FISHERY MANAGEMENT PLAN UPDATE
BLUE CRAB
AUGUST 2019

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	December 1998
Amendments:	Amendment 1 – December 2004 Amendment 2 – November 2013
Revisions:	May 2016
Supplements:	None
Information Updates:	None
Recommended Schedule Change:	None
Next MFC Scheduled Review:	July 2025

The original North Carolina Blue Crab Fishery Management Plan (FMP) was adopted in December 1998 (NCDMF 1998). The plan adopted several management changes including: 1) requiring sinking lines to be used on all crab pot buoys, 2) prohibited commercial gears (except attended gill nets) in crab spawning sanctuaries from March 1 through August 31, 3) prohibited baiting peeler pots except with live legal-size male blue crabs, 4) repealed the exemption for culling peelers before reaching shore in the hard crab fishery, 5) prohibiting the possession of white line peelers from June 1 through September 30, 6) changed the unattended pot rule from 10 days to seven days, 7) prohibiting setting pots in any navigation channel marked by State or Federal agencies, 8) modified crab pot area regulations to use depth instead of distance from shore, 9) implemented marking requirements for recreational pots, 10) defined collapsible traps as non-commercial gear, and 11) established a permit for shedding operations.

Amendment 1 was adopted in December 2004 (NCDMF 2004). The amendment implemented several management changes including: 1) establishing a 6.75-inch maximum size limit for mature females from September 1 through April 30 if the spawner index fell below the threshold for two consecutive years, 2) establishing a 5.25-inch maximum size limit for female peeler crabs from September 1 through April 30 if the spawner index fell below the threshold for two consecutive years, 3) prohibiting the sale of white-line peelers but allow possession by licensed peeler operations and requiring white-line peelers to be kept separate from pink and red-line peelers, 4) extending the pot cleanup period by nine days, 5) change the unattended pot rule from seven days to five days, 6) requiring a four-inch stretch mesh tail bag for crab trawls in western Pamlico Sound (including the Pamlico, Pungo, Bay, and Neuse rivers), 7) separate hard and

peeler crab trawl landings on trip ticket, 8) modifying channel net rule to incorporate limited blue crab bycatch provisions identical to those for shrimp trawls, 9) modifying user conflict rule to resolve user conflicts on a regional basis, 10) rule change to allow crab pots in all designated long haul areas in the Hyde, Beaufort, and Pamlico counties, 11) modifying the dates for designated crab pot areas from May 1 through October 31 to June 1 through November 30, 12) change designated pot area boundary description to a standardized six foot depth contour in many areas, and 13) prohibit the use of trawls in designated pot areas.

Amendment 2 was adopted in November 2013 (NCDMF 2013). The amendment implemented several management changes including: 1) repealing the spawner index trigger (and associated maximum size limits for mature female and peeler blue crabs) and replacing it with adaptive management framework based on the results of the annual Traffic Light Stock Assessment update, 2) open long haul areas in the Pungo River to pots, 3) add Lower Broad Creek to non-pot areas in rule, 4) modify crab dredging rule to conform to current harvest management, 5) incorporate Pamlico Sound four-inch crab trawl line into rule, 6) redefine criteria for exempting escape rings in crab pots from the 1.5-inch pot mesh size to unbaited pots and pots baited with a male crab, 7) repeal proclamation authority that allowed for the exemption of escape ring requirement to allow harvest of peeler crabs, 8) adopt no trawl line in Pamlico Sound and Newport River boundary in rule as new boundary for areas where closure of escape rings to take small mature female crabs is allowed, 9) modify trawl nets rule to identify Pamlico, Back, and Core sounds as areas that can open to peeler trawling by proclamation, 10) modify rule to clearly state the intent of the exceptions, culling tolerance, and separation requirements for various crab categories, and 11) establish proclamation authority to require terrapin excluders in crab pots and establish a framework for developing criteria and terrapin excluder specifications.

The NCMFC preferred adaptive management strategy for blue crabs (Table 1) relies on the Traffic Light Stock Assessment as the tool to provide information on the relative condition of the stock. The base years (1987 to 2009) for assigning the signals in the Traffic Light Stock Assessment will remain constant until the next amendment of the FMP. The Traffic Light Stock Assessment will be updated annually by July of each year.

Based on the results of the annual Traffic Light update, with 2015 data, management action was required by the North Carolina Marine Fisheries Commission (NCMFC). At their May 19, 2016 business meeting, the NCMFC was presented with several management options identified in the adaptive management framework in Amendment 2 to the N.C. Blue Crab FMP (NCDMF 2016). To improve the condition of the blue crab stock the NCMFC adopted the following management measures: 1) require one additional escape ring in crab pots and one of the three escape rings must be located within one full mesh of the corner of the pot and within one full mesh of the bottom of the apron/stairs (divider) of the upper chamber of the pot; 2) eliminate the harvest of v-apron immature female hard crabs (excluding peeler crabs); and include v-apron immature female hard crabs in the culling tolerance; 3) prohibit the harvest of dark sponge crabs (brown and black) from April 1-April 30 each year; and include dark sponge crabs in the culling tolerance; 4) lower the culling tolerance from 10 percent to five percent for all crabs, except mature females; and 5) prohibit the harvest of crabs with dredges except incidental to lawful oyster dredging as outlined in NCMFC Rule 15A NCAC 03L .0203(a)(2).

All adaptive management measures became effective June 6, 2016 except for the additional escape ring requirement which was postponed until January 15, 2017 (NCDMF 2016). This delay coincided with the annual pot closure period to allow fishermen time to modify pots. The above actions taken by the NCMFC are documented in the May 2016 Revision to Amendment 2 to the N.C. Blue Crab FMP (NCDMF 2016).

The Benchmark Review of the Blue Crab FMP was originally scheduled to begin in July 2018 but at their August 2016 business meeting the NCMFC voted to move the review up on the FMP schedule to begin immediately. Consequently, the review of the Blue Crab FMP for development of Amendment 3 began in August 2016. The stock assessment has been completed and accepted for management use and the division's plan development team is working on development of Amendment 3 in conjunction with the advisory committee and is expected to be adopted in early 2020.

Management Unit

The management unit includes the blue crab (*Callinectes sapidus*) and its fisheries in all coastal fishing waters of North Carolina.

Goal and Objectives

The goal of Amendment 2 to the North Carolina Blue Crab FMP is to manage the blue crab fishery in a manner that promotes its ecological and economic value, and the long-term viability of the resource through sustainable harvest. The following objectives will be utilized to achieve this goal.

1. Utilize a management strategy that provides resource protection and sustainable harvest, promotes blue crab ecological and economic value, provides opportunity for resource utilization, and considers the needs of all users.
2. Promote harvesting practices that minimize waste of the resource and environmental damage.
3. Promote the protection, restoration, and enhancement of habitats and environmental quality necessary for the perpetuation of the blue crab resource.
4. Maintain a clear distinction between conservation goals and allocation issues.
5. Minimize conflicts among and within user groups, including non-crabbing user groups.
6. Identify and promote research to improve the understanding and management of the blue crab resource.
7. Promote education and public information to help users understand the causes and nature of problems for blue crabs in North Carolina, its habitats and fisheries, and the rationale for efforts to address resource management.

STATUS OF THE STOCK

Life History

The blue crab is common to all North Carolina coastal waters, but most reside in the Albemarle and Pamlico sounds and their tributaries. Blue crabs mature at approximately 12 to 18 months of

age and have an average lifespan of three years with some living as long as eight years (Fischler 1965; Johnson 2004; Rugolo et al. 1997). Mating occurs in brackish areas of the estuary and lower portions of the rivers from late spring to early fall, and spawning occurs in high-salinity waters near the ocean inlets from early summer to fall (Forward et al. 2003; Whitaker 2006). The first larval stage is carried offshore by ocean currents where they undergo several stages of development (Van Engel 1958; Epifanio 1995). Settlement of larval blue crabs occurs in the estuaries after winds and tides transport them through the inlets from the ocean. Once within the estuary, larval blue crabs settle in beds of submerged aquatic vegetation and other complex habitats, like salt marsh and oyster shell, where they become juvenile blue crabs. Juvenile blue crabs gradually migrate to lower salinity waters in the upper estuaries and rivers to grow (molt) and mature (Etherington and Eggleston 2000). Molting is a process of growth in blue crabs that requires shedding the hard exoskeleton. Following each molt, the shell is soft for several hours until it hardens, during this time the crab is more vulnerable to predators. Juvenile and adult blue crabs typically eat what is available to them such as dead and live fish, crabs, shrimp, and shellfish (Laughlin 1982; Williams 1984; Hines et al. 1990; Cordero and Seitz 2014) and serve as food for predator species such as striped bass and red drum (NCSU unpublished data).

Male and female blue crabs are easily identified by the shape of the apron on their abdomen. A mature male crab is called a "jimmy" and is easily recognized by the blue shading on his shell and claws and T-shaped apron on its underside. Female crabs are either called "sooks" as adults or "she-crabs" when immature. The immature female apron is triangular-shaped and held tightly against the abdomen. The mature female's apron becomes rounded and can be easily pulled away from the body after the final molt. The "sponge crab" is a female that has an egg mass on her abdomen.

Stock Status

Results of the 2018 blue crab stock assessment indicate the stock is overfished and overfishing is occurring (NCDMF 2018). The threshold spawner abundance was estimated to be 64 million mature females on average, and the target spawner abundance was estimated to be 73 million mature females on average (Figure 1). The average spawner abundance for 2016 was estimated to be 50 million mature females (< the threshold) with a 95% CI of 37-68 million, which determines the population in 2016 is overfished with a probability of 0.98. The fishing mortality threshold and target were estimated to be 1.46 and 1.22 on average, respectively. The average fishing mortality for 2016 was 1.48 (> *F* threshold) with a 95% CI of 0.86-2.42, which indicates overfishing is occurring in 2016 with a probability of 0.52.

Stock Assessment

The 2018 blue crab stock assessment used a sex-specific two-stage model applied to available data to assess the status of North Carolina's blue crab stock for 1995–2016 (NCDMF 2018). Data were available from commercial fishery monitoring programs and several fishery-independent surveys. Only hard crab landings were incorporated in the model and neither recreational or soft/peeler landings were included primarily due to their minimal contribution to the overall harvest. The two-stage model was developed based on the catch-survey analysis designed for species lacking information on the age structure of the population. The model

synthesized information from multiple sources, tracked population dynamics of male and female recruits and fully recruited animals, estimated critical demographic and fishery parameters such as natural and fishing mortality, and thus, provided a comprehensive assessment of blue crab status in North Carolina. The hierarchical Bayesian approach was used to estimate model parameters, which can incorporate uncertainty associated with the data and model assumptions.

The model estimated an overall declining trend in catch, relative abundance indices, population size of both male and female recruits and fully recruited crabs, with a rebound starting in 2007. Females had higher natural mortality estimates than males. The estimated fishing mortality remained high before 2007, and decreased by approximately 50% afterwards.

The status of the blue crab stock was evaluated using biological reference points based on maximum sustainable yield (MSY). The MSY-based biological reference points (BRPs) have been widely used in fishery stock assessments including blue crabs, e.g., Chesapeake Bay 2001 (Miller et al. 2011), Florida 2007 (Murphy et al. 2007) and Gulf of Mexico 2013 assessments (VanderKooy 2013).

The fishing mortality that maximizes the total yield (F_{MSY}) was set to be the threshold for overfishing, and $0.75F_{MSY}$ was set to be the target fishing mortality. The spawner abundance at F_{MSY} (SP_{MSY}) and 0.75 F_{MSY} was set to be the threshold and target for overfished population, respectively. In the current stock assessment, the populaion is determined to be overfished if the average spawner abundance in 2016 falls below SP_{MSY}, and is determined to be undergoing overfishing if the average F in 2016 remains above F_{MSY}.

STATUS OF THE FISHERY

Current Regulations

General Statutes

All management authority for North Carolina's blue crab fishery is vested in the State of North Carolina. Statutes that have been applied to the blue crab fishery include:

- Definitions relating to resources. G.S. 113-129.
- Definitions relating to activities of public. G.S. 113-130.
- Jurisdiction of fisheries agencies. G.S. 113-132.
- It is unlawful for any person without the authority of the owner of the equipment to take fish from said equipment. G.S. 113-268(a).
- It is unlawful for any vessel in the navigable waters of the State to willfully, wantonly, and unnecessarily do injury to any seine, net, or pot. G.S. 113-268(b).
- It is unlawful for any person to willfully destroy or injure any buoys, markers, stakes, nets, pots, or other devices or property lawfully set out in the open waters of the state in connection with any fishing or fishery. G.S. 113-268(c).

Marine Fisheries Commission Rules

The NCMFC has established several rules that directly govern the harvest of blue crabs. Below are rules and excerpts from rules that directly affect the blue crab fishery. The rules below do not

cover all gear, area, or other rules which may impact the blue crab fishery. As regulations may change, please contact the North Carolina Division of Marine Fisheries (NCDMF) for the most current regulations.

Definitions

Blue Crab Shedding: The process whereby a blue crab emerges soft from its former hard exoskeleton. A shedding operation is any operation that holds peeler crabs in a controlled environment. A controlled environment provides and maintains throughout the shedding process one or more of the following: (i) food, (ii) predator protection, (iii) salinity, (iv) temperature controls, or (v) water circulation, utilizing technology not found in the natural environment. A shedding operation does not include transporting pink or red-line peeler crabs to a permitted shedding operation. 15A NCAC 03I .0101(2)(c).

Peeler Crab: A blue crab that has a soft shell developing under a hard shell and having a white, pink, or red-line or rim on the outer edge of the back fin or flipper. 15A NCAC 03I .0101(2)(f).

Commercial Fishing Equipment or Gear: All fishing equipment used in coastal fishing waters except: (i) Cast nets; (ii) Collapsible crab traps, a trap used for taking crabs with the largest open dimension no larger than 18 inches and that by design is collapsed at all times when in the water, except when it is being retrieved from or lowered to the bottom; (iii) Dip nets or scoops having a handle not more than eight feet in length and a hoop or frame to which the net is attached not exceeding 60 inches along the perimeter; (iv) Gigs or other pointed implements which are propelled by hand, whether or not the implement remains in the hand; (v) Hand operated rakes no more than 12 inches wide and weighing no more than six pounds and hand operated tongs; (vi) Hook and line and bait and line equipment other than multiple hook or multiple bait trotline; (vii) Landing nets used to assist in taking fish when the initial and primary method of taking is by the use of hook and line; (viii) Minnow traps when no more than two are in use; (ix) Seines less than 30 feet in length; (x) Spears, Hawaiian slings or similar devices, which propel pointed implements by mechanical means, including elastic tubing or bands, pressurized gas or similar means. 15A NCAC 03I .0101(3)(c).

Mesh Length: The diagonal distance from the inside of one knot to the outside of the other knot, when the net is stretched hand-tight. 15A NCAC 03I .0101(3)(k).

Crab Harvest Restrictions

Hard crab minimum size limit of five inches measured from tip of spike to tip of spike for male and immature female hard blue crabs. Soft crabs shall be separated where taken and placed in a separate container. Peeler crabs shall be separated where taken and placed in a separate container. White-line peeler crabs shall be separated from pink and red-line peeler crabs where taken and placed in a separate container. Male crabs to be used as peeler bait are exempt from the five-inch size limit from March 1 through October 31 and shall be placed in a separate container. A culling tolerance of not more than five percent by number shall be allowed for white-line peelers in the pink and red-line peeler container [suspended by Proclamation M-11-2016]. It is unlawful to: sell white-line peelers, possess white-line peelers unless they are to be used by the harvester in the harvester's permitted blue crab shedding operation, possess male white line peelers from June 1 through September 1. It is unlawful to possess more than 50 crabs

per person per day not to exceed 100 blue crabs per vessel per day for recreational purposes. To comply with management measures in the N.C. Blue Crab Fishery Management Plan, the Director, may by proclamation, close the harvest of blue crabs and may impose any or all of the following restrictions on the commercial and recreational blue crab harvest: specify, areas, season; time periods, means and methods, culling tolerance, and limit harvest based on size, quantity, sex, reproductive stage, or peeler stage. 15A NCAC 03L .0201.

Spawning Sanctuaries
It is unlawful to set or use trawls, pots, and mechanical methods for oysters or clams or take crabs with the use of commercial fishing equipment from crab spawning sanctuaries [15A NCAC 03R .0110] from March 1 through August 31. During the remainder of the year the Director may, by proclamation, close these areas and may impose any or all of the following restrictions: areas, time periods, means and methods, and limit harvest based on size, quantity, sex, reproductive stage, or peeler stage. 15A NCAC 03L .0205.

Peeler and Soft Crabs
It is unlawful to possess more than 50 blue crabs in a shedding operation without first obtaining a Blue Crab Shedding Permit from the NCDMF. 15A NCAC 03O .0503(c).

Recreational Harvest
- Blue crabs may be taken without a commercial license if the following gears are used; cast nets, collapsible crab traps with the largest open dimension no larger than 18 inches, a dip net having a handle not more than eight feet in length and a hoop or frame to which the net is attached not exceeding 60 inches along the perimeter; single bait-and-line equipment, or seines less than 30 feet. 15A NCAC 03I .0101(3)(c)(i), (ii), (iii), (vi), and (ix).
- Recreational crab pot buoys must be any shade of hot pink in color, and be no less than five inches in diameter and length and be engraved with the owner's last name and initials. If a vessel is used the buoy must also be engraved with the gear owner's current motorboat registration number or owner's U.S. vessel documentation name. 15A NCAC 03J .0302(a)(1) and (2).
- It is unlawful for a person to use more than one crab pot attached to the shore along privately owned land or to a privately-owned pier without possessing a valid Recreational Commercial Gear License. 15A NCAC 03J .0302(b).
- Up to five crab pots may be used by holders of the Recreational Commercial Gear License. 15A NCAC 03O .0302(a)(3).
- Peeler pots are not permitted to be used by holders of the Recreational Commercial Gear License. 15A NCAC 03O .0302(a)(3).
- One multiple hook or multiple bait trotline up to 100 feet in length may be used to harvest blue crabs. 15A NCAC 03O .0302(a)(4).
- Trotlines must be marked at both ends with any shade of hot pink in color, and be no less than five inches in diameter and length and be engraved with the owner's last name and initials. If a vessel is used the buoy must also be engraved with the gear owner's current motorboat registration number or owner's U.S. vessel documentation name. 15A NCAC 03J .0302.

Trawls

- It is unlawful to use trawl nets in designated pot areas opened to the use of pots and within an area bound by the shoreline to the depth of six feet. 15A NCAC 03J .0104(b)(6).
- It is unlawful to use shrimp trawls for the taking of blue crabs in internal waters, except that it shall be permissible to take or possess blue crabs incidental to commercial shrimp trawling provided that the weight of the crabs shall not exceed; 50 percent of the total weight of the combined crab and shrimp catch; or 300 pounds, whichever is greater. For individuals using shrimp trawls authorized by a Recreational Commercial Gear License, 50 blue crabs, not to exceed 100 blue crabs if two or more Recreational Commercial Gear License holders are on board. The Fisheries Director may, by proclamation, close any area to trawling for specific time periods in order to secure compliance with this rule. 15A NCAC 03J .0104(f)(1), (f)(2)(A) and (B), and (g).
- From December 1 through March 31 it is unlawful to possess finfish caught incidental to shrimp and crab trawling in the Atlantic Ocean unless the weight of the combined catch of shrimp and crabs exceeds the weight of finfish; except that trawlers working south of Bogue Inlet may keep up to 300 pounds of kingfish, regardless of their shrimp or crab catch weight. 15A NCAC 03J .0202(5).
- It is unlawful to take or possess crabs aboard a vessel in internal waters except in areas and during such times as the Fisheries Director may specify by proclamation. 15A NCAC 03L .0202(a).
- It is unlawful to take crabs with crab trawls with a mesh less than three inches, except in areas of western Pamlico Sound the minimum mesh length is four inches; the Director may, by proclamation, specify other areas for trawl mesh length and increase the minimum mesh length to no more than four inches. 15A NCAC 3L .0202(b)(1) and (2).
- It is unlawful to use trawls with a mesh length less than two inches or with a combined total headrope length exceeding 25 feet for taking soft or peeler crabs. 15A NCAC 03L .0202(c).
- It is unlawful to use trawl nets for any purpose in any of the special secondary nursery areas, except that the Fisheries Director, may, by proclamation, open any or all of the special secondary nursery areas, or any portion thereof to crab trawling from August 16 through May 14. 15A NCAC 03N .0105(b), 03R .0105, 03L .0100 and .0200.
- It is unlawful to use trawl nets in areas listed in 15A NCAC 03R .0106, except that certain areas may be opened to peeler trawling for single-rigged peeler trawls or double-rigged boats whose combined total headrope length does not exceed 25 feet. 15A NCAC 03J .0104(b)(4) and 03R .0106(1).

Crab Pots

- It is unlawful to leave pots in any coastal fishing waters for more than five consecutive days, when such pots are not being employed in fishing operations, except upon a timely and sufficient showing of hardship. 15A NCAC 03I .0105(b)(1), (b)(2)(A) and (B), (b)(3), and (c).
- All pots shall be removed from internal waters from January 15 through February 7. Areas may be reopened, by proclamation, to the use of pots after January 19 if it is determined that such areas are free of pots. 15A NCAC 03J .0301(a)(1).
- From June 1 through November 30 the use of crab pots is restricted in certain areas north and east of the Highway 58 Bridge at Emerald Isle. These areas are described in 15A NCAC 03R .0107(a). To allow for the variable spatial distribution of crustacea and finfish, the

Fisheries Director may, by proclamation, specify time periods for or designate the areas described in 15A NCAC 03R .0107(b); or any part thereof, for the use of pots. From May 1 through November 30 in the Atlantic Ocean and west and south of the Highway 58 Bridge at Emerald Isle in areas and during time periods designated by the Fisheries Director by proclamation.15A NCAC 03J .0301(a)(2)(A) and (B), (a)(3), and 03R .0107(a) and (b).

- It is unlawful to use pots in any navigation channel maintained and marked by State or Federal agencies. 15A NCAC 03J .0301(b)(1).
- It is unlawful to use pots in any turning basin maintained and marked by the North Carolina Ferry Division. 15A NCAC 03J .0301(b)(2).
- It is unlawful to use pots in a commercial fishing operation unless each pot is marked by attaching a floating buoy which shall be of solid foam or other solid buoyant material no less than five inches in diameter and no less than five inches in length. Buoys may be any color except yellow or hot pink or any combination of colors that include yellow or hot pink. The pot owner's N.C. motorboat registration number, or U.S. vessel documentation name, or last name and initials shall be engraved in the buoy, or on a metal or plastic tag attached to the buoy. 15A NCAC 03J .0301(c)(1), (2), and (3).
- It is unlawful to use crab pots in coastal fishing waters unless each pot contains no less than two unobstructed escape rings that are at least 2 and 5/16 inches inside diameter and located in the opposite outside panels of the upper chamber of the pot except: unbaited pots, pots baited with a male crab, and pots set in areas described in 15A NCAC 03R .0118. 15A NCAC 03J .0301(g) [suspended by Proclamation M-11-2016, effective January 15, 2017].
- The Fisheries Director may, by proclamation, exempt the escape ring requirement describe in paragraph (g) in order to allow the harvest of mature female crabs and may impose any or all of the following restrictions: specify time, areas, means and methods, seasons, and quantity. 15A NCAC 03J .0301(h).
- It is unlawful to use more than 150 pots per vessel in the Newport River. 15A NCAC 03J .0301(i).
- It is unlawful to remove crab pots from the water or remove crabs from pots between one hour after sunset and one hour before sunrise. 15A NCAC 03J .0301(j).
- It is unlawful to use pots to take crabs unless the line connecting the pot to the buoy is non-floating. 15A NCAC 03J .0301(k).

Crab Dredging

- It is unlawful to use any dredge weighing more than 100 pounds except in the Atlantic Ocean. 15A NCAC 03J .0303(a).
- It is unlawful to use more than one dredge per vessel to take crabs or to use any dredges between sunset and sunrise. 15A NCAC 03J .0303(b).
- It is unlawful to take crabs with dredges except from January 1 through March 1 in portions of Pamlico Sound. 15A NCAC 03L .0203(a)(1) [suspended by Proclamation M-11-2016, effective June 6, 2016] and 15A NCAC 03R .0109.
- Crabs may be taken incidental to lawful oyster dredging provided the weight of the crabs shall not exceed 50 percent of the total weight of the combined oyster and crab catch; or 500 pounds, whichever is less. 15A NCAC 03L .0203(a)(2)(A) and (B) [suspended by Proclamation M-11-2016, effective June 6, 2016].

- It is unlawful to take crabs with dredges between sunset and sunrise and between sunset on any Saturday and sunrise on the following Monday, except in the Atlantic Ocean. 15A NCAC 03L .0203(b).

Miscellaneous

- It is unlawful to possess, sell, or purchase fish under four inches in length except for use as bait in the crab pot fishery in North Carolina with the following provision: such crab pot bait shall not be transported west of U.S. Interstate 95 and when transported, shall be accompanied by documentation showing the name and address of the shipper, the name and address of the consignee, and the total weight of the shipment. 15A NCAC 03M .0103(1).

<u>Wildlife Resources Commission Rules</u>

Manner of Taking Nongame Fish Purchase and Sale

- Blue crabs shall have a minimum carapace width of five inches (point to point) and it is unlawful to possess more than 50 crabs per person per day or to exceed 100 crabs per vessel per day. 15A NCAC 10C .0401(a)(1).
- Blue crab taken by hook and line, grabbling or by licensed special devices may not be sold. 15A NCAC 10C .0401(c).

Taking Nongame Fish, Crustaceans, and Mollusks for Bait or Personal Consumption

- A single, multiple bait line for taking crabs not to exceed 100 feet in length that is under the immediate control and attendance of the user and is limited to one line per person and no more than one line per vessel. The line is required to be marked on each end with a solid float no less than five inches in diameter and bearing legible and indelible identification of the user's name and address. 15A NCAC 10C .0402(a)(6).
- A collapsible crab trap with the largest opening not greater than 18 inches and which, by design, collapses at all times when in the water, except when being retrieved or lowered to the bottom. 15A NCAC 10C .0402(a)(7).
- Nongame fishes, crustaceans (crayfish and blue crabs), and mollusks taken for bait or personal consumption may not be sold. 15A NCAC 10C .0402(b).
- No more than 50 crabs per person, per day or 100 per vessel, per day with a minimum carapace width of five inches (point to point) from inland fishing waters or in designated waterfowl impoundments located on game lands. 15A NCAC 10C .0402(d)(3).

Special Device Fishing

- It is unlawful to use crab pots in inland fishing waters, except by persons owning property adjacent to the inland fishing waters of coastal rivers and their tributaries who are permitted to set two crab pots to be attached to their property and not subject to special device license requirements. 15A NCAC 10C .0404(e).

Commercial Landings

Commercial blue crab landings (hard, soft, and peeler crabs) averaged 40.5 million pounds from 1987 – 2009 (base years used in the traffic light; Table 2). Generally, commercial blue crab landings have been lower recently and ranged from a high of 67.1 million pounds in 1996 to a

low of 17.0 million pounds in 2018 The majority of blue crab landings are hard blue crabs. Landings for 2018 were 17.0 million pounds, under the base years' average (Figure 2). Landings for 2018 were 12 percent lower than 2017 and have been below the base years' average since 2004. The majority of blue crab landings come from crab pots (97.1 percent in 2018) followed by peeler pots (2.7% in 2018), crab trawls (0.1% in 2018) and other gears (0.1% in 2018; Figure 3). Most crabs landed in 2018 were hard crabs (96.5 percent), followed by peeler (2.1 percent) and soft (1.4 percent) crabs (Figure 4).

Recreational Landings

A survey of Recreational Commercial Gear License (RCGL) holders conducted from 2002 – 2008 by the NCDMF indicated blue crabs were the most abundant species landed (by weight) by RCGL participants. During this time, on average, blue crabs accounted for 20 percent (116,797 pounds) of the total poundage (587,172 pounds) landed by RCGL holders. This survey was discontinued in 2009 so more recent estimates of RCGL harvest are unavailable. The harvest of RCGL exempted shore and pier based pots, as well as other non-commercial gear, is unknown.

The Marine Recreational Information Program is primarily designed to sample anglers who use rod and reel as the mode of capture. Since blue crab are also harvested recreationally throughout coastal North Carolina, primarily by pots, this program does not provide precise estimates of recreational harvest. To address this, the division began a mail survey of Coastal Recreational Fishing License (CRFL) holders in the fall of 2010 to attempt to generate recreational harvest estimates for blue crab. One weakness of the survey is a CRFL is not required to harvest blue crab so the harvest from the recreational sector is likely underestimated. Full year results from this survey are available for 2011-2018 (Figure 5; Table 2). Generally, estimates of recreational blue crab harvest were low, ranging from 47,766 blue crabs (approximately 15,922 pounds, using an average of three crabs per pound) in 2018 to 120,979 blue crabs (approximately 40,326 pounds) in 2012. For 2011 – 2018, the average annual recreational harvest of blue crab was 88,382 blue crabs (approximately 29,461 pounds).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

The number of blue crab lengths obtained from the fishery dependent sources from 1995 through 2018 ranged from 7,698 in 2018 to 33,007 in 1995 (Table 3). Mean carapace width (CW) varied little ranging from 5.5 inches to 6.0 inches. Minimum CW ranged from 1.2 inches to 3.8 inches. Maximum CW ranged from 7.8 inches to 9.1 inches. In general, the commercial fishery harvests a narrow size range of blue crab, with most crabs running from 5 to 6.25 inches CW. The length composition and modal length of blue crab caught in the commercial fishery has varied little over time (Figure 6).

The Traffic Light, used to monitor the health of the blue crab stock, uses commercial crab sampling data (combined with fishery-independent data) to determine the annual length of 50 percent maturity for female blue crabs. This index is used in the Production characteristic of the Traffic Light. The annual length of 50 percent maturity is compared to the mean length of 50

percent maturity for the base years of 1987 – 2009 (112.1 mm CW [4.4 inches]). In 2018, the length of 50 percent maturity was 118.7 mm CW (4.7 inches) and was above the mean for the base years (112.1 mm CW [4.4 inches]). The length of 50 percent maturity has been above the base years mean since 2005 (Figure 7).

Fishery-Independent Monitoring

The Traffic Light, used to monitor the condition of the blue crab stock, uses several fishery-independent indices for the Adult Abundance, Recruit Abundance, and Production characteristics. The status of each indicator is compared to the mean of that indicator over a set of base years. The base years used for the blue crab traffic light were 1987 – 2009.

Adult Abundance

The adult abundance characteristic uses data from the Juvenile Anadromous Trawl Survey (Program 100), the Estuarine Trawl Survey (Program 120), and the Pamlico Sound Survey (Program 195) to monitor adult blue crab abundance. Indices from Program 120 and Program 195 consist of blue crabs greater than or equal to 100 mm CW (3.9 inches); an index of total abundance (no size restrictions) is derived from Program 100. Two indices are derived from Program 120, a Pamlico index using data from tributaries in and around Pamlico Sound and Core Sound and a Southern index using data collected from Back Sound and south (Figure 8).

Adult abundance for Program 100 was above the mean for the base years (0.27 crabs/minute) from 2006 – 2012, both 2013 (0.266 crabs/minute) and 2014 (0.23 crabs/minute) adult abundance estimates were below the base year mean but in 2015 (1.04 crabs/minute), 2016 (0.78 crabs/minute), 2017 (1.39 crabs/minute), and 2018 (1.82 crabs/minute) adult abundance estimates were above the base year mean. Adult abundance for Program 120 in the Pamlico region has been below the base year mean (0.62 crabs/tow) since 2013 (2018=0.28 crabs/tow). In the Southern region, adult abundance for Program 120 was below the base year mean (0.15 crabs/tow) from 2011-2014, 2016, 2017, and 2018 (0.13 crabs/tow). Adult abundance for Program 195 has been below the base year mean (4.52 crabs/tow) since 2000. In 2018 adult abundance was 3.20 crabs/tow, the highest it has been since 2003. Figure 9 shows the individual traffic lights for each index as well as the composite adult abundance traffic light.

Recruit Abundance

The recruit abundance characteristic uses data from the Estuarine Trawl Survey (Program 120) and the Pamlico Sound Survey (Program 195) to monitor blue crab recruit abundance. Each index consists of blue crabs less than 100 mm CW (3.9 inches) and greater than or equal to 30 mm CW (1.2 inches). Two indices are derived from Program 120, a Pamlico index using data from tributaries in and around Pamlico Sound and Core Sound and a Southern index using data collected from Back Sound and south. Two indices are also derived from Program 195, a summer (June) and a fall (September) index (Figure 10).

Recruit abundance for Program 120 in the Pamlico region has been below the base year mean (1.93 crabs/tow) since 2013 (2018=0.93 crabs/tow). In the Southern region, recruit abundance has been below the base year mean (0.44 crabs/tow) since 2005. In 2018, recruit abundance was 0.31 crabs/tow in the Southern region. Recruit abundance for Program 195 in the summer has

been below the base year mean (29.66 crabs/tow) since 2011 and was 8.95 crabs/tow in 2018. In the fall, recruit abundance was below the base year mean (3.49 crabs/tow) from 1998-2017. In 2018, recruit abundance was 6.93 crabs/tow in the fall, almost double the base year mean. Figure 11 shows the individual traffic lights for each index as well as the composite recruit abundance traffic light.

Production

The production characteristic uses data from the Juvenile Anadromous Trawl Survey (Program 100), the Estuarine Trawl Survey (Program 120), and the Pamlico Sound Survey (Program 195) to monitor the blue crab stock's production potential. The production indicators include measures of median carapace width, pre-recruit abundance (blue crabs less than 30 mm CW [1.2 inches]), length at 50 percent maturity (see fishery-dependent monitoring section), spawning stock (mature female mm/minute), and frequency of occurrence of mature females (percent of samples with mature female blue crabs; Figure 14).

Three indices are derived from Program 100 including median carapace width, spawning stock, and frequency of occurrence of mature females (Figure 11). Median carapace width was below the base year mean (114.2 mm [4.5 inches]) from 2009-2017 (2018=102 mm [4.0 inches]). The spawning stock index was below the base year mean (19.54 mm/minute [0.8 inches]) from 2012-2014 and 2016. In 2017 (32.44 mm/minute [1.3 inches]) and 2018 (24.44 mm/minute [1.0 inches]), the spawning stock index was above the base year mean. The frequency of occurrence of mature females was above the base year mean (23.4 percent) from 2005 – 2013 and 2015 – 2018 (2018=51.3 percent).

Three indices are derived from Program 120 including Pamlico and Southern region median carapace width and a statewide pre-recruit abundance index (Figure 12). Median carapace width was below the base year mean (34.3 mm [1.4 inches]) in 2018 (31.0 mm [1.2 inches]) in the Pamlico region. In the Southern region, median carapace width was below the base year mean (32.7 mm [1.3 inches]) in 2018 (29.0 mm [1.1 inches]). The statewide pre-recruit index has been below the base year mean (1.10 crabs/tow) since 2010; in 2018 the pre-recruit index was 0.73 crabs/tow.

Four indices are derived from Program195 including summer and fall median carapace width, fall spawning stock, and fall frequency of occurrence of mature female indices (Figure 13). The summer median carapace width index was below the base year mean (72.2 mm [2.8 inches]) in 2018 (62 mm [2.4 inches]). The fall median carapace width index was below the base year mean (109.1 mm [4.3 inches]) in 2018 (57 mm [2.2 inches]). The fall spawning stock index has been below the base year mean (741.7 mm/tow [29.2 inches]) since 2004; in 2018 the fall spawning index was 585.7 mm/tow (23.1 inches). The frequency of occurrence of mature females was below the base year mean (55.9 percent) from 2004-2017; in 2018 the frequency of occurrence of mature females was above the base year mean at 63.0 percent. Figure 15 shows the individual traffic lights for each index as well as the composite production traffic light.

MANAGEMENT STRATEGY

Traffic Light

The NCMFC preferred management strategy under Amendment 2 relies on the Traffic Light analysis to provide information on the relative condition of the stock. The base years (1987 to 2009) for assigning the signals in the Traffic Light analysis will remain constant until the next amendment of the FMP. The adaptive management framework in Amendment 2 will remain in effect until the adoption of Amendment 3. The Traffic Light analysis is updated annually by July of each year to gauge the status of the stock. To trigger management actions, either the adult abundance or production characteristic of the assessment must be at or above the 50 percent red threshold for three consecutive years to trigger the moderate management actions and must be at or above the 75 percent red threshold for two of three consecutive years to trigger the elevated management actions established in the plan (Table 1). The recruit abundance indicator, while not used to trigger initial management action, may be used to supplement any management actions taken if the adult abundance or production triggers are activated.

Based on the results of the Traffic Light update in 2016, management action was required by the NCMFC. At their May 19, 2016 business meeting the NCMFC was presented with several management options identified in the adaptive management framework in Amendment 2 to the N.C. Blue Crab FMP. To improve the condition of the blue crab stock, the NCMFC took the following actions:

1. Required one additional escape ring in crab pots and one of the three escape rings must be located within one full mesh of the corner of the pot and within one full mesh of the bottom of the apron/stairs (divider) of the upper chamber of the pot.
2. Eliminated the harvest of v-apron immature female hard crabs (excluding peeler crabs); and include v-apron immature female hard crabs in the culling tolerance.
3. Prohibited the harvest of dark sponge crabs (brown and black) from April 1-April 30 each year; and include dark sponge crabs in the culling tolerance.
4. Lowered the culling tolerance from 10 percent to five percent for all crabs, except mature females.
5. Prohibited the harvest of crabs with dredges except incidental to lawful oyster dredging as outlined in NCMFC Rule 15A NCAC 03L .0203(a)(2).

All adaptive management measures were effective June 6, 2016 except for the additional escape ring requirement which was not effective until January 15, 2017 (NCDMF 2016). This delay was to allow fishermen time to modify their pots.

For the management measures implemented in May 2016 under the adaptive management framework to be relaxed, the adult abundance characteristic of the traffic light must fall below the 50 percent red threshold for three consecutive years. For 2018, the adult abundance characteristic is at 47 percent red, this was the first year below the moderate management threshold since 2012. The production characteristic is at 48 percent red and has been above the moderate management threshold for one (2016) of the last three years (2016-2018). The recruit abundance characteristic has exceeded the moderate threshold for eight consecutive years (2011-

2018) and had exceeded the elevated threshold for five consecutive years (2013-2017). For 2018, recruit abundance characteristic is at 67 percent red (Figure 15).

The current update indicates 2018 will count as the first of three consecutive years required below the 50 percent red threshold for the adult abundance characteristic to allow management measures to be relaxed.

Principal Issues
Several management issues were explored in Amendment 2; Table 4 outlines the specific issues explored and the implementation status of each management strategy.

RESEARCH NEEDS

Several research needs were identified in N.C. Blue Crab Fishery Management Plan Amendment 2; the bulleted list below outlines the specific needs and highlights the progress made towards each management and research need.

- Continue to support research to determine the status of protected species (e.g., migration patterns, habitat utilization) along the North Carolina coast to better anticipate and prevent interactions (needed)
- Support research on blue crab fishery interactions with protected species (e.g., identifying any seasonal or spatial peaks in potential for interactions) (needed)
- Support gear modification research and testing that could reduce protected species interactions (needed)
- Continue socioeconomic surveys of blue crab harvesters and include wholesale and retail benefits, the entire support industry for this fishery including suppliers, picking houses, and restaurants (needed)
- Update Recreational Commercial Gear License (RCGL) survey (needed)
- Continue survey and compile data of recreational crabbers not possessing a RCGL license (ongoing through NCDMF mail survey of CRFL holders)
- Determine the economic effects of imported crabmeat, including the mixture of imported meat with local crabmeat, on processing and demand (needed)
- Determine the costs associated with crab processing. Identify the factors and their relative importance in predicting processor closures (needed)
- Research the changing demographics of the commercial blue crab fishery (needed)
- Continue research on the impacts of endocrine disrupting chemicals (EDCs) on the various life stages of the blue crabs and way to reduce introduction of EDCs into estuarine waters. (needed)
- Assess the impact of winter inlet deepening dredge activities on the overwintering female blue crabs and their habitat (needed)
- Determine the spatial and biological characteristics of SAV beds that maximize their ecological value to the blue crab for restoration or conservation purposes (needed)
- Identify, research, and map shallow detrital areas important to blue crabs (needed)
- Additional research is needed on the extent, causes, and impacts of hypoxia and anoxia on blue crab behavior and population abundance in North Carolina's estuarine waters (needed)

- Conduct research on the water quality impacts of crab pot zincs, bait discard, and alternative crab baits in the pot fishery (needed)
- Develop methods to expand sampling effort to more accurately assess the status of the blue crab stock and its fisheries (needed)
- Continue research on blue crab discards in the shrimp trawl fishery (ongoing through NCDMF observer studies)
- Expand research state wide on the use of terrapin excluder devices in crab pots (needed)
- Implement outreach programs to inform state agencies, the public, and the commercial and recreational fishing industries about issues relating to protected species and fishery management (needed)
- Continue gear development research to minimize species interactions (needed)
- Continue existing programs that have been used to monitor North Carolina's blue crab stock to maintain baseline data (ongoing through NCDMF fishery-independent sampling)
- Identify key environmental factors that significantly impact North Carolina's blue crab stock and investigate assessment methods that can account for these environmental factors (needed)
- Conduct a study of the selectivity of the gear used in the Juvenile Anadromous Trawl Survey (Program 100) to evaluate the size at which blue crabs are fully-selected to the survey gear; the results of such a study could help determine whether the survey data could be used to develop a reliable index of blue crab recruitment for the Albemarle region; no such index is currently available (needed)
- Expand spatial coverage of the Estuarine Trawl Survey (Program 120) to include shallow-water habitat in Albemarle Sound; sampling in shallow-water habitat is intended to target juvenile blue crabs so that a recruitment index for the Albemarle Sound could be developed (needed)
- Expand temporal coverage of the Estuarine Trawl Survey (Program 120) beyond May and June sampling; additional sampling later in the blue crab's growing season would provide more information on within-year changes in growth, mortality, and abundance; at a minimum, recommend addition of September sampling in order to capture the fall settlement peak (needed)
- Expand spatial coverage of Pamlico Sound Survey (Program 195) to include deep water habitat in Albemarle Sound and the Southern Region; expanding the sampling region of adult blue crab habitat would allow for a more spatially-comprehensive adult index; additionally, there would be increased confidence in comparison of adult abundance trends among regions since all would derive from the same sampling methodology (needed)
- Implement a statewide survey with the primary goal of monitoring the abundance of blue crabs in the entire state; such a survey would need to be stratified by water depth to ensure capture of all stages of the blue crab life cycle and standardized among North Carolina waters (needed)
- Implement monitoring of megalopal settlement near the ocean inlets could potentially add a predictive function to the blue crab stock assessments in the future; Forward et al. (2004) detected a positive, linear relationship between megalopal abundance and commercial landings of hard blue crabs for both the local estuarine area and the entire state of North Carolina when a two-year time lag was implemented (Forward et al. 2004); such monitoring is critical to track larval ingress peaks and the effect of natural forces, such as tropical storms and prevailing winds, on ingress (needed)

- Continue surveys of recreational harvest and effort to improve characterization of the recreational fishery for blue crabs (ongoing through NCDMF mail survey of CRFL holders)
- Identify programs outside the NCDMF that collect data of potential use to the stock assessment of North Carolina's blue crabs (needed)
- Perform in-depth analysis of available data; consider standardization techniques to account for gear and other effects in development of indices; explore utility of spatial analysis in assessing the blue crab stock

FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATION

The division will continue developing Amendment 3 in conjunction with the advisory committee. Amendment 3 is scheduled for adoption in spring 2020.

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TABLES

Table 1. Management measures in N.C. Blue Crab Fishery Management Plan Amendment 2 that may be implemented by proclamation as described in the blue crab adaptive management framework when a stock characteristic exceeds a designated management threshold.

Characteristic	Moderate management level	Elevated management level
Adult abundance	A1. Increase in minimum size limit for male and immature female crabs	A4. Closure of the fishery (season and/or gear)
	A2. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 5%) and/or implement gear modifications to reduce sublegal catch	A5. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 1%) and/or implement gear modifications to reduce sublegal catch
	A3. Eliminate harvest of v-apron immature hard crab females	A6. Time restrictions
Recruit abundance	R1. Establish a seasonal size limit on peeler crabs	R4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots in specific areas
	R2. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color)	R5. Expand existing and/or designate new crab spawning sanctuaries
	R3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	R6. Closure of the fishery (season and/or gear)
		R7. Gear modifications in the crab trawl fishery
Production	P1. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color)	P4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots for specific areas
	P2. Minimum and/or maximum size limit for mature female crabs	P5. Reduce peeler harvest (no white line peelers and/or peeler size limit)
	P3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	P6. Expand existing and/or designate new crab spawning sanctuaries
		P7. Closure of the fishery (season and/or gear)

Table 2. Blue crab recreational harvest (number and weight) and releases (number) and commercial harvest, 1987 – 2018. Recreational harvest weight is calculated using a standard conversion of 3 crabs per pound.

	Recreational*			Commercial	Total
	Numbers		Weight (lb)	Weight (lb)	Weight (lb)
Year	Landed	Released	Landed	Landed	Landed
1987	-	-	-	32,423,604	32,423,604
1988	-	-	-	35,604,423	35,604,423
1989	-	-	-	34,724,673	34,724,673
1990	-	-	-	38,070,328	38,070,328
1991	-	-	-	41,829,676	41,829,676
1992	-	-	-	41,068,374	41,068,374
1993	-	-	-	43,672,732	43,672,732
1994	-	-	-	53,513,124	53,513,124
1995	-	-	-	46,443,541	46,443,541
1996	-	-	-	67,080,200	67,080,200
1997	-	-	-	56,090,109	56,090,109
1998	-	-	-	62,076,171	62,076,171
1999	-	-	-	57,546,676	57,546,676
2000	-	-	-	40,638,384	40,638,384
2001	-	-	-	32,180,390	32,180,390
2002	-	-	-	37,736,319	37,736,319
2003	-	-	-	42,769,797	42,769,797
2004	-	-	-	34,130,608	34,130,608
2005	-	-	-	25,430,119	25,430,119
2006	-	-	-	25,343,158	25,343,158
2007	-	-	-	21,424,960	21,424,960
2008	-	-	-	32,916,691	32,916,691
2009	-	-	-	29,707,232	29,707,232
2010	-	-	-	30,683,011	30,683,011
2011	114,426	81,763	38,142	30,035,392	30,073,534
2012	120,979	79,072	40,326	26,785,669	26,825,995
2013	94,174	61,452	31,391	22,202,623	22,234,014
2014	100,597	67,413	33,532	26,231,112	26,264,644
2015	71,587	60,135	23,862	32,127,043	32,150,905
2016	84,879	82,781	28,293	25,462,740	25,491,033
2017	72,645	67,667	24,215	19,273,156	19,297,371
2018	47,766	57,024	15,922	17,012,354	17,028,276
Average	88,382	69,663	29,461	36,319,825	36,327,190
Traffic Light Base Years' Average (1987-2009)				40,540,056	

*Recreational data collection began in October 2010 and the first full year estimates were available in 2011.

Table 3. Blue crab length (carapace width [CW], inches) data from commercial fish house samples, 1995-2018.

Year	Mean CW	Minimum CW	Maximum CW	Total Number Measured
1995	5.6	2.0	8.3	33,007
1996	5.7	2.7	8.3	23,333
1997	5.6	2.7	8.1	22,001
1998	5.7	3.4	7.9	15,246
1999	5.5	1.2	7.8	13,456
2000	5.7	3.4	8.0	15,560
2001	5.7	2.9	9.1	18,316
2002	5.5	3.5	8.3	11,417
2003	5.7	3.3	7.8	11,802
2004	5.7	3.2	8.6	17,386
2005	5.6	3.2	8.3	10,474
2006	5.7	3.3	8.1	10,867
2007	5.7	3.4	8.0	14,898
2008	5.9	3.0	8.7	20,420
2009	6.0	3.7	8.7	17,910
2010	5.7	2.7	8.4	16,123
2011	5.8	2.9	8.3	16,461
2012	5.8	3.8	8.6	12,918
2013	5.8	1.9	8.5	17,616
2014	5.9	2.3	8.5	11,304
2015	5.8	2.2	9.0	14,681
2016	5.7	3.5	9.0	13,531
2017	5.8	3.6	8.1	9,978
2018	5.8	3.7	8.1	7,698

Table 4. Summary of management strategies and outcomes from N.C. Blue Crab Fishery Management Plan Amendment 2.

Management Strategy	Implementation Status
STOCK PROTECTION	
Repeal the current female stock conservation management trigger.	Rule change to 15A NCAC 03L .0201; Rule change implemented on April 1, 2014.
Continue existing sampling programs to maintain baseline information for the Traffic Light Stock Assessment method.	No action required.
Adopt the adaptive management framework based on the Traffic Light Stock Assessment and the proposed moderate and elevated management levels for recruit abundance, adult abundance, and production characteristics. Initial management action will only be implemented when either the adult abundance or production characteristic reach the management trigger of 50% red or greater for three consecutive years. The recruit abundance characteristic will be used as a supplement to further direct conservation management actions, if deemed necessary.	Rule change to 15A NCAC 03L .0201, 03L .0203, 03L .0204, 03L .0205, 03L .0206, 03L .0209 and 03J .0301; Rule change implemented on April 1, 2014.
USER CONFLICTS	
Status quo, continue with no crab pot limit in southern Bogue Sound.	No action required.
Open the non-pot (long haul net) areas all the time by rule in the Pungo River and keep status quo in the Long Point area on the Pamlico River.	Rule change to 15A NCAC 03R .0107; Rule change implemented on April 1, 2014.
CLARIFICATION OF RULES	
Modify the rule to include the lower Broad Creek area that is closed to crab pots from June 1 through November 30.	Rule change to 15A NCAC 03R .0107; Rule change implemented on April 1, 2014.
Amend the rule to match harvest management for crab dredging.	Rule change to 15A NCAC 03L .0203; Rule change implemented on April 1, 2014.
Modify Rule 15A NCAC 03L .0202 to incorporate the long-standing provisions of Proclamation SH-5-2007 (Pamlico Sound four-inch mesh crab trawl line), and retain the Director's proclamation authority to restrict crab trawl mesh size.	Rule change to 15A NCAC 03L .0202; Rule change implemented on April 1, 2014.
Amend the current rule to redefine criteria for exempting escape rings in crab pots from the 1.5-inch pot mesh size to unbaited pots and pots baited with a male crab.	Rule change to 15A NCAC 03J .0301 and 03L .0301; Rule change implemented on April 1, 2014.

Management Strategy	Implementation Status
Repeal the proclamation authority that allows for exempting the escape ring requirement in order to allow the harvest of peeler crabs.	Rule change to 15A NCAC 03J .0301; Rule change implemented on April 1, 2014.
Adopt the no trawl line along the Outer Banks in Pamlico Sound as the new boundary in Pamlico Sound, and the Newport River boundaries as delineated in the proposed rule as new boundaries for the area where closure of escape rings to take small mature females is allowed.	Rule change to 15A NCAC 03J .0301 and add new rule 03R .0118; Rule change implemented on April 1, 2014.
Modify Rule 15A NCAC 03J .0104(b)(4) TRAWL NETS to correctly reference the Pamlico, Back and Core sounds as the areas in which the Director can open peeler trawling by proclamation.	Rule change to 15A NCAC 03J .0104; Rule change implemented on April 1, 2014.
Modify rule to clearly state the intent of the exceptions, culling tolerance, and separation requirements for the various categories of crabs.	Rule change to 15A NCAC 03L .0201; Rule change implemented on April 1, 2014.
HARVEST PRACTICES	
Continue with non-floating line on crab pots.	No action required.
Establish proclamation authority for requiring terrapin excluder devices in crab pots.	Rule change to 15A NCAC 03L .0204; Rule change implemented on April 1, 2014.
Establish a framework for developing proclamation use criteria and terrapin excluder specifications which may extend until after adoption of the amendment.	Will be addressed in next fishery management plan amendment.
Do not allow multiple pots to a single buoy.	No action required.
Encourage crab potters in areas of high pot loss to incorporate methods to reduce pot loss. Develop and provide information on potential methods to reduce pot loss.	Need to develop and provide information on potential methods to reduce pot loss.
Encourage crab potters in areas of high pot loss to incorporate escape panel designs in pots to reduce potential ghost fishing impacts. Develop and provide information on potential methods and materials to reduce ghost fishing impacts.	Need to develop and provide information on potential methods and materials to reduce ghost fishing impacts.
ENVIRONMENTAL FACTORS	
Identify and designate Strategic Habitat Areas that will enhance protection of the blue crab.	Existing authority through the Coastal Habitat Protection Plan (CHPP).
Identify, research, and designate additional areas as Primary Nursery Areas that may be important to blue crabs as well as other fisheries.	Existing authority through the CHPP.

Management Strategy	Implementation Status
Continue to map blue crab spawning areas and evaluate any that need to adjust or expand the boundaries or restrictions of the crab spawning sanctuaries based on recent research.	Existing authority through the CHPP.
Remap and monitor submerged aquatic vegetation in North Carolina to assess distribution and change over time.	Existing authority through the CHPP.
Restore coastal wetlands to compensate for previous losses and enhance habitat and water quality conditions for the blue crab.	Existing authority through the CHPP.
Work with Coastal Resource Commission to revise shoreline stabilization rules to adequately protect riparian wetlands and shallow water habitat and significantly reduce the rate of shoreline hardening.	Existing authority through the CHPP.
Develop and implement a comprehensive coastal marina and dock management plan and policy to minimize impacts to submerged aquatic vegetation, wetland edge, and other habitat important to blue crab.	Existing authority through the CHPP.
Assess the distribution, concentration, and threat of heavy metals and other toxic contaminants in freshwater and estuarine sediments and identify the areas of greatest concern to focus water quality improvement efforts.	Existing authority through the CHPP.
Support oyster shell recycling and oyster sanctuary programs to provide areas of enhanced or restored shell bottom habitat.	Existing authority through the CHPP.
Consider if prohibition of crab dredging is advisable.	Existing authority through the CHPP.
Protect “recruitment bottlenecks”, like inlets for the blue crab, from trawling or other impacts including natural channel modification using hardened structures like groins and jetties.	Existing authority through the CHPP.
Shallow areas where trawling is currently allowed should be re-examined to determine if additional restrictions are necessary.	Existing authority through the CHPP.
Improve methods to reduce sediment and nutrient pollution from construction sites, agriculture, and forestry.	Existing authority through the CHPP.
Increase on-site infiltration of storm water through voluntary or regulatory measures.	Existing authority through the CHPP.
Provide more incentives for low-impact development.	Existing authority through the CHPP.

Management Strategy	Implementation Status
Aggressively reduce point source pollution from wastewater through improved inspections of wastewater treatment facilities, improved maintenance of collection infrastructure, and establishment of additional incentives to local governments for wastewater treatment plant upgrading.	Existing authority through the CHPP.
Provide proper disposal of unwanted drugs, prevent the use of harmful JHA insecticides near-surface waters or in livestock feed, and develop technologies to treat wastewater for antibiotics and hormones.	Existing authority through the CHPP.

FIGURES

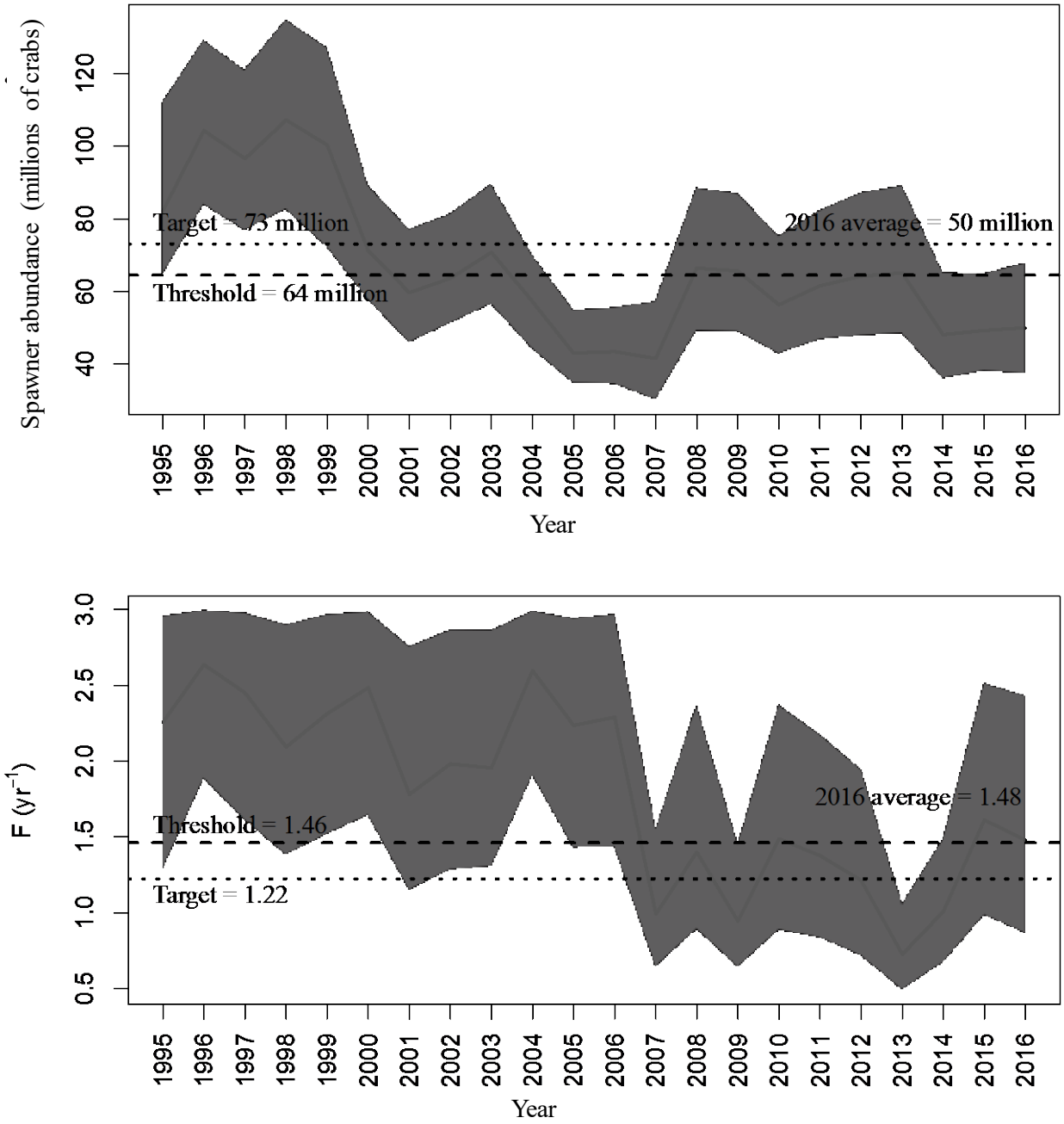

Figure 1. Estimated spawner abundance (mature female blue crabs) and fishing mortality (F) from the 2018 blue crab stock assessment (NCDMF 2018). The solid lines represent the posterior mean and the shaded area represents the 95% credible interval. The threshold and target values are the posterior means (dashed lines).

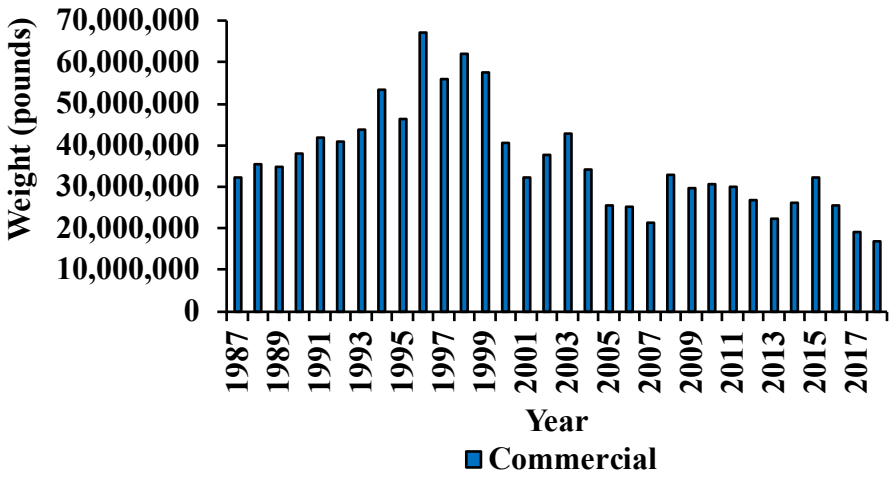

Figure 2. Annual blue crab commercial landings, 1987-2018. Landings include hard, soft, and peeler crabs.

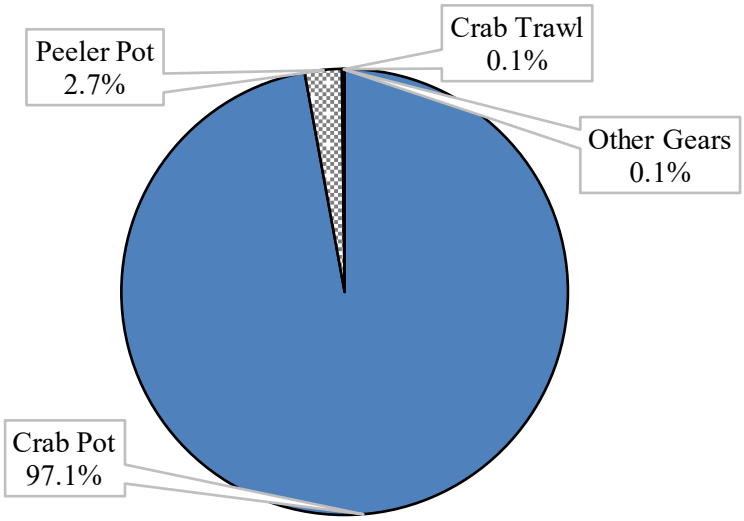

Figure 3. Commercial harvest (pounds) of blue crab by gear, 2018.

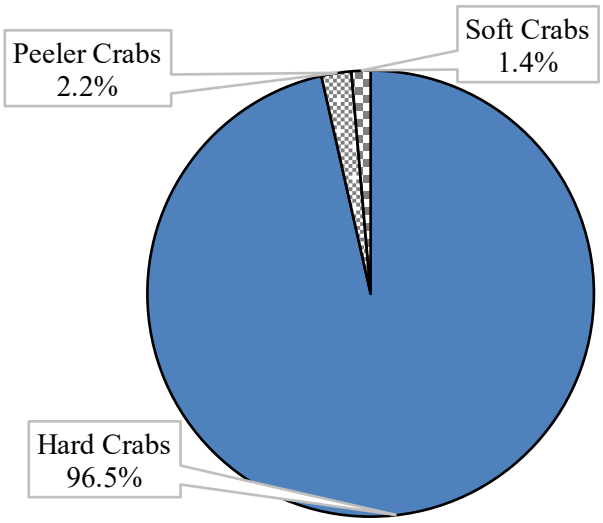

Figure 4. Commercial harvest (pounds) of blue crab by crab type, 2018.

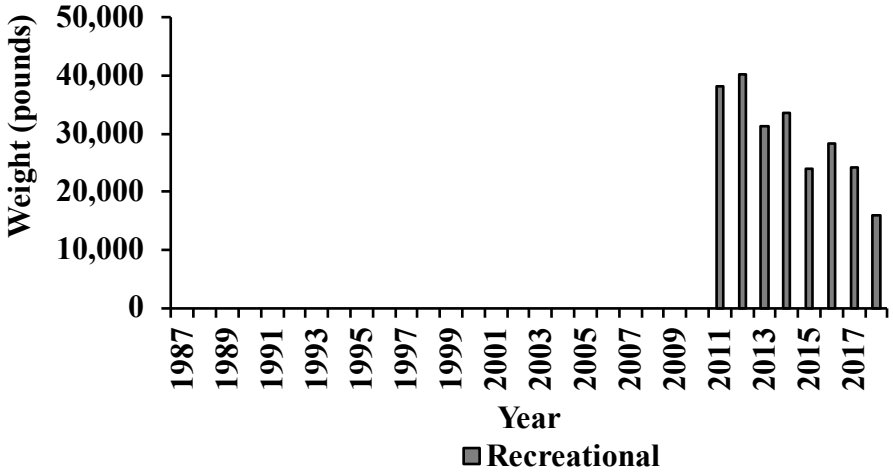

Figure 5. Annual blue crab recreational harvest, 1987-2018. Recreational mail survey began in October 2010 with the first full year of data available for 2011.

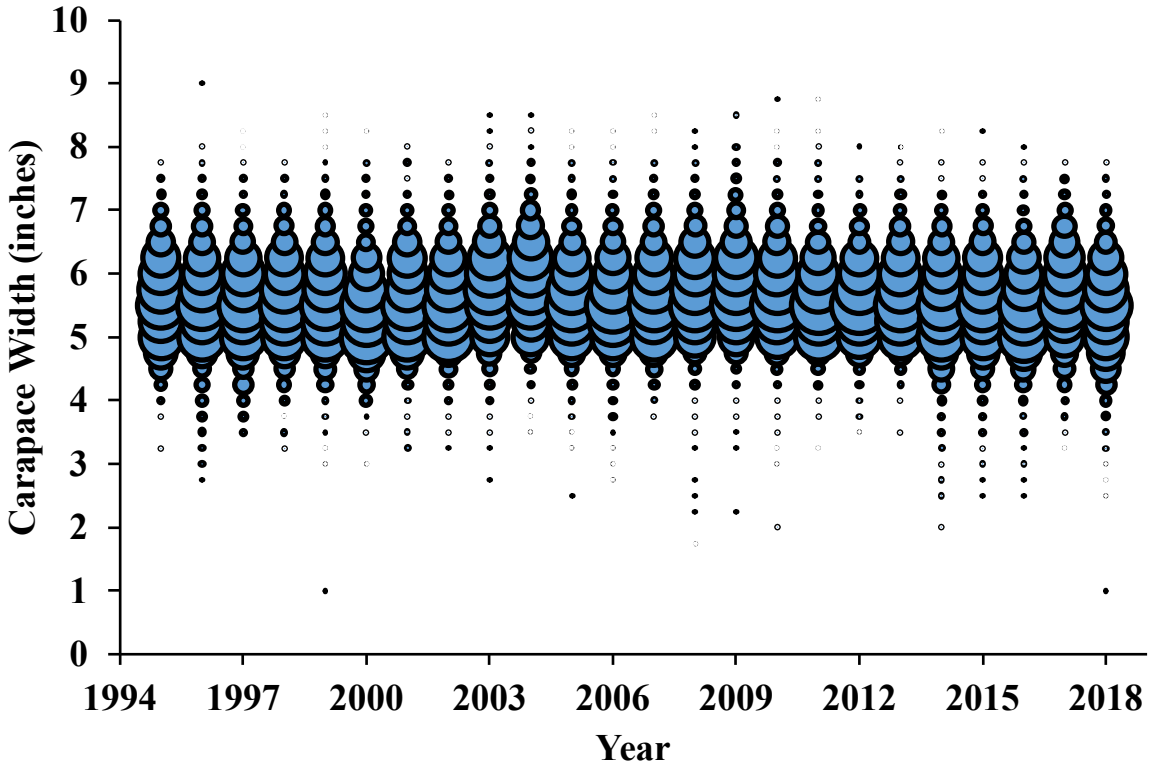

Figure 6. Commercial length frequency (carapace width, inches) of hard blue crab harvested, 1995-2018. Bubble represents the proportion of crabs at length.

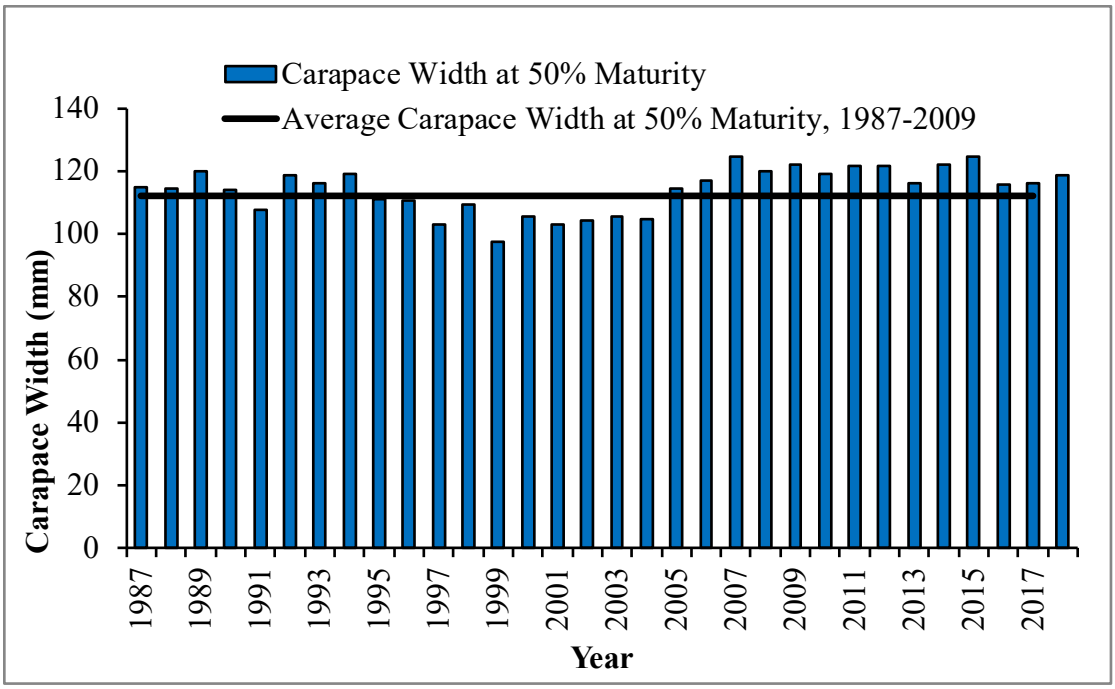

Figure 7. Length at 50% maturity for female blue crabs used in the production characteristic of the Blue Crab Traffic Light, 1987-2018. Fishery-dependent and independent data were included in the analysis.

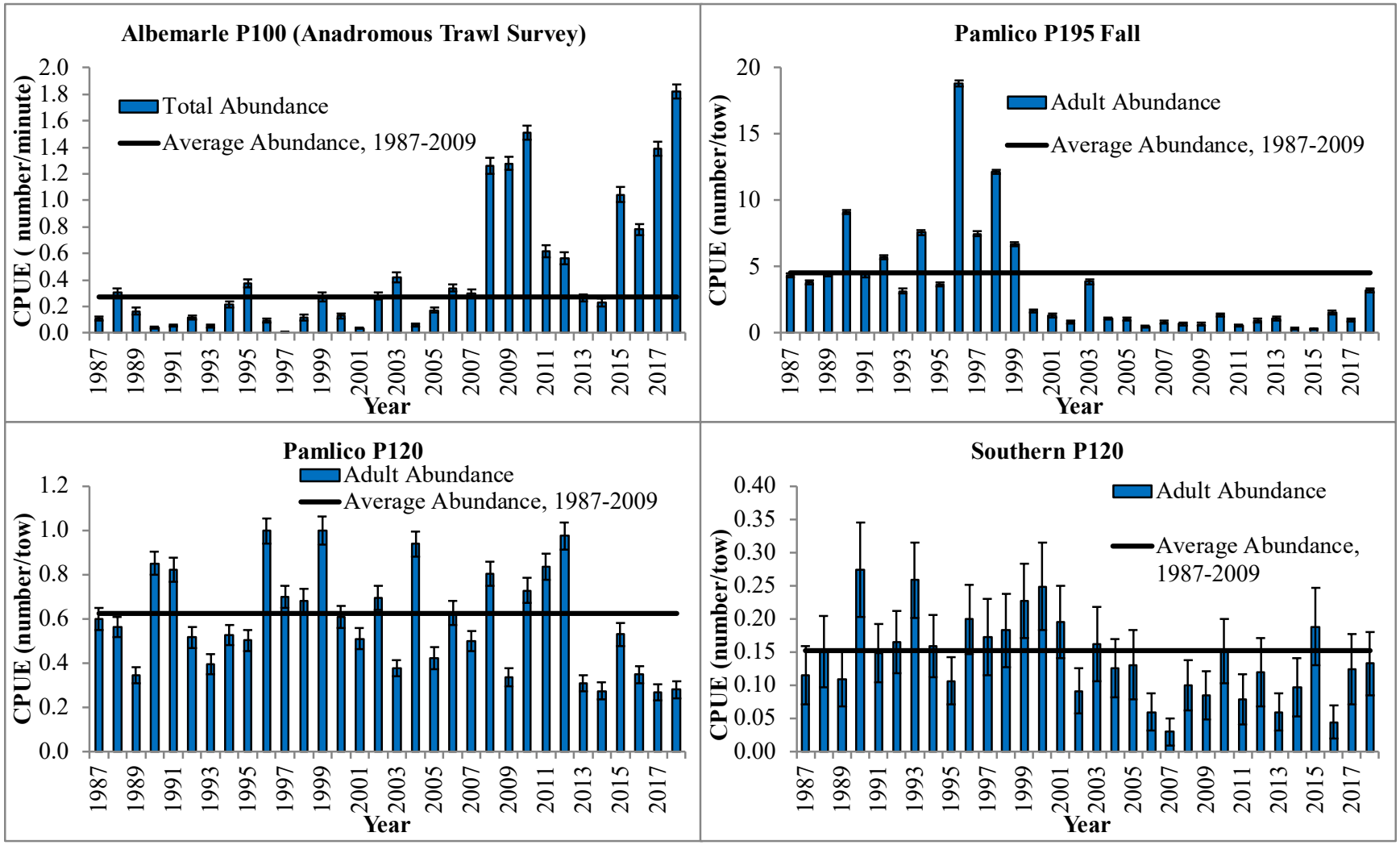

Figure 8. Indices from NCDMF sampling programs 100, 120, and 195 used for the adult abundance characteristic of the Blue Crab Traffic Light, 1987-2018. Error bars represent one standard error of the mean.

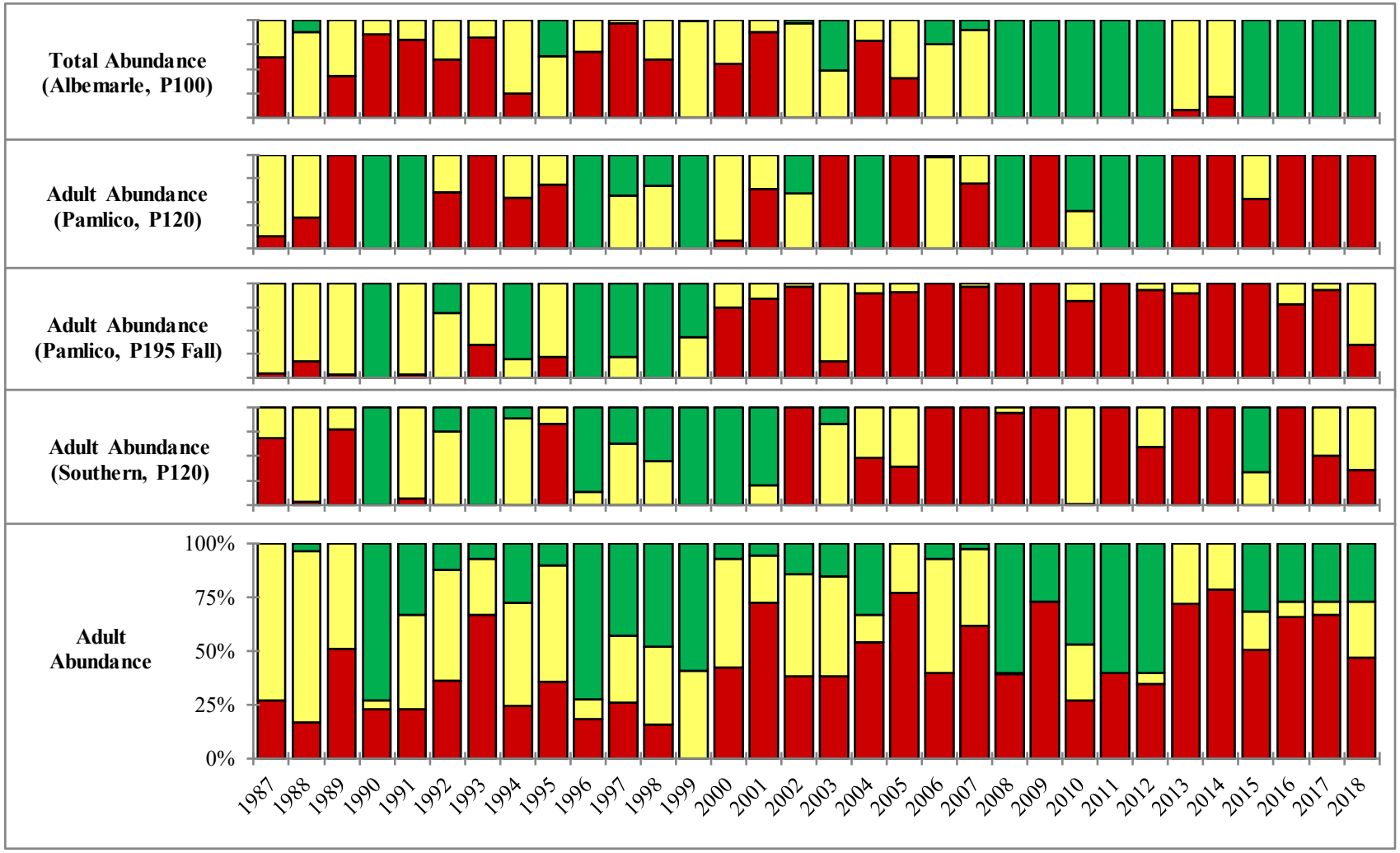

Figure 9. Blue Crab Traffic Light individual adult abundance indicators and the integrated summary (bottom figure), 1987-2018.

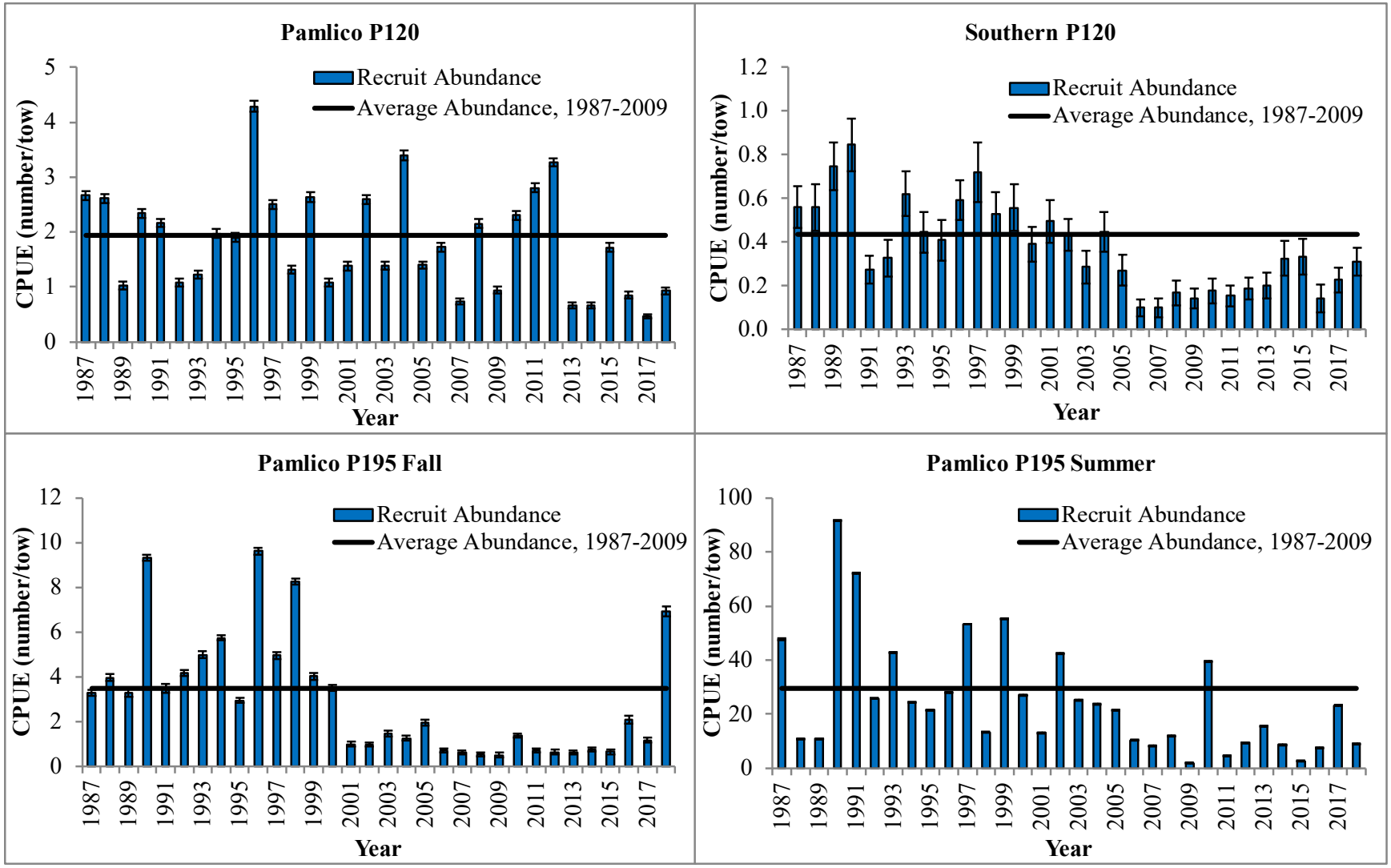

Figure 10. Indices from NCDMF sampling programs 120 and 195 used for the recruit abundance characteristic of the Blue Crab Traffic Light, 1987-2018. Error bars represent one standard error of the mean.

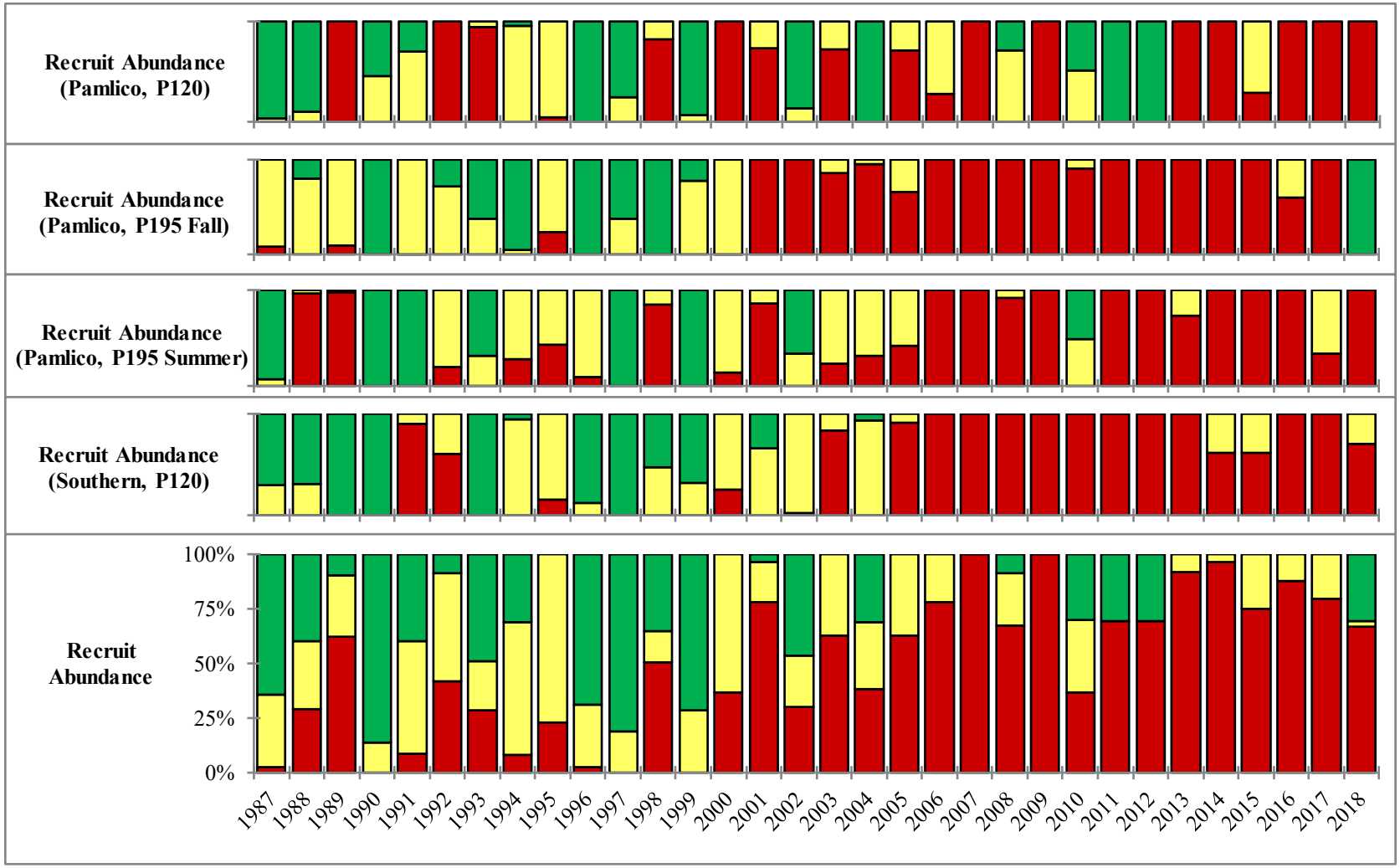

Figure 11. Blue Crab Traffic Light individual recruit abundance indicators and the integrated summary (bottom figure), 1987-2018.

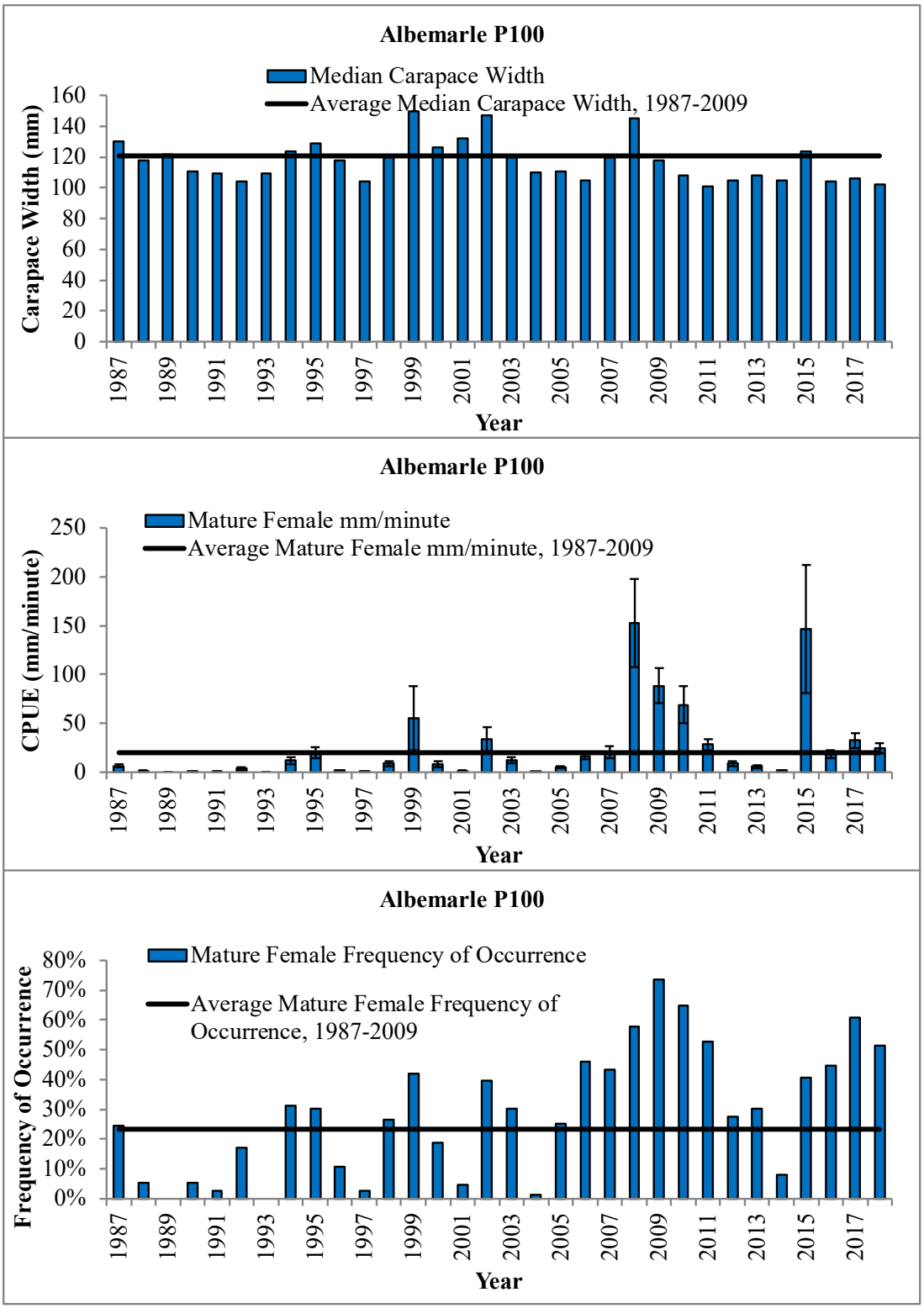

Figure 12. Indices from NCDMF sampling program 100 used for the production characteristic of the Blue Crab Traffic Light, 1987-2018. Error bars represent one standard error of the mean.

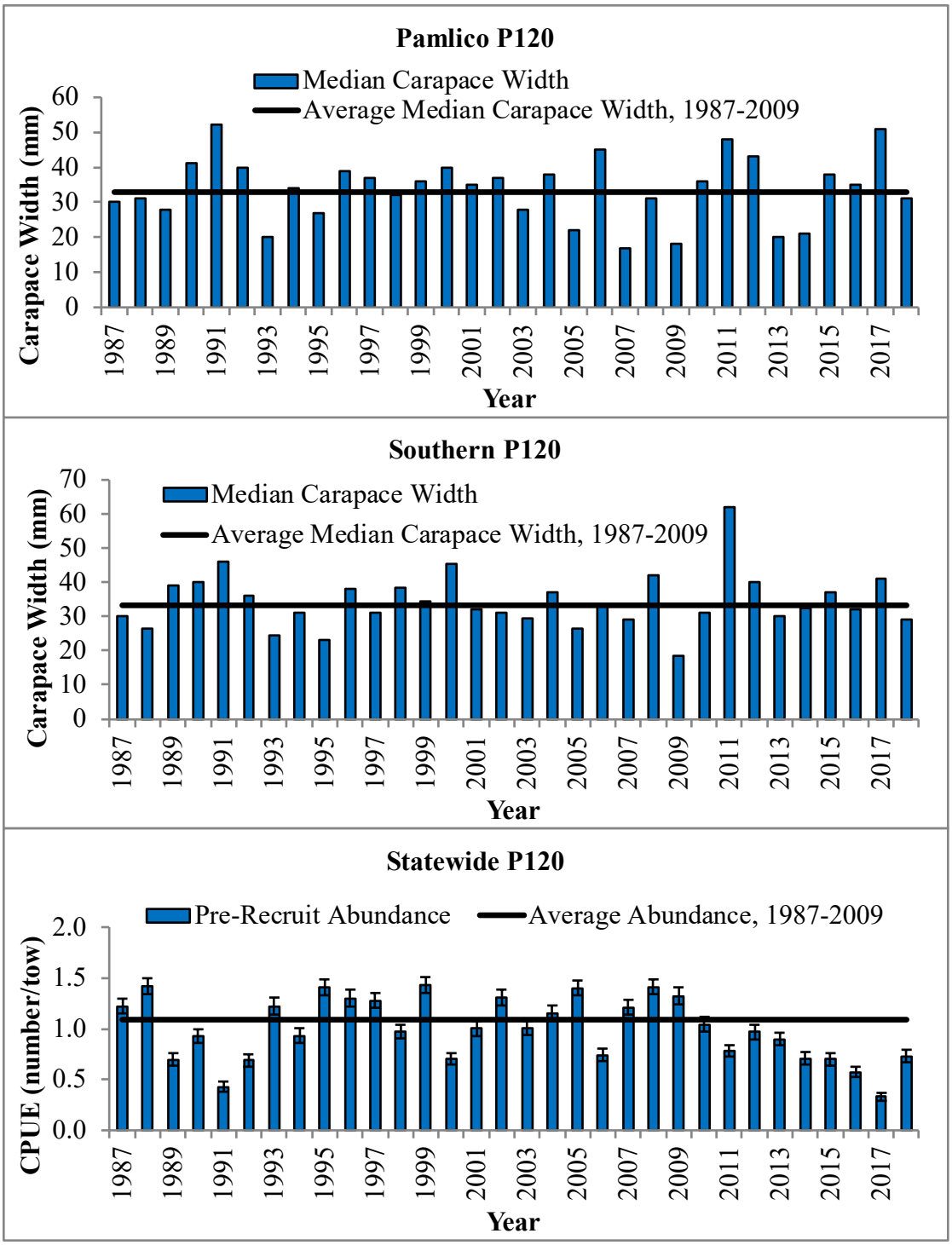

Figure 13. Indices from NCDMF sampling program 120 used for the production characteristic of the Blue Crab Traffic Light, 1987-2018. Error bars represent one standard error of the mean.

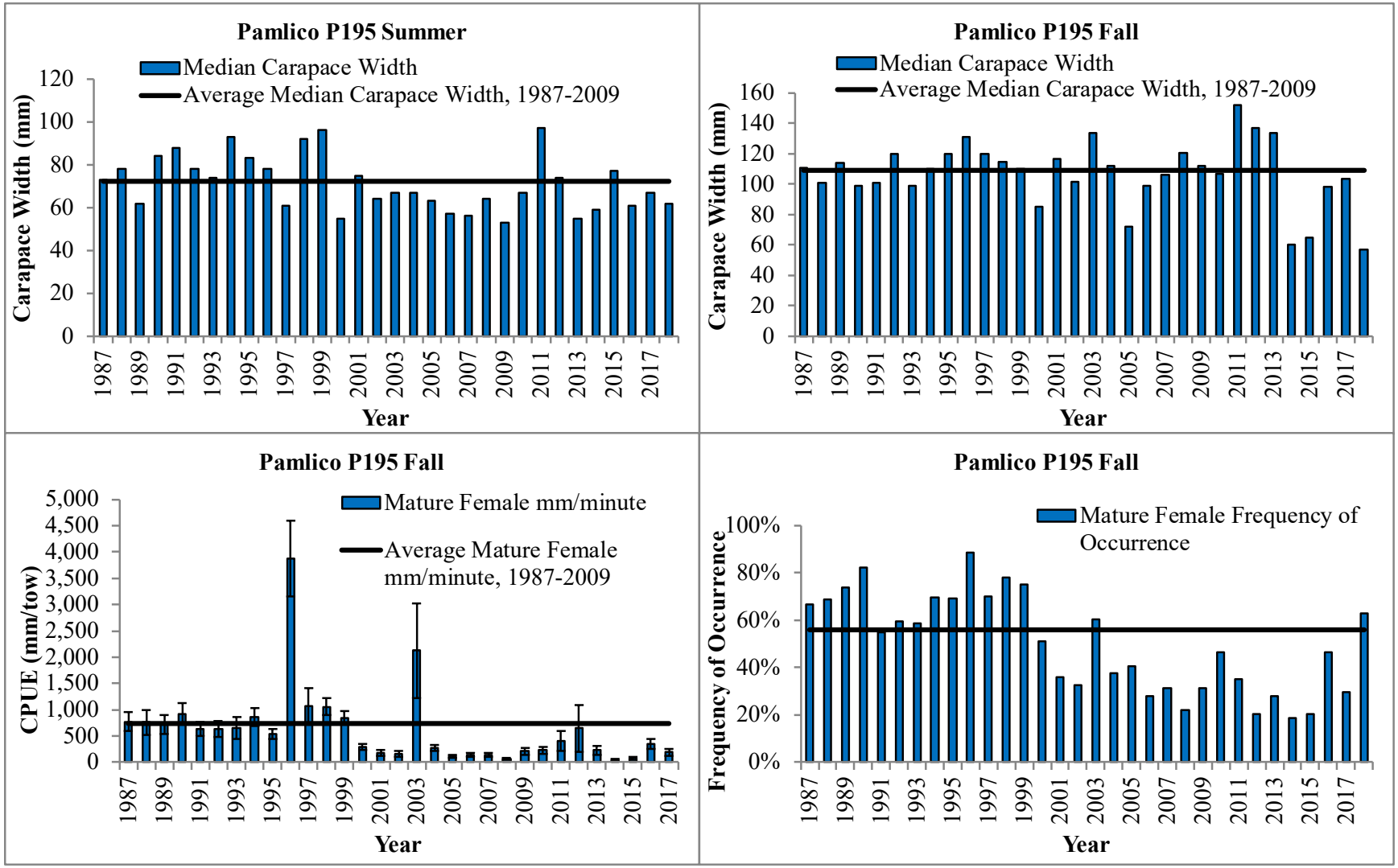

Figure 14. Indices from NCDMF sampling program 195 used for the production characteristic of the Blue Crab Traffic Light, 1987-2018. Error bars represent one standard error of the mean.

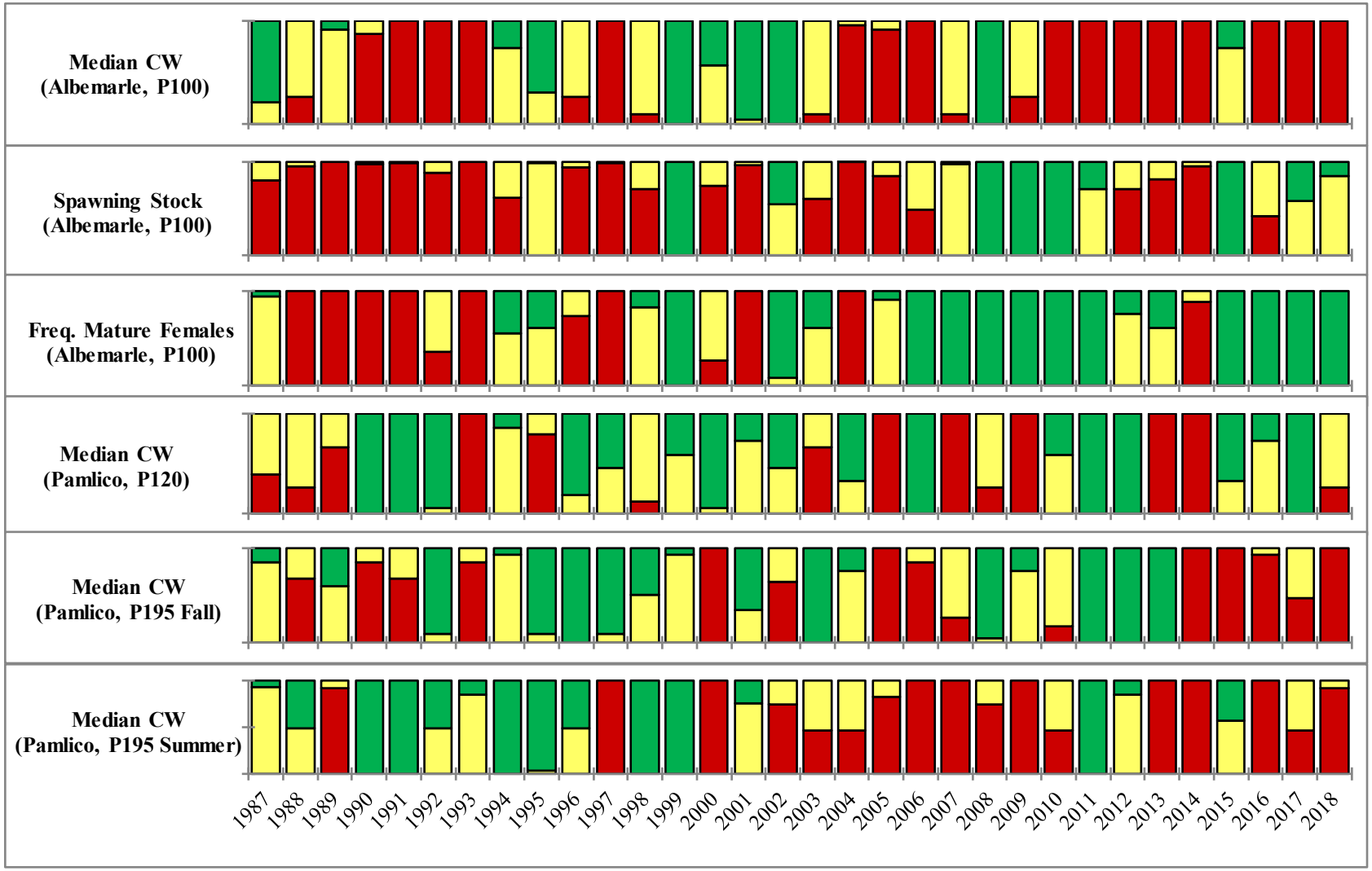

Figure 15. Blue Crab Traffic Light individual production indicators and integrated summary (bottom figure, next page), 1987-2018.

Figure 15 (cont.). Blue Crab Traffic Light individual production indicators and integrated summary (bottom figure), 1987-2018.

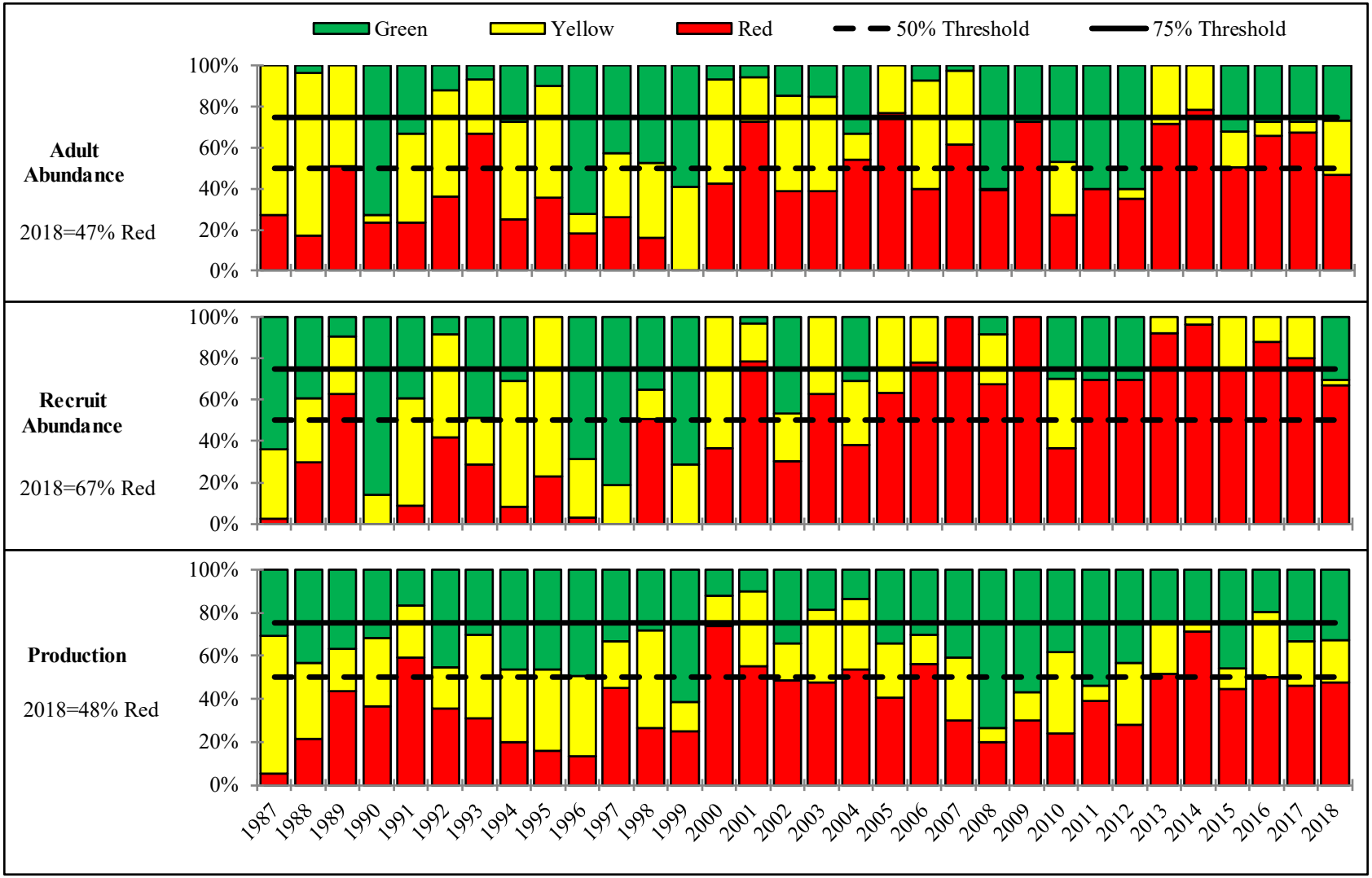

Figure 16. Blue Crab Traffic Light indicators for the adult abundance, recruit abundance, and production characteristics, 1987-2018. The dashed line represents the second quartile (50%) moderate management trigger and the solid line represents the third quartile (75%) elevated management trigger relative to the proportion of red.