FISHERY MANAGEMENT PLAN UPDATE
STRIPED MULLET
AUGUST 2018

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	April 2006
Amendments:	Amendment 1 – November 2015
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	July 2020

The North Carolina Striped Mullet Fishery Management Plan (FMP) was adopted in April 2006. The management plan established minimum and maximum landings triggers of 1.3 million pounds and 3.1 million pounds, respectively. If landings fall below the minimum trigger, the North Carolina Division of Marine Fisheries (NCDMF) would initiate further analysis of the data to determine if the decrease in landings is attributed to stock decline, decreased fishing effort, or both. If landings exceed 3.1 million pounds, the NCDMF would initiate analysis to determine if harvest is sustainable and assess what factors are driving the increase in harvest. The striped mullet FMP established a possession limit of 200 mullets (white and striped in aggregate) per person in the recreational fishery.

Amendment 1 to the N.C. Striped Mullet FMP was adopted in November 2015 and rules were implemented in April 2016. Issues addressed in Amendment 1 included: 1) resolution of Newport River gill net attendance, 2) addressing user group conflicts, and 3) updating the management framework for the N.C. striped mullet stock. Amendment 1 updated the minimum and maximum commercial landings triggers to 1.13 and 2.76 million pounds, respectively, that would warrant a closer examination of data. Amendment 1 maintains the 200 mullet possession limit per person in the recreational fishery.

Management Unit

Coastal and joint waters of North Carolina.

Goal and Objectives

The goal of Amendment 1 to the North Carolina Striped Mullet FMP is to manage the striped mullet fishery to preserve the long-term viability of the resource, maintain sustainable harvest, maximize social and economic value, and consider the needs of all user groups. The following objectives will be used to achieve this goal:

1. Use a management strategy that provides for conservation of the striped mullet resource and promotes sustainable harvest while considering the needs of all user groups.

2. Promote the protection, enhancement, and restoration of habitats and water quality necessary for the striped mullet population.

3. Minimize conflict among user groups, including non-fishing user groups and activities.

4. Promote research to improve the understanding of striped mullet population dynamics and ecology to improve management of the striped mullet resource.

5. Initiate, enhance, and/or continue studies to collect and analyze the socio-economic data needed to properly monitor and manage the striped mullet fishery.

6. Promote public awareness regarding the status and management of the North Carolina striped mullet stock.

STATUS OF THE STOCK

Life History

Striped mullet are found in a wide range of depths and habitats, but primarily inhabit freshwater to estuarine environments until a spawning migration into the ocean occurs during the fall (Able and Fahay 1998; Pattillo et al. 1999; Cardona 2000; Whitfield et al. 2012). Striped mullet serve as an ecological link between some of the smallest aquatic organisms and the highest-level predators in the marine food chain. Striped mullet feed on microorganisms such as bacteria and single-celled algae found on aquatic plants, in mud, silt, and sand and in decaying plant material (Odum 1968; Moore 1974; Collins 1985a; Larson and Shanks 1996; Torras et al. 2000). In turn, striped mullet are prey to top predators such as birds, fish, sharks and porpoises (Breuer 1957; Thomson 1963; Collins 1985a; Barros and Odell 1995; Fertl and Wilson 1997). Striped mullet are highly fecund (upwards of 4 million eggs for a large female; Bichy 2000) and spawn in large aggregations near inlets to offshore areas (Collins and Stender 1989). Spawning individuals have been reported from September to March; however, peak spawning activity occurs from October to early December (Bichy 2000).

Stock Status

The most recent assessment of the North Carolina striped mullet stock was completed in 2013 utilizing data from 1994-2011 (NCDMF 2013). The results of the stock assessment indicated spawning stock biomass increased from 2003 through 2007 but declined through 2011. Recruitment also declined in the latter portion of the time series, though a slight increase was observed in 2011. Fishing mortality (F) increased toward the end of the time series, but F in the terminal year ($F_{2011} = 0.437$) was below both the fishing mortality target ($F_{35\%} = 0.566$) and threshold ($F_{25\%} = 0.932$). Based on the assessment results, the stock was not undergoing overfishing in 2011. A poor stock-recruit relationship resulting in unreliable biomass based reference points prevented determining if the stock was overfished.

In 2016, striped mullet commercial landings were 965,198 pounds which is 15 percent less than the minimum commercial landings trigger established by Amendment 1. The decline in commercial landings occurred in conjunction with declines in relative abundance of striped mullet from fishery independent surveys. In July 2017, the NCDMF initiated further analysis of striped mullet data as outlined in Amendment 1 and is in the process of updating the striped mullet stock assessment model with data through 2017 to determine the current status, in relation to overfishing, of the striped mullet stock.

Stock Assessment

The striped mullet stock was modeled using Stock Synthesis text version 3.24f (Methot 2000, 2011; NFT 2011; Methot and Wetzel 2013), which was also used to calculate reference points (NCDMF 2013). The Stock Synthesis model can incorporate information from multiple fisheries, multiple surveys, and both length and age composition data. The structure of the model allows for a wide range of model complexity depending upon available data. The strength of the model is it explicitly models both the dynamics of the population and the processes by which one observes the population and its fisheries. That is, the comparison between the model and the data is kept close to the natural basis of the observations, instead of manipulating the observations into the format of a simpler model. Another important advantage is the model allows for (and estimates) selectivity patterns for each fishing fleet and survey.

STATUS OF THE FISHERY

Current Regulations

There are no size restrictions, but as of July 1, 2006 there is a 200 mullet (white and striped aggregate) daily possession limit per person in the recreational fishery and the mutilated finfish rule was modified to exempt mullet used as bait.

Commercial Landings

Historically, seines and gill nets are the two primary gear types used in the striped mullet commercial fishery, with most commercial landings prior to 1978 coming from the seine fishery. Gill nets replaced seines as the dominant gear type in the striped mullet commercial fishery in

1979. Because the commercial fishery primarily targets striped mullet roe, the fishery is seasonal with the highest demand and landings occurring in the fall when large schools of striped mullet form during their spawning migration to the ocean. Striped mullet are targeted commercially using runaround gill nets in the estuarine waters of North Carolina with most landings occurring in the fall. Most striped mullet commercial landings from beach seines occur during the Bogue Banks stop net fishery. The stop net fishery has operated under fixed seasons and net and area restrictions since 1993. Stop nets are limited in number (four), length (400 yards), and mesh sizes (minimum eight inches outside panels, six inches middle section). Stop nets are only permitted along Bogue Banks (Carteret County) in the Atlantic Ocean from October 1 to November 30. However, the stop net season was extended to include December 3 to December 17 in 2015 due to minimal landings of striped mullet (Proclamation M-28-2015). Due to the schooling nature of striped mullet the beach seine fishery has the potential to be, and historically has been, a high volume fishery with thousands of pounds landed during a single trip.

Since 1994 striped mullet landings have ranged from a low of 965,198 pounds in 2016 to a high of 2,829,086 pounds in 2000 (Figure 1). From 2003 to 2009 landings were stable between 1,598,617 and 1,728,607 pounds before increasing to 2,082,832 pounds in 2010. Since 2010, landings have fluctuated annually between approximately 1.5 and 2 million pounds before declining significantly in 2015 and again in 2016, dropping below the minimum commercial landings trigger established by Amendment 1 by 164,802 pounds in 2016. Commercial landings in 2017 were 1,362,073 pounds, which is a 396,875 pound increase from 2016 commercial landings.

Recreational Landings

The federal Marine Recreational Information Program (MRIP) is primarily designed to sample anglers who use rod and reel as the mode of capture. Since most striped mullet are caught with cast nets for bait, striped mullet recreational harvest data are imprecise. In addition, angler misidentification between striped mullet and white mullet is also common, and bait mullet are usually released by anglers before visual verification by creel clerks and therefore are not identified to the species level in the MRIP data (Catch Type B). Because of imprecise estimates, MRIP data are not considered to be a reliable source for estimates of recreational striped mullet harvest and catch.

In October 2011, NCDMF began a mail survey to develop catch and effort estimates for recreational cast net and seine use. The mail survey was established as a direct response to a lack of precision in MRIP estimates for difficult to sample or overlooked recreational fisheries and activities. The survey does not distinguish between striped and white mullet and all data should be interpreted with caution because the ratio of striped mullet to white mullet in the recreational catch will differ between seasons and areas of the state. Recreational cast net effort directed toward mullet is generally highest from July through October and decreased between 2016 and 2017 (Table 1). Mullet harvest and total catch is also highest from July through October and increased between 2016 and 2017. Number of releases increased between 2016 and 2017.

Striped mullet harvest data from the Recreational Commercial Gear License (RCGL) were collected from 2002 to 2008. The program was discontinued in 2009 due to lack of funding and the minimal contributions from RCGL to overall harvest. From 2002 through 2008 an average of 41,512 pounds of striped mullet were harvested per year using a RCGL (Table 2).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

The total number of striped mullet measured in fishery dependent programs between 2005 and 2017 ranged from 4,480 to 13,263, with the lowest number measured in 2017 (Table 3). Mean length varied little, generally falling between 343 and 364 millimeters fork length (FL), with the lowest mean length occurring in 2007 (343.2 millimeters FL). Minimum and maximum lengths generally fell within a small range, though in 2011 the minimum was 166 millimeters FL which is much lower than the minimum in other years (Table 3).

From 2004 through 2017 the size range of striped mullet captured in the commercial fishery ranged from 160 to 730 millimeters FL (Figure 2). Modal length was 290 millimeters FL in the 2004-2007 time block, 370 millimeters FL in the 2008-2011 time block, 370 to 390 millimeters FL 2012-2015 time block and 380 millimeters FL in the 2016-2017 time block. The length frequency distribution began to truncate during the 2012-2015 time block and truncated further in the 2016-2017 time block. Modal age of striped mullet in the commercial fishery was two in every time block (Figure 3). Age two striped mullet generally comprise between 40 to 45 percent of the commercial catch. Few striped mullet over age three are captured in North Carolina commercial fisheries.

Fishery-Independent Monitoring

Modal age was two in all years except 2005 when the modal age was one, and in 2017 when modal age was 1-2 (Table 4). Minimum age was zero in every year except 2010 when the minimum age was one. Maximum age ranged from six in 2012, 2014, and 2015 to 15 in 2017. From 2005 through 2008 the maximum age was 10, in 2009 the maximum age was 13, and in 2011 the maximum age was 14.

The striped mullet electrofishing survey also known as Program 146 (P146) was initiated in 2003 to produce a fisheries-independent index of relative abundance for striped mullet. Twelve sampling stations were established among four sites (three stations per site) in the Neuse River and its tributaries, with each station samples once per month from January through April and from October through December. To provide the most relevant striped mullet index from the striped mullet electrofishing survey, data were limited to those collected during January through April, when striped mullet were most abundant in the Neuse River. Since the survey primarily catches adult striped mullet, juveniles were excluded from analysis. A sample represents all the fish collected over a 500 m transect. Striped mullet catch-per-unit-effort (CPUE) was stable at approximately 100 fish per sample from 2005 through 2009 before peaking in 2011 (Figure 4). Striped mullet CPUE dropped significantly in 2012, potentially due to hurricanes, before increasing to near the time series average in 2013 and 2014. Striped mullet CPUE declined in

2015 to approximately 45 fish per sample, declined again in 2016 to 20 fish per sample and remained low in 2017 at 26 fish per sample.

From 2004 through 2017 the size range of striped mullet captured during the January to April portion of P146 sampling generally ranged from 120 to 550 millimeters FL (juveniles excluded; Figure 5). Modal length was 280 millimeters FL in the 2004-2007 time block, 260 millimeters FL in the 2008-2011 time block, 270 millimeters FL in the 2012-2015 time block and 310 millimeters FL in the 2016-2017 time block. The length frequency distribution began to truncate during the 2012-2015 time block and truncated further in the 2016-2017 time block. Modal age of striped mullet from P146 was two during the 2004-2007 time block, one during the 2008-2011 time block, one during the 2012-2015 time block, and two during the 2016-2017 time block (Figure 6). Few striped mullet over age two are captured during P146 sampling.

The fisheries independent gill net Survey, also known as Program 915 (P915), has sampled in Hyde and Dare Counties since 2001 and the Neuse, Pamlico, and Pungo rivers since 2003. Sampling in the Cape Fear and New rivers was added in 2008, and sampling in Carteret County was added in 2018. To provide the most relevant striped mullet index from the independent gill net survey data were limited to samples from shallow river areas (Pamlico, Pungo and Neuse rivers) during October-November, where and when most striped mullet occurred. The survey primarily catches adult striped mullet, so juveniles were excluded from analysis. From 2004-2014 striped mullet CPUE generally fluctuated between 7-16 striped mullet per sample (Figure 7). Striped mullet CPUE dropped significantly in 2015 to 3.7 and then again in 2016 to a time series low of 3.1 striped mullet per sample. Striped mullet CPUE remained low in 2017 at 3.4 fish per sample.

From 2004 through 2017 the size range of striped mullet captured during the October to November portion of P915 sampling in the Pamlico and Neuse rivers generally ranged from 220 to 600 millimeters FL (juveniles excluded; Figure 8). Modal length was 310 millimeters FL in the 2004-2007, 2008-2011 and 2012-2015 time blocks, and 330 millimeters FL in the 2016-2017 time block. The length frequency distribution began to truncate during the 2012-2015 time block and truncated further in the 2016-2017 time block. Modal age of striped mullet from P915 was two during every time block (Figure 9).

In October 1990, the NCDMF initiated the striped bass independent gill net survey, also known as Program 135 (P135). The survey was designed to monitor the striped bass population in the Albemarle Sound and Roanoke River but also encounters striped mullet. To provide the most relevant striped mullet index from the striped bass independent gill net survey data were limited to those collected from 2.5-inch to 5.5-inch mesh sizes during November through February (fall-winter), when and where the majority of striped mullet occurred. Since the survey primarily catches adult striped mullet, juveniles were excluded from calculations. Data were also limited to those collected in less than 10 feet of water because these samples covered most of the water column. Striped mullet CPUE averaged approximately three fish per set from 1994-2013 before peaking at 15 fish per set in 2014 and 13 fish per set in 2015 (Figure 10). Striped mullet CPUE decreased to a time series low of zero fish per set in 2016 and 2017. Modal length was 300 millimeters FL in the 2003-2007 and 2008-2012 time blocks, and 260 millimeters FL in the

2013-2017 time block (Figure 11). Since no striped mullet were captured in 2016 or 2017 no lengths were collected.

MANAGEMENT STRATEGY

The management strategy for the striped mullet fisheries in North Carolina is to: 1) optimize resource utilization over the long-term; 2) reduce user group conflicts; and 3) promote public education. The first strategy will be accomplished by protecting critical habitats and monitoring stock status. To address user group conflicts, a rule change was made to limit how much of a waterway may be blocked by runaround, drift, or other non-stationary gill nets. Specific user group conflict issues will continue to be dealt with on a case-by-case basis and management actions will be implemented to address specific fishery related problems. The NCDMF will work to enhance public information and education. Issues addressed in formulating Amendment 1 of the management plan for North Carolina's striped mullet fishery included: 1) resolution of the Newport River gill net attendance and 2) user group conflicts, and 3) updating the management framework for the N.C. striped mullet stock. See Table 5 for a summary of management strategies and outcomes.

Minimum and maximum landings triggers of 1.13 million and 2.76 million pounds have been established to monitor the striped mullet fishery. If landings fall below the minimum landings trigger or exceed the maximum landings trigger the NCDMF will initiate further analysis of the data to determine if a new stock assessment and/or interim management action is needed.

RESEARCH NEEDS

The following research needs were compiled from those listed in Amendment 1.

- Initiate a fishery independent adult striped mullet survey in the Core and Bogue sound areas where approximately 20 percent of the striped mullet harvest occurs – HIGH (independent gill net survey will begin in 2018)
- Develop a reliable fisheries independent index of juvenile abundance – HIGH (Needed)
- Initiate a tagging study to provide estimates of stock size, fishing mortality, and natural mortality that are not dependent on assumptions about steepness – HIGH (Needed)
- Increase the number of age samples from both fisheries dependent and fisheries independent sources – MEDIUM (Ongoing)
- Investigate how catchability of striped mullet by NCDMF Program 146 is affected by variations in salinity and conductivity and expand survey to other coastal rivers and tributaries – MEDIUM (Needed)
- Initiate a study to estimate fecundity and update the current maturity schedule microscopically – MEDIUM (Needed)
- Initiate a survey to estimate RCGL landings of striped mullet to estimate recreational landings, as well as social and economic elements of the striped mullet fishery – MEDIUM (Ongoing through NCDMF)
- Increase sampling of the commercial bait mullet cast net fishery to improve estimates of striped mullet and white mullet harvest – LOW (Needed)

- Restart fishery independent cast net sampling to improve estimates of the proportion of striped mullet and white mullet in this fishery – LOW (Needed)
- Analyze the data from the CRFL recreational cast net and seine survey to better characterize the recreational striped mullet fishery, including the social and economic elements – LOW (Needed)
- Improve recreational fisheries statistics provided by the Marine Recreational Information Program (MRIP) or some other program to reliably characterize the magnitude and length and age structure of recreational fisheries losses – LOW (Ongoing)
- Initiate a plankton survey covering all inlets to determine inlet use by striped mullet – LOW (Needed)
- Investigate the disappearance of males from the population after age three – LOW (Needed)
- Initiate and acoustic tagging study to determine spatial and temporal variations in habitat use throughout the state to help provide better indices for stock assessments – LOW (Needed)
- Implement public outreach on waste reduction of striped mullet in the commercial and recreational fisheries – LOW (Needed)

FISHERY MANAGEMENT PLAN RECOMMENDATION

Striped mullet commercial landings in 2016 were 965,198 pounds, which is below the minimum commercial landings trigger (1.13 million pounds) established in Amendment 1 of the Striped Mullet Fishery Management Plan. Following the management strategy in Amendment 1, the NCDMF initiated further analysis of all striped mullet data in July 2017 to determine if the decrease in striped mullet commercial landings is attributed to a stock decline, decreased fishing effort, or both.

The division presented preliminary data analysis and recommendations to the North Carolina Marine Fisheries Commission (NCMFC) at its November 2017 business meeting. At that time, the division recommended no management action but stated further analysis of commercial landings, specifically from trips that targeted striped mullet, and developing standardized fishery independent indices to account for the impact of environmental factors would be completed and presented to the NCMFC at their February 2018 business meeting. The division also recommended updating the data time series through 2017 for the commercial landings and fishery independent data to better assess trends in the striped mullet commercial fishery and striped mullet stock abundance.

While commercial landings of striped mullet did increase in 2017 (396,875 pound increase from 2016 commercial landings), compared to historical averages, the trend of depressed striped mullet commercial landings has continued. In further analysis, concerning trends in the commercial fishery were identified including; declines in the number of commercial trips landing striped mullet, declines in average pounds of striped mullet landed per trip, declines in the number of commercial trips targeting striped mullet, and declines in the average pounds of striped mullet landed per targeted trip. Fishery independent indices, including those used in the 2011 striped mullet stock assessment, indicated low abundance of striped mullet from 2015

through 2017. Standardized fishery independent indices, accounting for environmental variables, also indicated low abundance of striped mullet from 2015 through 2017.

Based on results of the completed data analysis the division concluded that the striped mullet stock had likely declined since completion of the 2013 stock assessment (terminal year 2011). At the February 2018 NCMFC business meeting, the division recommended updating the 2013 stock assessment model to include data through 2017 prior to taking any management action. As an assessment update, there were no changes to model parameters and peer review was not required, as the configuration of the model that previously passed peer review was maintained. Results of the stock assessment update indicate overfishing is not occurring through 2017.

Following completion of the assessment update management options were developed, and the division selected a preferred option. Per the striped mullet FMP, management options were brought to the Finfish, Southern, and Northern advisory committees in July 2018 to receive their input, and their recommendations will be presented to the NCMFC at its August 2018 business meeting. At that meeting, the commission will be asked to decide on management options to be implemented via proclamation authority of the Fisheries Director. Implementing management measures in August 2018 provides adequate time for management measures to be in place prior to the peak of the 2018 fishing season, which occurs in the fall. Any changes to striped mullet management would be made as a revision to the existing plan.

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TABLES

Table 1. Number of trips, number of mullet harvested, number of mullet released, and total number of mullet caught in the recreational cast net fishery estimated from the NCDMF mail survey with associated percent standard error (PSE) by wave, 2012-2017. Estimates with a PSE value greater than 50 are shaded in gray.

Year	Wave	Total Effort	PSE Effort	Total Harvest	PSE Harvest	Total Releases	PSE Releases	Total Catch	PSE Catch
2012	Jan/Feb	10,484	22.1	23,346	32.8	9,050	42.3	32,395	32.4
	Mar/Apr	9,734	19.8	17,055	32.0	3,931	57.2	20,986	31.8
	May/Jun	20,903	12.5	84,180	25.7	26,845	32.9	111,025	23.9
	Jul/Aug	29,725	13.8	107,409	23.7	64,453	29.6	171,862	21.3
	Sep/Oct	29,810	11.3	135,318	19.9	72,941	16.0	208,259	15.5
	Nov/Dec	21,094	15.9	24,484	38.0	31,774	26.5	56,258	26.0
2013	Jan/Feb	12,635	18.6	26,244	51.4	6,668	39.1	32,911	46.4
	Mar/Apr	8,642	24.1	6,915	69.5	2,741	56.4	9,656	52.2
	May/Jun	24,541	11.8	25,409	40.4	21,957	30.5	47,366	29.9
	Jul/Aug	41,197	11.3	210,888	23.4	121,012	21.7	331,900	20.1
	Sep/Oct	25,277	16.6	33,918	46.0	39,065	26.1	72,983	31.0
	Nov/Dec	25,666	15.3	37,667	27.3	34,740	30.9	72,407	23.8
2014	Jan/Feb	5,036	25.7	4,886	82.2	744	70.9	5,631	73.7
	Mar/Apr	15,247	19.7	11,284	53.1	1,563	69.2	12,847	50.7
	May/Jun	28,343	13.1	39,438	33.2	22,465	23.6	61,903	24.4
	Jul/Aug	42,572	12.0	37,774	36.9	56,604	20.4	94,378	22.2
	Sep/Oct	63,250	12.7	82,343	23.2	146,886	17.3	229,229	16.0
	Nov/Dec	24,174	14.6	29,518	29.6	24,946	25.6	54,464	21.2
2015	Jan/Feb	6,554	26.0	11,172	52.5	2,884	54.8	14,056	48.2
	Mar/Apr	13,338	18.8	9,870	40.8	5,880	33.6	15,751	35.3
	May/Jun	49,792	12.2	103,793	22.9	48,774	26.3	152,567	19.5
	Jul/Aug	63,706	10.6	149,016	20.0	133,629	20.5	282,645	16.1
	Sep/Oct	37,938	11.0	32,683	30.0	39,298	19.8	71,981	18.2
	Nov/Dec	24,264	17.7	34,817	36.7	34,672	25.5	69,489	25.2
2016	Jan/Feb	11,400	28.3	.	.	73	100.0	73	100.0
	Mar/Apr	13,803	20.5	15,411	49.5	1,238	63.5	16,649	46.2
	May/Jun	35,478	14.4	28,748	37.0	40,159	31.4	68,907	26.6
	Jul/Aug	51,299	11.8	140,659	29.5	112,351	22.0	253,010	19.8
	Sep/Oct	41,928	11.9	42,855	26.5	29,109	20.7	71,964	19.7
	Nov/Dec	33,813	16.7	43,571	46.4	33,017	32.2	76,588	37.9
2017	Jan/Feb	6,178	25.3	5,722	65.1	994	70.9	6,716	63.1
	Mar/Apr	17,512	15.9	20,607	35.7	13,568	30.5	34,175	30.9
	May/Jun	36,167	13.4	64,209	35.4	54,339	22.3	118,548	24.6
	Jul/Aug	55,330	13.7	92,670	23.6	95,611	18.8	188,281	17.5
	Sep/Oct	40,032	13.8	93,323	21.7	54,989	25.8	148,312	19.6
	Nov/Dec	27,478	14.4	44,132	29.9	28,040	27.3	72,172	24.3

Table 2. North Carolina RCGL survey estimates of the number of striped mullet harvested, pounds harvested, number released, and total number caught. The RCGL survey was conducted from 2002-2008, funding was discontinued in 2009.

Year	Number Harvested	Pounds Harvested	Number Released	Total Number
2002	66,305	64,213	6,549	72,854
2003	28,757	24,774	3,514	32,270
2004	34,736	35,947	2,875	37,611
2005	35,888	36,314	3,492	39,380
2006	38,175	37,385	5,352	43,527
2007	35,472	40,168	7,449	42,921
2008	51,465	51,785	9,207	60,672

Table 3. Mean length, minimum length, maximum length (mm fork length), and total number of striped mullet measured from North Carolina commercial fish house samples, 2005-2017.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	343.5	199	574	10,270
2006	347.5	197	563	12,108
2007	343.2	180	698	12,188
2008	357.6	208	612	13,263
2009	359.2	202	568	8,241
2010	352.6	206	577	10,991
2011	353.5	166	561	7,751
2012	356.6	200	565	12,833
2013	360.5	212	617	8,535
2014	349.5	195	610	6,527
2015	360.5	205	632	5,923
2016	364.3	226	612	5,661
2017	361.6	199	726	4,480

Table 4. Modal age, minimum age, maximum age and total number of striped mullet aged from fishery independent and fishery dependent sampling, 2004-2017.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2004	2	0	9	1,142
2005	1	0	10	654
2006	2	0	10	685
2007	2	0	10	699
2008	2	0	10	771
2009	2	0	13	349
2010	2	1	8	748
2011	2	0	14	633
2012	2	0	6	873
2013	2	0	7	850
2014	2	0	6	855
2015	2	0	6	794
2016	2	0	8	956
2017	1-2	0	15	695

Table 5. Summary of management strategies and outcomes from the NCMFC rules adopted in April 2006.

MANAGEMENT STRATEGY	**OUTCOME**
Implement a recreational harvest limit of 200 mullet per person, per day – currently there are no bag restrictions for mullet.	Completed, MFC Rule April 2006 adoption 15ANCAC 03M.0502 (a), (b)
Modify mutilated finfish rule to exempt mullet when used as bait.	15ANCAC 03M.0101

FIGURES

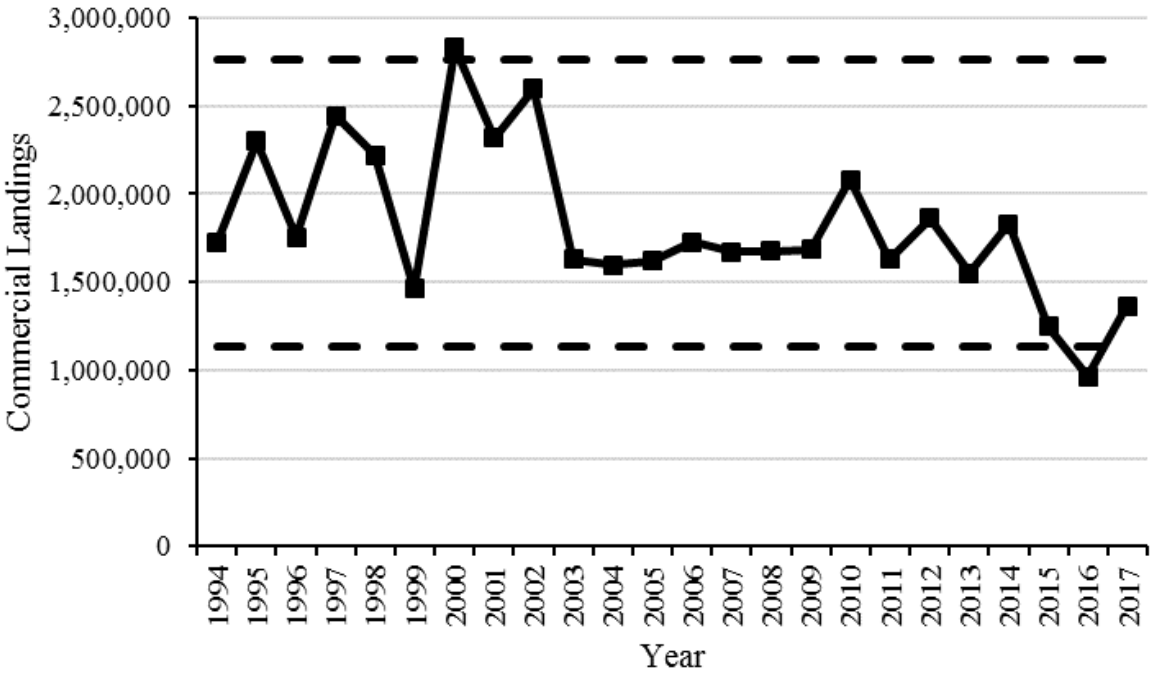

Figure 1. Commercial landings of striped mullet, 1994-2017. Dashed lines represent upper (2.76 million lb.) and lower (1.13 million lb.) landings limits that would trigger a closer examination of data. Landings limits were changed from upper and lower limits of 3.1 million and 1.3 million pounds by Amendment 1 (NCDMF 2014).

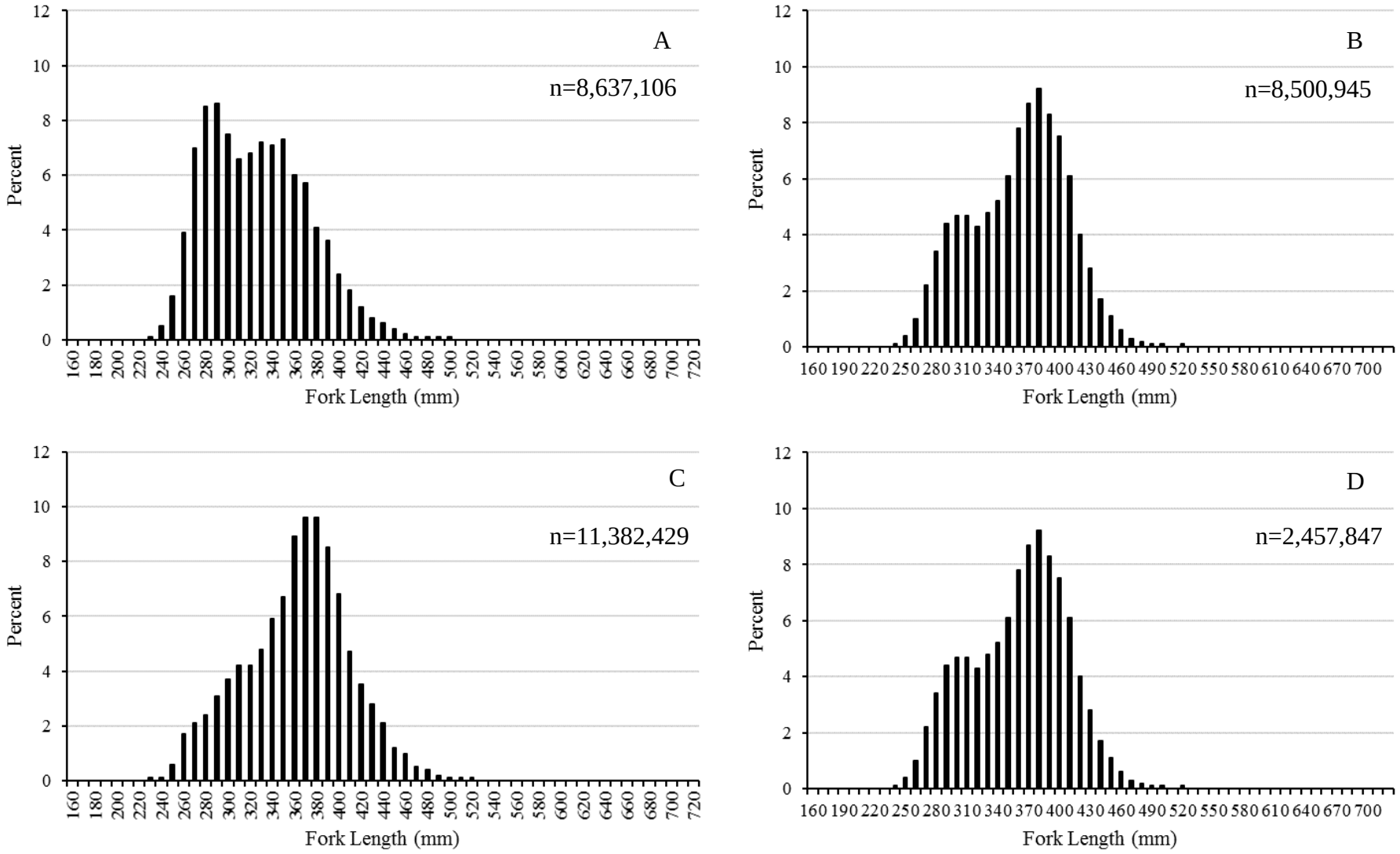

Figure 2. Expanded length-frequency of striped mullet from the commercial fishery based on NCDMF fish house sampling, 2004-2017. Panel A is 2004-2007; Panel B is 2008-2011; Panel C is 2012-2015; and Panel D is 2016-2017.

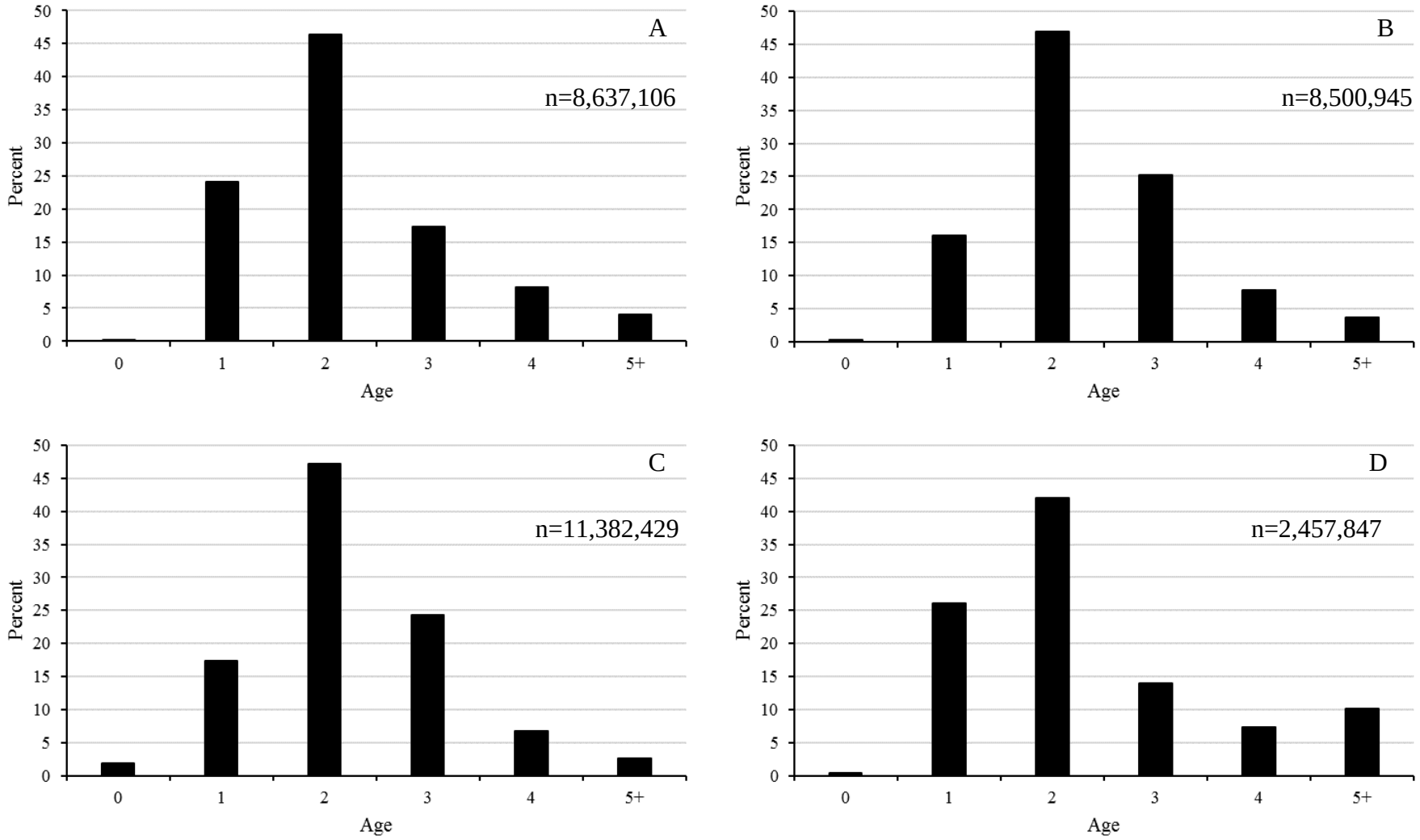

Figure 3. Expanded age-frequency of striped mullet from the commercial fishery based on otolith ages, 2004-2017. Panel A is 2004-2007; Panel B is 2008-2011; Panel C is 2012-2015; and Panel D is 2016-2017.

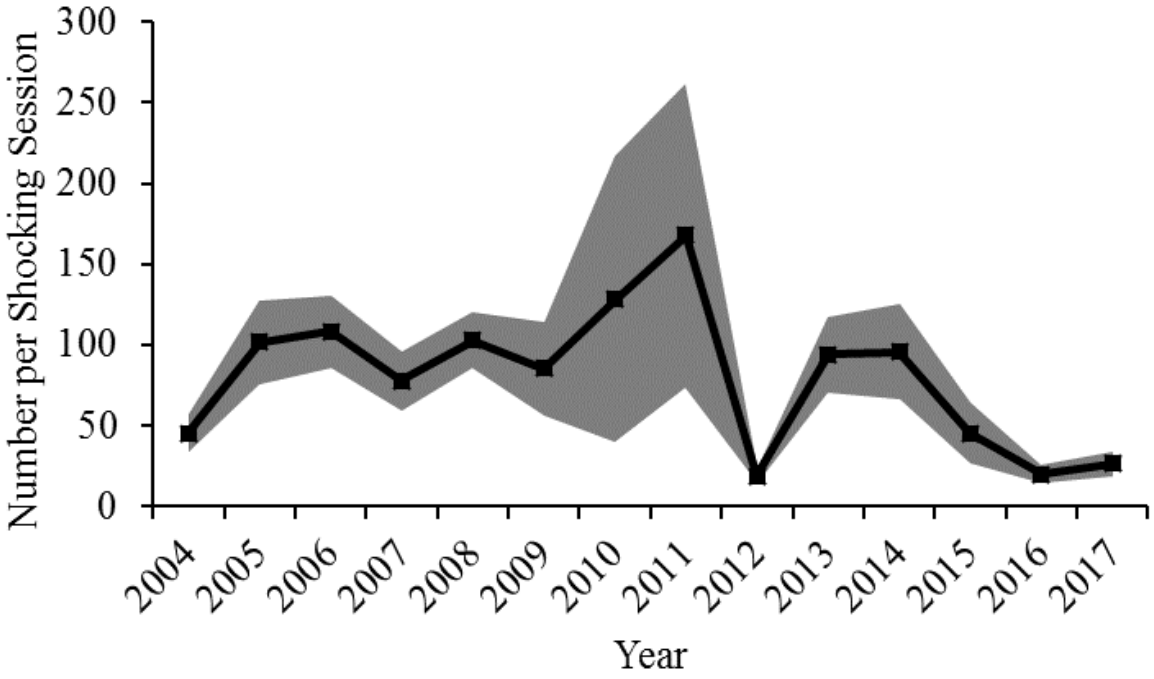

Figure 4. Number of striped mullet per 500 m sampling session from the striped mullet electrofishing survey (P146), 2004-2017. To provide the most relevant index, data were limited to those collected during January through April. The shaded area represents standard error.

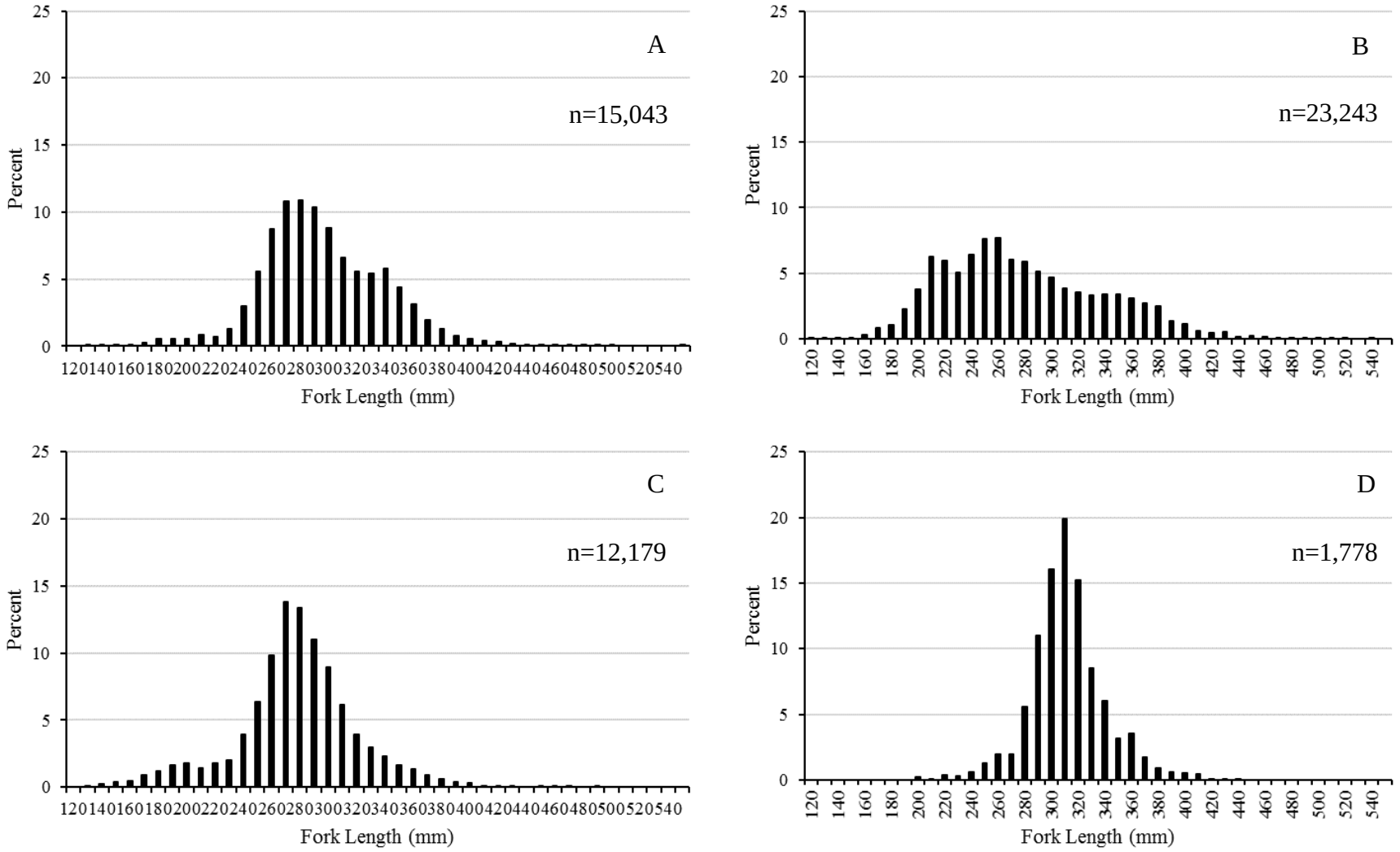

Figure 5. Expanded length-frequency of striped mullet from the striped mullet electrofishing survey (P146), 2004-2017. Lengths include striped mullet collected during January-April. Panel A is 2004-2007; Panel B is 2008-2011; Panel C is 2012-2015; and Panel D is 2016-2017.

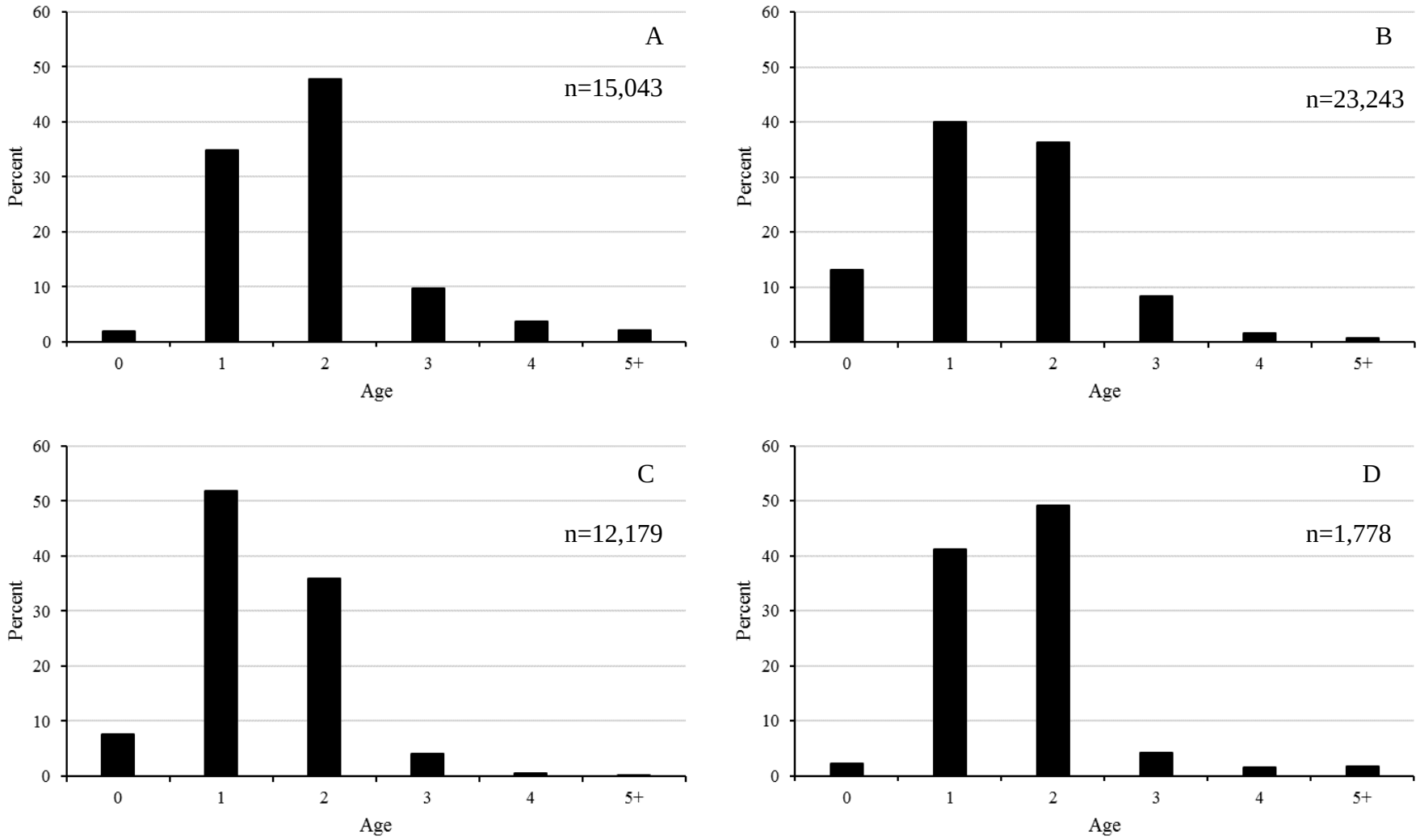

Figure 6. Expanded age-frequency of striped mullet from the striped mullet electrofishing survey (P146) based on otolith ages, 2004-2017. Striped mullet from January-April are included in expansions. Panel A is 2004-2007; Panel B is 2008-2011; Panel C is 2012-2015; and Panel D is 2016-2017.

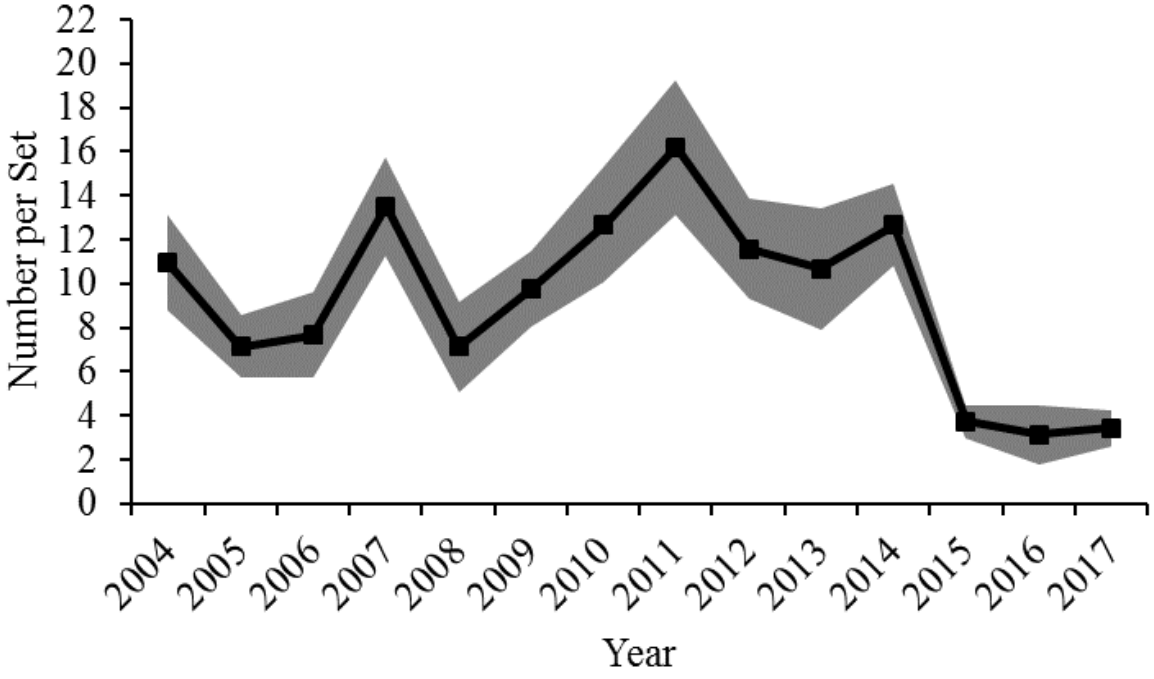

Figure 7. CPUE (number/set) of striped mullet from the independent gill net survey (P915), 2004-2017. To provide the most relevant index, only shallow river (Neuse, Pamlico, Pungo) samples collected during October-November were included. The shaded area represents standard error.

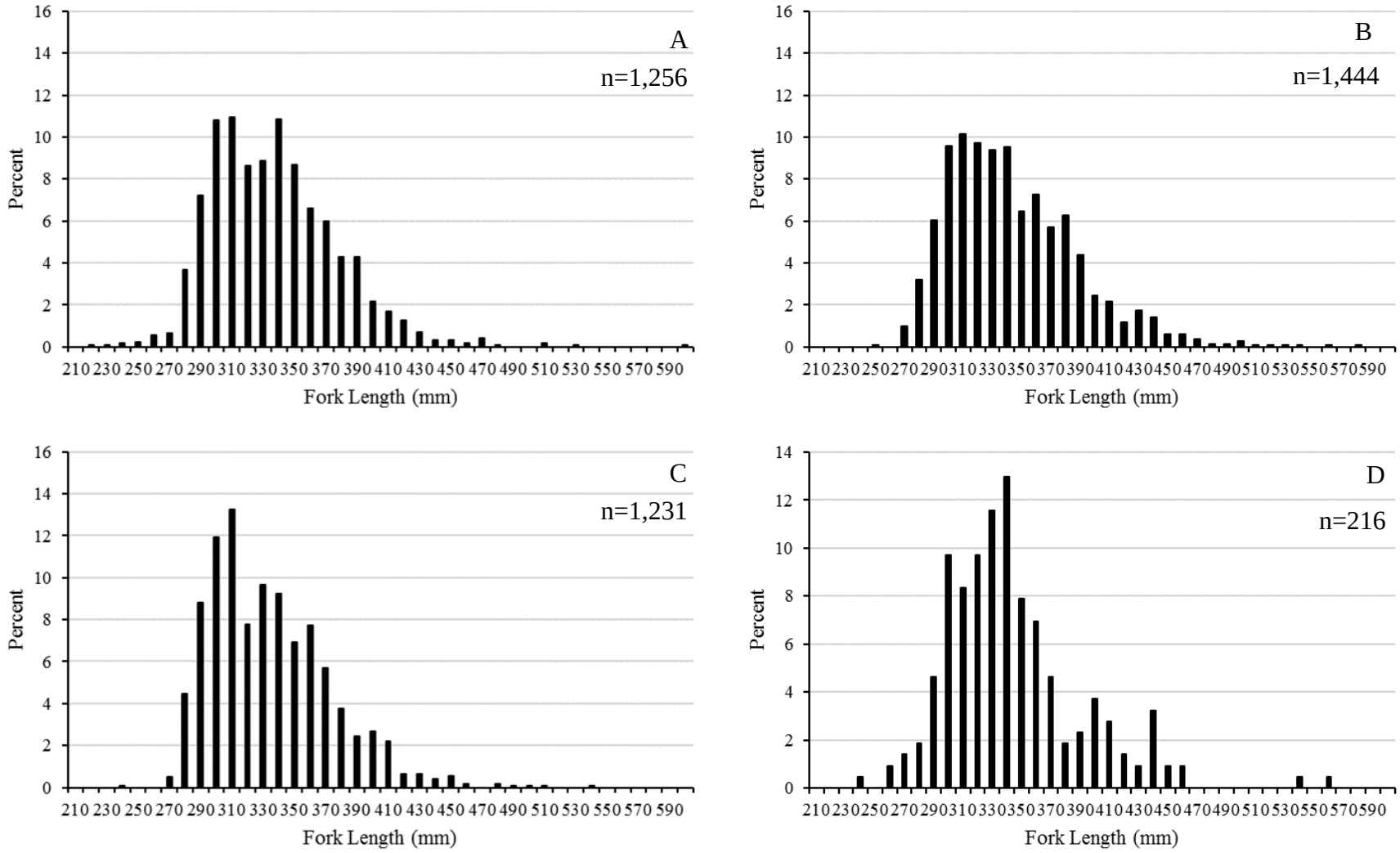

Figure 8. Expanded length-frequency of striped mullet from the independent gill net survey (P915), 2004-2017. Lengths include striped mullet from shallow river (Neuse, Pamlico, Pungo) samples collected during October-November. Panel A is 2004-2007; Panel B is 2008-2011; Panel C is 2012-2015; and Panel D is 2016-2017.

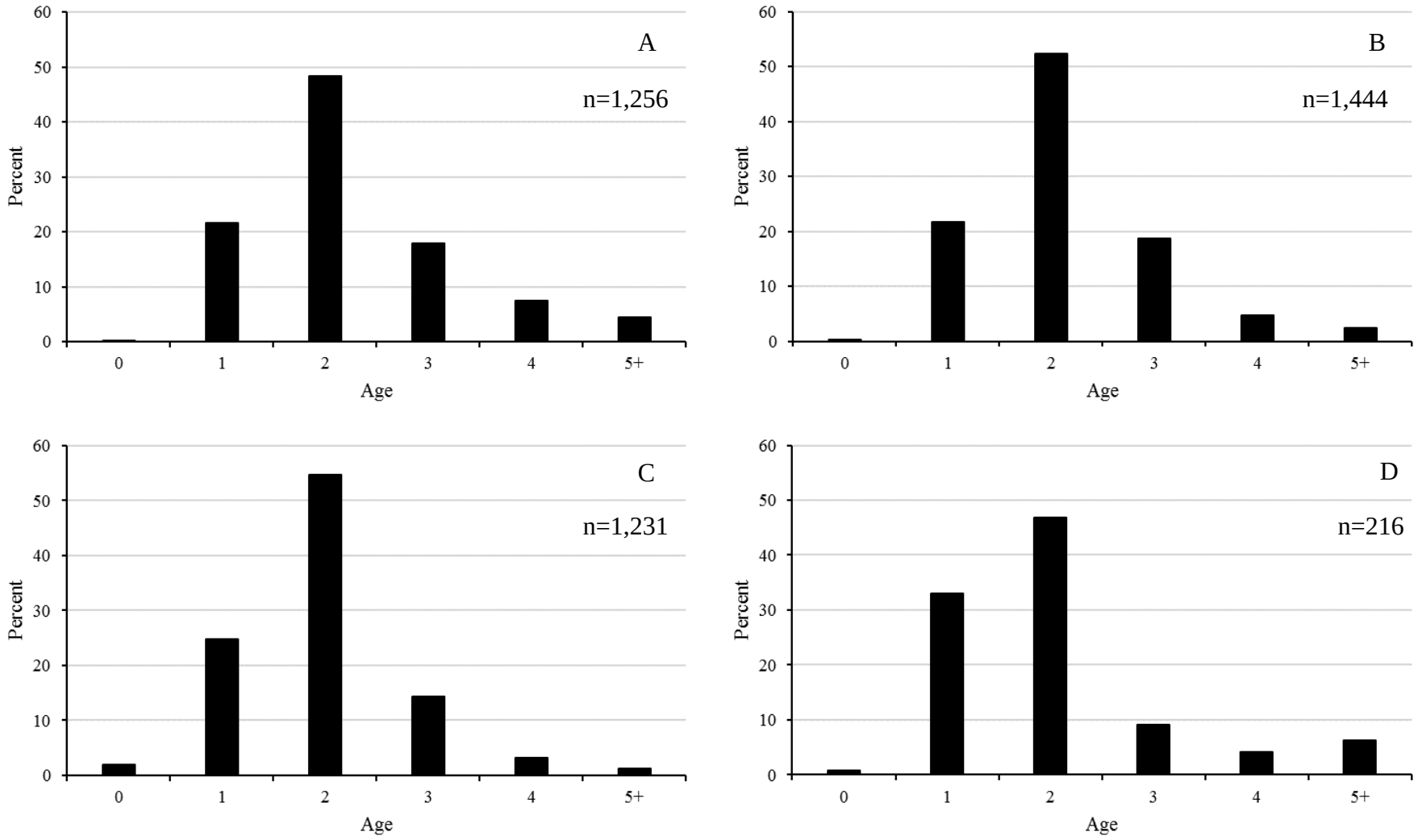

Figure 9. Expanded age-frequency of striped mullet from the independent gill net survey (P915) based on otolith ages, 2004-2017. Striped mullet from shallow river (Neuse, Pamlico, Pungo) samples collected during October-November were included in expansions. Panel A is 2004-2007; Panel B is 2008-2011; Panel C is 2012-2015; and Panel D is 2016-2017.

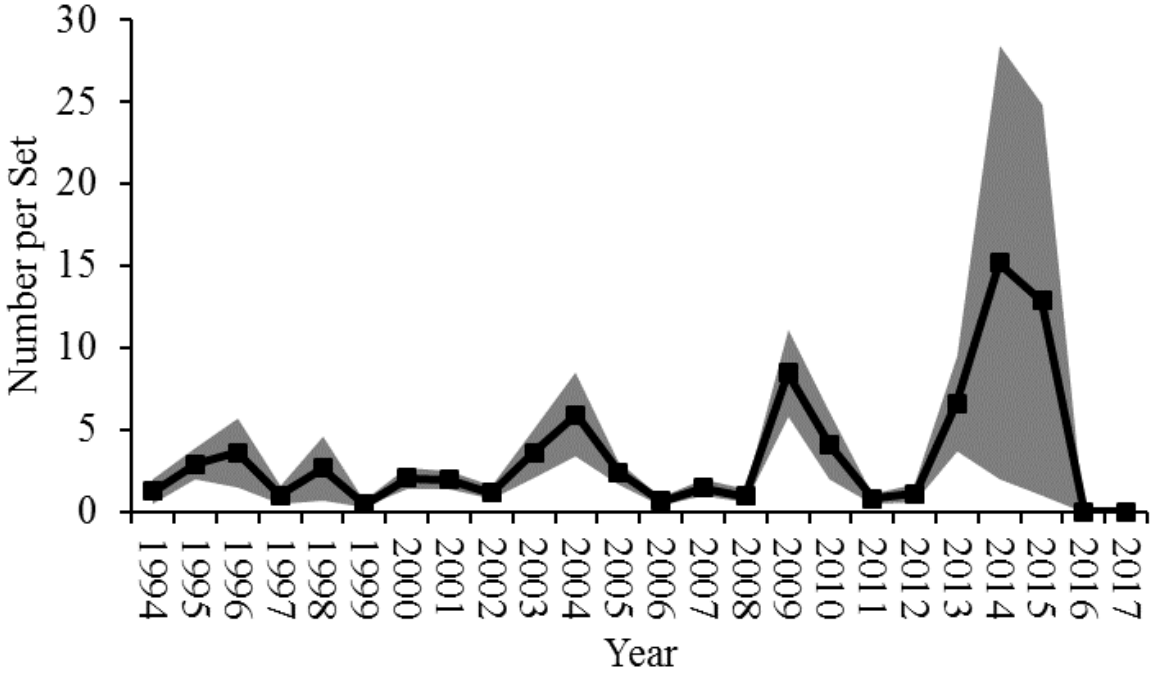

Figure 10. CPUE (number/set) of striped mullet from the striped bass independent gill net survey (P135), 1994-2017. To provide the most relevant index, only shallow river (Neuse, Pamlico, Pungo) samples collected during October-November were included. The shaded area represents standard error.

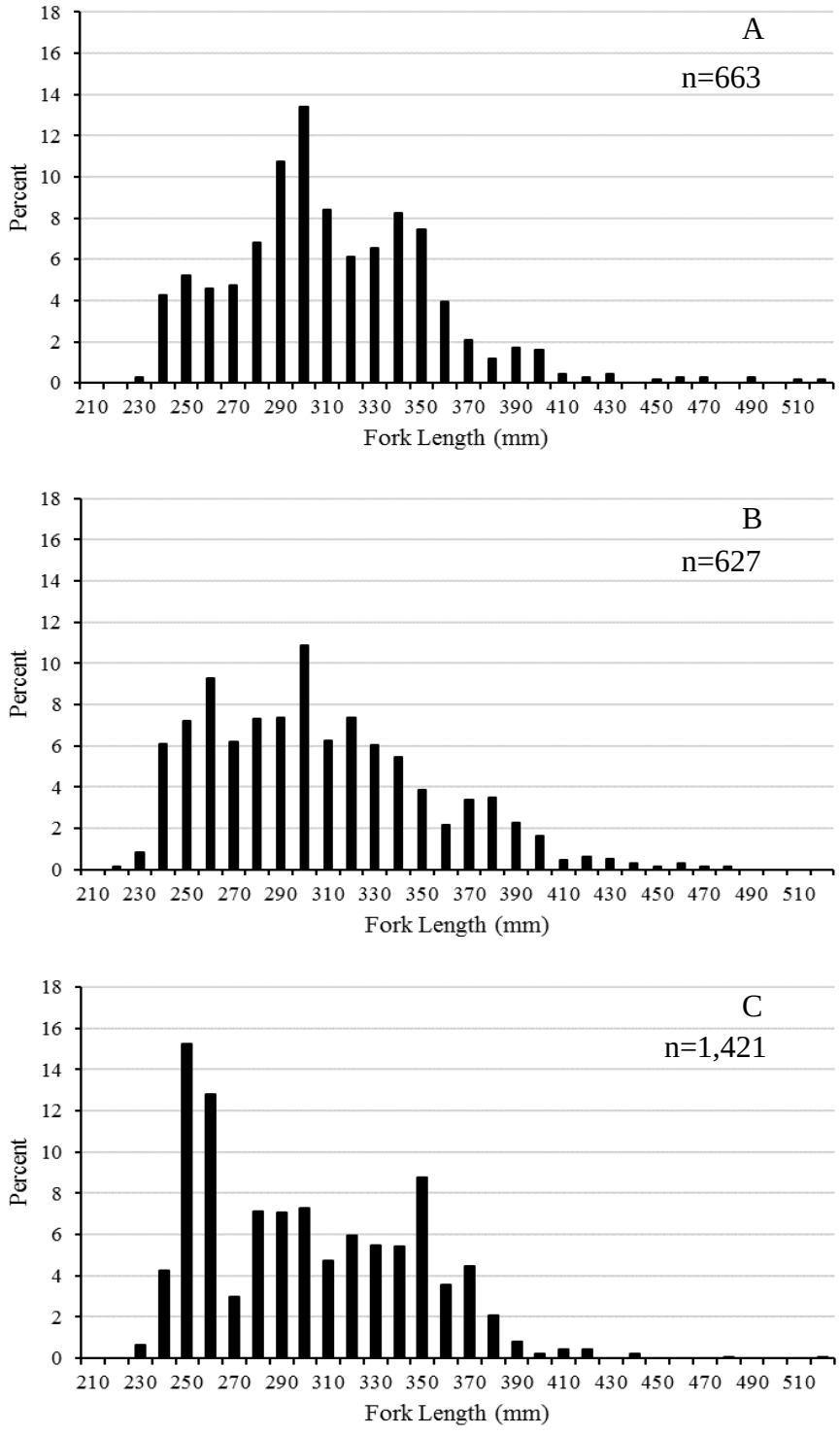

Figure 11. Expanded length-frequency of striped mullet from the fall-winter portion of the striped bass independent gill net survey (P135), 2003-2017. Panel A is 2003-2007; Panel B is 2008-2012; Panel C is 2013-2017. No striped mullet were caught in 2016 or 2017 so no length data is included.