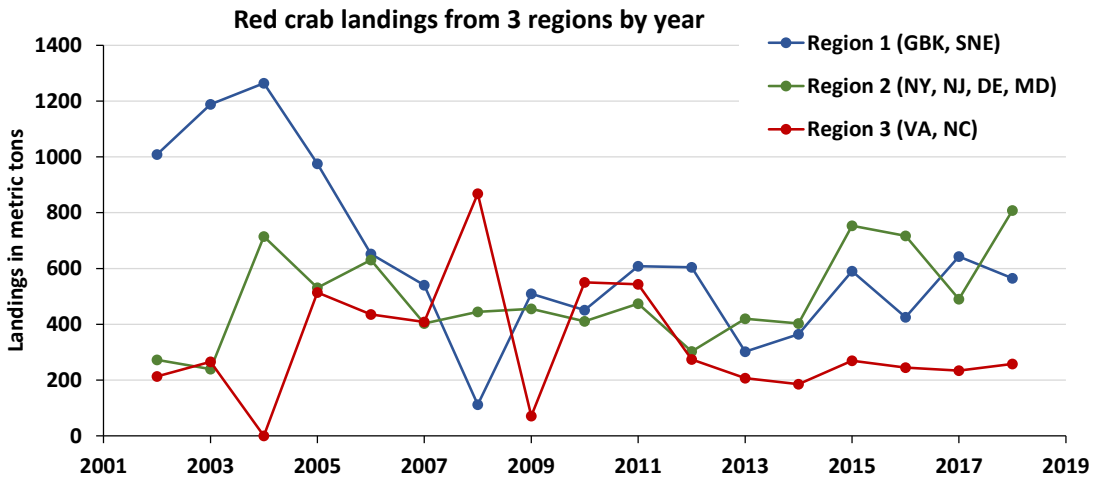


Figure 3. Red crab landings by region from 2002-2018

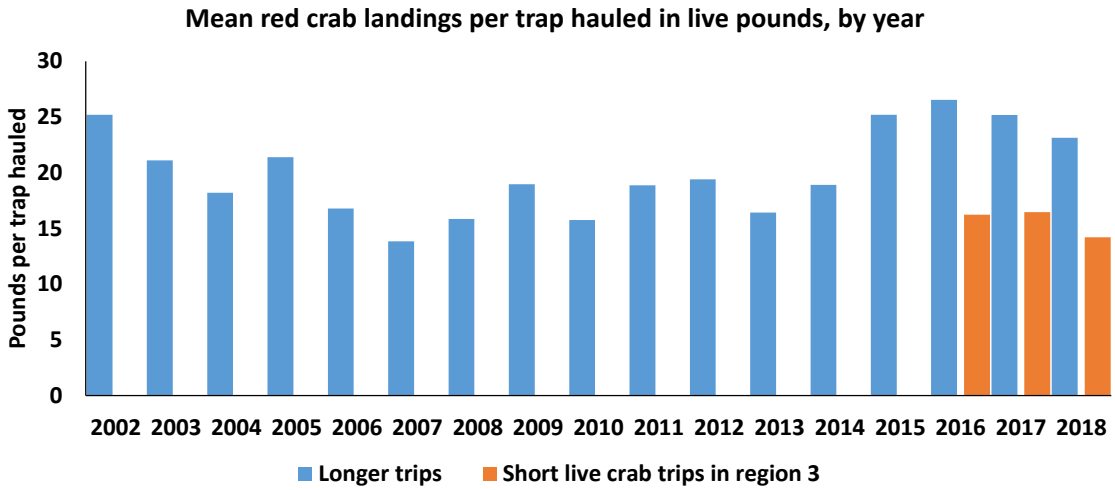


Figure 4. Red crab LPUE (live lbs) caught per trap hauled for all trips across regions, estimated using VTR data from 2002-2018

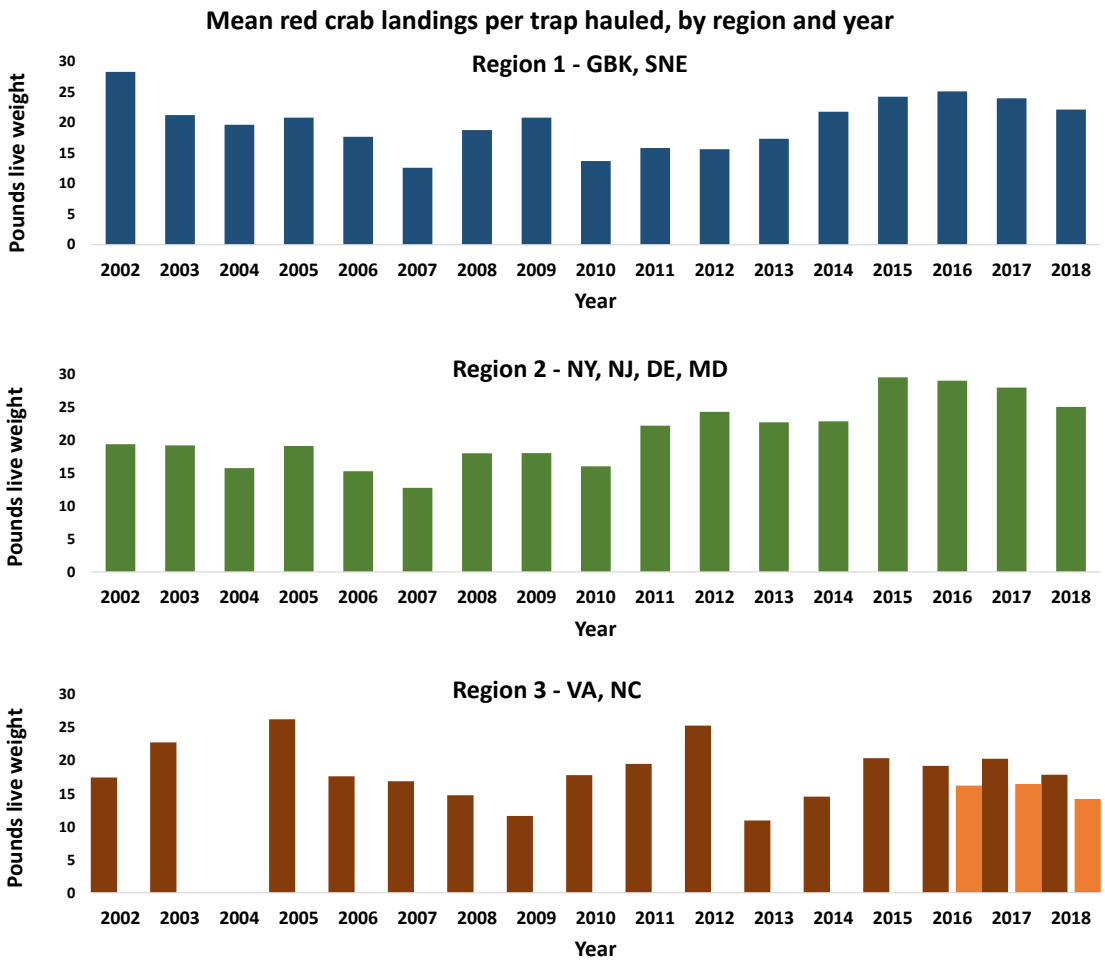


Figure 5. Red crab LPUE (live lbs) caught per trap hauled for all trips by region, estimated using VTR data from 2002-2018 (orange columns represent a single vessel that makes short trips for the live market)

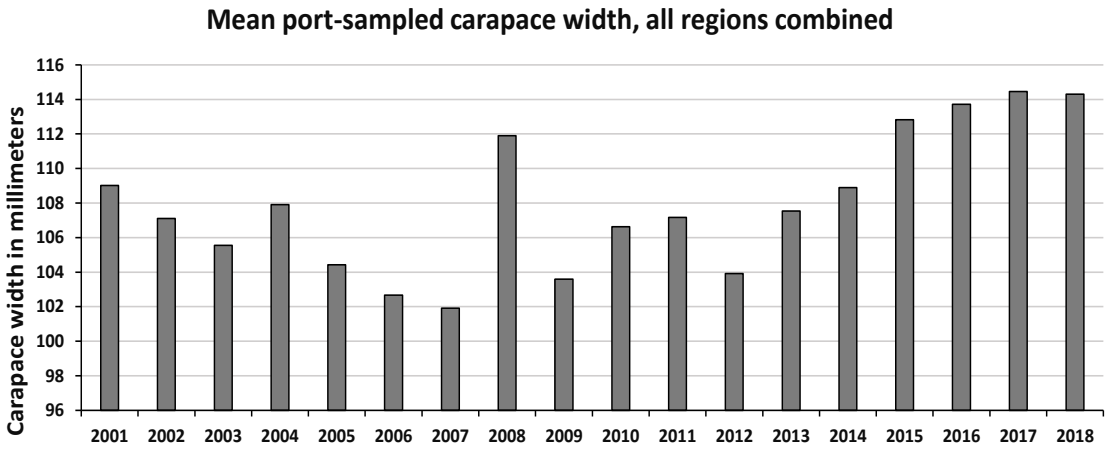


Figure 6. Mean carapace width in millimeters of all landed red crabs (males) in all regions, sampled by port agents from 2001-2018

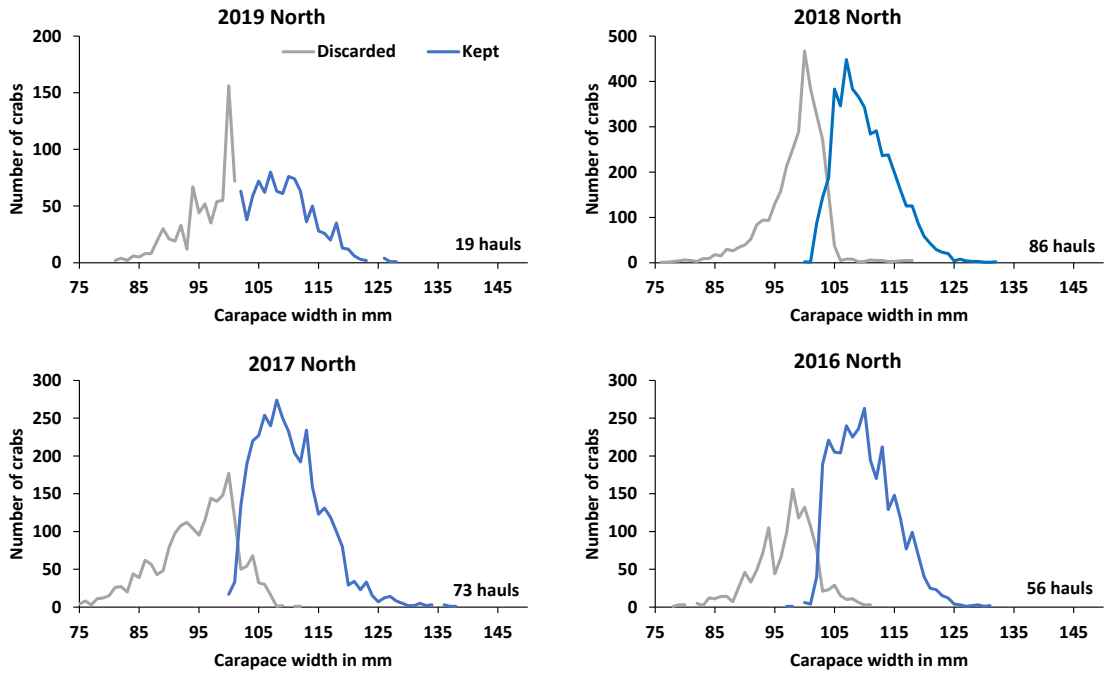


Figure 7. Carapace-width frequencies of discarded and kept male crabs, measured by observers in the northern region (1), from 2016-2019

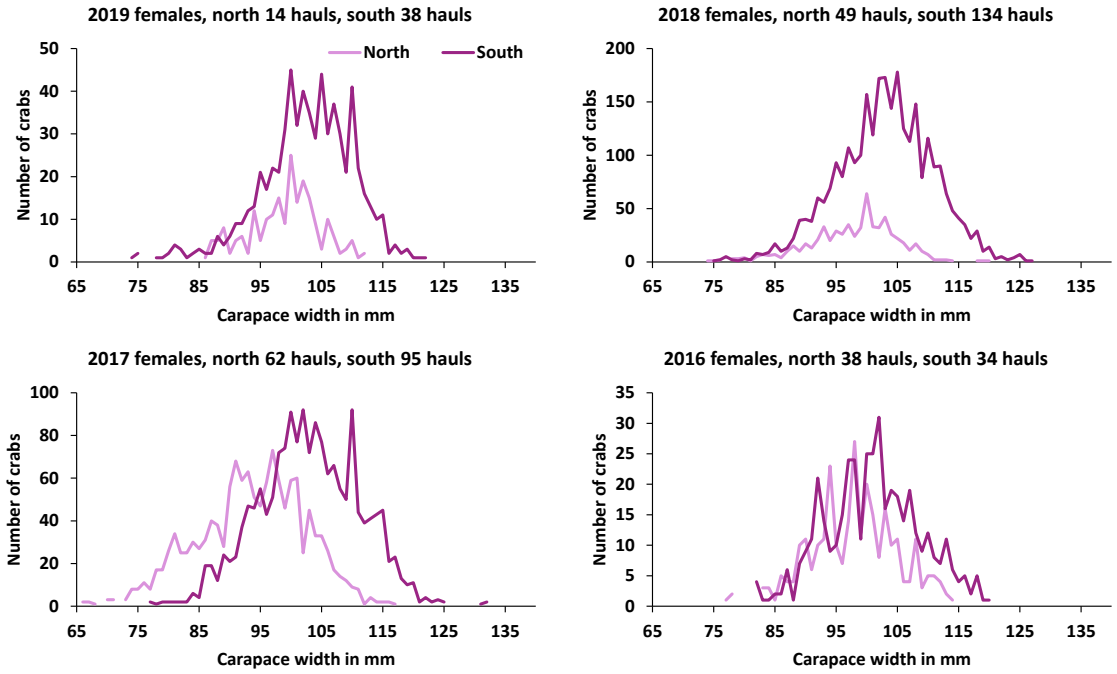


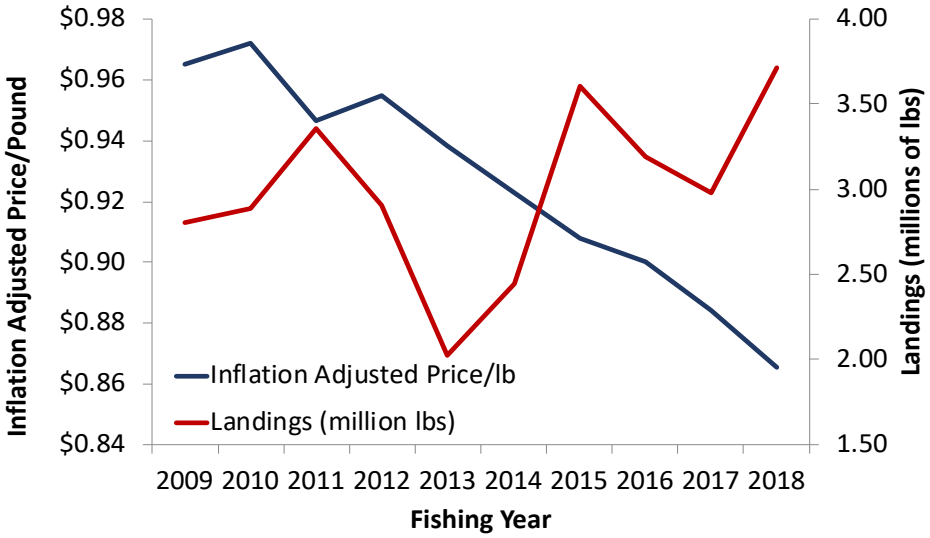
Figure 8. Carapace-width frequencies of discarded female crabs, measured by observers in all regions, from 2016-2019

Gear	July 2011 - June 2012	July 2012 - June 2013	July 2013 - June 2014	July 2014 - June 2015	July 2015 - June 2016	July 2016 - June 2017	July 2017 - June 2018
Mid-Atlantic small-mesh otter trawl	47	222	3	0.002	7	19	3
Mid-Atlantic large-mesh otter trawl		3	2	4	3	14	17
New England small-mesh otter trawl						1	
New England large-mesh otter trawl	94	107	37	25	35	108	7
Mid-Atlantic shrimp trawl				77	37	7	80
New England large-mesh gillnet	0.2	0.08	0.08	0.04			
Scallop dredge	0.05	0.7	0.01	0.9			
Lobster pots and traps		0.6	4		23	6	45
Total estimated discards by other fleets (mt)	141	334	46	108	104	154	152

Table 1. Estimated red crab discards (mt) by other fisheries by year, from July 2011- June 2018 (Data source: Wigley et al. 2019, 2018, 2017, 2016, 2015, 2014, 2013)

Fishing Year	Total Landings (live lbs)	Dealer Landings (live lbs)	Dealer Revenue	Nominal Price	2010 CPI Inflation Adjusted Price
2009	2,890,058	2,804,735	$2,685,393	$0.96	$0.97
2010	2,884,484	2,882,807	$2,811,807	$0.98	$0.97
2011	3,358,997	3,358,517	$3,262,627	$0.97	$0.95
2012	2,901,427	2,901,252	$2,900,394	$1.00	$0.95
2013	2,024,420	2,024,420	$2,024,420	$1.00	$0.94
2014	2,441,033	2,440,974	$2,440,974	$1.00	$0.92
2015	3,609,779	3,609,774	$3,586,613	$0.99	$0.91
2016	3,189,964	3,189,963	$3,189,504	$1.00	$0.90
2017	2,978,799	2,978,729	$2,978,797	$1.00	$0.88
2018	3,713,982	3,713,947	$3,711,759	$1.00	$0.87
FY 2009-2018 Annual Average	2,999,294	2,990,512	$2,959,229	$0.99	$0.93

Table 2. Red crab landings, revenue, price per pound, and inflation-adjusted price from FY 2009-2018



Data source: DMIS, June 2019, Greater Atlantic Regional Fisheries Office

Figure 9. Red crab landings, revenue, and inflation-adjusted price from FY 2009-2018