

**FISHERY MANAGEMENT PLAN UPDATE  
BLUEFISH  
AUGUST 2022**

**STATUS OF THE FISHERY MANAGEMENT PLAN**

**Fishery Management Plan History**

FMP Documentation:	1990	
	Amendment 1	2000
	Framework 1	2001
	Amendment 2	2007
	Amendment 3	2011
	Addendum I	2012
	Amendment 4	2013
	Amendment 5	2015
	Amendment 6	2017
	Framework 2	2017
	Framework 3	2018
	Framework 4	2020
	Framework 5	2020
	Amendment 7	2021
Comprehensive Review:	2022	

The Fishery Management Plan (FMP) for bluefish was developed through a joint management effort between the interstate Atlantic States Marine Fisheries Commission (ASMFC) and the federal Mid-Atlantic Fishery Management Council (MAFMC). Amendment 1 initiated a 10-year rebuilding schedule to eliminate overfishing and allow for stock rebuilding which was achieved in 2009. Amendment 1 also established commercial and recreational quota allocations, state-specific commercial allocations, and allowed for the transfer of unused recreational quota to the commercial fishery. Framework 1 established annual harvest allocations specifically for biological monitoring programs. Amendments 2 and 5 were implemented to establish a strategy for monitoring bluefish bycatch. Amendment 3 added a formalizing process to incorporate scientific and management uncertainty when establishing catch limits. Addendum I established a coast-wide biological monitoring program to improve the quantity and quality of information available for use in bluefish stock assessments. Amendment 4 modified the accountability measures for the recreational bluefish fishery. Amendment 6 addressed considerations for examining potential influence of the removal of forage fish species by increasing directed fishing and advocated for future ecosystem-based management approaches. Framework 2 required for-hire vessels with federal permits for species managed by MAFMC to submit electronic vessel trip reports to the National Oceanic and Atmospheric Administration. Framework 3 established a process to specify constant multi-year acceptable biological catches. Framework 4 established a requirement for commercial vessels with federal permits for any species managed by the Mid-Atlantic and New England Councils to submit vessel trip reports electronically within 48 hours after entering port at the conclusion of a trip. Framework 5 modified the Council's ABC control rule and risk policy.

The revised risk policy is intended to reduce the probability of overfishing as stock size falls below the target biomass while allowing for increased risk and greater economic benefit under higher stock biomass conditions. This action also removed the typical/atypical species distinction currently included in the risk policy. Amendment 7, the Bluefish Allocation and Rebuilding Amendment, revised the goals and objectives of the fishery management plan, reallocated quota between the commercial and recreational fisheries, reallocated commercial quota among the states, implemented a rebuilding plan, revised the sector quota transfer process, and revised how management uncertainty is applied during the specifications process. Amendment 7 took effect on January 1, 2022. The bluefish FMP, associated amendment documents, and framework information can be found at <https://www.mafmc.org/bluefish>.

To ensure compliance with interstate requirements, North Carolina (N.C.) also manages bluefish under the North Carolina Fishery Management Plan for Interjurisdictional Fisheries (IJ FMP). The goal of the IJ FMP is to adopt fishery management plans consistent with N.C. law and approved by the MAFMC, South Atlantic Fishery Management Council, or the ASMFC by reference and implement corresponding fishery regulations in North Carolina to provide compliance or compatibility with approved fishery management plans and amendments, now and in the future. The goal of these plans, established under the Magnuson-Stevens Fishery Conservation and Management Act (federal council plans) and the Atlantic Coastal Fisheries Cooperative Management Act (ASMFC plans), are like the goals of the Fisheries Reform Act of 1997 to “ensure long-term viability” of these fisheries (NCDMF 2022).

The MAFMC and ASMFC are also in the process of developing an initiative to consider improvements to management of the recreational fisheries for summer flounder, scup, black sea bass, and bluefish. The Recreational Reform Initiative was initiated in 2019 and is addressing a range of recreational management issues through a joint framework/addendum and a joint amendment.

## **Management Unit**

The FMP defines the management unit of bluefish as a single stock occurring in U.S. waters of the western Atlantic Ocean. All member Atlantic states participate in the ASMFC bluefish FMP process with the exception of Pennsylvania and the District of Columbia.

## **Goal and Objectives**

Amendment 7 revised the goals and objectives of the bluefish FMP to the following:

- Goal 1: Conserve the bluefish resource through stakeholder engagement to maintain sustainable recreational fishing and commercial harvest.
  - Objective 1.1: Achieve and maintain a sustainable spawning stock biomass and rate of fishing mortality.
  - Objective 1.2: Promote practices that reduce release mortality within the recreational and commercial fishery.

- Objective 1.3: Maintain effective coordination between the National Marine Fisheries Service, Council, Commission, and member states by promoting compliance and to support the development and implementation of management measures.
- Objective 1.4: Promote compliance and effective enforcement of regulations.
- Objective 1.5: Promote science, monitoring, and data collection that support and enhance effective ecosystem-based management of the bluefish resource.
- Goal 2: Provide fair and equitable access to the fishery across all user groups throughout the management unit.
  - Objective 2.1: Ensure the implementation of management measures provides fair and equitable access to the resource across all user groups within the management unit.
  - Objective 2.2: Consider the economic and social needs and priorities of all groups that access the bluefish resource in the development of new management measures.
  - Objective 2.3: Maintain effective coordination with stakeholder groups to ensure optimization of economic and social benefits.

## DESCRIPTION OF THE STOCK

### Biological Profile

Bluefish (*Pomatomus saltatrix*) are migratory open water (pelagic) species found throughout the Atlantic Ocean. Bluefish migrate seasonally, moving north as water temperatures rise during spring and summer and south during the fall and winter to areas along the South Atlantic Bight (Shepherd et al. 2006). During the summer, bluefish mostly concentrate in waters from Maine to Cape Hatteras (Klein-MacPhee 2002). During the winter, they are found in offshore waters between North Carolina and Florida (Goodbred and Graves 1996). Within North Carolina's estuarine waters, bluefish are most common from March through October. Bluefish generally school with similarly sized fish (Austin et al. 1999). Bluefish are fast growers (Wilk 1977) and opportunistic predators who feed indiscriminately. Over 70 different marine species have been documented in bluefish stomach contents including Atlantic menhaden, butterfish, silversides, spotted seatrout, Atlantic croaker, spot, shrimp, lobster, squid, crabs, worms, and clams (Buckel et al. 1999; Scharf et al. 2004). The maximum documented age for bluefish is 14 years (Robillard et al. 2009). Bluefish can exceed 39 inches and 31 pounds (NCDMF 2021). Bluefish usually reach sexual maturity by age 2 around a length of 13 inches (Robillard et al. 2008). They spawn offshore from Massachusetts through Florida. Some research suggests that two discrete cohorts of bluefish spawn at different times during the year with one group spawning during the spring and a second spawning during the summer (Lassiter 1962). More recent research suggests that bluefish continue to spawn as they migrate northward during the spring and summer (Robillard et al. 2008).

### Stock Status

The 2019 operational stock assessment, which included data through 2018, determined that bluefish are overfished but are not experiencing overfishing (NMFS 2019).

## **Stock Assessment**

Estimates from the 2019 operational stock assessment show that spawning stock biomass (SSB) has been decreasing since 2008 and has been below the SSB threshold since 2014 (Figure 1). SSB in 2018 was estimated to be 91,041 MT, which is 46% of the target reference point (NMFS 2019). Based on the 2019 operational assessment, bluefish are overfished, but are not experiencing overfishing.

## **DESCRIPTION OF THE FISHERY**

### **Current Regulations**

In North Carolina, the private recreational (all persons not fishing on a for-hire vessel) bag limit is three bluefish per person per day and the recreational for-hire (all persons fishing on a for-hire vessel) is five bluefish per person per day. These regulations have been in effect since 2020. Commercial fishery landings are monitored and if necessary, trip limits are implemented to prevent exceeding the annual quota. The commercial fishery was opened on January 1, 2021, with no possession limit. In 2021, proclamation authority was used four times to reduce the daily trip limit from no trip limit at the beginning of the year to 50 pounds by the end of November 2021.

### **Commercial Fishery**

Bluefish commercial landings have fluctuated annually since 1972 (Table 1; Figure 2); however, landings in recent years have been lower than average. The commercial quota allocated to North Carolina for 2021 was 887,377 pounds. North Carolina received a total of 195,000 pounds of quota transfer from New Jersey, Maryland, Delaware, and Virginia, which resulted in an adjusted 2021 commercial quota of 1,082,377 pounds. North Carolina's 2021 commercial bluefish landings totaled 1,051,026 pounds at a dockside value of \$663,053. Estuarine and ocean gill nets combined represent the largest commercial landings of bluefish accounting for 96.4% of the harvest in 2021 (Figure 4).

### **Recreational Fishery**

Recreational landings for bluefish have been annually variable but relatively stable for the last few decades (Table 1; Figure 2). Marine Recreational Information Program (MRIP) data collected by the NOAA Fisheries indicates that just under 1 million pounds of bluefish were recreationally harvested in 2021. Recreational estimates across all years have been updated and are now based on the Marine Recreational Information Program (MRIP) new Fishing Effort Survey-based calibrated estimates. See <https://www.fisheries.noaa.gov/topic/recreational-fishing-data> for more information.

The NCDMF offers award citations for exceptional catches of bluefish. Bluefish exceeding 15 pounds are eligible for an award citation. The number of citations awarded was highest in 1991 (n=187), with less citations awarded in the last 20 years, compared to the 1990's (Figure 3). Since 2017, the NCDMF has offered an additional citation for released bluefish that exceed 34 inches in length. Approximately 66% of the citations awarded since 2017 have been for released fish.

## **MONITORING PROGRAM DATA**

### **Fishery-Dependent Monitoring**

Bluefish are sampled from a variety of North Carolina commercial fishery gears including estuarine long haul, ocean trawl, pound net, ocean gill net, estuarine gill net, and ocean beach seine fisheries. Information on location, gear type, specifications, soak time, and water depth are recorded. Subsampling of commercial catch to collect biological information on bluefish includes fork length (FL) and aggregate weight (kg) by market grade. Trip ticket information (total weight of catch) is also recorded and reported to NCDMF by licensed dealers. The size of fish harvested recreationally is characterized through the MRIP survey.

A total of 4,203 bluefish were measured from commercial landings in 2021 (Table 2). Mean fork length was 16 inches and ranged from 8 to 34 inches. Size ranges have varied minimally since 1991. The mean length of fish harvested and measured by MRIP in the recreational fishery in 2021 was 12 inches and ranged from 6 to 26 inches fork length (Table 3). Overall, the size distribution of fish taken in the recreational fishery tends to be smaller than the distribution of fish harvested in the commercial fishery (Figure 5). Since 1991, the annual length distribution of harvest in both the commercial and recreational fisheries has varied little with most fish harvested ranging from 7 to 16 inches fork length (Figures 6 and 7). Larger bluefish (>20 inches) have been less common in recent years.

### **Fishery-Independent Monitoring**

The Division's Pamlico Sound Independent Gill Net Survey was initiated in May of 2001 and has been sampled continuously through 2019. Sampling in this program was suspended in February 2020 due to COVID-19 restrictions and protected species interactions but resumed July 2021. This survey catches more bluefish than any other independent survey. This survey provides fishery-independent indices of relative abundance along with associated length and age data. These estimates provide essential data for input into the coastwide bluefish stock assessment. The relative abundance index, defined as the number of bluefish per set, has ranged from 2.8 in 2015 to 8.6 in 2019 during the 21-year time-series (Figure 8). The relative abundance index in 2021 was 4.95, which is slightly below the time-series average (5.4). It should be noted that the index in 2021 is calculated from samples collected from Jul.-Dec while the index for all other years was calculated for Feb.-Dec.

North Carolina is a state subject to compliance of the biological monitoring program implemented under Addendum I to Amendment 1. To comply with these monitoring requirements, NCDMF must collect at least 100 aging structures from bluefish each year. When possible, at least 50 fish should be collected from January-June and 50 fish from July-December. Most years, the majority of bluefish age samples are obtained from the Pamlico Sound Independent Gill Net Survey as well as the commercial and recreational fisheries. In 2021, 793 age samples were collected (Table 4). The maximum age over the time-series is 12 years of age. Bluefish length increases with age, although the size at a given age can be quite variable (Figure 9).

## **RESEARCH NEEDS**

- Continue research on species interactions and predator-prey relationships. Investigate the feasibility of alternative survey methods that target bluefish across all age classes to create a more representative fishery-independent index of abundance.
- Initiate sampling of offshore populations in winter months.
- Initiate coastal surf zone seine study to provide more complete indices of juvenile abundance.
- Develop additional adult bluefish indices of abundance (e.g., broad spatial scale longline survey or gillnet survey).
- Expand age structure of Southeast Area Monitoring and Assessment Program index.
- Investigate species associations with recreational angler trips targeting bluefish (on a regional and seasonal basis) to potentially modify the MRIP index used in the assessment model.
- Explore age- and time-varying natural mortality from, for example, predator prey relationships; quantify effects of age- and time-varying natural mortality in the assessment model.
- Continue to evaluate the spatial, temporal, and sector-specific trends in bluefish growth and quantify their effects in the assessment model.
- Continue to examine alternative models that take advantage of length-based assessment frameworks.
- Evaluate the source of bimodal length frequency in the catch (e.g., migration, differential growth rates).
- Modify thermal niche model to incorporate water temperature data more appropriate for bluefish in a timelier manner [e.g., sea surface temperature data & temperature data that cover the full range of bluefish habitat (South Atlantic Bight and estuaries)].
- Quantify recreational discard mortality of bluefish has discards are a large component of the recreational fishery.
- Investigate potential spatial distribution shifts of the Atlantic stock.

## MANAGEMENT STRATEGY

Bluefish in North Carolina are jointly managed by ASMFC and MAFMC under Amendment II of the FMP. Amendment II uses annual catch limits (ACLs) for both the recreational and commercial sectors. The recreational quota is a coast-wide quota while the commercial quota is further divided into state-specific quotas. Amendment II allows quota transfers between states and between sectors. Additionally, daily limits are used to manage recreational harvest and trip limits can be implemented for commercial fishermen if needed in order to prevent exceeding North Carolina's commercial quota.

## LITERATURE CITED

Austin, H.M., D. Scoles, and A.J. Abell. 1999. Morphometric separation of annual cohorts within mid-Atlantic bluefish, *Pomatomus saltatrix*, using discriminant function analysis. *Fishery Bulletin*. 97(3):411-420

- Buckel, J.A., M.J. Fogarty, and D.O. Conover. 1999. Foraging habits of bluefish, *Pomatomus saltatrix*, on the U.S. east coast continental shelf. *Fishery Bulletin*. 97:758-775
- Goodbred, C.O., and J.E. Graves. 1996. Genetic relationships among geographically isolated populations of bluefish (*Pomatomus saltatrix*). *Marine and Freshwater Research* 47:347-355
- Klein-MacPhee, G. 2002. Bluefish: family Pomatomidae. In Bigelow and Schroeder's fishes of the Gulf of Maine (B.B. Collette, and G. Klein-MacPhee, eds.), p. 400-406. Smithsonian Institution Press, Washington, D.C.
- Lassiter, R.R. 1962. Life history aspects of the bluefish, *Pomatomus saltatrix*, larvae and juveniles off the east coast of the United States. *Fishery Bulletin*. 77:213-227
- NCDMF (North Carolina Division of Marine Fisheries). 2021. North Carolina State Saltwater Records. <http://portal.ncdenr.org/web/mf/north-carolina-state-saltwater-records>
- NCDMF. 2022. North Carolina Fishery Management Plan for Interjurisdictional Fisheries, 2022 Information Update. North Carolina Division of Marine Fisheries, Morehead City, North Carolina. 19 pp.
- NMFS (National Marine Fisheries Service), Northeast Fisheries Science Center. 2015. 60th Northeast Regional Stock Assessment Workshop (60th SAW) Assessment Report. US Department of Commerce, Northeast Fisheries Science Center Reference Document 15-08. 335-708 pp.
- NMFS, Northeast Fisheries Science Center. 2019. Operational Assessment of the Black Sea Bass, Scup, Bluefish, and Monkfish Stocks, Updated Through 2018. US Department of Commerce, Northeast Fisheries Science Center. Highlands New Jersey.
- Robillard, E., C.S. Reiss, and C.M. Jones. 2008. Reproductive biology of bluefish (*Pomatomus saltatrix*) along the east coast of the United States. *Fisheries Research*. 90:198-208
- Robillard, E., C.S. Reiss, and C.M. Jones. 2009. Age-validation and growth of bluefish (*Pomatomus saltatrix*) along the east coast of the United States. *Fisheries Research*. 95(1): 65-75
- Scharf, F.S., J.P. Manderson, M.C. Fabrizio, J.P. Pessutti, J.E. Rosendale, R.J. Chant, and A.J. Bejda. 2004. Seasonal and interannual patterns of distribution and diet of bluefish within a Middle Atlantic Bight estuary in relation to abiotic and biotic factors. *Estuaries*, 27(3): 428-436
- Shepherd, G.R., J. Moser, D. Deuel, and P. Carlson. 2006. The migration patterns of bluefish (*Pomatomus saltatrix*) along the Atlantic coast determined from tag recoveries. *Fishery Bulletin*. 104:559-570
- Wilk, S.J. 1977. Biological and fisheries data on bluefish, *Pomatomus saltatrix* (Linnaeus). NOAA, NMFS, NEFC, Sandy Hook Lab. Technical Series Report. No. 11.

## TABLES

Table 1. Bluefish recreational harvest and number released (Marine Recreational Information Program) and commercial harvest (North Carolina Trip Ticket Program) in North Carolina, 1985–2021.

Year	Recreational			Commercial	
	Number Landed	Number Released	Weight Landed (lb)	Weight Landed (lb)	Total Weight (lb)
1985	3,706,930	1,281,466	7,001,181	3,604,445	10,605,626
1986	5,184,834	1,233,792	16,245,390	3,450,230	19,695,620
1987	3,248,002	1,402,327	8,542,577	4,561,101	13,103,678
1988	3,131,369	1,002,321	4,475,001	5,039,039	9,514,040
1989	4,843,723	2,314,161	7,123,822	3,291,468	10,415,290
1990	6,838,820	2,427,701	10,345,929	4,578,172	14,924,101
1991	2,423,772	1,478,829	4,627,434	3,919,786	8,547,220
1992	1,562,752	1,957,741	2,226,311	2,839,057	5,065,368
1993	1,620,184	1,825,095	1,991,395	2,705,278	4,696,673
1994	673,341	3,235,793	847,458	1,782,345	2,629,803
1995	660,979	2,345,163	770,490	3,010,742	3,781,232
1996	632,382	1,613,566	1,352,444	3,298,640	4,651,084
1997	1,476,271	2,286,439	2,366,435	4,003,160	6,369,595
1998	1,530,106	1,530,488	1,888,463	2,925,929	4,814,392
1999	1,774,946	2,749,327	1,232,827	2,761,084	3,993,911
2000	2,325,583	5,231,507	1,721,367	3,368,610	5,089,977
2001	3,410,135	6,756,435	3,048,743	4,066,000	7,114,743
2002	2,484,516	4,357,535	2,327,789	2,323,964	4,651,753
2003	2,161,780	3,432,547	1,843,018	3,470,100	5,313,118
2004	2,825,382	3,781,031	2,773,518	3,762,944	6,536,462
2005	3,004,921	4,417,822	2,938,814	2,837,661	5,776,475
2006	2,842,593	5,213,436	2,651,326	2,791,187	5,442,513
2007	3,749,514	6,740,155	3,616,359	2,329,718	5,946,077
2008	2,855,199	5,146,870	2,385,349	1,930,391	4,315,740
2009	3,190,313	6,447,822	3,566,768	2,360,081	5,926,849
2010	3,691,868	7,419,644	3,185,652	3,216,030	6,401,682
2011	3,613,883	7,150,476	3,158,287	1,897,471	5,055,758
2012	2,684,392	3,268,032	2,872,922	758,858	3,631,780
2013	4,287,526	7,050,725	3,517,233	1,159,580	4,676,813
2014	4,418,858	5,862,762	3,764,005	2,019,279	5,783,284
2015	4,123,461	6,356,252	3,754,577	804,094	4,558,671
2016	4,489,223	6,802,960	3,356,049	1,148,643	4,504,692
2017	3,173,218	8,255,510	3,634,502	1,544,053	5,178,555
2018	3,304,587	7,912,210	2,630,685	910,262	3,540,947
2019	2,752,589	7,162,431	3,011,480	1,108,205	4,119,685
2020	2,108,296	6,557,751	2,124,224	1,113,009	3,237,233
2021	982,389	3,539,333	1,031,760	1,051,026	2,082,786
Mean	3,276,389	3,990,634	4,374,953	2,901,215	7,276,169



Table 2. Summary of fork length (inches) data sampled from all sources of length data (harvest and bait) from the bluefish commercial fishery in North Carolina, 1985–2021.

Year	Mean Fork Length (in)	Minimum Fork Length (in)	Maximum Fork Length (in)	Total Number Measured
1985	15	4	33	5,351
1986	14	4	33	4,220
1987	16	4	33	3,902
1988	16	3	32	4,243
1989	16	4	33	5,701
1990	16	4	33	8,090
1991	14	4	35	6,068
1992	13	4	32	6,771
1993	16	3	35	3,796
1994	15	5	33	2,096
1995	15	3	32	2,095
1996	16	5	33	2,428
1997	14	4	35	4,355
1998	16	5	33	4,693
1999	18	5	34	7,063
2000	18	6	35	8,369
2001	18	4	35	11,748
2002	18	5	35	8,288
2003	19	6	34	7,861
2004	19	6	33	9,608
2005	19	5	33	9,766
2006	18	5	33	10,255
2007	15	6	33	8,856
2008	16	5	33	8,035
2009	18	6	34	7,471
2010	17	6	35	6,721
2011	16	6	33	5,768
2012	14	5	34	7,030
2013	14	6	33	6,928
2014	15	8	34	6,459
2015	14	7	31	6,100
2016	14	3	33	7,616
2017	16	7	35	5,580
2018	15	7	34	3,778
2019	15	8	33	4,812
2020	16	7	35	3,396
2021	16	8	34	4,203

Table 3. Summary of fork length (inches) data sampled from the bluefish recreational fishery in North Carolina, 1985–2021.

Year	Mean Fork Length (in)	Minimum Fork Length (in)	Maximum Fork Length (in)	Total Number Measured
1985	14	6	34	312
1986	18	6	38	420
1987	16	5	40	1,319
1988	7	0	38	1,117
1989	12	5	40	1,633
1990	13	5	34	2,413
1991	14	5	36	1,572
1992	13	7	33	1,044
1993	13	7	36	1,187
1994	14	7	36	1,174
1995	14	4	36	740
1996	15	6	38	1,177
1997	14	6	37	2,404
1998	13	6	40	1,624
1999	12	6	34	1,316
2000	12	6	34	1,356
2001	13	7	31	2,191
2002	13	7	34	999
2003	13	7	34	781
2004	13	6	40	1,149
2005	12	6	35	1,056
2006	12	6	36	1,028
2007	12	6	37	1,048
2008	12	5	35	894
2009	13	7	34	778
2010	12	6	38	1,323
2011	12	6	34	1,784
2012	12	7	35	1,190
2013	11	7	29	563
2014	12	7	29	660
2015	12	7	18	577
2016	11	8	23	732
2017	12	6	35	657
2018	11	6	30	846
2019	13	8	32	910
2020	12	8	32	713
2021	12	6	26	299

Table 4. Summary of bluefish age samples collected in North Carolina from both dependent (commercial and recreational fisheries) and independent (surveys) sources, 1985–2021.

Year	Modal Age	Minimum Age	Maximum Age	Number of Samples
1985	1	0	11	548
1986	1	0	9	437
1987	1	0	9	380
1988	1	0	9	346
1989	1	0	9	320
1990	1	0	9	372
1991	1	0	8	289
1992	1	0	9	704
1993	1	0	10	722
1994	1	0	10	517
1995	1	0	9	634
1996	1	0	10	230
1997	1	0	10	446
1998	1	0	9	658
1999	1	0	10	442
2000	1	0	10	290
2006	3	0	10	89
2007	2	0	11	433
2008	1	0	10	656
2009	3	0	10	488
2010	3	0	8	527
2011	3	0	9	551
2012	1	0	9	818
2013	0	0	9	742
2014	1	0	9	803
2015	1	0	10	622
2016	1	0	11	678
2017	2	0	10	630
2018	1	0	10	669
2019	1	0	8	853
2020	2	0	12	244
2021	1	0	5	793

## FIGURES

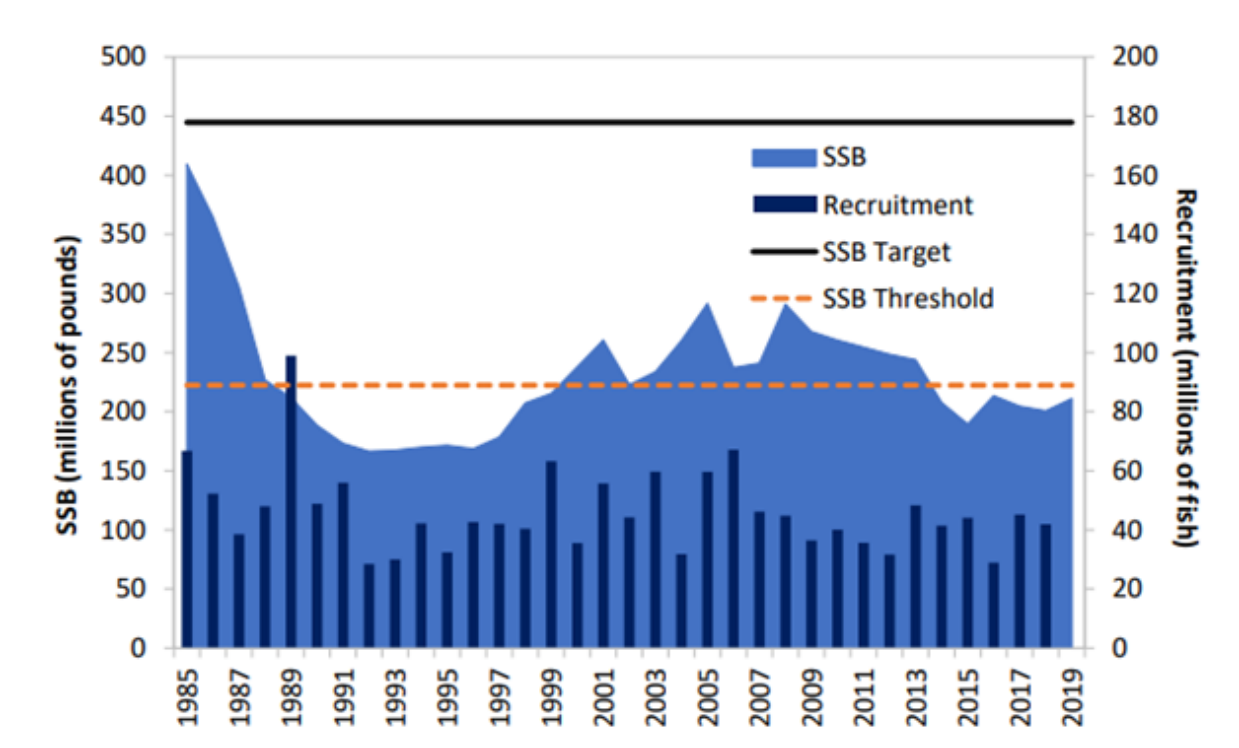


Figure 1. Bluefish spawning stock biomass and recruitment at age 0 by calendar year. The Yellow horizontal dashed line is the updated biomass target  $SSB_{MSY} \text{ Proxy} = SSB_{40\%} = 198,717 \text{ mt}$ , and the dotted black line is the  $SSB_{\text{threshold}} = 99,359 \text{ mt}$ . Source: 2019 Bluefish Operational Stock Assessment, NEFSC (NMFS 2019).

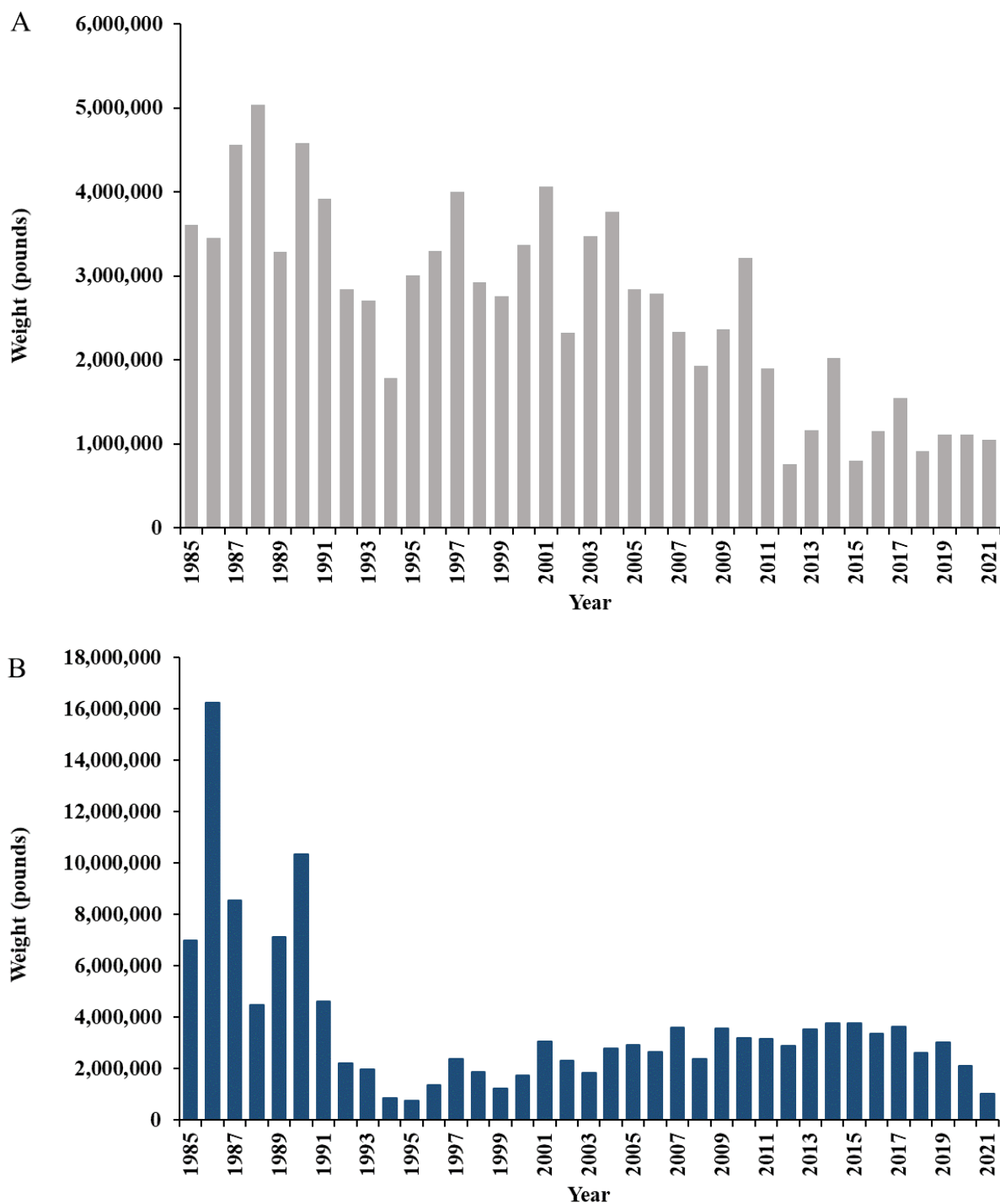


Figure 2. North Carolina commercial (A) and recreational (B) landings of bluefish, 1985–2021.

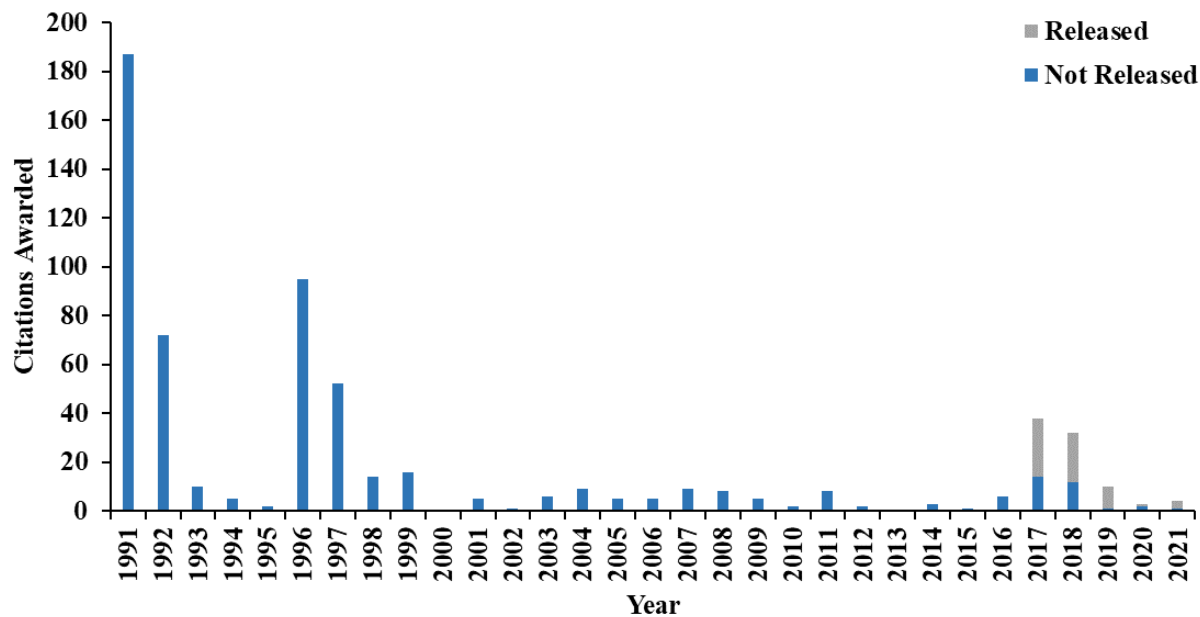


Figure 3. North Carolina recreational award citations for bluefish, 1991–2021.

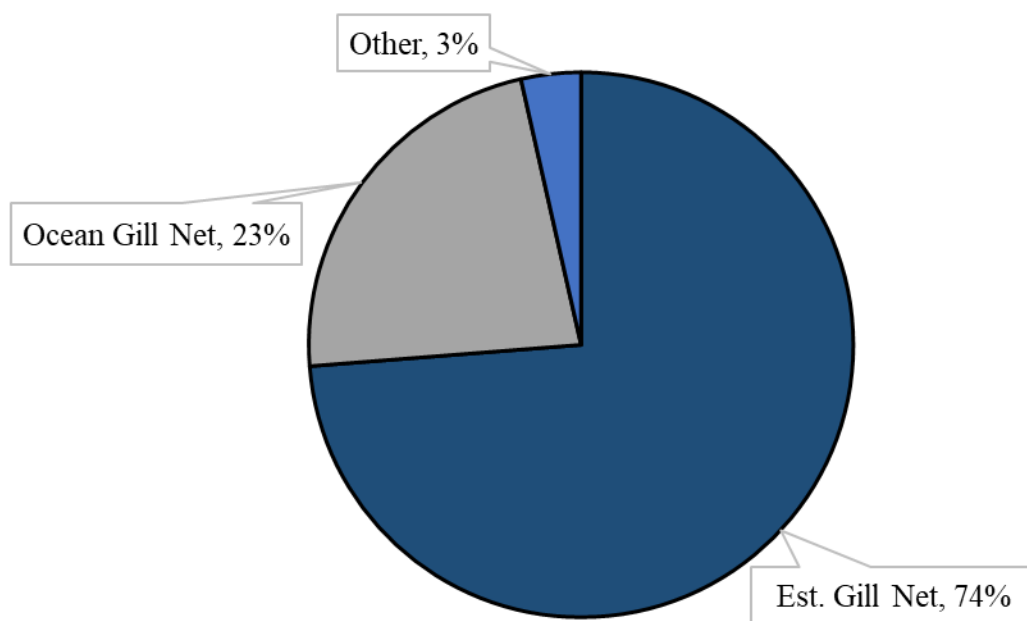


Figure 4. Commercial harvest of bluefish in North Carolina during 2021 by gear type.

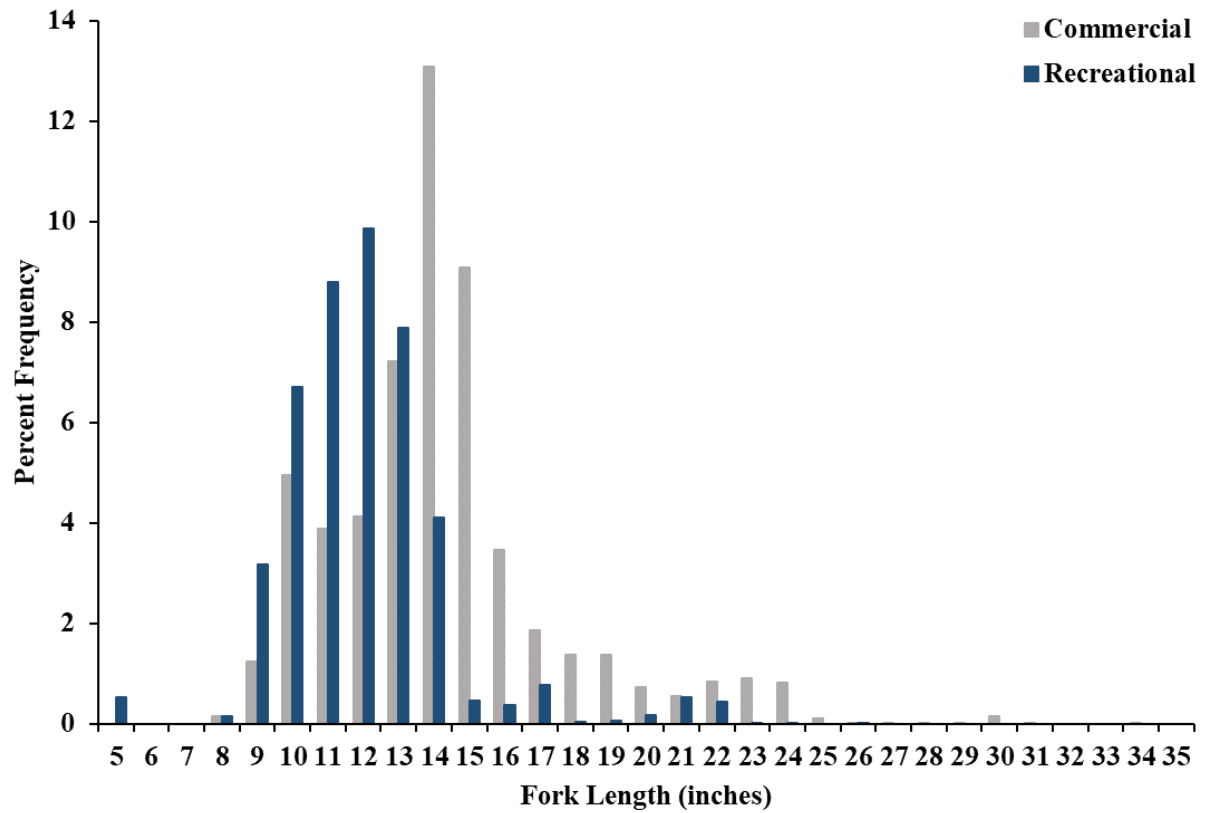


Figure 5. Commercial and recreational length frequency distribution from bluefish harvested in North Carolina, 2021.

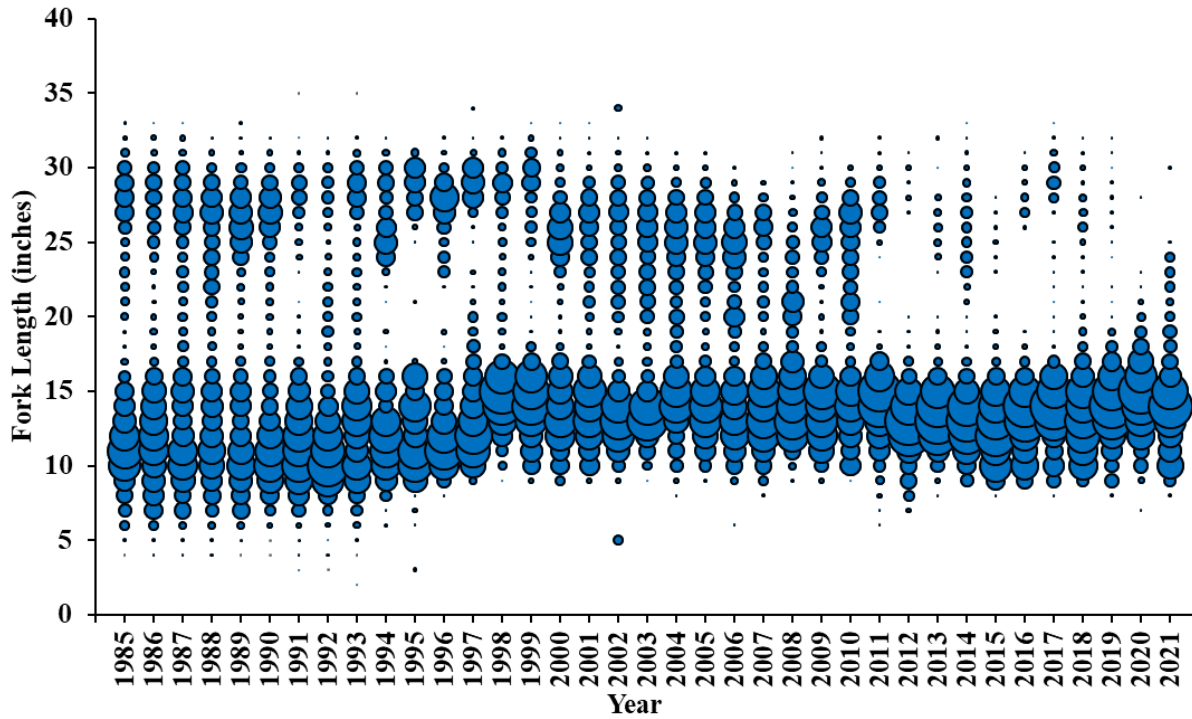


Figure 6. Commercial length frequency of bluefish harvested in North Carolina, 1985–2021. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.

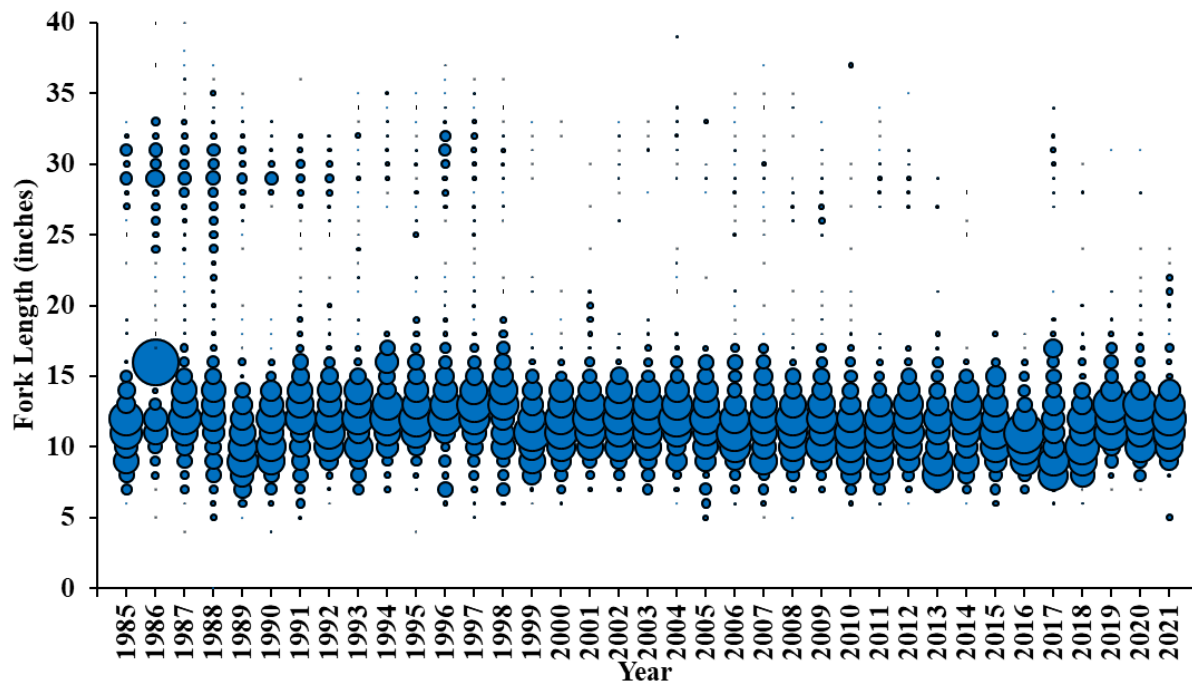


Figure 7. Recreational length frequency (fork length, inches) of bluefish harvested in North Carolina, 1985–2021. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.



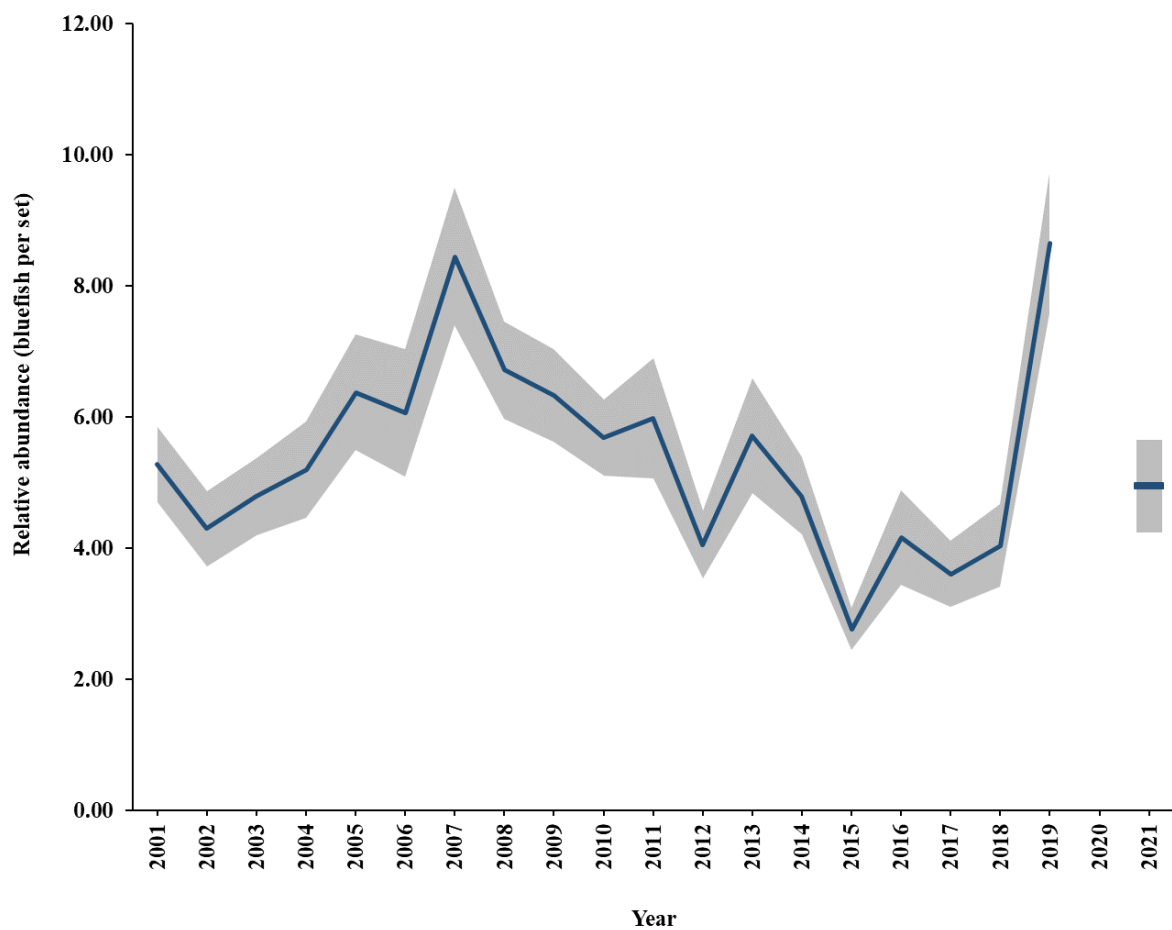


Figure 8. Relative abundance index of bluefish, from the North Carolina Pamlico Sound Independent Gill Net Survey, 2001–2021. Shading represents the standard error about the annual relative abundance index estimates. Pamlico Sound Independent Gill Net Survey sampling did not occur in 2020 and the first half of 2021.

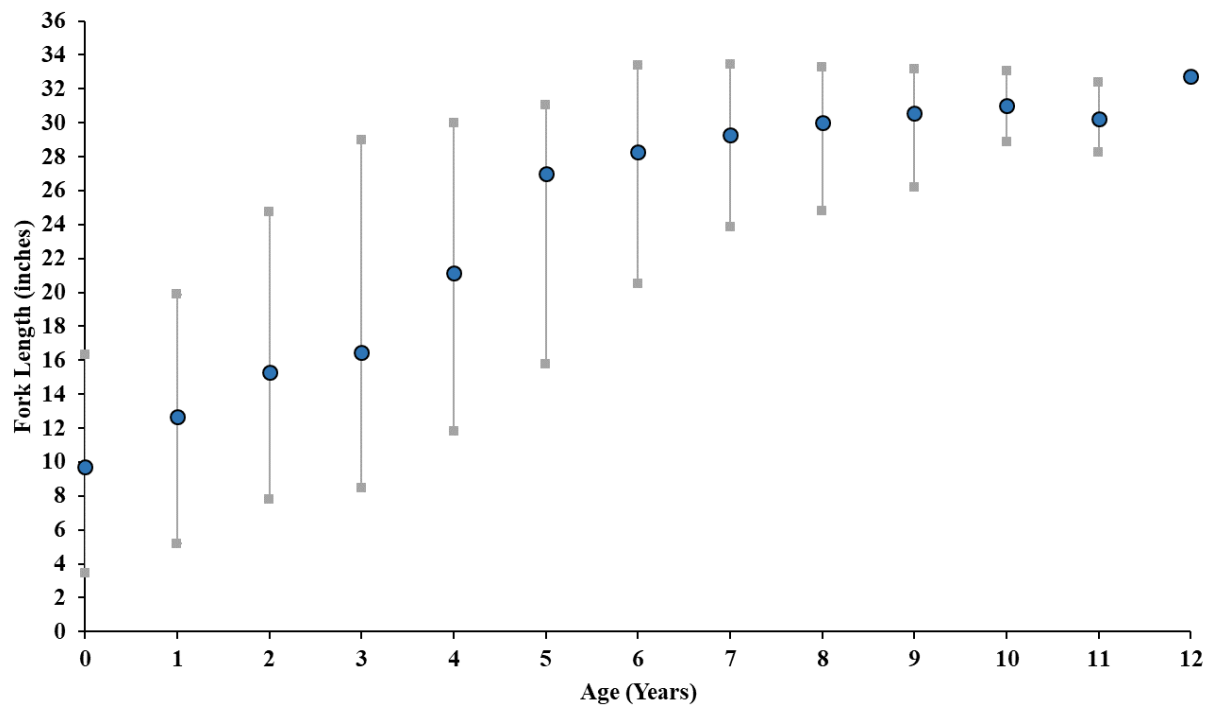


Figure 9. Bluefish length at age based on all age samples collected in North Carolina, 1985–2021. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum observed size for each age.