Length-weight, Age and Growth, and Landings Observations for Sheepshead *Archosargus probatocephalus* from North Carolina

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Sheepshead *Archosargus probatocephalus* range from Nova Scotia to Brazil (Robins and Ray 1986). Three subspecies have been recognized, based on the number and size of body bars: *A. p. probatocephalus* ranges along the Atlantic coast of the United States; *A. p. oviceps*, from St. Mark's, Florida to the Campeche Banks; and *A. p. aries*, from Belize to Babia de Sepetiba, Brazil (Caldwell 1958, 1965). Little is known concerning length-weight or age and growth relationships for this common edible fish.

This paper presents the age and growth and length-weight relationships, reviews changes in historical catch for sheepshead from North Carolina, and resolves discrepancies in the literature concerning maximum length and weight of this species (Hildebrand and Schroeder 1928, Hildebrand and Cable 1938, Bigelow and Schroeder 1953, Robins and Ray 1986).

Methods

Most specimens were captured in 12-m otter trawls, 91-m gillnets, or by spear. Most specimens were obtained from two sites where sheepshead are presently common in North Carolina: the Masonboro and Carolina Beach Inlets-Cape Fear River area of New Hanover and Brunswick counties, and Radio Island Jetty, Carteret County, extending from Beaufort Inlet in the Atlantic Ocean to just south of Shackleford Banks and Cape Lookout Jetty. The largest specimens and the state record-sized fish were caught in the Carolina Beach area by hook-and-line fishermen as part of the state's fishing citation program. Specimens were measured to the nearest millimeter standard (SL) and total length (TL) and weighed to the nearest gram, except for the tournament fish, which represented the upper end of the length-weight curve and were weighed to the nearest 114 g. Conversion from total length to standard length, for study fish larger than 100 mmSL, was possible by the formula $SL = 0.817TL$, $N = 240$; for fish smaller than 100 mmSL the conversion formula was $SL = 0.780$ TL. The latter conversion was determined by utilizing data for 412 young specimens (6–48 mm) measured by Hildebrand at Beaufort, North Carolina in 1914 (Hildebrand's field notes, Inst. Mar. Sci., Morehead City). Length-weight and standard length-scale radius relationships were calculated using log-log formulas where $\log(y) = a + b \log(x)$, where x is either standard length or scale radius, measured from the focus to the outer lateral edge of the scale, and y equals weight.

Scales were removed for ageing from just below the spinous/soft-ray dorsal-fin junction and the area above the lateral line. Scales were read at 10K magnification using a Baush and Lomb dissecting microscope. No validation of annulus formation was attempted considering the diverse availability of specimens. Therefore, the values I report are only presumed ages.

Results

The length-weight relationship for 282 sheepshead, measuring 9–591 mmSL (723 mmTL) and weighing 0.042–8370 g (18 lb, 7 oz), was calculated by the formula $\log(y) = -4.5287 + 3.0446 \log(x)$, $r = 0.9929$ (Fig. 1).

A linear relationship between standard length and scale radius was described for 68 fish measuring 31–525 mmSL by the formula $\log(y) = 0.8801 + 0.820 \log(x)$, $r = 0.9789$. Too few scales from specimens smaller than 30 mm were available for inclusion in the relationship calculation. Scales of fish 17–400 mmSL or those to age 4 were easy to read. Scales of older and larger specimens were difficult to read as the focus often became opaque and thickened, thereby obscuring the first two annuli.

Backcalculations of age and size from 50 of the best scales suggested seven age-classes (Table 1); however, these did not agree with a simple length-frequency plot where eight age classes seemed to prevail (Fig. 2). Also the maximum backcalculated size was 482 mm, whereas the largest fish studied was 525 mmSL. This discrepancy strengthened the observation that perhaps one or two annulae were obscured on scales of specimens larger than 400 mmSL, which were probably older than 8 years of age.

Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

Manuscript accepted 29 June 1990.
Fishery Bulletin, U.S. 88:829–832.

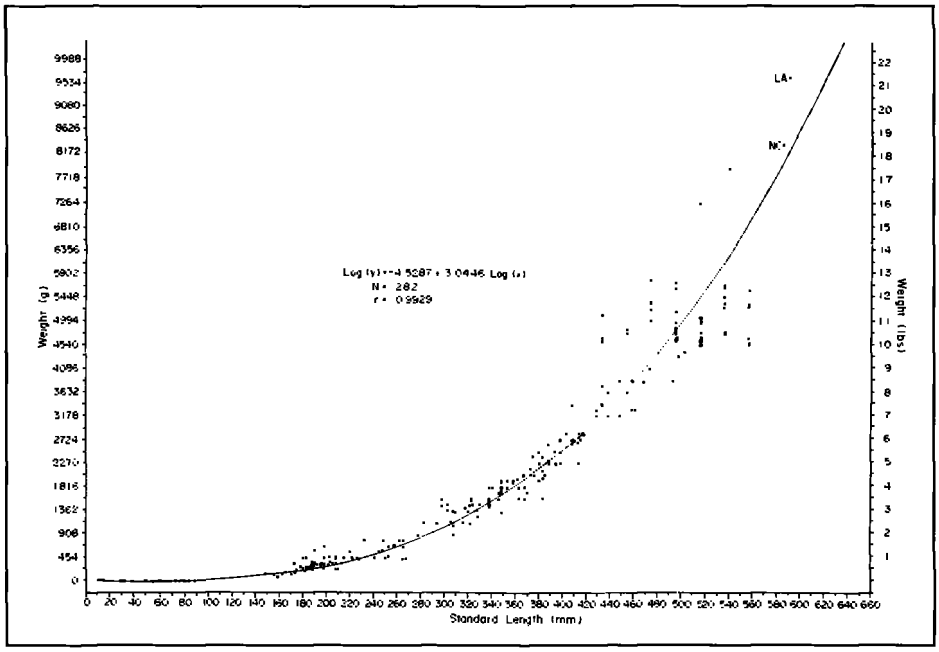

Figure 1
Length-weight relationship for 282 sheepshead captured in North Carolina. NC = largest North Carolina specimen; LA = world record Louisiana sheepshead.

Table 1
Backcalculation of standard lengths at presumed age for sheepshead from North Carolina.

		Age							
N	Y of Y	1	2	3	4	5	6	7	8
2	67	91							
30	73	156	189						
1	74	142	218	237					
1	106	158	205	248	295				
7	100	177	242	316	349	381			
7	81	135	242	274	325	366	387		
1	95	140	225	322	351	372	411	432	
1	97	138	222	266	355	397	422	466	482
		Weighted mean							
50	79	152	207	289	336	375	394	449	482
		Increment							
		73	55	82	47	39	19	55	33

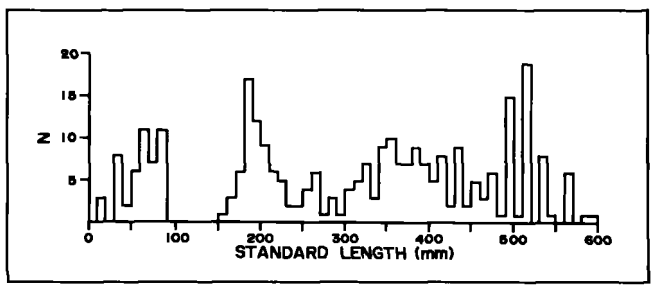

Figure 2
Length-frequency histogram, in 10-mm units, of the 282 sheepshead captured in North Carolina.

Discussion

Only Ogburn (1984) has examined the length-weight of sheepshead from Masonboro Inlet Jetty, New Hanover County, NC. Her specimens measured 56–340 mmSL and weighed 4.3–1535 g, $N = 45$; data on five extremely small specimens, 56–63 mmSL, were excluded from the length-weight relationship. However, recalculation of this relationship, using all data, yielded the equation $\log (y) = -4.6927 + 3.1309 \log (x)$, $r = 0.9829$. Superimposing that recalculation on Figure 1 indicated good agreement between her data and that reported here.

Mook (1977) noted scales on 10–12 mm specimens. Johnson (1978) noted no scales for specimens of 12-mm lengths, but did depict them on a 17-mm specimen. North Carolina specimens smaller than 16 mm possessed no scales but their outlines were present on 11–12 mmSL specimens.

A variety of structures have been used to age fishes (Summerfelt and Hall 1987). The reason only scales were used to age sheepshead was that they were the only structures consistently available during this study, as the fish were obtained from many sources or could not be kept for age determination by vertebra, otoliths, etc.

The largest sheepshead from nearby South Carolina were 513 mmSL (641.4 mmTL) weighing 6015.5 g, and 505 mmSL (625 mmTL) weighing 4900 g (D. Hammond and E. Wenner, S.C. Wildl. Mar. Res. Dep., Charleston, pers. commun., Jan. 1990). These data also fall within the length-weight curve plotted for North Carolina sheepshead (Fig. 1).

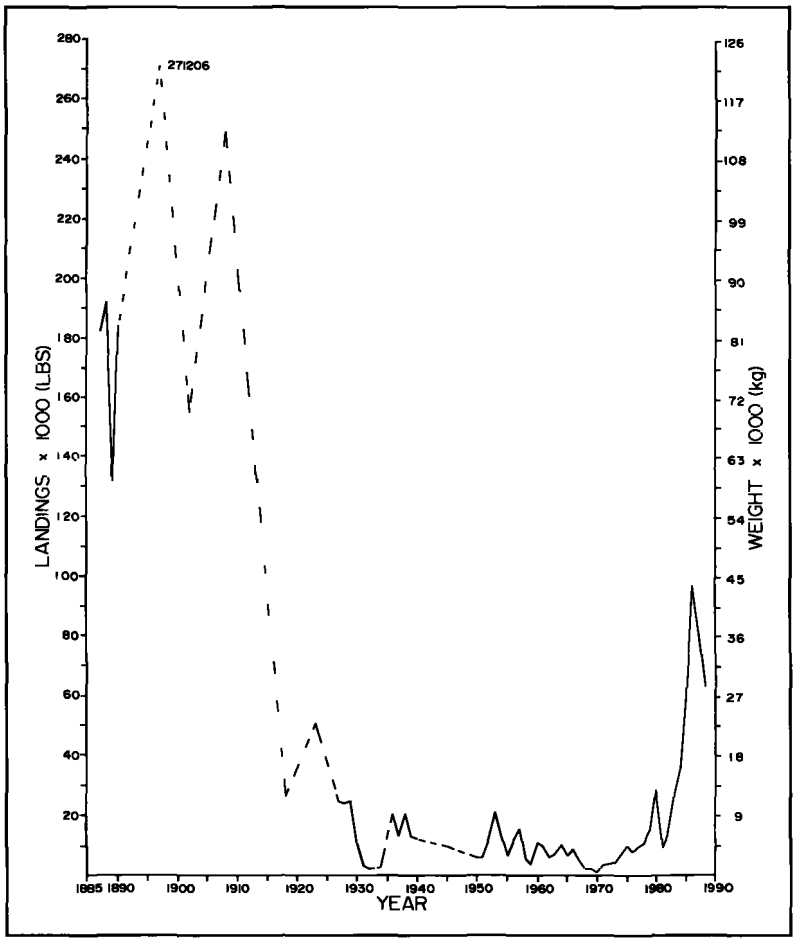

Figure 3
North Carolina catch landings for sheepshead, 1887–1989. Dashed lines indicate missing year data.

Like Hildebrand and Cable (1938) for Beaufort, NC, and Springer and Woodburn (1960) for Gulf of Mexico sheepshead, the smallest North Carolina sheepshead were also captured between May and October. Note the peculiar hiatus in the length frequency and length-weight curve (Figs. 1, 2) for sheepshead 90–150 mmSL. Absence of specimens within these size ranges may have been caused by their shifting from a seagrass habitat to piling, jetty, and other hard substrates preferred by larger young and adults (Hildebrand and Cable 1938, Johnson 1978).

A search of major museums and taxidermist records has failed to uncover sheepshead that attain the size and weight (91 cm and 9–13.5 kg) reported in the literature (Hildebrand and Schroeder 1928, Hildebrand and Cable 1938, Bigelow and Schroeder 1953, Robins and Ray 1986). Even if 91 cm was an accurate total-length measurement, conversion to SL would make that specimen 743 mm, a size far larger than even the officially recognized world-record specimen from Louisiana (probably *A. p. oviceps*), which was 596 mmSL and 730 mmTL, and weighed 9648 g (21 lb, 4 oz, and plotted in Figure 1) and would fall far outside the length-weight data depicted in Fig. 1. This is strong evidence that sheepshead do not attain the large sizes mentioned in the literature. In essence, future literature should be emended to note that the maximum sizes of sheepshead in North Carolina, to date, are 591 mmSL, 723 mmTL, weighing 8370 g, and elsewhere 596 mmSL, 730 mmTL, weighing 9248 g. All larger sizes reported should remain or be considered erroneous.

A dramatic shift in the commercial landings of sheepshead (mostly caught by haul seine) has occurred in North Carolina between 1887 and 1989 (Fig. 3) (Chestnut and Davis 1975; Goode 1884; NC Div. Mar. Fish. statistical data, Morehead City). Yarrow noted (Smith 1907) that sheepshead were very abundant in 1871. Commercial catches prior to 1900 remained over 61500 kg. Catches between 1918 and 1981 remained low (27000–47000 kg, lowest in 1970, 675 kg). Only since 1981 has a recent surge been noted in the landings (Fig. 3), mostly in Carteret County.

Hildebrand and Cable (1938) and Johnson (1978) noted that larval and juvenile sheepshead are usually found associated with seagrasses which they depend

upon for shelter and food. Whether the early and recent landings can be correlated with seagrass abundance remains unknown, for no early records of seagrass abundance exist prior to and following the wasting disease of the 1930s (Orth and Moore 1981, Short et al. 1987). To date, the beds have seemingly not increased (G. Thayer, NMFS Beaufort Lab., pers. commun., Jan. 1990). It would have been beneficial to know whether the early-life-history stages that depend on vegetation for food and protection were or are increasing in relation to seagrass incidence and just how dependent they are on that habitat for their growth and survival.

Acknowledgments

Thanks are extended to Dr. D. Lindquist, UNC-Wilmington, for access to specimens collected by Ogburn; to G. Ogburn for comments on her length-weight calculations; to K. Hartel of the Museum of Comparative Zoology (Harvard) for a search of possible specimens reported by Bigelow; and to taxidermists Cherfinski and Swanson of NC, and Bill Alden Reese Taxidermy, FL, for a search of their records for data on extremely large sheepshead. The International Game Fish Association, Fort Lauderdale, FL provided information on the world-record recognized sheepshead from Louisiana. C.R. Robins, Univ. Miami-RSMAS reviewed the manuscript and commented on large specimens. C. Manooch, NMFS Beaufort Lab., also reviewed the manuscript and provided helpful comments on age interpretation. D. Tootle and R. Piner of N.C. Division of Marine Fisheries, Morehead City, provided catch landings for years 1962–89, while Susanne Guthrie supplied size data for fish caught in North Carolina tournaments. G. Thayer, NOAA-NMFS, Beaufort, NC gave freely of his historical knowledge about seagrass abundances in NC. R. Barnes and H. Page of IMS produced the figures. B. Bright typed the manuscript.

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