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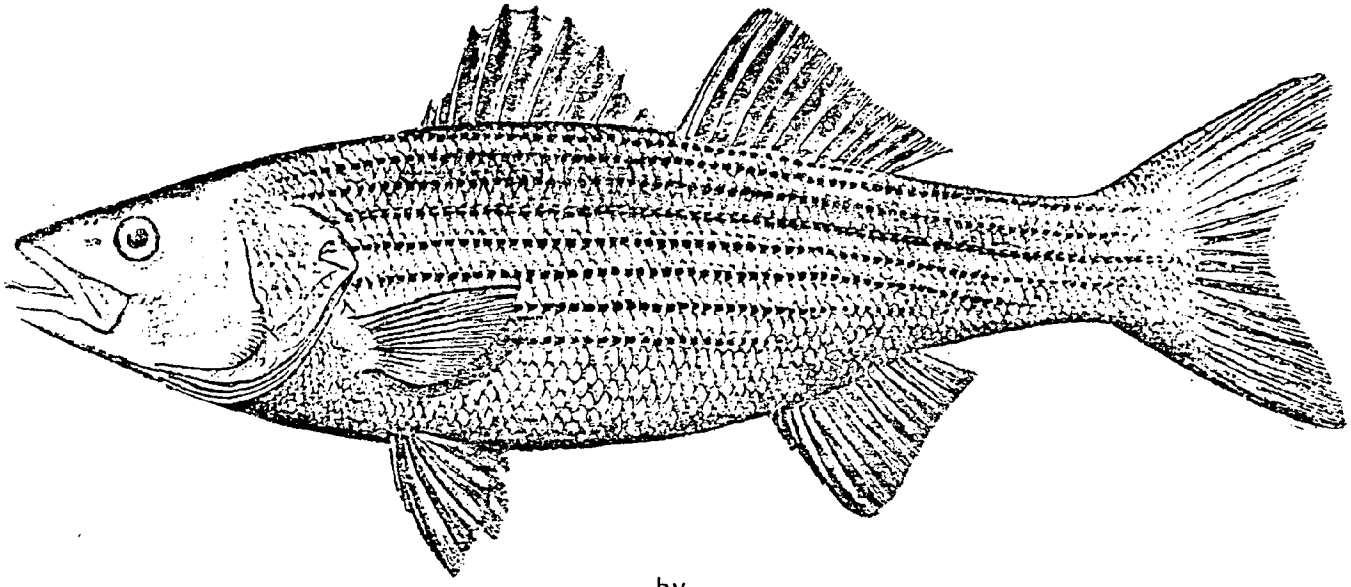
THE STATUS, ABUNDANCE, AND EXPLOITATION OF STRIPED BASS IN THE ROANOKE RIVER AND ALBEMARLE SOUND, NORTH CAROLINA, 1982, 1983



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Completion Report

Project AFC-19

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SUMMARY

1. The commercial landings of striped bass in North Carolina decreased in 1982 to 338,000 pounds. This was the lowest catch since 1939. The landings of striped bass have been under the million pound mark since 1977 following ten years (1967-1976) of landings exceeding one million pounds.
2. The 1983 commercial catch of striped bass in North Carolina amounted to 361,275 pounds which was above the 1982 landings.
3. In 1982 the greatest quantity of striped bass were landed in March (90,981 pounds) followed by February (62,166 pounds) and April (56,704 pounds).
4. In 1983 December accounted for the largest landings when 77,119 pounds were caught. This was followed by October with 72,447 pounds, March with 52,728 pounds, and February with 52,265 pounds.
   Minimal commercial landings of striped bass were recorded for the summer months in both 1982 and 1983.
5. Because of the commercial fishing regulations for striped bass in the Roanoke River in effect since 1981, only 398 fish were landed in the spring of 1982, and 650 in the spring of 1983.
6. In 1982 striped bass set gill nets accounted for 367 of the 398 striped bass caught (92.21%), herring-drift gill nets landed 27 striped bass (6.78%).
7. In 1983 striped bass set gill nets yielded 647 of the 650 striped bass caught (99.54%). Only 3 fish were landed in herring-drift gill nets (0.46%).
8. The commercial striped bass fishery was concentrated in the Williamston area in 1982 and 1983.
9. In 1982 the largest number of striped bass were caught during the week of April 12-18.
10. In 1983 the largest number of striped bass were caught during the week of April 11-17 (191) followed by the week of April 25-May 1 (186), and April 18-24 when 143 striped bass were landed.
11. During 1982 from May 1 to June 1 rod and reel striped bass catches at Weldon, N. C. amounted to 4,445 fish.
12. The rod and reel striped bass catches at Weldon, N. C. from April 30 to June 11 in 1983 amounted to 2,728 fish.

13. In the upper river in 1982 the sport catch of striped bass during the creel census, and before and after the census amounted to 5,497 striped bass, with a c.u.e. of 1.95 fish. Sport catches in the middle section of the river amounted to 219 striped bass (c.u.e. 0.46), and in the lower river, 1608 striped bass (c.u.e. 0.80).
14. In 1983 the upper river sport catch of striped bass was 4,202 fish (c.u.e. 1.51), the middle river catch was 126 striped bass (c.u.e. 0.41), and the lower river catch was 2,648 striped bass (c.u.e. 0.76).
15. The estimated sport catch of striped bass by all methods in the Roanoke River in 1982 (7,324) was considerably above the 1981 catch of 3,905, but about one-half the estimated catch in 1980 (15,239). The number of fishing units in 1982 was 5,301 compared to 4,189 in 1980, and the catch per unit effort was 3.64 in 1980 against 1.38 in 1982.
16. The estimated sport catch in the Roanoke River in 1983 was 6,976 striped bass, and the c.u.e. was 1.06 fish per boat.
17. During 1982 striped bass tagging studies were conducted at Williamston and 314 striped bass were tagged and released in the Roanoke River. The greatest number of striped bass were tagged during the week of April 14-20 (111).
18. During 1983 481 striped bass were tagged and released in the Roanoke River. The greatest number were tagged during the weeks of April 26-May 2 (156) and April 12-18 (146).
19. During 1982 39 striped bass tags were recovered, 3 in the Roanoke River and 36 in Albemarle Sound (12.42%).
    In 1983 44 striped bass were recovered, 5 in the Roanoke River, and 39 in Albemarle Sound (9.14%).
20. The annual rate of exploitation for 1982 was 12.42% overall with a 11.46% recovery rate in Albemarle Sound and 0.96% in the Roanoke River.
    The annual rate of exploitation for 1983 was 9.14% overall with 8.10% recovered in Albemarle Sound and 1.04% in the Roanoke River.
21. The 1982 estimated total of striped bass eggs spawned in the Roanoke River was 1,698,888,853 eggs. Peak spawning occurred on May 9 and 10.

21. The 1983 estimated total of striped bass eggs spawned in the Roanoke River was 1,352,611,202 eggs. Peak spawning occurred on May 29, 30, and 31.
22. Striped bass egg viability was 71.9% in 1982, and 33.29% in 1983.
23. In 1982 the young-of-year striped bass trawl catches in Albemarle Sound amounted to 3.80 striped bass per trawl. This was the greatest c.u.e. since 1976. The 1983 young-of-year striped bass trawl catches decreased to 0.84 striped bass per trawl.
24. The total number of striped bass ascending the Roanoke River in 1982 was 70,650 fish. The 1983 spawning population was estimated to be 69,771 striped bass.
25. Sample correlation coefficients were calculated for occurrence, mean velocity, and peak velocity of easterly winds in May and June in relation to subsequent abundance of young-of-year striped bass in Albemarle Sound. These correlation coefficients were not significant.
26. The relationship between southerly winds in May and June and the subsequent abundance of young-of-year striped bass was not significant.
27. The time of peak spawning and the duration of the spawning season were not significantly associated with the abundance of young-of-year striped bass in Albemarle Sound.
28. There was a significant relationship between the May discharge rate of the Roanoke River and the abundance of young-of-year striped bass. Low to moderate discharge rates were associated with increased abundance. High discharge rates were unfavorable.
29. Correlation coefficients were determined for the relationship between young-of-year striped bass abundance and (1) the size of the spawning population, (2) the abundance of striped bass eggs, (3) the total sport catch in the Roanoke River, and (4) the commercial catch in the Roanoke River. All of these correlation coefficients were not significant.
30. The annual relative abundance of young-of-year striped bass was not related to the commercial catch of striped bass, two, three, and four years later.

INTRODUCTION

The Roanoke River is a major coastal stream of North Carolina. It originates in Virginia on the eastern slopes of the Appalachian Ridge, traverses the rolling Piedmont Plateau, descends the Atlantic Coastal Plain and discharges into Albemarle Sound through several channels (Figure 1). A descent of 2,900 feet occurs in the 410 miles from the headwaters to the estuary. The drainage basin of the Roanoke covers approximately 9,600 square miles, of which two-thirds are in Virginia and one-third in North Carolina. The average annual discharge of the Roanoke River at Weldon, North Carolina is approximately 8,500 cubic feet per second. Carnes (1965) presented a general description of the chemical, physical, and biological features of the Roanoke River Basin.

Albemarle Sound is a shallow coastal estuary which extends about 60 mi in an east-west direction from the mouth of the Roanoke River. It averages about 7 mi in width (range 3.5 to 15 mi), and its area is about 500 square miles. Eight rivers drain into Albemarle Sound, which empties into the Atlantic Ocean via Oregon Inlet. Salinities vary from 0 parts per thousand (ppt) in the western end to approximately 10 ppt at the eastern extremity.

Hydroelectric Impoundments

The record flood which occurred in 1940 instigated the construction of hydroelectric impoundments on the Roanoke River by the Corps of Engineers, U. S. Army and the Virginia Electric and Power Company. The John H. Kerr Dam was completed in 1952 at river mile 179.5. It is a multipurpose impoundment for flood control and hydroelectric power and covers an area of about 49,000 acres at normal elevation. The Gaston Dam was constructed downstream (river mile 145.5) from the John H. Kerr Dam. It was completed in 1963 and serves primarily for hydroelectric power. It has a surface area of 20,300 acres. The Roanoke Rapids Dam, located at river mile 137.5, was completed in 1955. It impounds approximately 4,900 acres (Figure 1).

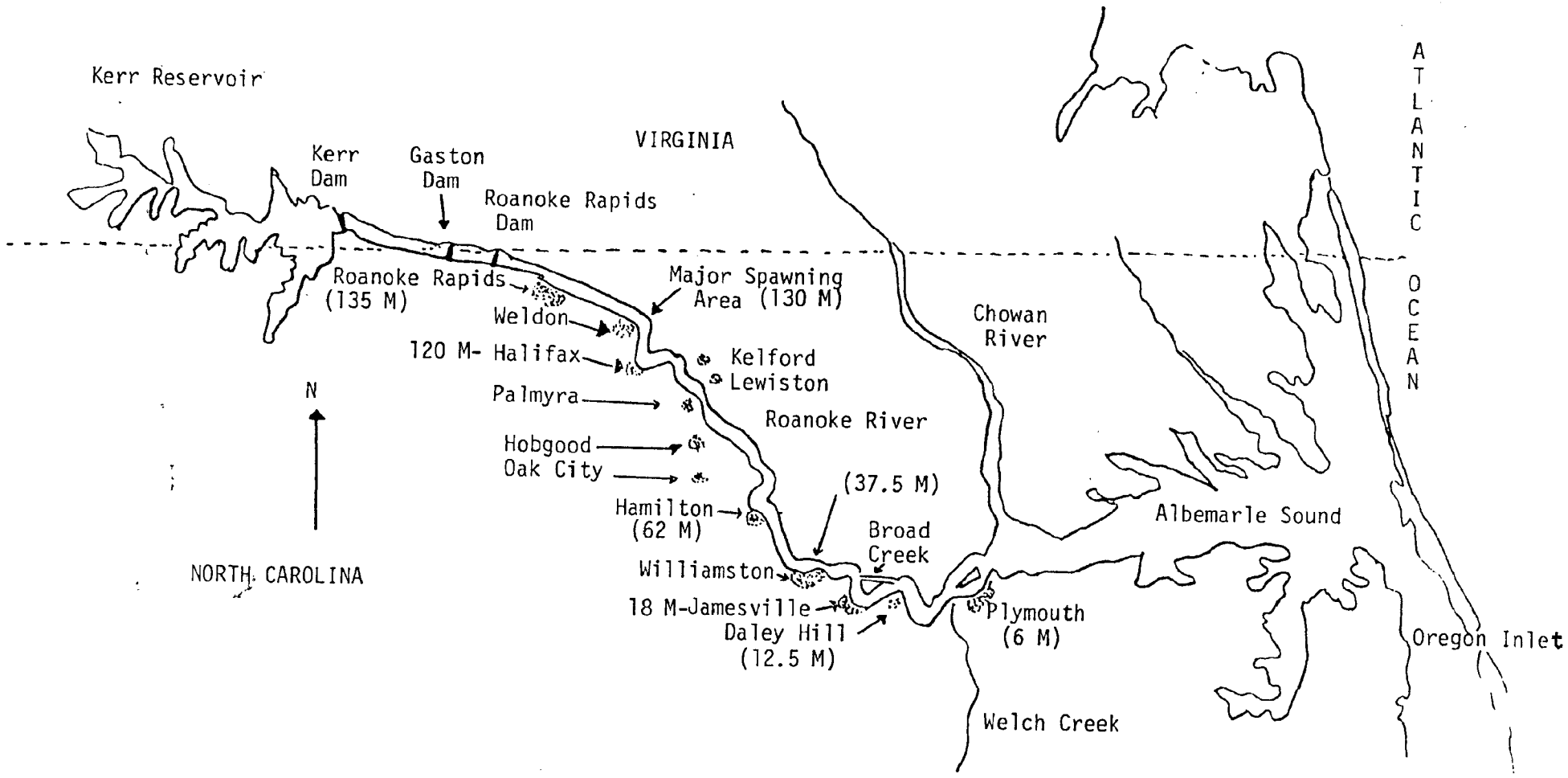

Figure 1. Map of the Roanoke River and Albemarle Sound, N. C.

The waters of the Roanoke River serve three major users--hydroelectric power, industrial, and fisheries, both sport and commercial. Other important users include agriculture, lumbering, transportation, and recreation.

The conflicting uses of the Roanoke River necessitated the formation of a Steering Committee for Roanoke River Studies in 1955. This organization, composed of state, federal, and private agencies and interests, made a comprehensive study of the river in order to adjudicate conflicting interests and maintain river conditions to permit multiple use. The results of this study were presented in detail by Fish (1959).

The cooperative Roanoke-Albemarle Striped Bass Studies originated in 1955 as part of the Steering Committee studies. Our studies were originally supported by the National Council for Stream Improvement, Weyerhaeuser Company, and Albemarle Paper Manufacturing Company. The steering Committee Studies were terminated in 1958, but the Weyerhaeuser Company continued its support in an endeavor to be a concerned and responsible corporate neighbor. However, cooperative field work was resumed in 1975 with the U. S. Fish and Wildlife Service and the North Carolina Department of Natural Resources and Community Development, Division of Marine Fisheries, under the Anadromous Fish Act (PL 89-304).

These studies have been conducted annually since 1955 to provide long term information on the status and abundance of the striped bass which is the most valuable sport and commercial fish in the Roanoke River and Albemarle Sound. This annual study provides a continuing source of data on the status of the striped bass population. The data are utilized by state agencies for current management information and decisions.

The long term objectives of the striped bass studies are as follows: (1) to determine the striped bass catch and rate of exploitation by commercial fishermen; (2) to determine the catch and rate of exploitation by sport fishermen; (3) to record the prevailing ecological conditions during the spawning season in the Weldon area; (4) to collect striped bass eggs during the spawning season in order to estimate the number of eggs spawned and the viability of the eggs; (5) to estimate the size of the spawning population; (6) to detect changes in the size of the spawning population; (7) to determine the ecological conditions prevailing in Albemarle Sound when the striped bass larvae reach the estuary; (8) to make periodic

trawl collections in Albemarle Sound during the summer and fall to determine the relative abundance and growth of striped bass young-of-year; (9) to detect variations in recruitment of striped bass in the Albemarle Sound population; (10) to observe and recommend fishery management practices which might provide the best sustained yield for the present and future purposes; and (11) to develop methods of predicting future commercial catches.

The data acquired during these studies have been available to graduate students for special problems and thesis material and also to biologists in other areas.

This report was prepared in compliance with the agreement for Project AFC-19 funded, in part, by the National Marine Fisheries Service, U. S. Department of Commerce under the Anadromous Fish Conservation Act, PL-89-304 (as amended). Additional funding was provided by the Weyerhaeuser Company.

COMMERCIAL FISHING

Commercial Catch of Striped Bass in North Carolina

The commercial fish landings in North Carolina have been recorded since 1887 by various federal agencies, including the U. S. Fish Commission, the U. S. Bureau of Commercial Fisheries, and the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration. Since 1978, data have been collected by the North Carolina Department of Natural Resources and Community Development, Division of Marine Fisheries in cooperation with NMFS. In 1980 the North Carolina Division of Marine Fisheries assumed the publication of these data.

From 1967 to 1976 the commercial striped bass catch exceeded 1,000,000 pounds annually. The peak year was 1970, and a total of 2,318,000 pounds was landed during that year. However, by 1977 the commercial striped bass landings had declined to approximately 572,000 pounds.

The commercial striped bass catch increased to 698,000 pounds in 1978 but declined progressively for each year from 1979 through 1982. The 1982 commercial striped bass landings were 338,000 pounds and the 1983 landings were 361,000 pounds. These data are included in Table 1.

Perusal of North Carolina commercial striped bass landings over a 96-year span indicate only a few years in which the catch has been so limited. Reduced

Table 1. Commercial catch and monetary value of striped bass in North Carolina, 1887-1983*

Year	Quantity in Pounds x 1000	Value in Dollars x 1000	Year	Quantity in Pounds x 1000	Value in Dollars x 1000
1887	500	25	1954	1,122	188
1888	560	28	1955	737	120
1889	531	31	1956	764	119
1890	568	32	1957	597	90
1897	845	58	1958	1,097	197
1900	568	-	1959	872	158
1902	1,175	114	1960	782	125
1908	510	36	1961	550	88
1918	287	46	1962	747	120
1923	477	76	1963	736	115
1927	738	119	1964	714	117
1928	507	72	1965	484	77
1929	246	41	1966	653	100
1930	457	61	1967	1,817	253
1931	327	35	1968	1,912	385
1932	507	55	1969	1,568	326
1934	362	36	1970	2,318	479
1936	768	61	1971	1,449	314
1937	713	69	1972	1,261	358
1938	523	49	1973	1,752	592
1939	339	34	1974	1,016	393
1940	540	59	1975	1,303	630
1945	609	121	1976	1,038	523
1948	500	-	1977	572	405
1949	797	-	1978	698	623
1950	797	165	1979	614	577
1951	702	134	1980	473	435
1952	647	121	1981	417	452
1953	757	137	1982	338	531
			1983	361	491

* From reports of the U. S. Fish Commission, Bureau of Fisheries, and the National Marine Fisheries Service in cooperation with the N. C. Division of Marine Fisheries, Department of Natural Resources and Community Development.

landings were recorded in 1918 (287,000 pounds), 1929 (246,000 pounds, 1931 (327,000 pounds), 1934 (362,000 pounds), and 1939 (339,000 pounds). The 1980-1983 landings are the lowest recorded since 1939.

Decreased striped bass landings have been reported throughout the United States since the mid 1970's, and this decline is generally attributed to long-term cyclic fluctuations, short-term meteorological conditions, and wide-spread pollution. These reduced catches have instigated coastwide review of striped bass management policies by regulatory agencies because of pressure from commercial and sport fishermen.

The monthly commercial catch records for striped bass during 1982 and 1983 are tabulated in Table 2. The most productive month for commercial striped bass in 1982 was March when approximately 91,000 pounds were landed. During 1982 approximately 80% of the catch occurred from January through May. In 1983 the peak catch occurred in December (77,119 pounds) and October (72,447 pounds), and only 47% of the catch was landed from January through May. The 1982 fall catch (October-December) comprised 9% of the total catch while the 1983 fall catch (October-December) amounted to 48% of the catch. The landings during the summer months for both years were very low, and commercial fishing during these warm months is restricted by spoilage of fish in the nets and high incidence of blue crabs.

Commercial Catch of Striped Bass in the Roanoke River

Commercial fishermen and project personnel reported 398 striped bass caught in commercial gear in the Roanoke River during the spring season, 1982. In Table 3 these data indicate that 367 striped bass were caught in set gill nets and 31 by other gear.

During 1983 a total of 650 striped bass was caught by commercial gear in the lower Roanoke River, and 647 of these fish were caught in set gill nets (Table 4). The catch per unit effort for set gill nets was 1.52 striped bass per net day in 1982 and 2.41 striped bass per net day in 1983.

Table 2. Commercial catch of striped bass in North Carolina, 1982-1983 by months, quantity in pounds

	By Months		Cumulative to Date	
Months	1982	1983	1982	1983
January	38,515	16,854	38,515	16,854
February	62,166	52,265	100,681	69,119
March	90,981	52,728	191,662	121,847
April	56,704	29,896	248,366	151,743
May	24,286	21,176	272,652	172,919
June	8,878	1,998	281,530	174,917
July	7,457	1,389	288,987	176,306
August	8,108	2,005	297,095	178,311
September	9,973	7,460	307,068	185,771
October	13,325	72,447	320,393	258,218
November	8,640	25,938	329,033	284,156
December	9,277	77,119	338,310	361,275

Table 3. Commercial catch of striped bass by gear and effort, Roanoke River, N. C., Spring, 1982

Gear	Number of days	Number of fish	C.U.E.	Percent of Total catch
Striped bass set gill net	242	367	1.52	92.21
Fishing machine	1	4	4.00	1.01
Trotline	18	0	-	-
Hoop net	1,000	0	-	-
Herring-drift gill net	85	27	0.32	6.78
Total	1,346	398	0.30	100.00

Table 4. Commercial catch of striped bass by gear and effort, Roanoke River, N. C., Spring, 1983

Gear	Number of days	Number of fish	C.U.E.	Percent of total catch
Striped bass set gill net	269	647	2.41	99.54
Herring gill net	192	3	0.02	0.46
Total	461	650	1.41	100.00

Detailed records of the commercial striped bass catch by gear are presented in Table 5. These records indicate the sharp decline in striped bass landings in the lower Roanoke River since the ban on set gill nets was promulgated in 1981.

The 1982 commercial catch of striped bass in the Roanoke River is listed by location in Table 6. These data indicate that 95% of the catch was taken in set gill nets used for tagging purposes in the Williamston area.

In 1983 all of the reported catch in commercial gear occurred in the Williamston area. These data are recorded in Table 7. We have noted a refusal of commercial fishermen to report catches even though these catches are made in legal gear. Several fishermen have stated that they think that gear exempted from the commercial fishing ban may be declared illegal in the near future.

Table 8 shows the commercial catch by location for the 24-year period, 1960-1983. Commercial fishing was permitted in the Roanoke River from its mouth upstream to the Scotland Neck bridge, a distance of 102 miles. The striped bass catches made in the lower sixty-mile stretch of the river accounted for approximately 95% of the total catch during the 1960-1980 time period. The 1981 change which restricted set gill nets and mesh size of drift gill nets in the lower river has resulted in the sharply curtailed landings.

The 1982 and 1983 commercial catch of striped bass from the Roanoke River is listed by weeks in Tables 9 and 10. These data indicate peaking of the migratory run during April in the lower Roanoke River.

The total commercial catch of striped bass is listed by number and weight in Table 11 for the period 1956-1983. In 1982 a total of 398 striped bass weighing approximately 1393 pounds were taken commercially from the Roanoke River. The 1983 striped bass catch of 650 fish totalled approximately 2,942 pounds. Again, we reiterate that this reduction in commercial striped bass landings in the Roanoke River has resulted from a decline in the population and restrictions on the catch. The catch restrictions were initiated because of the population depletion.

For long term analysis it should be noted here that river flow was very low in 1980 and 1981. Above average flows were experienced in 1982 and 1983. The commercial fishery is impacted by both high river flow and low river flow.

Table 5. Roanoke River commercial catch of striped bass by gear (in numbers of fish), 1956-1983

Year	Anchor gill net	Drift gill net	Haul seine	Trot-line	Hoop net	Fishing machine	Rod and reel	Herring set gill net	Herring drift gill net	Perch basket	Total catch
1956*	175	125	452	1,407	50	0	-	-	-	-	2,209
1957*	415	60	227	710	200	0	-	-	-	-	1,827
1958*	1,814	0	0	1,477	383	566	-	-	-	-	4,240
1959	902	97	830	2,795	433	79	306	-	-	-	5,442
1960	9,764	32	0	1,691	533	606	1,151	-	-	-	13,820
1961	2,294	12	97	1,781	1,664	99	584	-	-	-	6,531
1962	4,502	42	39	779	823	152	1,189	-	-	-	7,526
1963	4,807	276	639	1,038	524	46	149	-	-	-	7,479
1964	5,739	1,296	530	1,338	75	0	**	72	246	4	9,300
1965	12,153	1,052	***	969	58	22	**	-	40	-	14,294
1966	17,992	8	***	222	99	0	155	-	32	-	18,508
1967	5,422	0	***	79	13	-	-	1	11	-	5,526
1968	6,347	161	1,148	1,454	4	-	933	-	1	-	10,050
1969	12,314	262	1,400	678	12	-	740	-	25	-	15,431
1970	12,952	1,070	1,114	603	19	-	551	-	176	-	16,485
1971	20,257	6,263	1,864	1,071	23	0	624	2	0	-	30,104
1972	12,791	10,350	17	458	46	88	937	4	0	-	24,691
1973	6,467	2,070	2	6	25	41	391	2	16	-	9,020
1974	7,302	7,824	***	52	2	1	428	0	0	-	15,609
1975	14,089	5,039	***	55	25	764	7	10	0	-	19,989
1976	5,554	919	***	131	135	35	328	-	54	-	7,156
1977	6,597	3,134	***	59	155	220	164	-	136	-	10,465
1978	12,085	3,278	***	4	48	698	94	14	32	-	16,253
1979	8,511	433	***	3	81	571	142	20	37	-	9,798
1980	1,935	66	***	0	5	138	138	0	4	-	2,286
1981	322	0	***	9	1	14	0	1	2	-	349
1982	367	0	***	0	0	4	0	0	27	0	398
1983	647	-	***	-	-	-	0	0	3	-	650

* 1956-1958 compiled by US Fish & Wildlife Service, Bureau of Commercial Fisheries, Report to Steering Committee, Roanoke River Studies.

** Rod and reel catch included under another category

*** The Jamesville Haul Seine did not operate in 1965-1967, and it was permanently shut down in 1974.

Table 6. Commercial catch of striped bass by location, Roanoke River, N. C., Spring, 1982

Location	Number striped bass caught	Percent of total catch
Williamston	380	95.48
Jamesville	5	1.25
Hamilton	13	3.27
Total	398	100.00

Table 7. Commercial catch of striped bass by location, Roanoke River, N. C., Spring, 1983

Location	Number striped bass caught	Percent of total catch
Williamston	650	100.00

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Table 8. Roanoke River commercial catch of striped bass (in number of fish) by location, 1960-1983

Year	Plymouth, Daley Hill, Broad Creek	Jamesville	Williamston	Hamilton	Oak City, Hobgood, Palmyra, Kelford, Lewiston	Scotland Neck	Total
1960	-	3,083	8,995	552	853	337	13,820
1961	490	728	3,025	960	578	750	6,531
1962	636	1,061	4,515	654	223	437	7,526
1963	201	1,269	5,145	214	316	334	7,479
1964	110	3,948	4,285	68	641	248	9,300
1965	216	5,457	8,175	51	319	76	14,294
1966	2,959	7,473	7,964	-	73	39	18,508
1967	1,512	2,082	1,888	20	14	10	5,526
1968	1,614	3,470	4,137	596	167	66	10,050
1969	4,611	5,399	4,932	116	348	25	15,431
1970	4,126	7,072	4,695	280	268	44	16,485
1971	5,983	16,678	6,438	478	494	33	30,104
1972	1,994	14,201	8,308	149	12	27	24,691
1973	35	2,398	6,571	-	16	-	9,020
1974	209	8,390	6,876	120	-	14	15,609
1975	661	6,510	11,348	855	580	35	19,989
1976	770	2,012	4,018	257	48	51	7,156
1977	538	5,900	3,519	298	85	125	10,465
1978	283	4,458	11,469	39	4	-	16,253
1979	1,057	1,375	6,957	409	-	-	9,798
1980	83	147	2,007	49	-	-	2,286
1981	0	1	348	0	0	0	349
1982	0	5	380	13	0	0	398
1983	0	0	650	0	0	0	650
Total	28,088	103,117	126,645	6,178	5,039	2,651	271,718
Percent of total catch	10.34	37.95	46.61	2.27	1.85	0.98	100.00

Table 9. Roanoke River commercial catch of striped bass by weekly intervals, 1982

Week	Number striped bass caught	Percent of total catch
March 29-April 4	39	9.80
April 5-11	84	21.11
April 12-18	114	28.64
April 19-25	93	23.37
April 26-May 2	68	17.08
Total	398	100.00

Table 10. Roanoke River commercial catch of striped bass by weekly intervals, 1983

Week	Number striped bass caught	Percent of total catch
April 4-10	45	6.92
April 11-17	191	29.38
April 18-24	143	22.00
April 25-May 1	186	28. 62
May 2-4	85	13.08
Total	650	100.00

Table 11. Commercial catch of striped bass, Roanoke River, N. C., by numbers and weights in pounds, 1956-1983

Year	Number caught	Total weight in pounds
1956*	2,209	7,732
1957*	1,827	6,394
1958*	4,240	14,840
1959	5,442	19,047
1960	13,820	48,370
1961	6,531	22,858
1962	7,526	26,341
1963	7,479	26,177
1964	9,300	32,550
1965	14,294	50,029
1966	18,508	64,778
1967	5,526	19,341
1968	10,050	35,175
1969	15,431	54,009
1970	16,485	57,698
1971	30,104	105,364
1972	24,691	86,419
1973	9,020	31,570
1974	15,609	54,632
1975	19,989	69,962
1976	7,156	25,046
1977	10,465	36,620
1978	16,253	56,886
1979	9,798	34,293
1980	2,286	8,001
1981	349	1,468
1982	398	1,393
1983	650	2,942

* - 1956-1958 data from US Fish and Wildlife Service, Bureau of Commercial Fisheries

SPORT FISHING

Sport fishing for striped bass in the Roanoke River occurs over a 140-mile area from the mouth of the river to the Roanoke Rapids dam. The Weldon and Roanoke Rapids areas are the most popular sites for striped bass anglers, and we collect complete creel census data at Weldon and Roanoke Rapids during the fishing season. Sport fishing in other areas of the river are checked by interview, postal cards, and local observers.

In Table 12 the 1982 sport catch and effort data for striped bass in the Roanoke River are tabulated by location. Approximately 74% of the total striped bass catch was made in the Weldon area, 3% in the middle river area, and 23% in downstream locations. A total of 7,324 striped bass were captured by sport fishermen in all areas, and the c.u.e. per boat was 1.38 striped bass.

The 1983 sport catch and effort data for striped bass in the Roanoke River are contained in Table 13. These data reveal that approximately 60% of the sport catch was made in the Weldon area, 39% in downstream locations, and 1% in the middle section of the river. A total of 6,976 striped bass were caught, and the c.u.e. was 1.06 striped bass per boat.

The 1982 striped bass sport catch and effort data for striped bass at Weldon, N. C. are summarized in Table 14 by date. These data indicate that a total of 4,445 striped bass were taken by anglers in 2,296 boats for a c.u.e. of 2.00 striped bass per trip.

During 1983 the Weldon and Roanoke Rapids striped bass catch records were compiled separately and these data are presented in Tables 15 and 16. At Weldon a total of 3,250 striped bass were caught for a c.u.e. of 2.00 striped bass per trip. At Roanoke Rapids sport fishermen caught 1,471 striped bass for a c.u.e. of 1.41 striped bass per boat.

Table 12. Sport catch of striped bass in the Roanoke River, N. C. by location, 1982

Area	Creel Census Period			Before & After Census			Total		
	No. Boats	No. Str. Bass Caught	C.U.E.	No. Boats	No. Str. Bass Caught	C.U.E.	No. Boats	No. Str. Bass Caught	C.U.E.
Upper River (Weldon, Roanoke Rapids, Halifax, Barnhill's Landing	2634	5267	2.00	179	230	1.28	2813	5497	1.95
Middle River (Lewiston, Palmyra, Oak City, Scotland Neck, Tillery)	475	219	0.46	-	-	-	475	219	0.46
Lower River (Hamilton, Williamston, Jamesville, Plymouth)	2613	1608	0.80	-	-	-	2013	1608	0.80
Total	5122	7094	1.39	179	230	1.28	5301	7324	1.38

Table 13. Sport catch of striped bass in the Roanoke River, N. C. by location, 1983

Area	Creel Census Period			Before & After Census			Total		
	No. boats	No. str.bass caught	c.u.e.	No. boats	No. str.bass caught	c.u.e.	No. boats	No. str.bass caught	c.u.
Upper River (Weldon, Roanoke Rapids, Halifax, Barnhill's Landing)	2666	4053	1.52	117	149	1.27	2783	4202	1.5
Middle River (Lewiston, Palmyra, Oak City, Scotland Neck, Tillery)	311	126	0.41				311	126	0.4
Lower River (Hamilton, Williamston, Jamesville, Plymouth)	3503	2648	0.76				3503	2648	0.7
Total	6480	6827	1.05	117	149	1.27	6602	6976	1.0

Table 14. Striped bass sport fishing (rod and reel) catch and effort data at Weldon, N. C., spring, 1982

Date		Number of boats counted	Number of boats checked	Number of striped bass caught	Mean number of striped bass/ boat ± S.E.	S.D.	Σx^2
May	1	53	15	19	1.267 ± 0.46	1.79	69
	2	67	32	62	1.938 ± 0.59	3.31	460
	3	50	50	317	6.340 ± 0.94	6.63	4,163
	4	59	59	48	0.814 ± 0.16	1.21	124
	5	82	82	135	1.646 ± 0.34	3.07	987
	6	85	85	472	5.553 ± 0.55	5.07	4,776
	7	84	84	277	3.298 ± 0.48	4.38	2,505
	8	87	87	758	8.713 ± 1.48	13.83	23,062
	9	118	118	155	1.314 ± 0.19	2.02	681
	10	119	119	282	2.370 ± 0.36	3.97	2,532
	11	119	119	128	1.076 ± 0.16	1.72	488
	12	87	87	117	1.345 ± 0.20	1.89	465
	13	135	135	128	0.948 ± 0.14	1.62	474
	14	166	166	350	2.108 ± 0.31	3.95	3,314
	15	222	222	237	1.068 ± 0.20	3.00	2,245
	16	141	141	157	1.113 ± 0.18	2.09	789
	17	46	46	45	0.978 ± 0.22	1.48	143
	18	63	63	81	1.286 ± 0.28	2.25	419
	19	101	101	169	1.673 ± 0.25	2.53	923
	20	76	76	58	0.763 ± 0.15	1.31	172
	21	94	94	88	0.936 ± 0.15	1.47	282
	22	74	74	79	1.068 ± 0.28	2.39	503
	23	31	31	37	1.194 ± 0.52	2.91	299
	24	40	40	59	1.475 ± 0.57	3.62	597
	25	24	24	50	2.083 ± 0.71	3.48	382
	26	43	43	45	1.047 ± 0.26	1.68	165
	27	9	9	24	2.67 ± 1.22	3.67	172

Table 14 (continued)

Date		Number of boats counted	Number of boats checked	Number of striped bass caught	Mean number of striped bass/ boat ± S.E.	S.D.	Σx^2
May	28	4	4	9	2.25 ± 1.31	2.63	41
	29	5	5	33	6.60 ± 3.40	7.60	449
	30	4	4	8	2.00 ± 0.91	1.83	26
	31	6	6	11	1.833 ± 1.17	2.86	61
June	1	2	2	7	3.50 ± 2.50	3.54	37
Total		2,296	2,223	4,445	2.00 ± 0.13		

Table 15. Striped bass sport fishing (rod and reel) catch and effort data at Weldon, N. C., spring, 1983

Date	Number of boats counted	Number of boats checked	Number of striped bass caught	Mean number of striped bass per boat	Estimate total catch
April 30	33	31	10	0.32	11
May 1	14	12	3	0.25	4
2	15	9	1	0.11	2
3	12	10	0	0.00	0
4	7	5	41	8.20	57
5	18	15	21	1.40	25
6	12	5	24	4.80	58
7	38	31	59	1.90	72
8	46	46	32	0.70	32
9	28	26	34	1.31	37
10	29	23	53	2.30	67
11	36	32	63	1.97	71
12	50	44	56	1.27	64
13	49	44	53	1.20	53
14	63	43	84	1.95	123
15	50	46	49	1.07	54
16	18	18	27	1.50	27
17	27	22	39	1.77	48
18	66	55	176	3.20	211
19	41	38	111	2.92	120
20	48	42	70	1.67	80
21	88	84	143	1.70	150
22	71	61	139	2.28	162
23	36	27	61	2.26	81
24	71	53	110	2.08	148
25	72	69	225	3.26	235
26	55	43	97	2.26	124
27	54	45	113	2.51	136
28	72	57	53	0.93	67
29	46	37	52	1.41	65
30	63	60	137	2.28	144
31	37	34	56	1.68	62

Table 15 (continued)

Date		Number of boats counted	Number of boats checked	Number of striped bass caught	Mean number of striped bass per boat	Estimat total catch
June	1	23	21	64	3.05	70
	2	33	31	103	3.32	110
	3	29	29	55	1.90	55
	4	49	38	106	2.79	136
	5	37	25	39	1.56	58
	6	13	12	17	1.42	18
	7	20	18	28	1.56	31
	8	17	13	32	2.46	42
	9	10	9	31	3.44	34
	10	9	9	10	1.11	10
	11	22	18	34	1.89	41
Total		1627	1390	2728	2.00 (weighted)	3250

Table 16. Striped bass sport fishing (rod and reel) catch and effort data at Roanoke Rapids, N. C., spring, 1983

Date		Number of boats counted	Number of boats checked	Number of striped bass caught	Mean number of striped bass per boat	Estimat total catch
May	1	31	27	17	0.63	20
	2	33	31	10	0.32	11
	3	16	14	8	0.57	9
	4	20	20	79	3.95	79
	5	37	34	61	1.79	66
	6	35	19	19	1.00	35
	7	49	36	23	0.64	31
	8	36	28	26	0.93	33
	9	38	38	57	1.50	57
	10	32	26	23	0.88	28
	11	28	27	26	0.96	27
	12	21	20	4	0.20	4
	13	28	24	63	2.63	74
	14	45	41	49	1.20	54
	15	26	26	22	0.85	22
	16	22	17	52	3.06	67
	17	38	32	138	4.31	164
	18	33	28	77	2.75	91
	19	26	22	29	1.32	34
	20	48	45	71	1.58	76
	21	37	25	63	2.52	93
	22	28	20	22	1.10	31
	23	24	21	40	1.90	46
	24	26	24	53	2.21	57
	25	29	27	60	2.22	64
	26	16	15	6	0.40	6
	27	22	20	31	1.55	34
	28	32	22	9	0.41	13
	29	18	13	11	0.85	15
	30	17	15	6	0.40	7
	31	17	12	6	0.50	9

Table 16 (continued)

Date		Number of boats counted	Number of boats checked	Number of striped bass caught	Mean number of striped bass per boat	Estimat total catch
June	1	11	10	0	0.00	0
	2	13	12	0	0.00	0
	3	11	10	11	1.10	12
	4	22	15	8	0.53	12
	5	14	14	20	1.43	20
	6	12	11	15	1.36	16
	7	10	9	12	1.33	13
	8	8	4	10	2.50	20
	9	12	10	9	0.90	11
	10	8	7	9	1.29	10
	11	10	10	8	0.80	8
Total		1039	881	1203	1.41	1471

The Weldon area (including Roanoke Rapids) sport fishing catch and effort data for striped bass are summarized in Table 17 for the years 1956-1983. These data indicate that the c.u.e. for 1981, 1982, and 1983 are the lowest on record for the 28-year period. However, it should be noted that striped bass size limits and creel limits were changed in 1982. Also, bow netting and fight netting were eliminated in that year. The new and more restrictive regulations would have an effect by decreasing the striped bass catches by rod and reel fishermen.

A 28-year review of the estimated sport catch and effort for striped bass in the Roanoke River by all methods and locations is included in Table 18. These data emphasize the decline in catch in recent years, but the regulatory changes imposed by the North Carolina Wildlife Resources Commission have also curtailed the catch.

Bank fishermen were also checked in the Weldon and Roanoke Rapids areas during 1983, and the catch records in Appendix Table 1 indicate that the catch is negligible amounting to approximately 0.07 fish per angler.

Detailed rod and reel catches for striped bass are tabulated daily for the Hamilton area of the Roanoke River in Appendix Tables 2 and 3 for 1982 and 1983. Herring drift net records are also included in the same tables.

Table 17. Catch and effort data for striped bass caught by rod and reel in the Weldon area of the Roanoke River, 1956-1983

Year	Boat days	Total catch	C.U.E. ± S.E.
1956	2,576	9,138	3.55
1957	3,158	12,184	3.86
1958	1,878	9,381	5.00
1959	4,238	31,132	7.35
1960	3,016	25,252	8.37
1961	3,552	20,596	5.80
1962	2,159	6,657	3.08
1963	1,056	3,174	2.88 ± 0.10
1964	2,393	12,002	5.02 ± 0.14
1965	3,116	18,858	6.05 ± 0.13
1966	1,091	5,979	5.30 ± 0.23
1967	1,333	4,692	3.52 ± 0.18
1968	3,916	23,557	6.05 ± 0.14
1969	3,459	12,271	3.55
1970	3,389	12,435	3.67 ± 0.10
1971	5,099	37,446	7.34 ± 0.15
1972	4,557	25,490	5.59 ± 0.12
1973	4,481	22,068	4.92 ± 0.11
1974	3,320	13,233	3.99 ± 0.11
1975	1,895	5,637	2.97 ± 0.12
1976	4,246	15,372	3.62 ± 0.10
1977	2,739	10,898	3.98 ± 0.11
1978	1,923	4,481	2.33 ± 0.14
1979	3,525	11,126	3.16 ± 0.11
1980	2,567	7,452	2.90 ± 0.18
1981	2,128	3,427	1.61 ± 0.11
1982	2,223	4,445	2.00 ± 0.13
1983	2,783	4,202	1.51 ± 0.10

Table 18. Estimated sport catch and effort of striped bass in the Roanoke River, N. C., 1956-1983

Year	Number fishing units	Number striped bass	C.U.E.
1956	3,902	16,434	4.21
1957	4,574	15,970	3.49
1958	2,006	9,931	4.95
1959	5,475	48,131	8.79
1960	3,536	28,821	8.15
1961	4,013	26,627	6.64
1962	2,524	14,688	5.82
1963	1,351	10,308	7.63
1964	2,872	28,114	9.79
1965	3,500	32,116	9.18
1966	1,363	13,368	9.81
1967	1,696	7,433	4.38
1968	4,345	31,988	7.36
1969	4,147	23,891	5.76
1970	6,814	28,257	4.15
1971	8,368	65,399	7.82
1972	10,088	45,650	4.53
1973	7,843	42,047	5.36
1974	7,489	38,826	5.18
1975	6,156	22,219	3.61
1976	10,209	40,799	4.00
1977	10,074	32,983	3.27
1978	10,161	28,016	2.76
1979	9,048	29,419	3.25
1980	4,189	15,239	3.64
1981	2,706	3,905	1.44
1982	5,301	7,324	1.38
1983	6,701	6,976	1.06
Total	150,452	714,879	

* - 1956-1959 data from USFWS, Bureau of Commercial Fisheries

** - For catch-per-unit effort, the bank fishermen have been adjusted to the average number of boat fishermen.

STRIPED BASS TAGGING STUDY

Since 1956 striped bass have been tagged during their spawning migration up the Roanoke River to obtain information concerning population abundance, rate of exploitation, and movements of the Albemarle Sound striped bass population.

During 1982 and 1983 the North Carolina Division of Marine Fisheries permitted project personnel to set gill nets in the Roanoke River above Williamston for the purpose of tagging striped bass. In Table 19 the gill net data show that this gear caught 367 striped bass of which 314 fish or 85.56% were tagged in 1982. The untagged fish were delivered to the North Carolina Division of Marine Fisheries for growth analysis.

The 1982 tagging program is summarized by weeks in Table 20. These data show that the peak of the run occurred during the week of April 14 to April 20.

Table 21 shows that in 1983 gill nets caught 647 striped bass, and 481, or 74.34% were tagged and released. The untagged fish were used by the North Carolina Division of Marine Fisheries for growth studies.

The 1983 migration peaked from April 12 to May 2. During this 3-week period 86% of the striped bass were tagged (Table 22).

A resume of the striped bass tagging operation is presented in Table 23. These data indicate an annual increase in the number of striped bass tagged since 1980. However, the paucity of striped bass available for tagging in 1980 and 1981 is attributed to low river discharges.

Striped bass tag recoveries are recorded in Table 24. These data indicate that 12.42% of the tags were recovered in 1982 and 9.14% in 1983. Both years show that the majority of the tagged striped bass were caught in Albemarle Sound. In 1982 a total of 39 tagged striped bass were recovered of which 36 were captured in Albemarle Sound (92%), and three were caught in the Roanoke River.

The 1983 tag recoveries in Table 24 show that 39 tagged fish (89%) were caught in Albemarle Sound while five fish (11%) were caught in the Roanoke River.

The type of recapture gear for tagged striped bass is listed in Table 25 for the years 1982 and 1983. Gill nets and pound nets accounted for 59 striped bass, rod and reel caught 11, and the type of gear was not reported for 13 returns. However, these unlisted tag recoveries were from the Albemarle Sound area and were presumably from commercial gear.

Table 19. Striped bass tagging summary by location and gear in the Roanoke River, N. C., Spring, 1982.

Location	Gill nets		Percentage tagged
	No. caught	No. tagged	
Williamston	367	314	85.56

Table 20. Striped bass tagging by weeks in Roanoke River, N. C., 1982

Dates	No. striped bass tagged
April 1 - 6	50
April 7 - 13	43
April 14 - 20	111
April 21-27	70
April 28 - May 4	40
Total	314

Table 21. Striped bass tagging summary by location and gear in the Roanoke River, N. C., Spring, 1983

Location	Gill nets		Percentage tagged
	No. caught	No. tagged	
Williamston	647	481	74.34

Table 22. Striped bass tagging by weeks in the Roanoke River, N. C., 1983

Weeks	No. striped bass tagged
April 5-11	34
April 12-18	146
April 19-25	106
April 26-May 2	156
May 3-9	39
Total	481

Table 23. Number of striped bass tagged in the Roanoke River, N. C., 1956-1983

Year	Number of striped bass tagged
1956	115
1957	85
1958	377
1959	822
1960	493
1961	482
1962	412
1963	776
1964	558
1965	533
1966	889
1967	117
1968	598
1969	497
1970	498
1971	582
1972	627
1973	295
1974	267
1975	-
1976	440
1977	334
1978	452
1979	385
1980	77
1981	156
1982	314
1983	481
Total	11,662

Table 24. Striped bass tag recoveries from the Roanoke River and Albemarle Sound with reference to original tagging site - 1982,1983

Year	Original Tagging site	Number striped bass tagged	No. striped bass recovered in Roanoke River	No. striped bass recovered in Albemarle Sound	Total no. recovered	Percentag recoverec
1982	Williamston	314	3	36	39	12.42
1983	Williamston	481	5	39	44	9.14

Table 25. Recovery of tagged striped bass by type of gear, 1982, 1983

Recovery gear	Number striped bass recovered		Total Recoverec
	1982	1983	
Gill net	13	10	23
Pound net	17	19	36
Rod and reel	4	7	11
Unknown gear	5	8	13
Total	39	44	83

The annual rate of exploitation for tagged striped bass is listed in Table 26 for the time period 1956-1983. These data show that the Roanoke River exploitation rate exceeded the Albemarle Sound exploitation rate during ten of the years. The Albemarle Sound exploitation rate was greater than the Roanoke River rate during 16 of the years.

The Roanoke River and Albemarle Sound exploitation rate were similar for one year. During 1982 the exploitation rate was approximately 12 times greater in Albemarle Sound than in the Roanoke River. The 1983 tag recoveries indicate an approximately eight times greater exploitation rate in Albemarle Sound over the Roanoke River.

It would seem reasonable that the fish would be more vulnerable to capture in the confined areas of the river in contrast to the vast expanse of the sound. However, this is generally not the situation. On the other hand these fish frequent the sound over a longer time period than in the river. The banning of gill nets in the Roanoke River may be reflected in the lower rates of recovery for these tagged fish. In any event rod and reel recoveries are demonstrably less than those in commercial gear.

A resume of the cumulative recovery rate of tags is presented in Table 27. These recoveries differ from the preceding table since recoveries in years beyond the tagging year are included. These data show that of 12,019 tagged striped bass 3,264 fish were eventually recovered (27.16%). The recovery rate in recent years has been considerably lower than that observed during the first 20 years of the study.

Table 26. Annual rate of exploitation for striped bass in the Roanoke River, N. C. and Albemarle Sound, 1956-1983

Year	Roanoke River (percent)	Albemarle Sound (percent)	Multiple over Roanoke River	Albemarle Sound and Roanoke River (percent)
1956	5.56	16.23	2.9	21.79
1957	6.45	13.17	2.0	19.62
1958	7.49	8.68	1.2	16.17
1959	11.84	15.08	1.3	26.92
1960	9.48	21.76	2.3	31.24
1961	7.25	16.61	2.3	23.86
1962	27.59	7.36	0.3	34.95
1963	9.18	17.81	1.9	26.99
1964	11.36	16.21	1.4	27.57
1965	13.81	13.21	1.0	27.02
1966	14.53	9.06	0.6	23.59
1967	20.18	3.75	0.2	23.93
1968	11.34	15.42	1.4	26.76
1969	14.02	4.89	0.3	18.91
1970	11.28	18.24	1.6	29.52
1971	22.33	9.97	0.4	32.30
1972	13.87	6.38	0.5	20.25
1973	6.44	5.42	0.8	11.86
1974	1.87	19.1	10.2	20.97
1975	(no fish tagged in 1975)			
1976	18.41	7.27	0.4	25.68
1977	8.68	6.89	0.8	15.57
1978	7.08	12.83	1.8	19.91
1979	8.57	7.79	0.9	16.36
1980	3.90	7.79	2.0	11.69
1981	1.28	5.13	4.0	6.41
1982	0.96	11.46	11.9	12.42
1983	1.04	8.1	8.4	9.14

Table 27. Cumulative rate of exploitation for striped bass in the Roanoke River and Albemarle Sound, N. C., 1956-1983

Year	Number striped bass tagged	Number recovered	Percent recovered
1956	115 142*	88	34.24
1957	85	39	24.68
1958	377 62*	81	18.45
1959	822	252	30.65
1960	493	192	38.95
1961	482	141	29.35
1962	412	158	39.35
1963	776	236	30.41
1964	558	170	30.46
1965	533	155	29.08
1966	889	338	38.02
1967	117 153*	32	27.35
1968	598	177	29.60
1969	497	110	22.13
1970	498	177	35.54
1971	582	213	36.59
1972	627	163	26.00
1973	295	48	16.27
1974	267	72	26.96
1975	-	-	-
1976	440	107	24.32
1977	334	45	13.47
1978	452	96	21.24
1979	385	63	16.36
1980	77	9	11.69
1981	156	10	6.41
1982	314	48	15.29
1983	481	44	9.14
Total	12,019	3,264	27.16

* - tagged in Albemarle Sound

QUANTITATIVE SAMPLING OF STRIPED BASS EGGS
ROANOKE RIVER, NORTH CAROLINA, 1982-1983

The Roanoke-Albemarle project striped bass egg sampling station was located at Johnson's Landing in 1982 and 1983. Johnson's Landing is located approximately nine miles downstream from the major spawning grounds at Weldon, North Carolina. Some striped bass spawning occurs below the sampling station, but it is relatively insignificant.

The river's contour at Johnson's Landing was surveyed, and a nomagraph was drawn indicating the cross-sectional area in square feet of the river for each river stage. A river stage gauge was constructed at the sampling station.

The samples were taken by a standard 10-inch net from each side of the stern of a small aluminum outboard motorboat. The nets were adjusted according to river flow to remain approximately six inches under the surface. Five-minute samples were collected eight times daily at three-hour intervals. The river stage, surface water temperature, and air temperature were recorded as each sample was taken. The number of striped bass eggs collected by each net was counted, the number of non-viable eggs determined, and the stage determined for the viable eggs. For each day the estimated number of eggs spawned was calculated by using the following equation:

$$N = 514.29\ XY$$

where N = estimated number of eggs spawned in 24-hour period

X = average number of eggs collected per net during 24-hour period

Y = cross-sectional area of river for average river stage during 24-hour period.

and 514.29 = constant for 10-inch net.

The 1982 striped bass egg sampling program began on May 3 and continued through June 2 for a total of 31 days. Table 28 shows that a total of 340 egg samples were taken, and the estimated number of striped bass eggs spawned was 1,698,888,853.

The 1983 striped bass egg sampling study commenced on May 6 and continued through June 12 for a total of 38 days. Table 29 shows that 508 egg samples were taken, and the estimated number of striped bass eggs spawned was 1,352,611,202.

Table 28. Summary of striped bass egg sampling study in the Roanoke River, N. C., Spring, 1982

No. of days sampled	No. of samples	Range of river stage (ft)	Range of estimated no. eggs/day x 1000	Estimated total no. eggs/season
31	340	12.2 - 19.2	907 - 861,738	1,698,888,853

Table 29. Summary of striped bass egg sampling study data in Roanoke River, N. C. spring, 1983

No. of days sampled	No. of samples	Range of river stage (ft)	Range of estimated no. eggs/day x 1000	Estimated total no. eggs/season
38	508	11.7 - 29.5	729 - 343,218	1,352,611,202

The daily striped bass egg spawning data are presented in Table 30 for 1982. These data indicate that peak spawning occurred on May 9 and May 10 when approximately 62% of the season's estimated total number of striped bass eggs was spawned. A minor spawning peak occurred from May 14 to May 18 when approximately 11% of the eggs were spawned.

The 1983 striped bass spawning data are contained in Table 31. These data indicate that peak spawning occurred on May 29, 30, and 31 when a total of approximately 40% of the striped bass eggs were spawned. Other spawning peaks were observed during the period from May 24-27 when approximately 36% of the eggs were spawned and May 15-17 when approximately 12% of the spawning was recorded. The 1983 spawning occurred much later in the season than in 1982.

The estimated number of striped bass eggs spawned annually in the Roanoke River for the period 1959-1983 is available in Table 32. These data show that the 1981 spawning season was the poorest observed during the 25-year span of the sampling. The 1982 and 1983 spawning seasons show a rebound in egg production from the 1981 low.

Viability of Striped Bass Eggs, Roanoke River, N. C., 1982-1983

The viability of the striped bass eggs is determined immediately following collection of each sample. Non-viable eggs have been classified into the following categories:

1. Milky-white and opaque
2. Yolk disintegrated and perivitellene space cloudy
3. Yolk disintegrated and perivitellene space clear
4. Yolk and oil globule disintegrated
5. Oil globule broken or disintegrated
6. Embryo disintegrated
7. Post larvae dead upon collection
8. Embryo normal but yolk subnormal in size
9. Embryo abnormal

Table 30. Striped bass spawning in the Roanoke River, N. C. as estimated from samples collected at Johnson's Landing, May 3-June 2, 1982

Date	Number Samples	Average river stage (ft)	Area of river X-section (ft^2)	Average no. eggs per net	Estimated number eggs per day	Percentage of total spawning	Cumulative percentage of spawning
May 3	2	16.5	4,710	4.00	9,689,224	0.57	0.57
4	8	15.6	4,425	7.00	15,930,133	0.94	1.51
5	8	16.8	4,805	5.13	12,677,068	0.75	2.26
6	8	16.7	4,773	9.86	24,203,403	1.42	3.68
7	8	19.2	5,565	12.88	36,862,867	2.17	5.85
8	8	15.4	4,362	23.38	52,449,125	3.09	8.94
9	10	13.0	3,602	105.80	195,991,599	11.54	20.48
10	12	12.7	3,506	477.92	861,737,906	50.72	71.20
11	12	12.6	3,475	21.67	38,727,708	2.28	73.48
12	12	12.4	3,411	1.92	3,368,147	0.20	73.68
13	12	15.1	4,267	7.67	16,831,627	0.99	74.67
14	12	15.4	4,362	26.67	59,829,691	3.52	78.19
15	12	12.6	3,475	7.17	12,813,921	0.75	78.94
16	12	12.2	3,348	34.50	59,403,581	3.50	82.44
17	12	13.3	3,697	29.67	56,412,465	3.32	85.76
18	12	14.3	4,013	34.83	71,883,748	4.23	89.99
19	12	13.5	3,760	4.08	7,889,620	0.46	90.45
20	12	12.3	3,380	9.83	17,087,491	1.01	91.46
21	12	12.2	3,348	21.75	37,450,084	2.20	93.66
22	12	12.2	3,348	8.50	14,635,665	0.86	94.52
23	12	12.2	3,348	5.08	8,746,962	0.51	95.03
24	12	12.4	3,411	7.42	13,016,484	0.77	95.80
25	12	12.7	3,506	3.75	6,761,628	0.40	96.20
26	12	12.4	3,411	1.25	2,192,804	0.13	96.33
27	12	12.3	3,380	9.92	17,243,938	1.02	97.35
28	12	12.8	3,538	12.00	21,834,696	1.29	98.64
29	12	13.6	3,792	1.75	3,412,828	0.20	98.84
30	12	12.7	3,506	1.33	2,398,124	0.14	98.98
31	12	12.4	3,411	7.17	12,577,924	0.74	99.72
June 1	12	13.2	3,665	2.08	3,920,536	0.23	99.95
2	12	14.9	4,203	0.42	907,856	0.05	100.00

Estimated total number of striped bass eggs spawned during sampling period 1,698,888,853

Table 31. Striped bass spawning in the Roanoke River, N. C. as estimated from samples collected at Johnson's Landing, May 6 - June 12, 1983

Date	Number samples	Average river stage (ft)	Area of river x-section (ft^2)	Average no. eggs per net	Estimated no. eggs per day	Percentage of total spawning	Cumulat percent of spawni
May 6	6	29.5	8827	0	-	-	-
7	8	27.0	8035	0	-	-	-
8	10	27.0	8035	0.6	2,479,392	0.18	0.18
9	8	26.3	7814	7.8	31,345,564	2.32	2.50
10	10	26.0	7719	0.7	2,778,863	0.21	2.71
11	12	25.7	7624	0.58	2,274,149	0.17	2.88
12	16	25.7	7624	1.0	3,921,461	0.29	3.17
13	16	25.6	7592	2.5	9,761,224	0.72	3.89
14	16	25.3	7497	0.56	2,159,153	0.16	4.05
15	16	25.0	7402	8.9	33,880,293	2.51	6.56
16	16	24.9	7370	21.9	83,007,948	6.14	12.70
17	16	24.9	7370	12.7	48,137,029	3.56	16.26
18	16	24.9	7370	0.94	3,562,898	0.26	16.52
19	16	24.8	7339	1.1	4,151,811	0.31	16.83
20	16	25.1	7434	0.5	1,911,615	0.14	16.97
21	14	25.4	7529	0.43	1,664,998	0.12	17.09
22	16	25.2	7465	0.19	729,443	0.05	17.14
23	16	25.2	7465	17.7	67,953,394	5.02	22.16
24	16	25.2	7465	19.1	73,328,239	5.42	27.58
25	16	24.9	7370	48.0	181,935,230	13.45	41.03
26	14	22.8	6705	24.7	85,173,366	6.30	47.33
27	16	22.2	6515	23.5	78,739,084	5.82	53.15
28	16	19.3	5597	5.8	16,695,190	1.23	54.38
29	16	15.8	4488	46.3	106,866,581	7.90	62.28
30	16	14.3	4013	166.3	343,217,551	25.37	87.65
31	16	16.6	4742	39.6	96,575,021	7.14	94.79
June 1	14	19.2	5565	0.93	2,661,682	0.20	94.99
2	12	18.8	5438	1.1	3,076,379	0.23	95.22
3	12	20.7	6040	1.2	3,727,573	0.28	95.50
4	12	15.3	4330	3.50	7,794,064	0.58	96.08
5	12	11.9	3253	13.4	22,418,003	1.66	97.74
6	12	15.6	4425	7.1	16,157,706	1.19	98.93
7	12	19.1	5533	0.75	2,134,174	0.16	99.09
8	10	18.7	5407	0.6	1,668,459	0.12	99.21
9	12	16.3	4647	1.3	3,106,877	0.23	99.44
10	12	15.5	4393	2.9	6,551,900	0.48	99.92
11	12	12.9	3570	0.58	1,064,888	0.08	100.00
12	6	11.7	3190	0	-	-	-

Estimated total number of striped bass eggs spawned during sampling period 1,352,611,20

Table 32. Estimated number of striped bass eggs spawned in the Roanoke River, N. C., 1959-1983

Year	Estimated number of striped bass eggs spawned
1959	300,000,000*
1960	740,000,000*
1961	2,065,232,519
1962	1,088,076,294
1963	918,652,436
1964	1,285,351,276
1965	823,522,540
1966	1,821,385,754
1967	1,333,312,869
1968	1,483,102,338
1969	3,229,715,526
1970	1,464,841,490
1971	2,833,119,620
1972	4,932,000,707
1973	1,501,498,887
1974	2,163,239,468
1975	2,193,008,096
1976	1,496,768,659
1977	1,775,957,318
1978	1,691,227,585
1979	1,613,382,382
1980	870,322,832
1981	344,364,065
1982	1,698,888,853
1983	1,352,611,202

* - Partial estimates - samples not taken during entire season.

The viability of the striped bass eggs was determined from daily samples, and the data are tabulated in Table 33 for 1982. These data show that an improved rate of viability (71.93%) occurred in 1982. The 1983 egg viability rate presented in Table 34 decreased to 33.29%. The striped bass egg viability percentages for the years 1960-1983 are tabulated in Table 35. These data show a high percentage of viability for the years 1960-1974. In 1975 a sharp decline in viability occurred, and this decline was recorded over a 6-year period, 1975-1980. The 1981 and 1982 seasons showed an increase in percent of egg viability. However, this increase was not to the same level experienced in earlier years. The 1983 striped bass egg viability declined to the lowest observed percentage.

The striped bass egg viability in relation to water temperature is presented in Tables 36 and 37 for the years 1982 and 1983 respectively. These data show a lower viability for striped bass eggs at all temperatures during the 1983 season.

Table 33. Striped bass egg viability at Johnson's Landing, Roanoke River, N. C., May 3 - June 2, 1982

Date	Number samples	Number non-viable eggs	Number viable eggs	Percent viable eggs
May 3	2	3	5	62.50
4	8	18	38	67.86
5	8	11	29	72.50
6	8	24	55	69.62
7	8	34	69	66.99
8	8	28	111	79.86
9	10	36	304	89.41
10	12	70	370	84.09
11	12	48	182	79.13
12	12	8	15	65.22
13	12	36	56	60.87
14	12	134	149	52.65
15	12	25	61	70.93
16	12	75	226	75.08
17	12	72	170	70.25
18	12	118	176	59.86
19	12	29	20	40.82
20	12	28	90	76.27
21	12	81	178	68.73
22	12	26	76	74.51
23	12	15	47	75.81
24	12	22	65	74.71
25	12	19	26	57.78
26	12	7	8	53.33
27	12	24	95	79.83
28	12	45	99	68.75
29	12	11	10	47.62
30	12	8	8	50.00
31	12	33	52	61.18
June 1	12	6	19	76.00
2	12	3	2	40.00
Total	340	1097	2811	71.93

Table 34. Striped bass egg viability at Johnson's Landing, Roanoke River, N. C. May 6 - June 12, 1983

Date	Number Samples	Number non-viable eggs	Number viable eggs	Percent viable eggs
May 6	6	0	0	0
7	8	0	0	0
8	10	6	0	0
9	8	30	32	51.61
10	10	6	1	14.29
11	12	7	0	0
12	16	16	0	0
13	16	39	1	2.50
14	16	9	0	0
15	16	127	17	11.81
16	16	257	39	13.18
17	16	189	14	6.90
18	16	13	0	0
19	16	17	0	0
20	16	7	0	0
21	16	4	2	33.33
22	16	3	0	0
23	16	207	76	26.86
24	16	237	69	22.55
25	16	521	204	28.14
26	16	219	127	36.71
27	16	218	158	42.02
28	16	58	34	36.96
29	16	258	289	52.83
30	16	402	246	37.96
31	16	132	150	54.55
June 1	14	12	1	7.69
2	12	12	0	0
3	12	10	4	28.57
4	12	28	13	31.71
5	12	82	80	49.69
6	12	49	36	42.35

Table 34. (continued)

Date	Number Samples	Number non-viable eggs	Number viable eggs	Percent viable eggs
June 7	12	8	1	11.11
8	12	6	0	0
9	12	9	6	40.0
10	12	28	7	20.0
11	12	3	4	57.14
12	6	0	0	0
Total	514	3,229	1,611	33.29

Table 35. Striped bass egg viability during the spawning season in the Roanoke River, N. C., 1960-1983

Year	Number of non-viable eggs	Number of viable eggs	Percent viable eggs
1960	329	4,292	92.88
1961	680	2,672	79.24
1962	1,068	6,685	86.22
1963	1,158	4,615	79.94
1964	481	10,879	95.77
1965	342	8,012	95.91
1966	1,481	25,489	94.51
1967	611	15,484	96.20
1968	2,310	14,435	86.20
1969	3,403	30,171	89.86
1970	1,618	13,401	89.23
1971	6,787	28,589	80.81
1972	2,330	22,236	90.51
1973	1,351	9,213	87.21
1974	2,803	19,284	87.31
1975	7,591	9,540	55.69
1976	5,711	5,881	50.73
1977	6,332	7,061	52.72
1978	2,942	1,782	37.72
1979	4,488	3,442	43.62
1980	3,025	2,319	43.39
1981	911	2,554	73.70
1982	1,097	2,811	71.93
1983	3,229	1,611	33.29

Table 36. Striped bass spawning and egg viability related to water temperature, Roanoke River, N. C., Spring, 1982.

Temperature Range (°C)	Number non-viable eggs	Number viable eggs	Percent viable eggs	Percent total No. eggs sample
15.0 - 15.9	8	2	20.00	0.26
16.0 - 16.9	79	302	79.27	9.75
17.0 - 17.9	110	412	78.93	13.36
18.0 - 18.9	134	567	80.88	17.94
19.0 - 19.9	241	368	60.43	15.58
20.0 - 20.9	211	485	69.68	17.81
21.0 - 21.9	150	259	63.33	10.46
22.0 - 22.9	121	339	73.70	11.77
23.0 - 23.9	10	30	75.00	1.02
24.0 - 24.9	33	47	58.75	2.05
Total	1097	2811	71.93	100.00

Table 37. Striped bass spawning and egg viability related to water temperature, Roanoke River, N. C., Spring, 1983

Temperature range (°C)	Number non-viable eggs	Number viable eggs	Percent viable eggs	Percent total No. eggs sample
15.0 - 15.9	1	0	0	0.02
16.0 - 16.9	59	34	36.56	1.92
17.0 - 17.9	409	105	20.43	10.62
18.0 - 18.9	1,352	511	27.43	38.49
19.0 - 19.9	480	311	39.32	16.34
20.0 - 20.9	729	517	41.49	25.74
21.0 - 21.9	133	76	36.36	4.32
22.0 - 22.9	66	57	46.34	2.54
Total	3,229	1,611	33.29	

GROWTH AND RELATIVE ABUNDANCE OF THE YOUNG-OF-YEAR STRIPED BASS 1982-1983

Sampling of Young-of-Year Striped Bass in Albemarle Sound

Annual sampling to determine the survival and relative abundance of young-of-year striped bass has been conducted in Albemarle Sound for the past 29 years. The sampling area is located in western Albemarle Sound extending eastward approximately 12 miles. Seven permanent sampling stations have been selected and demarcated by some fixed land feature. These locations are as follows:

Station No. 1 - Walnut Point
Station No. 2 - East of Edenton Bay
Station No. 3 - North side between bridges
Station No. 4 - North side east of N. C. 32 bridge
Station No. 5 - South side east of N. C. 32 bridge
Station No. 6 - South side between bridges
Station No. 7 - Albemarle Beach

The sampling area and station locations are illustrated in Figure 2.

A 5.29 m balloon trawl is used to collect the samples. The samples collected early in the sampling period are taken with a 6.35 mm stretched mesh cod end, while later samples are collected with a 12.7 mm stretched mesh cod end. Each trawl sample is of 15 minutes duration at a towing speed of approximately 2.75 miles per hour. The trawling depth varies between 6 and 10 feet. Wind direction and velocity, depth, air and water temperatures, and the time started and stopped are recorded for each sample. Young-of-year striped bass are measured, weighed, and released in good condition. Other species collected are identified, counted, measured, and released.

A total of 49 trawl samples was collected on seven dates in Albemarle Sound during the months of July, August, September, and October in 1982. Table 38 shows the catch composition by species and number of specimens collected at each station in 1982. A total of 8,514 specimens of 17 species was collected with white perch being the most abundant species (5,050 specimens, followed by blueback herring (1,807 specimens) and spot (703 specimens). A total of 66 blue crabs was also taken in the trawl samples.

A total of 186 young-of-year striped bass was collected, and this was a sharp increase over 1981 when only five young-of-year striped bass were collected. The 1982 collection of young-of-year striped bass is the highest number reported since 1977.

Station No. I (Walnut Point) accounted for the largest fish catch (2,039 specimens). The catches at all other stations were considerably less than those at Station I. Station No. I also was the site where the most young-of-year striped bass were collected (56). A total of 39 young of year striped bass was collected at Station VII (Albemarle Beach). Stations I and VII are the westernmost stations (Figure 2).

The 1982 catch composition is compiled by species and number of specimens taken by date in Table 39. The sampling began on July 7 and continued through October 1. Samples were collected at intervals of approximately two weeks. The largest number of fish was collected on the fourth sampling date (August 18) when 2,120 specimens were captured. The largest number of young-of-year striped bass was also collected on August 18.

The total number of each species collected and the mean catch per trawl are listed in Table 40. The number of fish caught by the balloon trawl by station and date and the c.u.e. are presented in Table 41. These data are included in this form for comparison with collections made in past years (see Hassler and Hill, 1979).

A total of 56 trawl samples was collected on eight sampling dates in Albemarle Sound during the months of July, August, September, and October, 1983. Table 42 shows the catch composition by species and number of specimens collected at each station in 1983. A total of 4,896 fish and 20 species was collected with blueback herring being the most abundant species (2,279 specimens), followed by white perch (1,795) and anchovies (435). A total of 112 blue crabs was also collected in the trawl samples.

A total of 47 young-of-year striped bass was collected, and this number constitutes a sharp decrease from 186 young-of-year collected in 1982.

Station I (Walnut Point) was the most productive station and accounted for 1,643 specimens. Station VII (Albemarle Beach) rated second in the number of fish caught (1,188). All of the other stations had reduced catches in comparison with the westernmost Stations I and VII.

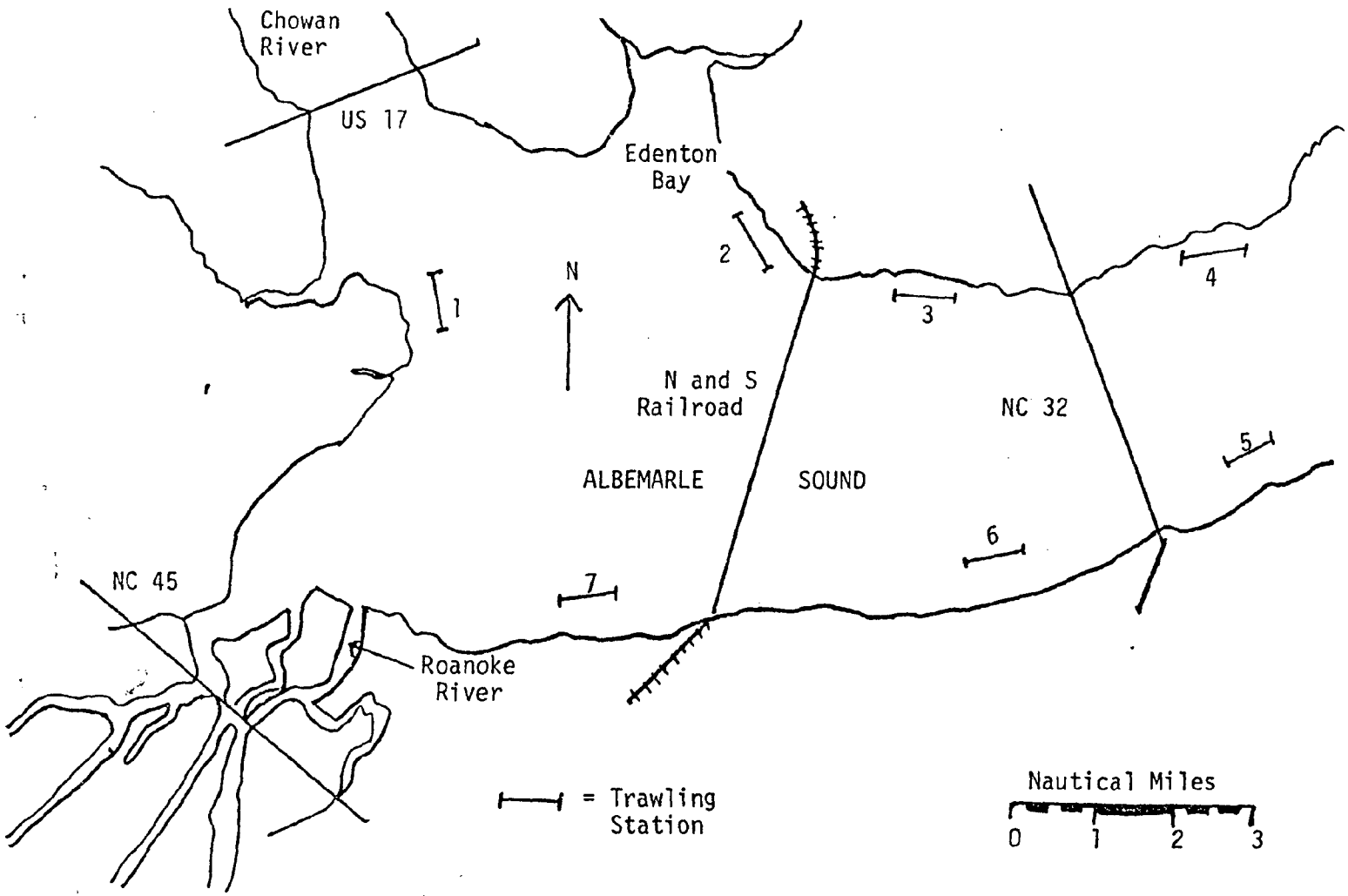

Figure 2. Map of the sampling area and station locations for young-of-year striped bass in the western end of Albemarle Sound, N. C.

Table 38. Catch composition by species and numbers of specimens collected at each station by bottom trawling in Albemarle Sound, N. C., 1982

Species	Station Number							
	I	II	III	IV	V	VI	VII	Total
Morone saxatilis (y-o-y)	56	17	8	27	16	23	39	186
Alosa aestivalis	1,464	20	136	55	2	29	101	1,807
Alosa mediocris	12					3		15
Anchoa mitchilli	5	5	64	12	13	18	55	172
Brevoortia tyrannus	2						2	4
Cyprinus carpio	1					2		3
Ictalurus catus	2					1		3
Ictalurus punctatus	6	1	2			2		11
Leiostomus xanthurus	2	27	2	357	108	138	69	703
Lepomis gibbosus			2					2
Micropogonias undulatus	2	179	42	223	26	21	12	505
Micropterus salmoides						1		1
Morone americana	467	714	454	614	860	1,030	911	5,050
Mugil cephalis					2			2
Notropis hudsonius	1							1
Perca flavescens	8		1	3	8	4	4	28
Trinectes maculatus	11	1	2	1	3	3		21
TOTAL	2,039	964	713	1,292	1,038	1,275	1,193	8,514
Callinectes sapidus		3	13	20	7	12	11	66

Table 39. Catch composition by species and number of specimens tabulated by date of collection by bottom trawling in Albemarle Sound, 1982

Species	7/7	7/21	8/3	8/18	9/3	9/15	10/1	Total
Morone saxatilis (y-o-y)	9	2	44	74	20	18	19	186
Alosa aestivalis	5	171	202	966	137	90	236	1,807
Alosa mediocris		8	6				1	15
Anchoa mitchilli	12	70		5		68	17	172
Brevoortia tyrannus	2				2			4
Cyprinus carpio			1	1	1			3
Ictalurus catus	2				1			3
Ictalurus punctatus	2	3		5	1			11
Leiostomus xanthurus	27		106	277	83	74	136	703
Lepomis gibbosus	2							2
Micropogonias undulatus	1		272	109	35	24	64	505
Micropterus salmoides			1					1
Morone americana	1,292	973	981	669	592	309	234	5,050
Mugil cephalis				1	1			2
Notropis hudsonius	1							1
Perca flavescens	12		4	6	3	3		28
Trinectes maculatus		2	2	7	3	3	4	21
TOTAL	1,367	1,229	1,619	2,120	879	589	711	8,514
Callinectes sapidus	3	3	9	13	2	25	11	66

Table 40. Mean catch per trawl for species collected by bottom trawl* in Albemarle Sound, N. C., 1982

Species	Total number collected	Mean catch per trawl
Morone saxatilis (y-o-y)	186	3.80
Alosa aestivalis	1,807	36.88
Alosa mediocris	15	0.31
Anchoa mitchilli	172	3.51
Brevoortia tyrannus	4	0.08
Cyprinus carpio	3	0.06
Ictalurus catus	3	0.06
Ictalurus punctatus	11	0.22
Leiostomus xanthurus	703	14.35
Lepomis gibbosus	2	0.04
Micropogonias undulatus	505	10.31
Micropterus salmoides	1	0.02
Morone americana	5,050	103.06
Mugil cephalus	2	0.04
Notropis hudsonius	1	0.02
Perca flavescens	28	0.57
Trinectes maculatus	21	0.43
Total finfish	8,514	
Callinectes sapidus	66	1.35

* - 49 trawls

Table 41. Number of fish caught by bottom trawl in Albemarle Sound, N. C. by date and station, catch-per-unit effort, July 7-October 1, 1982

Date	Station							Total	$\bar{X}$
	I	II	III	IV	V	VI	VII		
July 7	112	36	335	411	91	167	215	1,367	195.29
July 21	178	214	68	69	265	424	11	1,229	175.57
August 3	490	181	42	151	209	206	340	1,619	231.29
August 18	1,084	173	40	362	175	203	83	2,120	302.86
September 3	55	203	118	124	196	110	73	879	125.57
September 15	9	11	108	23	69	49	320	589	84.14
October 1	111	146	2	152	33	116	151	711	101.57
Total	2,039	964	713	1,292	1,038	1,275	1,193	8,514	

Table 42. Numbers of fishes collected by bottom trawl in Albemarle Sound, N. C. by species and station, July 14-October 20, 1983

Species	Station							Total
	I	II	III	IV	V	VI	VII	
Morone saxatilis (y-o-y)	10	10	1	3	3	11	9	47
Alosa aestivalis	1,366	116	140	169	49	11	428	2,279
Alosa mediocris							1	1
Alosa pseudoharengus	17	93		1		1		112
Amia calva			1					1
Anchoa mitchilli	36	29	121	69	178	1	1	435
Brevoortia tyrannus		1						1
Cyprinus carpio	3	1	1		2		1	8
Ictalurus catus	19	2	2	1			1	25
Ictalurus furcatus	1	1						2
Ictalurus punctatus	3	2	3				2	10
Leiostomus xanthurus	3	5	8	23	34	4		77
Micropogonias undulatus		3	5	11		1		20
Morone americana	164	365	68	223	144	93	738	1,795
Morone saxatilis (yearling)	1	3		1	7	1	2	15
Moxostoma sp.	1		1					2
Notropis hudsonius	6	1						7
Notropis sp.	1							1
Perca flavescens	2				27		1	30
Trinectes maculatus	10		4	1	3	6	4	28
Total finfish	1,643	632	355	502	447	129	1,188	4,896
Callinectes sapidus		2	39	37	14	9	11	112
Grand Total								5,008

Forty young-of-year striped bass were collected at Stations I, II, VI, and VII. These stations are located in the western end of the sound. Only seven young-of-year striped bass were collected at Stations III, IV, and V.

The 1983 catch composition is compiled by species and date in Table 43. The sampling began on July 14 and was terminated on October 20. The samples were collected at approximately two-week intervals. The greatest number of fish were collected on the sixth trawling trip when 1,258 fish were collected. The largest number of young-of-year striped bass were collected on October 20, the last sampling date. Inspection of the data shows that all of the young-of-year striped bass were collected after August 25.

The total number of each species collected and the mean catch per trawl are listed in Table 44. Also, the number of fish caught by the bottom trawl are listed by date, station, and c.u.e. in Table 45. Again, these data are listed for comparison purposes with previous years.

A 29-year record of the mean number of young-of-year striped bass collected in Albemarle Sound is presented in Table 46. These data show the sharp decline in the abundance of young-of-year striped bass since 1976. The 1977-1983 data show the most prolonged period of depletion for young-of-year striped bass since the study began in 1955.

The total weight and length measurements of young-of-year striped bass are included in Appendix Table 4 for 1982.

Table 43. Numbers of fishes collected by bottom trawl in Albemarle Sound, N. C. by species and date, July 14-October 20, 1983

Species	Date								
	7/14	7/28	8/11	8/25	9/8	9/22	10/6	10/20	Tot
Morone saxatilis (y-O-y)				2	8	10	9	18	
Alosa aestivalis	346			183	132	581	700	337	2,2
Alosa mediocris			1						
Alosa pseudoharengus		90			3	19			1
Amia calva	1								
Anchoa mitchilli					1	198	173	63	4
Brevoortia tyrannus								1	
Cyprinus carpio		5			3				
Ictalurus catus	1			1	1	19	2	1	
Ictalurus furcatus								2	
Ictalurus punctatus	2	2		2	1	1		2	
Leiostomus xanthurus				4	39	23		11	
Micropogonias undulatus					2	15		3	
Morone americana	370	297	50	293	246	376	28	135	1,7
Morone saxatilis (yearling)	1	2		2		2	6	2	
Moxostoma sp.		1					1		
Notropis hudsonius						5		2	
Notropis sp.							1		
Perca flavescens	2	27			1				
Trinectes maculatus	2	4		2	9	9		2	
Total finfish	725	428	51	489	446	1,258	920	579	4,8
Callinectes sapidus		25		22	11	13	25	16	1
Grand total									5,0

Table 44. Mean catch per trawl for species collected by bottom trawl* in Albemarle Sound, N. C., 1983

Species	Total number collected	Mean catch per trawl
Morone saxatilis (y-o-y)	47	0.84
Alosa aestivalis	2,279	40.70
Alosa mediocris	1	0.02
Alosa pseudoharengus	112	2.00
Amia calva	1	0.02
Anchoa mitchilli	435	7.77
Brevoortia tyrannus	1	0.02
Cyprinus carpio	8	0.14
Ictalurus catus	25	0.45
Ictalurus furcatus	2	0.04
Ictalurus punctatus	10	0.18
Lieostomus xanthurus	77	1.38
Micropogonias undulatus	20	0.36
Morone americana	1,795	32.05
Morone saxatilis (yearling)	15	0.27
Moxostoma sp.	2	0.04
Notropis hudsonius	7	0.13
Notropis sp.	1	0.02
Perca flavescens	30	0.54
Trinectes maculatus	28	0.50
Total finfish	4,896	87.43
Callinectes sapidus	112	2.00

* - 56 trawls

Table 45. Number of fish caught by bottom trawl in Albemarle Sound, N. C. by date and station, catch-per-unit effort, July 14-October 20, 1983

Date	Station								
	I	II	III	IV	V	VI	VII	Total	$\bar{X}$
July 14	358	28	1	3	0	2	333	725	103.57
July 28	10	114	4	53	77	26	144	428	61.14
August 11	2	1	22	1	3	8	14	51	7.29
August 25	147	105	19	66	80	3	69	489	69.86
September 8	26	81	7	54	94	22	162	446	63.71
September 22	277	188	178	174	0	50	391	1,258	173.71
October 6	684	14	20	1	181	5	15	920	131.43
October 20	139	101	104	150	12	13	60	579	82.71
Total	1,643	632	355	502	447	129	1,188	4,896	

Table 46. Mean number of young-of-year striped bass collected by trawling in Albemarle Sound, N. C., 1955-1983

Year	Number of samples	Number of fish	Mean number per 15 min trawl	Mean number during July and August
1955	38	124	3.27	3.68
1956	43	823	19.14	21.47
1957	51	291	5.71	3.00
1958	40	6	0.15	0.07
1959	51	1,217	23.86	26.40
1960	54	320	5.93	6.17
1961	61	630	10.33	15.20
1962	44	346	7.86	9.93
1963	45	216	4.80	5.60
1964	44	138	3.14	4.43
1965	49	494	10.08	9.22
1966	52	181	3.48	5.10
1967	33	772	23.39	25.69
1968	49	323	6.59	5.34
1969	49	141	2.99	4.71
1970	49	610	12.45	12.03
1971	49	140	2.86	4.60
1972	56	141	2.52	3.14
1973	56	109	1.95	2.09
1974	56	309	5.52	6.66
1975	56	605	10.80	13.37
1976	56	589	10.52	15.14
1977	54	196	3.63	3.32
1978	54	32	0.59	0.97
1979	49	27	0.55	0.43
1980	56	26	0.46	0.49
1981	56	5	0.09	0.18
1982	49	186	3.80	4.61
1983	56	47	0.84	0.04

POPULATION ABUNDANCE OF STRIPED BASS IN THE ROANOKE RIVER, 1982 and 1983

Population estimates of the striped bass population migrating up the Roanoke River during the spawning season have been made by two methods. The first method used is the Petersen (1896) technique which involves the tagging and recapture of tagged striped bass. The second method employed was that of Ricker (1940) which uses catch and effort data from the sport fishery. However, since 1981 considerable changes have occurred in the regulations pertaining to the commercial and sport fisheries. Since 1981 the fisheries regulations for the Roanoke, Cashie, Middle and Eastmost Rivers state that:

(1) No fixed or stationary gill net of any size shall be used during the period from April 1 to May 31 from the mouth of the Roanoke River to Highway 58 bridge.

(2) No drift gill net with a mesh length of less than two and one-fourth inches or greater than three inches stretched mesh shall be used during the period April 1 to May 31 from the mouth of the Roanoke River to Highway bridge 258.

Also, sport fishing regulations have been changed which provide for:

(1) The elimination of special devices such as bow nets.

(2) The imposition of a 16-inch total length size limit in the Roanoke River above the U.S. 258 bridge.

(3) A reduction in creel limit from 25 to 8 striped bass per day.

All of the regulatory changes have modified the harvest of striped bass in the Roanoke River. Also, the returns of tagged fish have declined considerably in recent years. Consequently, the average exploitation rate for the past 25 years has been used in this report to estimate the spawning population of striped bass up the Roanoke River.

The 1982 spawning population of striped bass was estimated in Table 47 to be 70,650 fish. The 1983 striped bass spawning population was estimated in Table 48 to be 69,771 fish.

Table 47. Estimation of the total number of striped bass in the spawning population in the Roanoke River, N. C., 1982

Total Catch of Striped Bass		Number Caught
Commercial Fishery		398
Sport Fishery		
Rod and Reel - Upper River		
Weldon, Roanoke Rapids, Halifax, Johnson's Landing	5,497	
Middle River		
Lewiston, Palmyra, Oak City, Scotland Neck, Tillery	219	
Lower River		
Hamilton, Williamston, Jamesville, Plymouth	1,608	
Total Sport Fishery		7,324
GRAND TOTAL COMMERCIAL AND SPORT		7,722

$$\text{Population Estimation} = \frac{\text{Total catch of striped bass in the Roanoke River by commercial and sport fishermen}}{\text{25-year average rate of exploitation}}$$

$$= \frac{7,722}{0.1093} = 70,650$$

Table 48. Estimation of the total number of striped bass in the spawning population in the Roanoke River, N. C., 1983

Total Catch of Striped Bass		Number Caught
Commercial Fishery		650
Sport Fishery		
Upper River	4,202	
Middle River	126	
Lower River	2,648	
Total Sport Fishery		6,976
GRAND TOTAL COMMERCIAL AND SPORT		7,626

$$\text{Population Estimation} = \frac{\text{Total catch of striped bass in the Roanoke River by commercial and sport fishermen}}{\text{25-year average rate of exploitation}}$$

$$= \frac{7,626}{0.1093} = 69,771$$

The estimated spawning population of striped bass in the Roanoke River is presented in Table 49 for the years 1956 to 1983. These data indicate a peak in 1972 when an estimated 507,145 striped bass migrated up the Roanoke River. The striped bass population was plentiful for a 10-year period from 1970 to 1979. In 1980 the striped bass population declined to 100,192 fish, and it declined further in 1981, 1982, and 1983. During the past three years the increase in size limit and decrease in creel limit has reduced the sport catch, and the population estimate does not include the fish smaller than 16 inches.

ENVIRONMENTAL AND BIOLOGICAL FACTORS IN RELATION TO STRIPED BASS ABUNDANCE

Many factors have been considered throughout the country in an effort to find the cause(s) of the striped bass decline. Some possible causes for this decline have been attributed to water diversions, domestic, agricultural, and industrial pollution, climatic changes, meteorological variations, long-term population cycles, short-term population cycles, acid rain, sunspots, eutrophication, genetic changes, and over-exploitation by the commercial fishery.

In the Roanoke River and Albemarle Sound two critical factors are evident which may contribute to the reduction in numbers of striped bass in the population. The first factor observed is the reduced viability of striped bass eggs in the Roanoke River commencing in 1975 when the egg viability declined from 87.31% in 1974 to 55.69% in 1975. This decline has continued each year through 1984 although some increased viabilities occurred during 1982 and 1983. The apparent cause of this lowered viability has not been identified.

The second factor linked with the striped bass decline may occur during the post yolk-sac stage of striped bass fry in the nursery area of western Albemarle Sound. Large numbers of viable striped bass fry are still being transported down the Roanoke River to Albemarle Sound even though the egg viability is reduced. Apparently the food supply in Albemarle Sound is insufficient for the striped bass fry after the yolk-sac is absorbed since there has not been an abundant year-class since 1976.

Striped bass young-of-year trawl collections have been made since 1955, and the 1977-1984 period is demarcated by practically negligible recruitment of young-of-year striped bass. The nursery area stage of recruitment is considered to be more critical than the egg viability reduction since large numbers of viable striped bass fry are still being received in the nursery area.

Table 49. Estimated number of striped bass in the spawning migration up the Roanoke River, 1956-1983

Year	Number of striped bass
1956	239,489
1957	173,289
1958	251,280
1959	448,292
1960	418,062
1961	310,135
1962	148,260
1963	157,246
1964	251,906
1965	310,003
1966	277,397
1967	174,286
1968	317,474
1969	200,259
1970	421,571
1971	441,823
1972	507,145
1973	402,593
1974	433,213
1975	337,024
1976	277,630
1977	347,584
1978	354,152
1979	313,736
1980	100,192
1981	34,032
1982	70,650
1983	69,771

One of the factors which could affect striped bass fry survival in the nursery area is wind-induced turbidity in the western region of Albemarle Sound. Increased turbidity would decrease first, phytoplankton abundance and, secondly, zooplankton abundance which would result in diminished production of food for striped bass fry. The extent of wind-induced turbidity in western Albemarle Sound depends on wind direction and velocity. Winds emanating from an easterly direction and blowing along the east-west axis of the sound cause considerable turbidity in the shallow, silt-laden waters of western Albemarle Sound. Likewise, winds of high velocity are marked by increases in the amount of turbidity. Another factor involved in wind effects occurring in western Albemarle Sound is the creation of "salt wedges" and increased salinities. Also, winds may induce "wind tides" which block or reduce river discharges and, subsequently, cause algae blooms because of the pooling of nutrients. In retrospect, wind effects in Albemarle Sound may cause increased turbidities, increased salinities, and increased concentration of nutrients. Subsequently, a reduction in phytoplankton and zooplankton may occur. Increased nutrients may result in blooms of blue-green algae which can be toxic and oxygen depleting.

With these factors in mind weather records were obtained for a 22-year period, 1955-1976. Wind direction, mean velocities, and peak velocities were determined for the months of May and June in relation to easterly winds (NE, E, SE). These data were analyzed in respect to the mean number of young-of-year striped bass collected for each respective year. Correlation coefficients were determined between the amount of easterly wind and mean number of young-of-year striped bass. This correlation coefficient was not significant. In addition correlation coefficients were derived for the mean number of young-of-year striped bass, mean velocity of easterly winds, and peak velocity of easterly winds. Each of these sample correlation coefficients was non-significant.

Southerly winds (SW, S, SE) were also analyzed for May and June in respect to the mean number of young-of-year striped bass, and no significant relationship was found.

Peak spawning dates and the duration of the spawning season were also examined to determine if any relationship existed between these factors and the abundance of young-of-year striped bass. There was no significant relationship between these factors.

Sample correlation coefficients between monthly mean Roanoke River discharge and mean abundance of young-of-year striped bass were significant only for the month of May. The data indicate low to moderate river discharge is favorable to abundance of young-of-year striped bass. High rates of river discharge are unfavorable.

Other factors investigated are the relationships between young-of-year abundance and (1) the size of the spawning population of striped bass in the Roanoke River, (2) the abundance of striped bass eggs, (3) the sport catch of striped bass in the Roanoke River, and (4) the commercial catch of striped bass in the Roanoke River. All of the correlation analyses were determined to be non-significant.

Another relationship which was examined was the predictive value of the young-of-year index in the determination of commercial landings 2, 3, and 4 years later. This correlation coefficient was not significant.

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APPENDIX

Appendix Table 1. Catch and effort data for striped bass caught by bank fishermen in the Weldon and Roanoke Rapids area of the Roanoke River, N. C., spring, 1983

Date	Weldon			Roanoke Rapids		
	Number fishermen	Number fishermen checked	Number striped bass caught	Number fishermen	Number fishermen checked	Number striped bass caught
April 30	7	6	0	-	-	-
May 1	5	5	0	7	7	0
2	1	1	0	4	4	0
3	-	-	-	4	4	0
4	-	-	-	5	5	0
5	-	-	-	8	8	4
6	-	-	-	-	-	-
7	2	2	0	4	4	0
8	3	3	0	6	6	0
9	1	1	0	4	4	0
10	4	4	0	3	3	0
11	2	2	0	3	3	0
13	3	3	1	-	-	-
14	5	4	0	-	-	-
16	1	1	0			
19	3	0	0			
22	5	1	0			
23	3	3	0			
24	-	-	-	1	1	0
25	2	2	0			
26	1	1	0			
28	-	-	-	1	1	1
Total	48	39	1	51	51	5

Appendix

Table 2. Striped bass sport fishing catch records (rod and reel) and drift net herring catches, Hamilton, N. C., spring, 1982

Date	Striped Bass			Herring		
	No. boats	No. caught	C.U.E.	No. boats	Total estimated catch	C.U.E.
April 11	6	5	0.83	8	950	118.75
12	3	2	0.67	4	600	150.00
13	4	4	1.00	5	700	140.00
14	4	7	1.75	4	450	100.00
15	6	6	1.08	7	950	135.71
16	5	2	0.33	8	1700	212.50
17	8	1	0.13	17	3250	191.18
18	8	0	0.00	20	4500	225.00
19	7	2	0.29	7	850	121.43
20	4	0	0.00	8	850	106.25
21	3	0	0.00	4	425	106.25
22	4	0	0.00	3	350	116.67
23	4	0	0.00	4	350	87.5
24	12	0	0.00	6	650	108.33
25	3	0	0.00	4	350	82.50
26	0	0	0.00	0	0	0.00
27	4	3	0.75	2	300	50.00
28	3	0	0.00	4	600	150.00
29	3	3	1.00	8	700	175.00
30	5	1	0.00	4	600	150.00
May 1	4	2	o.50	4	400	100.00
2	3	5	1.67	4	475	118.75
3	4	4	1.00	2	75	37.50
4	4	5	1.25	4	200	50.00
5	4	1	0.25	3	75	25.00
6	2	0	0.00	2	40	20.00
7	4	4	1.00	4	100	25.00
*8	4	4	1.00	3	45	15.00

Appendix
Table 2. Striped bass sport fishing catch records (rod and reel) and drift net herring catches, Hamilton, N. C., spring, 1982 (continued)

Date		Striped Bass			Herring		
		No. boats	No. caught	C.U.E.	No. boats	Total estimated catch	C.U.E.
May	9	4	4	1.00	3	110	36.67
	10	4	4	1.00	3	90	30.00
	11	4	2	0.50	4	100	25.00
	12	4	19	4.75	4	60	15.00
	13	4	25	6.25	4	50	12.50
	14	6	19	3.17	3	20	6.67
	15	6	13	2.17	0	0	0.00
	16	6	9	1.50	5	15	3.00
	17	5	11	2.20	6	20	3.33
	18	4	11	2.75	4	15	3.75
	19	3	7	2.33	5	15	3.00
	20	4	2	0.50	4	15	3.75
	21	3	2	0.67	2	7	3.50
	22	6	7	1.17	5	25	5.00
	23	6	4	0.67	3	0	0.00
	24	3	0	0.00	0	0	0.00
	25	2	1	0.50	2	0	0.00
	26	3	0	0.00	0	0	0.00
	27	3	1	0.33	0	0	0.00
	28	4	2	0.50	1	0	0.00
	29	6	2	0.33	0	0	0.00
	30	4	1	0.25	0	0	0.00
	31	4	1	0.25	0	0	0.00
June	1	3	0	0.00	0	0	0.00
	2	3	1	0.33	0	0	0.00
	3	2	0	0.00	0	0	0.00
	4	4	0	0.00	0	0	0.00
	5	5	2	0.40	0	0	0.00
Total		241	211	0.88	207	21,027	101.58

Appendix

Table 3. Striped bass sport fishing catch records (rod and reel) and drift net herring catches, Hamilton, N. C., spring, 1983

	Striped Bass			Herring		
Date	No. boats	No. caught	C.U.E.	No. boats	Total estimated catch	C.U.E.
April 5	2	0	0	3	10	3.33
6	3	0	0	4	12	3.00
7	1	0	0	3	6	2.00
8	4	0	0	9	4	0.44
9	3	0	0	10	65	6.50
10	4	0	0	15	70	4.67
11	1	0	0	7	50	7.14
12	1	0	0	4	15	3.75
13	0	0	0	6	30	5.00
14	2	0	0	4	35	8.75
15	3	0	0	7	70	10.00
16	3	1	0.33	8	125	15.63
17	5	3	0.60	15	500	33.33
18	0	0	0	2	50	25.00
19	3	3	1.0	15	250	16.67
20	4	5	1.25	10	150	15.00
21	2	4	2.00	5	50	10.00
22	5	6	1.20	13	100	7.69
23	7	8	1.14	17	75	4.41
24	5	3	0.60	14	80	5.71
25	5	0	0	15	1000	66.67
26	3	1	0.33	7	200	28.57
27	2	0	0	5	150	30.00
28	3	1	0.33	7	250	35.71
29	5	2	0.40	10	500	50.00
30	6	4	0.66	10	300	30.00
May 1	4	1	0.25	15	400	26.67
2	1	0	0	5	250	50.00
3	2	2	1.00	5	75	15.00
4	3	1	0.33	1	11	11.00
5	2	0	0	3	30	10.00
6	4	3	0.75	5	60	12.00
7	6	3	0.50	7	65	9.29

Appendix
Table 3. (continued)

Date		Striped Bass			Herring		
		No. boats	No. caught	C.U.E.	No. boats	Total estimated catch	C.U.E.
May	8	7	4	0.57	14	125	8.93
	9	2	0	0	3	20	6.67
	10	2	0	0	15	100	6.67
	11	3	1	0.33	10	50	5.00
	12	3	0	0	9	65	7.22
	13	2	0	0	4	35	8.75
	14	7	2	0.29	11	110	10.00
	15	3	1	0.33	10	90	9.00
	16	2	0	0	4	15	3.75
	17	3	1	0.33	2	0	0.00
	18	2	0	0	3	5	1.67
	19	1	0	0	4	10	2.50
	20	4	1	0.25	4	2	0.50
	21	5	5	1.0	10	15	1.50
	22	3	1	0.33	2	4	2.00
	23	1	0	0	0	0	0.00
	24	2	0	0	3	9	3.00
	25	3	0	0	4	0	0.00
	26	3	0	0	1	2	2.00
	27	1	1	1.0	2	0	0.00
	28	7	7	1.0	3	6	2.00
	29	3	4	1.33	4	10	2.50
	30	2	1	0.50	0	0	0.00
June	8	2	0	0	0	0	0.00
	9	1	0	0	1	0	0.00
	10	3	2	0.66	0	0	0.00
	11	4	1	0.25	0	0	0.00
	12	2	0	0	0	0	0.00
	13	1	0	0	1	0	0.00
	14	2	0	0	0	0	0.00
Total		190	83	0.44	390	5,711	14.64

Appendix
Table 4. Total weight and length measurements of each young-of-year striped bass collected by trawling in Albemarle Sound, N. C. by date and station, 1982

Date	Station	Weight (g)	Total Length (mm)
July 7	I	1.2	50
	I	1.3	51
	I	1.0	45
	II	1.7	55
	II	1.2	50
	VI	1.1	50
	VI	1.6	55
	VI	0.6	41
	VI	1.3	51
July 21	VII	1.7	55
	VII	1.1	50
August 3	I	1.1	50
	I	1.1	50
	I	1.0	49
	I	1.0	48
	I	1.0	48
	I	1.8	57
	I	1.7	56
	I	1.5	55
	I	1.0	48
	I	0.9	46
	II	3.2	70
	II	2.3	63
	IV	1.3	51
	IV	0.9	45
	IV	3.0	69
	IV	2.1	61

Appendix
Table 4. (continued)

Date	Station	Weight (g)	Total Length (mm)
August 3	V	2.3	62
	V	3.1	70
	V	3.0	67
	V	2.8	67
	V	2.3	62
	VI	2.3	61
	VI	3.2	70
	VII	2.1	60
	VII	1.3	53
	VII	2.0	58
	VII	2.1	60
	VII	3.8	73
	VII	1.9	58
	VII	2.6	63
	VII	2.3	63
	VII	2.2	63
	VII	1.2	51
	VII	2.1	60
	VII	1.8	57
	VII	2.5	54
	VII	2.7	66
	VII	2.0	59
	VII	2.0	60
	VII	1.6	56
	VII	1.0	47
	VII	1.3	53
	VII	2.1	61
August 18	I	1.9	56
	I	2.1	60
	I	1.6	55

Appendix
Table 4. (continued)

Date	Station	Weight (g)	Total Length (mm)
August 18	I	2.6	64
	I	2.6	63
	I	2.0	59
	I	2.0	59
	I	2.5	64
	I	2.0	60
	I	2.2	62
	I	2.3	62
	I	1.9	57
	I	2.2	63
	I	2.5	63
	I	1.9	57
	I	2.5	63
	I	2.2	62
	I	2.1	60
	I	2.2	61
	I	2.2	62
	I	2.5	64
	I	2.4	64
	I	2.0	59
	I	2.6	66
	I	1.9	57
	I	1.8	56
	I	1.1	53
	I	1.9	60
	I	1.5	57
	I	2.5	66
	I	2.1	62
	I	2.2	65
	I	2.7	66
	I	2.2	62
	I	1.9	57

Appendix
Table 4. (continued)

Date	Station	Weight (g)	Total Length (mm)
August 18	II	4.1	76
	II	4.0	74
	II	3.7	72
	II	3.0	66
	II	4.2	76
	II	3.5	70
	II	3.9	75
	II	4.4	79
	II	3.1	68
	II	3.6	73
	III	4.8	79
	III	3.2	69
	IV	5.5	82
	IV	5.4	80
	IV	4.9	78
	IV	3.2	67
	IV	2.4	61
	IV	3.9	72
	IV	6.0	84
	IV	4.6	77
	IV	3.6	71
	IV	4.3	75
	IV	4.5	76
	IV	3.9	73
	IV	3.2	67
	IV	4.5	78
	IV	6.3	88
	IV	4.1	74
	IV	4.5	76
	IV	5.0	80
	IV	3.2	69
	IV	3.6	70

Appendix
Table 4. (Continued)

Date	Station	Weight (g)	Total Length (mm)
August 18	V	4.0	74
	V	3.0	66
	V	3.2	68
	VI	2.8	65
	VI	3.0	67
	VI	3.8	73
	VI	3.1	70
September 3	I	2.9	68
	I	3.7	74
	I	2.1	62
	I	1.9	60
	II	4.6	79
	III	7.1	91
	III	4.6	79
	III	7.3	92
	III	4.2	78
	III	5.3	82
	III	5.3	82
	V	5.0	79
	V	5.0	80
	VII	3.9	79
	VII	3.8	74
	VII	1.9	60
	VII	3.6	73
	VII	3.5	73
	VII	4.1	76
	VII	4.2	77

Appendix
Table 4. (continued)

Date	Station	Weight (g)	Total Length (mm)
September 15	I	3.2	66
	I	3.4	71
	I	3.4	68
	IV	3.8	71
	V	6.5	82
	V	7.6	90
	V	3.7	73
	V	5.1	78
	VI	6.0	83
	VI	24.1	132
	VI	7.7	92
	VII	10.0	99
	VII	6.8	87
	VII	7.1	89
	VII	4.6	77
	VII	4.8	78
	VII	4.0	74
	VII	7.8	92
October 1	I	3.0	72
	II	6.1	91
	II	5.6	88
	IV	8.9	98
	IV	6.7	92
	V	7.3	94
	V	8.7	103
	VI	9.0	98
	VI	6.3	90
	VI	6.0	87
	VI	10.0	104
	VI	6.7	88

Appendix
Table 4. (continued)

Date	Station	Weight (g)	Total Length (mm)
October 1	VI	6.1	90
	VI	5.3	95
	VI	4.5	75
	VI	9.2	100
	VI	6.3	88
	VII	3.2	74
	VII	3.9	76