FISHERY MANAGEMENT PLAN UPDATE
SHEEPSHEAD
AUGUST 2021

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	None
Amendments:	None
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Comprehensive Review:	None

Sheepshead (*Archosargus probatocephalus*) was initially managed as part the South Atlantic Fishery Management Council's (SAFMC) Snapper Grouper Fishery Management Plan (FMP). The plan restricted recreational anglers to an aggregate 20 fish bag limit; there was no commercial trip limit, and neither sector had a size limit. In state waters, North Carolina deferred to the Council and the same regulations were followed. In April 2012, sheepshead was officially removed from the SAFMC's snapper grouper management complex through the Comprehensive Annual Catch Limit Amendment (Amendment 25; SAFMC 2011). Subsequently, North Carolina's proclamation authority for the management of the species was invalidated since sheepshead was no longer part of the North Carolina Fishery Management Plan for Interjurisdictional Fisheries or a Council managed species. In November 2012, the N.C. Marine Fisheries Commission (NCMFC) requested that a rule be developed for sheepshead; and in November 2013, approved the rule (15A NCAC 03M .0521) that specifies the Director's proclamation authority, including the ability to implement size, bag, and trip limits, as well as season and gear restrictions. In July 2014, N.C. Division of Marine Fisheries (NCDMF) began developing potential management measures for sheepshead to present to the NCMFC. In 2015, the Commission implemented new regulations that included size, bag, and trip limits in order to prevent overharvest, as well as to allow a greater number of individuals to spawn before being harvested. There currently is no state or federal FMP for sheepshead.

Management Unit

North Carolina manages sheepshead in state coastal waters (internal and 0 to 3 miles in Atlantic Ocean).

Goal and Objectives

None

DESCRIPTION OF THE STOCK

Biological Profile

Sheepshead are a relatively large and long-lived member of the porgy family that ranges from Nova Scotia, Canada to Florida and the Gulf of Mexico south to the Atlantic coast of Brazil. They are generally found year-round in North Carolina's coastal waters ranging from inshore brackish waters to offshore rocky bottom (Hildebrand and Cable 1938). Juveniles are associated with shallow vegetated habitat as well as hard structures that offer protection (Parsons and Peters 1987). As sheepshead grow larger, they move to more typical adult habitat including oyster reefs, rocks, pilings, jetties, piers and wrecks (Johnson 1978). Sheepshead exhibit strong site fidelity much of the year and, with the exception of a seasonal spawning migration, tend to stay in the same areas (Wiggers 2010). Migration patterns based on mark recapture studies have not documented large scale north-south movements. Movement instead tends to be towards inlets during the fall and winter when adult sheepshead migrate to ocean waters to spawn (Jennings 1985; Wiggers 2010).

Sheepshead are omnivores, meaning they eat plant material as well as animals (barnacles, crabs, oysters; Jennings 1985). Sheepshead grow quickly up to age 6, and then their growth slows. After their first year, sheepshead average 10 inches, at which less than 50%of the individuals are sexually mature (McDonough et al. 2011). Most sheepshead mature at age 2 (12 inches fork length) and all sheepshead are mature by ages 3 to 5 (14 inches fork length; McDonough et al. 2011). In North Carolina, sheepshead commonly attain a length of 20 to 25 inches with weights ranging from 5 to 15 pounds. The maximum reported age in North Carolina is 30 years.

Stock Status

The Division is continuing to collect data from recreational, commercial, and independent sampling efforts to estimate trends in abundance of sheepshead; age structure, maturity, and other biological information is also being collected.

Stock Assessment

Currently, there is not a stock assessment for sheepshead in North Carolina. A coast-wide stock assessment (from Virginia through the east coast of Florida) is being developed by a doctoral candidate at North Carolina State University. The assessment is expected to be complete in late 2021.

DESCRIPTION OF THE FISHERY

Current Regulations

In 2015, the NCMFC implemented a 10-inch fork length (FL) minimum size limit for both recreational and commercial fisheries. There is a recreational bag limit of 10 fish per person per day or per trip (if a trip occurs over more than one calendar day). Commercial fishing operations are limited to 300 pounds per trip with two exceptions; gig and spear operations are limited to 10 fish per person per day or trip (if a trip occurs over more than one calendar day), and pound net operations are exempt from the commercial trip limits.

Commercial Fishery

Commercial landings of sheepshead in North Carolina are available from 1950 to the present. However, monthly landings were not available until 1972. North Carolina instituted mandatory reporting of commercial landings through their Trip Ticket Program, starting in 1994. Landings information collected since 1994 is considered the most reliable. Landings have fluctuated from year to year, ranging from 9,782 pounds in 1981 to 180,225 pounds in 2013. In 2020, 76,501 pounds of sheepshead were landed in the commercial fishery (Table 1; Figure 1).

Sheepshead are primarily caught as bycatch in several of North Carolina's commercial fisheries (i.e., gill nets, pound nets, haul seines). Estuarine gill nets and pound nets have made up greater than 50% of the landings for most of the time series. A targeted spear fishery has developed in the last decade, and the gig fishery has also become more popular (Table 2). While the long haul fishery used to account for up to 20% of the landings, this fishery has accounted for less than one percent of the harvest in recent years. In 2020, the majority (87%) of the commercial landings came from pound nets (62%) and gill nets (25%; the majority from estuarine gill nets); an additional 9% was landed by spears and gigs, combined (Table 2; Figure 2).

Recreational Fishery

The recreational fishery tends to be more of a targeted fishery compared to the commercial. This fishery is primarily a hook and line fishery, but the species is becoming a favorite of spear fishermen. Recreational harvest estimates are available from 1981 to the present. 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. For more information see https://www.fisheries.noaa.gov/topic/recreational-fishing-data.

On average, the recreational harvest accounts for 80% of North Carolina's total harvest (pounds) from 1981-2020. In 2020, recreational harvest accounted for 89% of the total harvest (Table 1). Like the commercial harvest, landings have fluctuated from year to year, with a low of 19,285 pounds harvested in 1983 and a high of 1,456,396 pounds in 2007 (Table 1; Figure 1). In 2020, 592,774 pounds of sheepshead were landed recreationally. Recreational releases increased 66% in 2020 to 518,140 fish (Table 1).

The NCDMF offers award citations for exceptional catches of sheepshead. Harvested sheepshead weighing greater than eight pounds are eligible for an award citation. Since 1991, approximately 2,100 citations for sheepshead have been issued. From 1991 through 2007 the number of award citations remained under 50 citations per year. From 2007 through 2014 the number of award citations increased steadily but have decreased in recent years (Figure 3); eight-eight citations were issued in 2020.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fishing activity is monitored through fishery-dependent sampling programs conducted by NCDMF. Data collected in these programs allow the size and age distribution of sheepshead to be characterized by gear and fishery. In 2020, 168 lengths were measured at fish houses or on the water, the majority of which came from the estuarine gill net, spear, and pound net fisheries. The average size of commercial caught sheepshead was 14 inches FL (Table 3). This has varied from year to year (10 to 20 inches FL), with the average and minimum sizes being smaller when there was no size limit. The majority of sheepshead landed in 2020 were between 10 inches and 16 inches FL (Figure 4).

Similar to the commercial fishery, average size varies little from year to year in the recreational fishery (Table 4). In 2020, the average size recreational sheepshead was 13 inches FL (Table 4). The majority of sheepshead landed in 2020 were between 10 inches and 15 inches FL (Figure 5). In both fisheries, sublegal fish (<10 inches FL) are still being harvested (Tables 3 and 4; Figure 6). This is most likely due to fishermen being unaware of changes in regulations, and/or confusing sheepshead and black drum regulations. While the size limits differ, black drum are measured for total length and sheepshead for FL.

Fishery-Independent Monitoring

In 2001, the NCDMF initiated a fishery-independent gill net survey in Pamlico Sound (Program 915). The objective of this project is to provide annual, independent, relative-abundance indices for key estuarine species in the nearshore Pamlico Sound. The survey employs a stratified random sampling design and utilizes multiple mesh gill nets (3.0-inch to 6.5-inch stretched mesh, by half-inch increments). By continuing a long-term database of age composition and developing a relative index of abundance for sheepshead this survey will help managers assess the sheepshead stocks without relying solely on commercial and recreational fishery dependent data. The overall sheepshead index of abundance (number of sheepshead per set) was 0.33 in 2019, 36% above the time series average (Table 5; Figure 7).

For the 2020 sampling year, indices of abundance are not available for sheepshead from the Fishery-Independent Assessment (Program 915) due to the COVID pandemic. Executive Order (EO) 116, issued on March 10, 2020, declared North Carolina under a State of Emergency and was soon followed by EO 120 which implemented a statewide Stay at Home Order for all non-essential State employees.

Data collected by Program 120 (Estuarine Trawl Survey) were used to calculate a relative Juvenile Abundance Index (JAI) by the doctoral candidate working on the coast-wide stock assessment. Program 120 is a fishery independent multispecies monitoring program that has been ongoing since 1971 in the months of May and June. One of the key objectives of this program is to provide a long-term database of annual juvenile recruitment for economically important species. This survey samples a fixed set of 104 core stations with additional stations as needed. The core stations are sampled from western Albemarle Sound south to the South Carolina border each year without deviation two times in the months of May and June. An additional set of 27 spotted seatrout juvenile stations in Pamlico Sound and its major tributaries were added in 2004, and are sampled during the months of June and July. Data from the seatrout specific stations are used to generate an index of relative abundance of age zero sheepshead, calculated as the average number of fish per tow. The resulting relative abundance index for the time series is variable with no significant trend and peaks in 2008 and 2015 suggesting relatively higher recruitment in those years (Table 6; Figure 8). The Program 120 relative abundance index in 2020 was 0.19, which was an increase from the previous year.

In order to describe the age distribution of the harvest and indices, sheepshead age structures are collected from various fishery independent and dependent sources throughout the year. Otolith collection for sheepshead is relatively new; though there are samples going back to 2008, collection of sheepshead otoliths was not made a sampling priority until 2013. The majority of sheepshead collected were ages 1 to 8 (Table 7). In 2020, 205 sheepshead were collected ranging in age from 1 to 34; ages are preliminary at this time. The age-length relationship is hard to predict as there is overlap in age for a given length (Figure 9).

RESEARCH NEEDS

The following have been identified as research needs for sheepshead in North Carolina.

- Initiate a sheepshead tagging program to develop estimates of growth, natural mortality, fishing mortality, and track the movement of adults throughout the stock's range; include methods to estimate tag retention, reporting rate, and tagging-induced mortality
- Conduct reproductive studies including spawning periodicity, age- and size-specific fecundity, update maturity schedule, and conduct spawning area surveys in North Carolina and throughout the stock's range
- Expand discard sampling to collect information on gear, depth, location, and age and size distribution of discarded fish for the recreational and commercial sectors
- Conduct studies on size- and age-specific selectivity by gear type
- Determine the patterns and triggers of inshore-offshore migrations

MANAGEMENT STRATEGY

See Table 8 for current management strategies and implementation status for sheepshead.

LITERATURE CITED

Jennings, C.A. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico)–sheepshead. U.S. Fish and Wildlife Service Biological Report 82 (11.29). U.S. Army Corps of Engineers, TR EL-82-4. 10 pp.

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Parsons, G. R., and K. M. Peters. 1987. Age determination in larval and juvenile sheepshead, *Archosargus probatocephalus*. U.S. National Marine Fisheries Service Fishery Bulletin 87:985–988.

SAFMC (South Atlantic Fishery Management Council). 2011. Comprehensive Annual Catch Limit (ACL) Amendment (Amendment 25 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region). South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.

Wiggers, R. 2010. South Carolina Marine Game Fish Tagging Report, 1978-2009. Marine Resources Division, South Carolina Department of Natural Resources. Charleston, S.C. 29422.

TABLES

Table 1. Recreational harvest (number of fish released and weight) and releases (number of fish; MRIP) and commercial harvest (weight in lbs; Atlantic Coastal Cooperative Statistics Program and N.C. Trip Ticket Program) of sheepshead from North Carolina, 1981-2020. All weights are in lbs.

	Recreational				
	Numbers		Weight (lb)	Commercial	Total
Year	Landed	# Released	Landed	Weight (lb)	Weight (lb)
1981	83,626	12,772	262,503	9,782	272,285
1982	61,765		183,768	13,922	197,690
1983	5,930		19,285	28,224	47,509
1984	21,156		32,152	36,267	68,419
1985	12,691		42,573	61,190	103,763
1986	132,061	8,283	399,925	97,355	497,280
1987	52,061	70,117	172,377	81,101	253,478
1988	152,971	7,766	50,046	63,400	113,446
1989	136,175	17,747	243,496	56,940	300,436
1990	103,041	18,679	161,180	68,029	229,209
1991	67,277	34,505	154,193	52,611	206,804
1992	206,241	48,565	434,509	47,526	482,035
1993	221,442	51,981	289,634	57,884	347,518
1994	92,098	31,965	197,128	83,789	280,917
1995	157,769	39,779	407,729	91,198	498,927
1996	77,750	12,798	256,911	82,290	339,201
1997	209,662	55,258	308,381	50,414	358,795
1998	151,473	109,454	209,825	60,184	270,009
1999	255,885	124,676	758,153	60,895	819,048
2000	355,192	94,963	780,622	88,459	869,081
2001	183,781	66,594	654,527	64,522	719,049
2002	181,197	68,317	781,567	57,434	839,001
2003	294,989	85,877	983,640	53,361	1,037,001
2004	86,554	40,263	453,372	82,009	535,381
2005	87,504	65,863	340,227	53,259	393,486
2006	137,312	90,502	445,182	57,481	502,663
2007	433,872	334,014	1,456,396	77,173	1,533,569
2008	503,666	172,604	1,007,914	89,726	1,097,640
2009	362,439	299,221	577,311	132,390	709,701
2010	327,223	190,823	966,467	157,631	1,124,098
2011	196,844	78,821	522,896	120,976	643,872
2012	346,609	269,226	797,963	109,881	907,844
2013	784,747	391,809	1,220,357	180,225	1,400,582
2014	185,267	224,062	389,583	173,376	562,959
2015	181,554	160,447	520,382	124,827	645,209
2016	149,085	212,471	375,328	93,513	468,841
2017	282,480	910,841	810,633	128,608	939,241
2018	343,772	524,967	735,738	90,398	826,136
2019	221,419	312,479	590,150	86,406	676,556
2020	247,390	518,140	592,774	76,501	669,275
Average	202,349	143,916	489,670	80,029	569,699

Table 2. Commercial harvest (weight in lbs) of sheepshead by gear type, 2011-2020 (Source N.C. Trip Ticket Program).

Year	Spears and Gigs[$]	Estuarine Gillnet	Long Haul	Ocean Gillnet	Pound Net	Trawls	Other*	Total Harvest
2011	5,946	40,653	13,175	1,594	55,729	2,015	1,865	120,976
2012	15,916	32,565	9,801	1,974	46,233	2,140	1,253	109,881
2013	15,259	48,194	12,536	3,055	94,780	3,940	2,462	180,225
2014	21,886	39,524	11,805	3,253	92,988	2,581	1,339	173,376
2015	13,695	27,245	400	5,741	73,035	3,998	713	124,827
2016	14,761	30,851	322	2,509	36,839	7,068	1,163	93,513
2017	10,720	33,770	513	1,677	74,246	7,047	636	128,608
2018	9,076	25,686	40	2,936	50,457	1,012	1,191	90,398
2019	13,858	25,309	843	3,437	36,496	5,567	897	86,406
2020	7,262	16,964	838	1,966	47,445	1,600	427	76,501
Average	12,838	32,076	5,027	2,814	60,825	3,697	1,195	

** Other gears include fyke nets, crab pots, and hook and line.*

[$] Spear and gigs have also been combined due to data confidentiality.

Table 3. Sheepshead length (fork length, in) data from commercial fish house samples, 1982-2020.

Year	Mean Fork Length	Minimum Fork Length	Maximum Fork Length	Total Number Measured
1982	10	3	24	13
1983	18	8	24	25
1984	20	11	24	8
1985	10	3	13	3
1986	19	15	23	19
1987	16	8	24	53
1988	16	3	22	29
1989	14	3	23	42
1990	16	8	25	162
1991	15	6	23	124
1992	13	3	22	86
1993	13	4	22	107
1994	16	10	22	22
1995	15	5	23	164
1996	15	9	22	122
1997	16	8	24	97
1998	12	6	24	313
1999	13	8	24	461
2000	14	9	27	642
2001	15	8	22	296
2002	13	8	23	382
2003	14	9	24	406
2004	16	8	23	294
2005	17	9	25	415
2006	16	8	24	445
2007	14	7	24	826
2008	13	7	24	1,366
2009	12	6	23	1,388
2010	13	7	24	1,684
2011	15	9	24	1,246
2012	13	7	37	1,157
2013	13	7	24	1,282
2014	14	7	23	1,294
2015	15	8	24	982
2016	15	9	24	886
2017	14	9	23	333
2018	14	8	23	667
2019	15	8	24	625
2020	14	9	21	168

Table 4. Sheepshead length (fork length, inches) data from Marine Recreational Information Program samples, 1981-2020.

Year	Mean Fork Length	Minimum Fork Length	Maximum Fork Length	Total Number Measured
1981	18	9	20	13
1982	17	8	21	29
1983	19	15	20	3
1984	11	10	13	2
1985	13	13	13	1
1986	15	7	29	29
1987	15	7	23	70
1988	2	6	25	85
1989	13	7	21	76
1990	11	7	22	93
1991	12	5	23	83
1992	13	8	23	54
1993	11	6	22	176
1994	13	7	21	179
1995	14	7	22	174
1996	15	9	26	79
1997	11	6	24	134
1998	11	6	23	191
1999	15	7	29	187
2000	13	8	24	239
2001	16	10	30	132
2002	17	10	23	56
2003	15	8	26	96
2004	17	9	24	54
2005	16	9	23	34
2006	15	7	24	55
2007	15	7	24	118
2008	12	7	21	108
2009	11	7	21	159
2010	14	8	26	221
2011	14	7	25	160
2012	13	6	23	254
2013	11	6	24	351
2014	13	8	25	99
2015	14	9	23	134
2016	14	8	25	106
2017	14	4	22	272
2018	13	9	23	386
2019	14	9	25	243
2020	13	8	25	260

Table 5. Annual weighted sheepshead index of abundance (number per set, all ages combined) from the North Carolina Pamlico Sound Independent Gill Net Survey, 2001-2019. N=number of samples; SE=Standard Error; PSE=Proportional Standard Error. Survey was not conducted in 2020 due to the COVID pandemic.

Year	N	Index	SE	PSE
2001	237	0.13	0.06	46
2002	320	0.14	0.04	29
2003	320	0.08	0.02	25
2004	320	0.13	0.03	23
2005	304	0.08	0.02	25
2006	320	0.08	0.02	25
2007	320	0.11	0.03	27
2008	320	0.11	0.03	27
2009	320	0.30	0.05	17
2010	320	0.18	0.04	22
2011	298	0.16	0.06	38
2012	308	0.12	0.03	25
2013	308	0.30	0.07	23
2014	308	0.45	0.09	20
2015	306	0.26	0.06	23
2016	308	0.20	0.04	20
2017	308	0.44	0.10	23
2018	308	0.41	0.11	27
2019	306	0.33	0.09	27

Table 6. Annual weighted sheepshead juvenile index of abundance (number per tow) from the North Carolina Juvenile Trawl Survey, 2004-2020. N=number of samples; SE=Standard Error; PSE=Proportional Standard Error.

Year	N	CPUE	SE	PSE
2004	54	0.00	0.00	--
2005	54	0.00	0.00	--
2006	54	0.11	0.11	100
2007	54	0.11	0.05	46
2008	54	0.87	0.44	51
2009	54	0.06	0.03	57
2010	54	0.06	0.06	100
2011	54	0.22	0.13	57
2012	54	0.07	0.04	60
2013	54	0.07	0.05	70
2014	54	0.15	0.09	60
2015	54	0.65	0.50	78
2016	54	0.22	0.13	60
2017	54	0.00	0.00	--
2018	54	0.02	0.02	100
2019	54	0.04	0.04	100
2020	54	0.19	0.09	50

Table 7. Summary of sheepshead age samples collected from both dependent (commercial and recreational) and independent (survey) sources, 2008-2020*.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2008	2	2	8	10
2009	--	3	25	5
2010	6	3	18	10
2011	4	3	10	14
2012	1	1	26	8
2013	2	1	22	162
2014	3	1	24	243
2015	4	1	24	140
2016	5	0	29	211
2017	2	1	28	262
2018	2	0	30	227
2019*	3	0	29	345
2020*	1	1	34	205

**2019 and 2020 ages are preliminary pending second read*

Table 8. Summary of management strategies and their implementation status for sheepshead.

Management Strategy	**Implementation Status**
HARVEST MANAGEMENT	
Implement a size limit, recreational bag limit, and commercial trip limit by June 1, 2015	Proclamation authority through Rule 15A NCAC 03M .0521 (FF-28-2015)

FIGURES

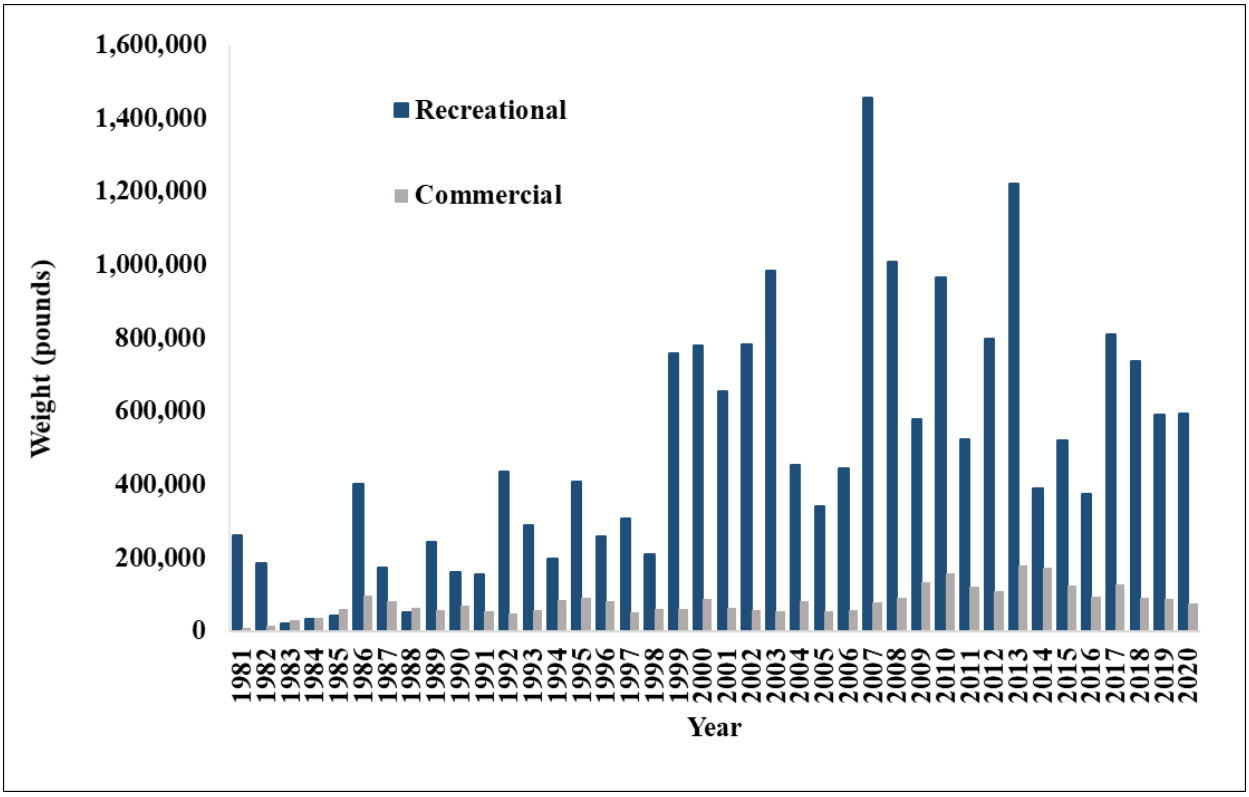

Figure 1. Annual commercial (Atlantic Coastal Cooperative Statistics Program and N.C, Trip Ticket Program) and recreational (MRIP) landings in pounds for sheepshead in North Carolina from 1981 to 2020.

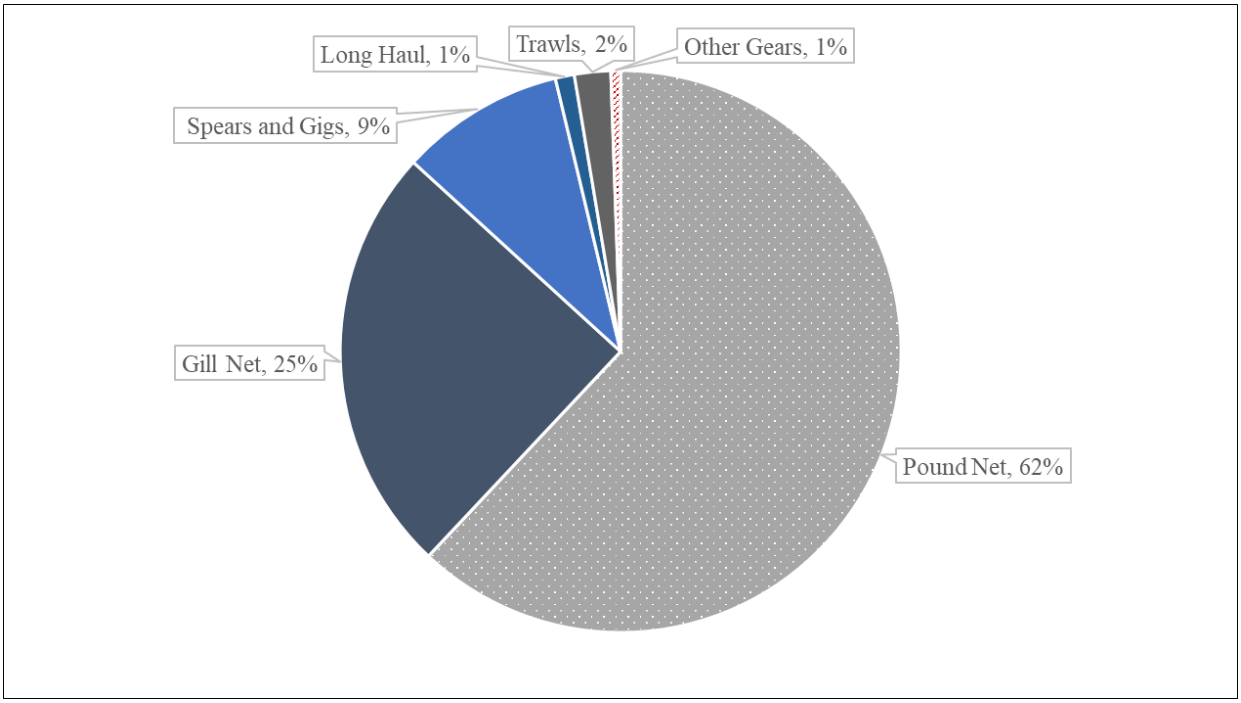

Figure 2. Commercial harvest in 2020 by gear type. Other gears include fyke nets, crab pots, and hook-and-line.

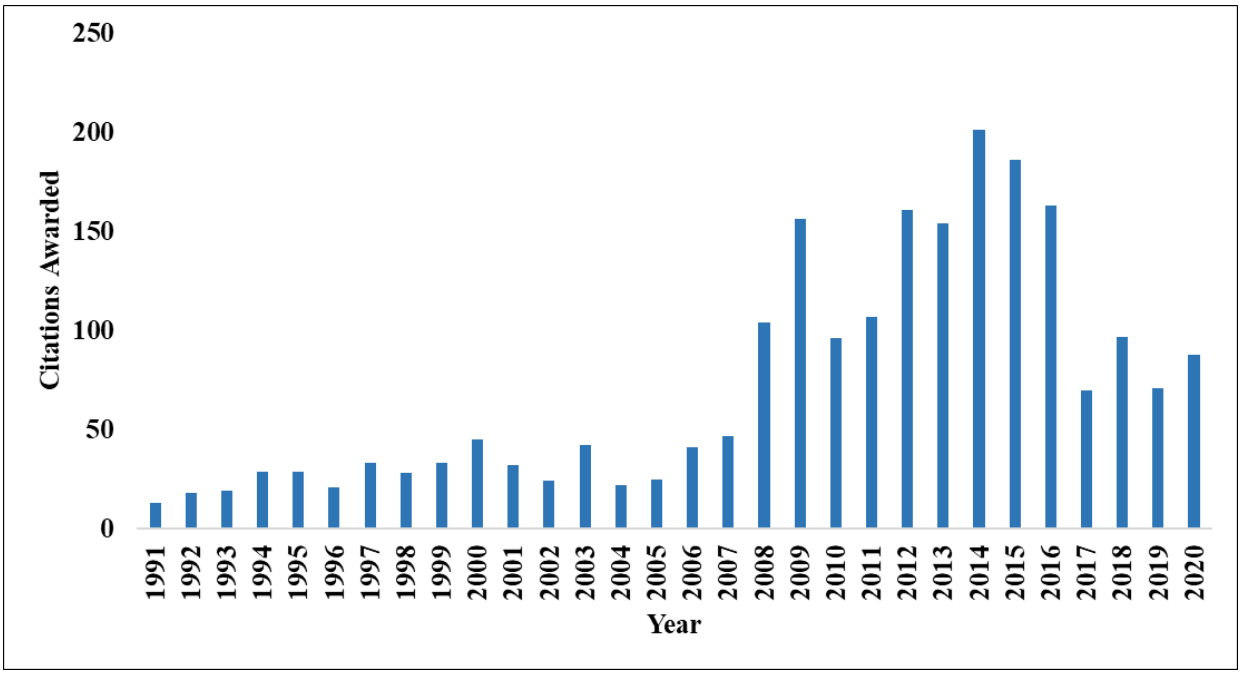

Figure 3. North Carolina Saltwater Fishing Tournament citations awarded for sheepshead from 1991 to 2020.

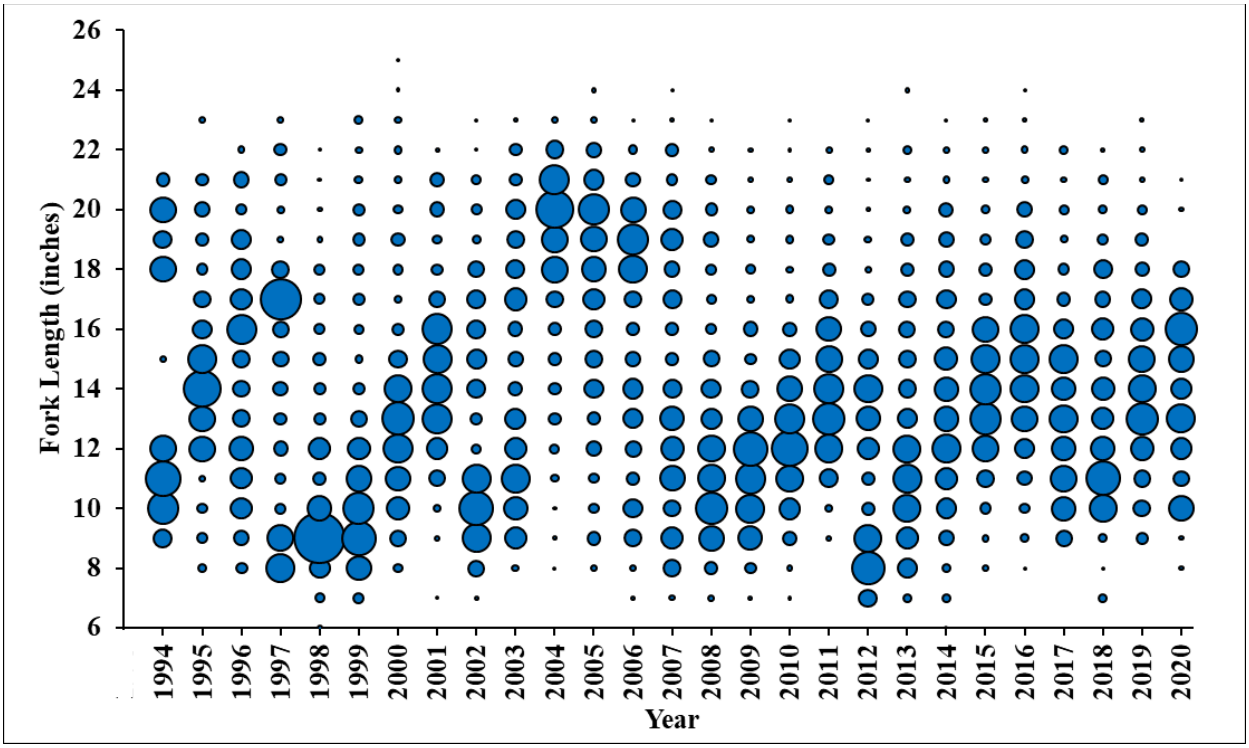

Figure 4. Commercial length frequency (fork length, in) of sheepshead harvested from 1994 to 2020. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.

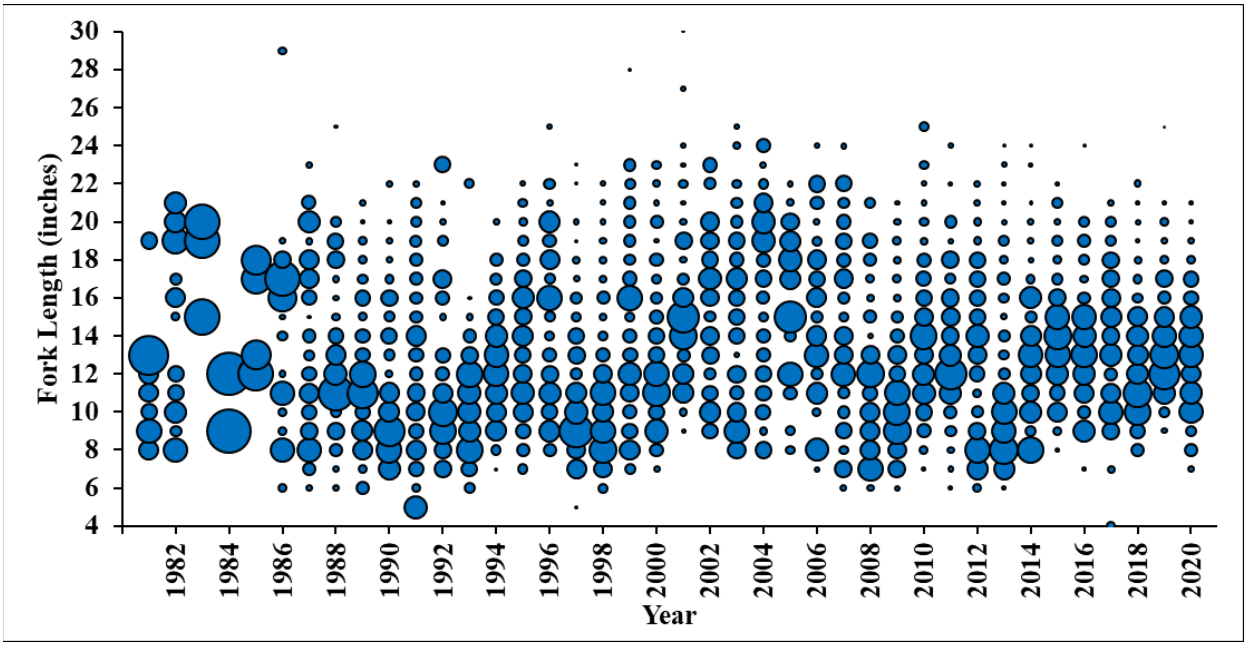

Figure 5. Recreational length frequency (fork length, in) of sheepshead harvested from 1981 to 2020. Bubbles represent fish harvested at length and the size of the bubble is equal to the proportion of fish at that length.

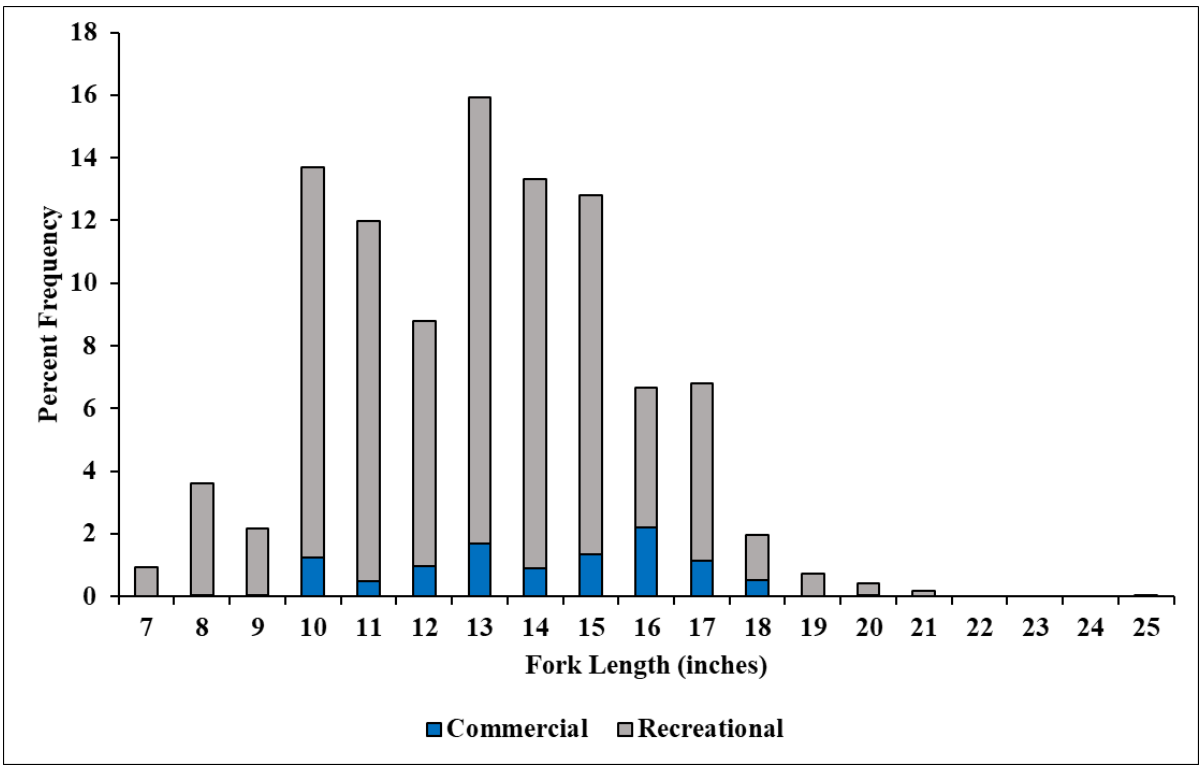

Figure 6. Commercial and recreational length frequency distribution from sheepshead harvested in 2020.

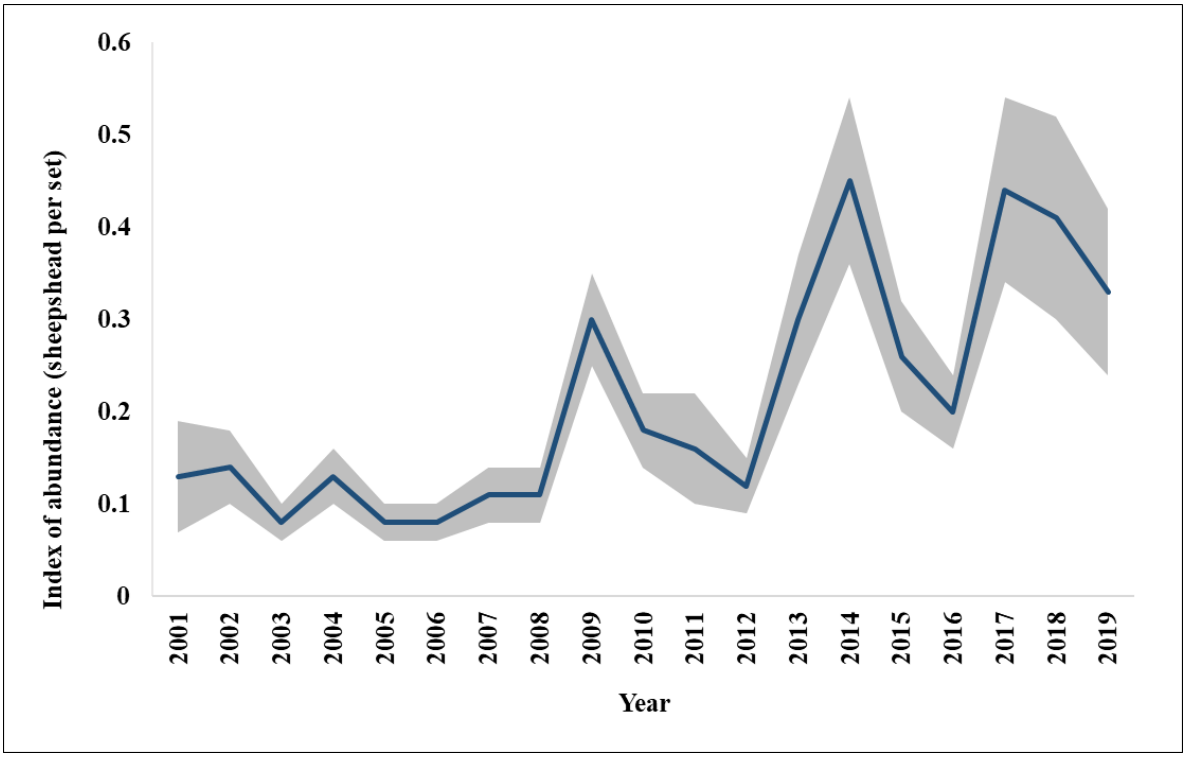

Figure 7. Annual index of abundance of sheepshead in the NCDMF Pamlico Sound Independent Gill Net Survey, 2001-2019. Survey was not conducted in 2020 due to the COVID pandemic.

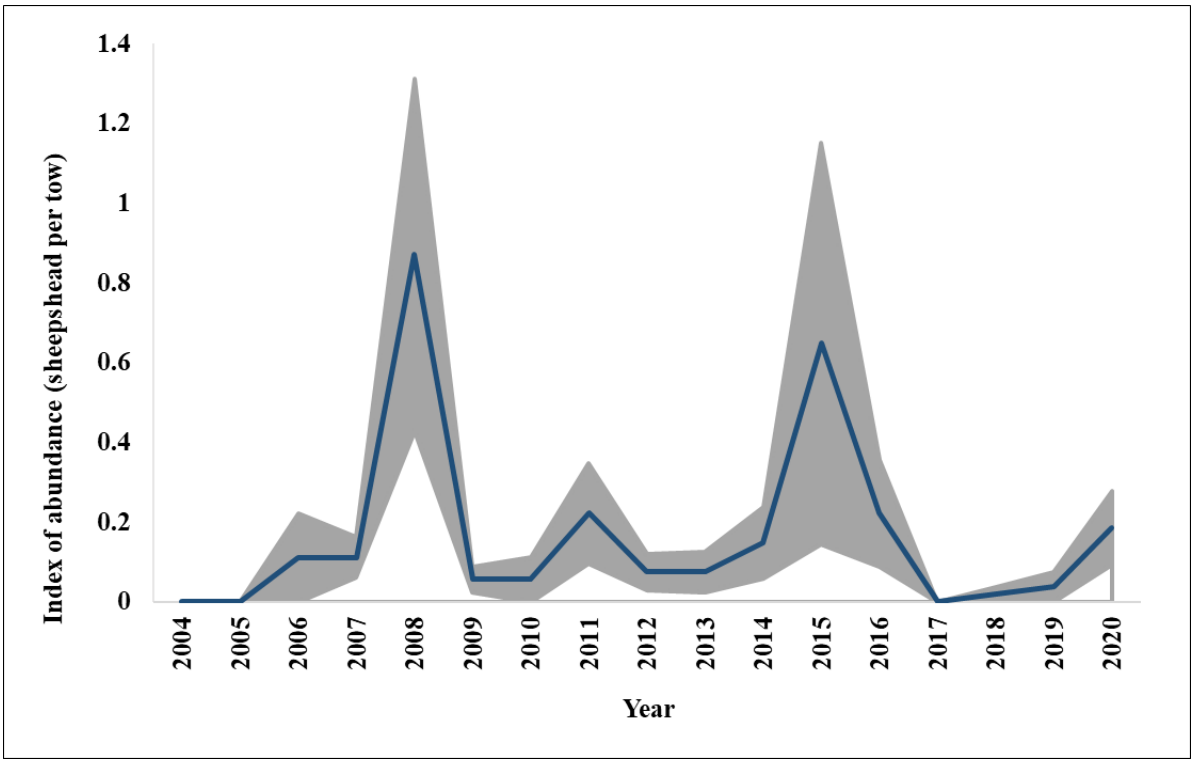

Figure 8. Annual juvenile index of abundance of sheepshead in the NCDMF Juvenile Trawl Survey, 2004-2020.

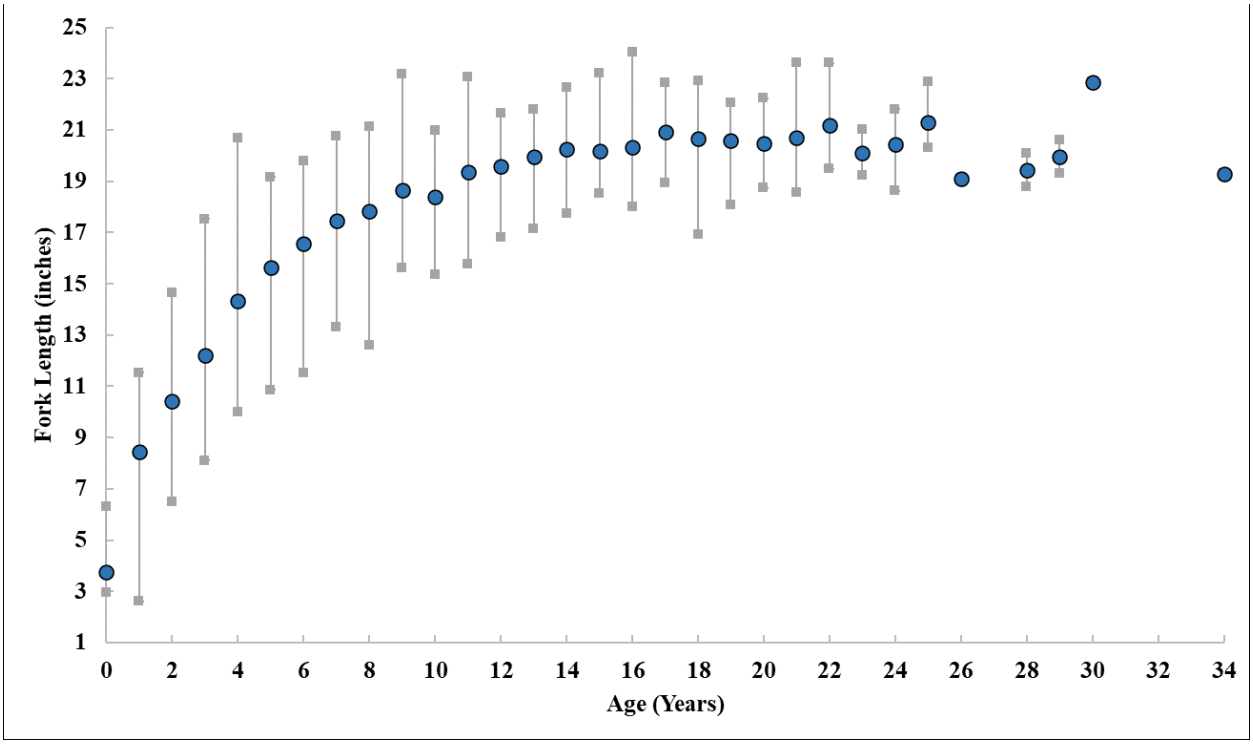

Figure 9. Sheepshead length at age based on all age samples collected from 2008 to 2020. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum observed size for each age.