1987

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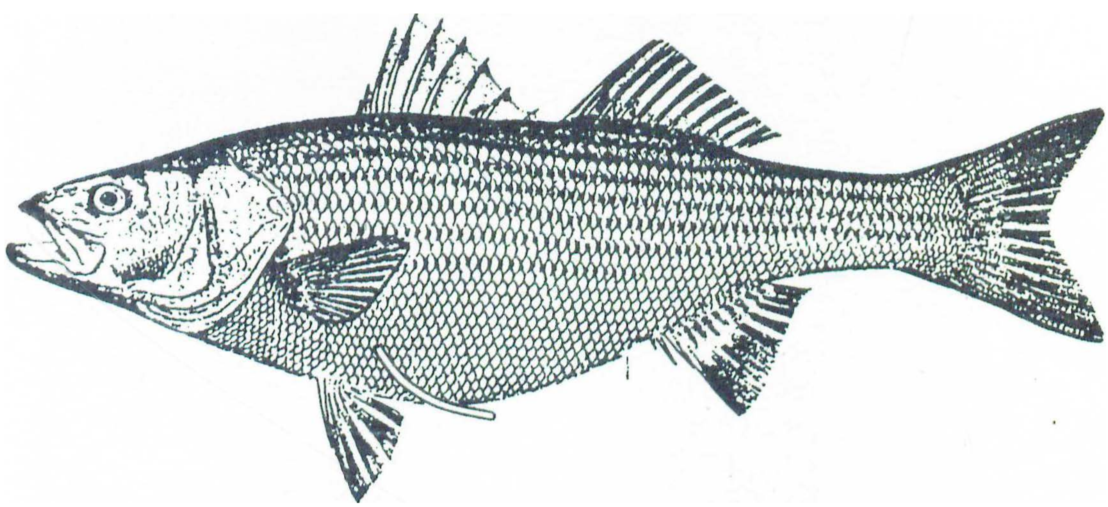
A MARK-RECAPTURE STUDY OF STRIPED BASS IN THE JAMES RIVER, VIRGINIA



ANNUAL REPORT 1987

Virginia Institute of Marine Science
School of Marine Science
The College of William and Mary
Gloucester Point, Virginia 23062

Annual Report, 1987

Project Title:	A Mark-Recapture Study of Striped Bass in the James River, Virginia
Project Number:	AFC-19-1
Project Period:	1 February 1987 - 31 January 1988
Principal Investigator:	Joseph G. Loesch

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PREFACE

Financial support for this project was provided, in part, by the National Marine Fisheries Service, Northeast Region, research grant AFC-19-1.

ACKNOWLEDGMENTS

We are indebted to the following commercial fishermen for the use of mooring facilities and the capture of striped bass for tagging in Spring 1987: Messrs. Norman Haynes, Ryland Hazelwood, Peter Pinholster, and Charles Tench. All personnel of the VIMS Anadromous Program, and many others from within and outside of VIMS assisted in the tagging program.

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EXECUTIVE SUMMARY

Internal anchor tags with external tubes were used to tag 1,986 striped bass in the James River in the Spring of 1987. The total number tagged was adjusted (at this time) to 823 because of observed and suspected tagging mortality. The available stock of striped bass in the Spring contained both young resident fish and mature nonresident fish which left the area of capture after spawning, presumably to migrate north in coastal waters. The exodus of the mature fish after spawning and the absence of a commercial fishery resulted in only 42 tag returns as of Spring 1988. This proportion (0.05) of returns is small relative to the proportion of returns in previous tagging programs in Chesapeake Bay when escapement was low due to high fishing pressures.

INTRODUCTION

Striped bass (Morone saxatilis) are an economically and socially important component of the commercial and recreational catches in the Chesapeake Bay area. From 1965 to 1972, commercial landings of striped bass in Virginia fluctuated from about 554 to 1,271 metric tons (MT). A dramatic decrease in catches has occurred, however, since 1973. For the years 1978 through 1987, commercial landings in Virginia averaged about 128 MT (Fig. 1). The decline in Virginia's striped bass landings is a typical example of the general situation from Maine to North Carolina. Berggren and Lieberman (1978) concluded from a morphological study that Chesapeake Bay striped bass were the major contributor (90.8%) to the Atlantic coast fisheries, and the Hudson River and Roanoke River stocks were minor contributors. However, they estimated that the exceptionally strong 1970 year class constituted 40% of their total sample: this "super" year class was also the major contributor to the high Virginia landings in 1972, 1973 and 1974. Van Winkle et al. (in press) reanalyzed Berggren and Lieberman's data and concluded that stock contributions to the coastal striped bass fishery were highly variable. Very strong year classes in Chesapeake Bay could lead to Berggren and Lieberman's conclusion. At other times, the relative abundance of the Hudson stock in the coastal fishery could be high, e.g., Van Winkle et al. estimated that the Hudson stock constituted between 40% to 50% of the striped bass caught in the Atlantic coastal fishery in 1965. Other investigators noticed that an abundance of young striped bass (primarily females ages 2 and 3) in New York and New England waters had an apparent correlation with strong year classes in Chesapeake Bay (Merriman 1941; Briggs 1962; Alperin 1966; Schaefer 1967, 1968). Regardless of the exact proportion, striped bass production in Chesapeake Bay not only affects the commercial and recreational fisheries in Virginia but influences the degree of success attained by the fisheries in other Atlantic coastal states.

Due to the concern about the decline in striped bass stocks along the Atlantic coast since the mid-1970's, an interstate fisheries management plan was developed under the auspices of the Atlantic States Marine Fisheries Commission (ASMFC) as part of their Interstate Fisheries Management Program (ASMFC 1981). Federal legislation was enacted in 1984 (Public Law #98-613, The Atlantic Striped Bass Conservation Act) which enables Federal imposition of a moratorium for an indefinite period in those states that fail to comply with the coastwide plan. To be in compliance with the plan, coastal states have imposed restrictions on their commercial and recreational striped bass fisheries ranging from combinations of catch quotas, size limits, and time-limited moratoriums (e.g., Virginia) to year-round moratoriums (e.g., Maryland). In addition, the Striped Bass Management Board has urged the coastal states to monitor the stocks and to institute tagging programs. Mark-recapture studies of striped bass in Virginia have been initiated in the James and Rappahannock rivers; elsewhere, striped bass are being tagged in Rhode Island, New York, and Maryland waters. These studies should provide information about exploitation rates, migration patterns, and the proportions of Hudson River, Maryland and Virginia striped bass in northern waters. The Maryland and Virginia studies will also provide information on the degree of striped bass movement within Chesapeake Bay. The data collected will be an important constituent of the total information base needed to assess present management strategies.

The long-term objectives of the mark-recapture study in Virginia are: 1) evaluate the degree of striped bass exploitation within and outside the Chesapeake Bay region under present fishery restrictions; 2) assess the coastal migratory pattern of Virginia striped bass; 3) assess the degree of fidelity to the rivers of capture by mature, migrant fish in subsequently spawning seasons; and 4) contribute to the present age-growth and size at maturity data base. Herein is an account of the striped bass tagging program in James River, for the year 1987.

METHODS

Striped bass were obtained from cooperating commercial fishermen. Fish were caught with fyke nets at river km 71 to 85 during Spring 1987 (Fig. 2). A length frequency distribution was constructed from all the fork lengths of tagged fish, but a days-at-large frequency distribution excluded all fish tagged on several days for which tagging mortality was documented.

A Floy internal anchor tag 10 mm X 32 mm, with a 100 mm external tube was used with striped bass greater than or equal to 300 mm in fork length. The anchor tag was inserted into the body cavity through a small surgical incision made just posterior to the apex of the pectoral fin on the museum (left) side of the fish. Thus, the anchor was inserted into the peritoneal cavity posterior to the pericardial cavity and anterior to the spleen. The tags were treated by the Floy Company with an algaecide which reduces algae build-up, reduces drag, and increases retention (Hillman and Werme 1983).

Basically, the VIMS tagging personnel would follow the fisherman to his net. Then the fisherman would pull several of the hoops of the fyke net into his boat and secure them. The tagging vessel would pull near to the side of the fisherman's vessel and place a "live car" (floating pocket) into the area between the two boats. The live car used during the tagging program measured 1.2 m x 2.4 m x 1.2 m with a 25.4-mm mesh. A float line was attached around the perimeter and a lead line attached on the bottom seam. Striped bass captured in the fyke net were transferred to the live car. Taggers would retrieve a fish from the live car, implant a tag, and record its total length (TL), fork length (FL), and, if possible, sex. Several scales were removed from each specimen to be used for age determination at a later date. Salinity, water temperature and tidal stage were also recorded.

The U. S. Fish and Wildlife Service (FWS) supplied the anchor tags for our project and to the other coastal states tagging striped bass, and it is functioning as the repository for the tag-return data. The data will be sorted and subsequently returned to the appropriate states. The external tube of the tag is inscribed with instructions to return the tag to, or telephone, the Annapolis, Maryland, office of the FWS. The National Fish and Wildlife Foundation (Washington, D. C.) forwards a reward of $5.00 or a fisherman's cap with a striped bass logo as an acknowledgment for the recapture information.

RESULTS

Tagging of striped bass in the James River in 1987 commenced on 22 April and ended on 28 May. A total of 1,986 striped bass were tagged and released. The maximum number of fish tagged in a day was 335 (11 May) and the fewest was 14 (22 April).

The striped bass tagged in the James River in Spring 1987 ranged in fork length (FL) from 263 mm to 945 mm and had a mean length of 469.5 mm (SE = 1.82 mm). Length frequency histograms by count and relative frequency (Figs. 3 and 4) show that 51% of the tagged fish were between 451 to 550 mm FL.

Of the 1,986 striped bass tagged, 55 fish were found washed ashore. Fish that were held in fyke nets over the weekend and tagged on the first three Mondays in May accounted for 74.5% of this mortality. Eighty percent of the fish beached were found in varying degrees of decomposition within one week, and 87% within two weeks (Table 1). The beaching of three striped bass, at large from 59 to 292 days, may be due to natural mortality, or handling during recapture and release. When more recapture data are available, a comparison will be made between the days-at-large distributions. Also, the percentage of recaptures of striped bass tagged on days of documented tagging mortality and fish tagged when there was no reported tagging mortality will be compared.

The total of 1,986 tagged striped bass was (for the present) adjusted to 823 by removing from consideration all fish tagged on days when there were five or more beached fish. With this restriction, the proportion of recaptures (N=42) was 0.05 as of Spring 1988.

Days at large for the tagged striped bass ranged from zero (day of tagging) to 393 (Fig. 5). Recaptures from hook and line fishing were more than two times greater than recaptures from either fyke nets or gill nets (Table 2). Most recaptures from fyke nets and gill nets occurred within the first two weeks (80% and 77.8%, respectively) while most recaptures by hook and line fishing (78.3%) occurred after the first two weeks. All but one recapture occurred in the James River or in its tributaries.

DISCUSSION

Due to prolonged flood conditions in the James River in Spring 1987, the planned use of at commercial haul seine to capture striped bass for tagging was not possible. After the flood conditions subsided, fish could be obtained only from fyke nets. We believe that crowding in the small nets and relatively warm water (because of placement of the nets in shoal water) stressed the fish and brought about the observed tagging mortality.

Due to the high retention rates of anchor tags in other studies, we did not conduct a tag-retention experiment. In overnight studies of phase II striped bass fingerlings tagged with an anchor tag (5 mm x 15 mm x 69 mm), Minton (1984) observed a mortality of less than 0.1%. Normandeau

Associates (1985) reported 100% retention of an internal anchor tag (6 mm x 26 mm x 88 mm) in another short-term (24 hr) tag-retention experiment with striped bass greater than 300 mm TL. Dunning and Ross (1985) conducted a longer tag-retention experiment (180 days) with striped bass ranging from 245 to 559 mm TL. They reported a 97.7% retention of internal anchor tags, but, in comparison, there was only a 50% retention of dart tags. Almost all tag loss occurred within 18 days.

Mark-recapture studies of striped bass in the Chesapeake Bay region from the 1930's to the 1970's have been summarized by Westin and Rogers (1978) and Kohlenstein (1981). The relatively numerous tagging studies in those four decades had two aspects in common: most of the tagged fish were age 4 or younger and the actual number and proportion of tags returned from outside the Bay region was low. The preponderance of young striped bass in those studies reflected their greater abundance in the Bay region relative to adults, and the season in which the fish were tagged. Many of the fish were tagged in the Winter or early Spring just before the arrival of mature coastal migrants, and the commencement of the Spring fisheries. At this time, when water temperatures are low, young striped bass concentrate in certain deep-water locations and are readily captured. Striped bass were also tagged in a Summer-Fall period when the available stock is composed mostly of nonmigrant, young fish. The tagging of striped bass prior to the commencement of the intensive Spring fisheries, and the large proportion of nonmigrant, young fish tagged, greatly reduced the probability of escapement of marked fish from the river of release and the general Bay region. Grant et al. (1970) had tag returns in the James River alone that were two and four-and-a-half times greater than our 5% when they tagged striped bass in Summer-Fall 1968 and Winter 1969. The actual difference may be greater because of tagging mortality and "non-response" in their study. They reported that nearly 95% of the tag returns for the Summer-Fall tagging period occurred within six weeks of release and at the site of tagging. We expect a high degree of escapement in the present tagging program because the Virginia Marine Resources Commission's six-month moratorium on the possession of striped bass from 1 December through 31 May' precludes a fishery for this species.

The tagging program in progress is expected to continue for several more years. After that time it is expected that reliable estimates of mortality and exploitation rates will be made and will be available for use in production and yield models. VIMS is currently aging a random subsample of the striped bass tagged in the James River during the Spring of 1987. Such analyses will be of assistance in formulating rational management plans. The present striped bass management plan, which relies heavily on an imprecise juvenile index (Heimbuch et al. 1983), should eventually be amended or replaced by management schemes that consider exploitation rates.

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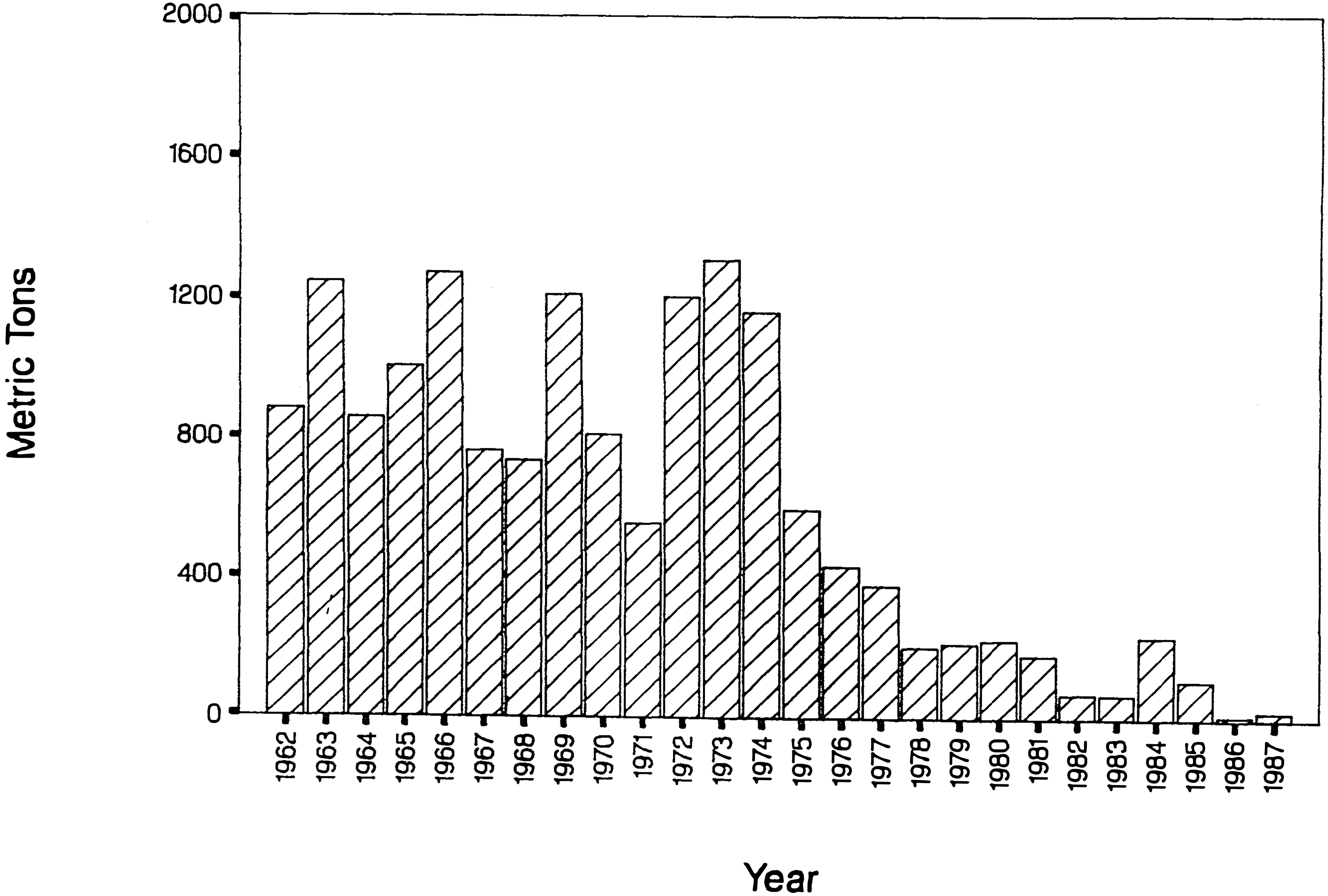
Table 1. Days at large for 55 beached striped bass tagged in the James River in Spring 1987.

Days at large	Number	Percent
0-3	25	45.4
4-7	19	34.5
8-14	4	7.3
15-21	3	5.5
25	1	1.8
59	1	1.8
83	1	1.8
292	1	1.8

Table 2. Days at large and number captured (in parentheses) for striped bass tagged in the James River in Spring 1987.

Gear	Days at large		
Fyke net	1 (3)	4 (3)	
	2 (1)	21 (1)	
	3 (1)	221 (1)	
Gill net	0 (2)	10 (1)	
	2 (3)	15 (1)	
	5 (1)	35 (1)	
Hook and line	4 (3)	44 (2)	210 (1)
	7 (1)	55 (2)	310 (1)
	14 (1)	57 (1)	330 (1)
	16 (2)	65 (1)	382 (1)
	36 (1)	68 (1)	383 (1)
	38 (1)	73 (1)	393 (1)

Figure 1. Annual landings of striped bass in Virginia, 1962 - 1987.



Metric Tons
2000
1600
1200
800
400
0
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
Year

Figure 2. Locations of fyke nets used to capture striped bass in the James River in Spring 1987.

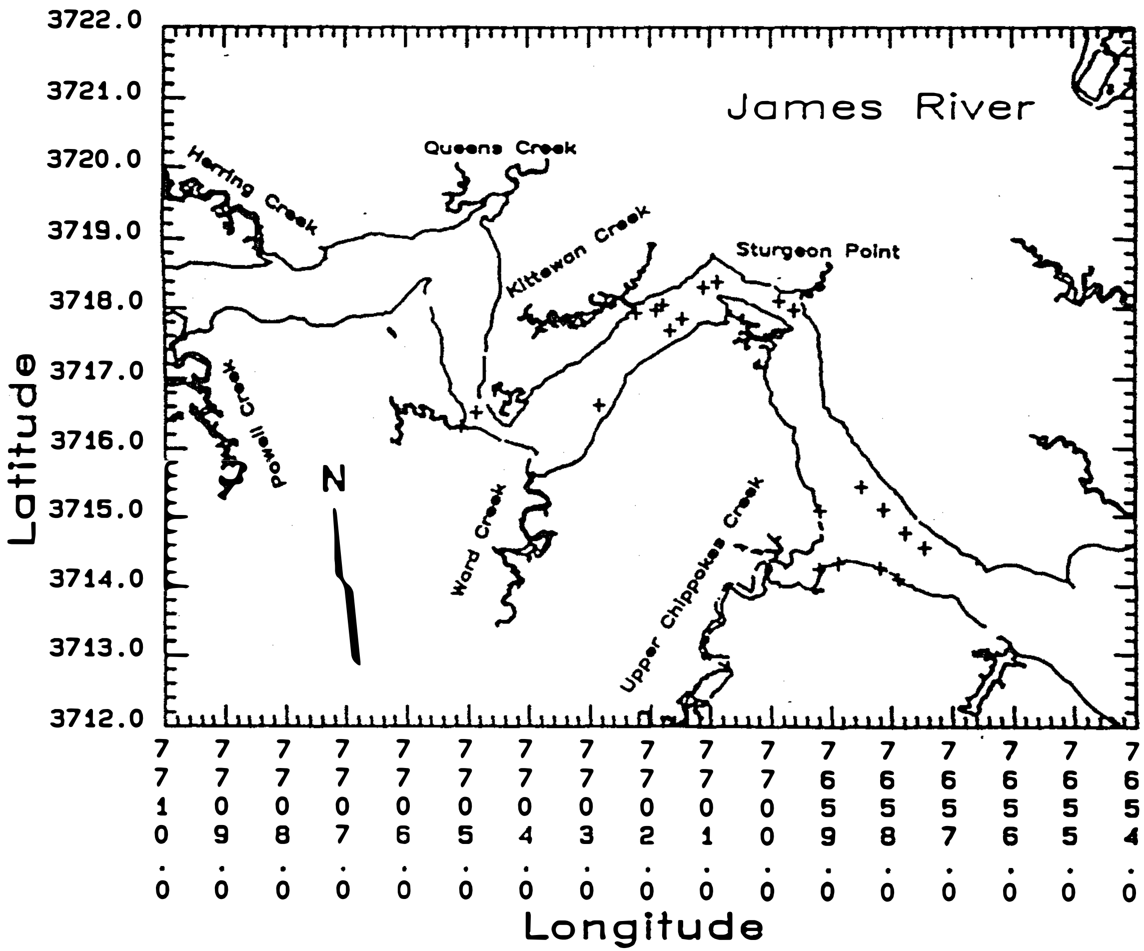
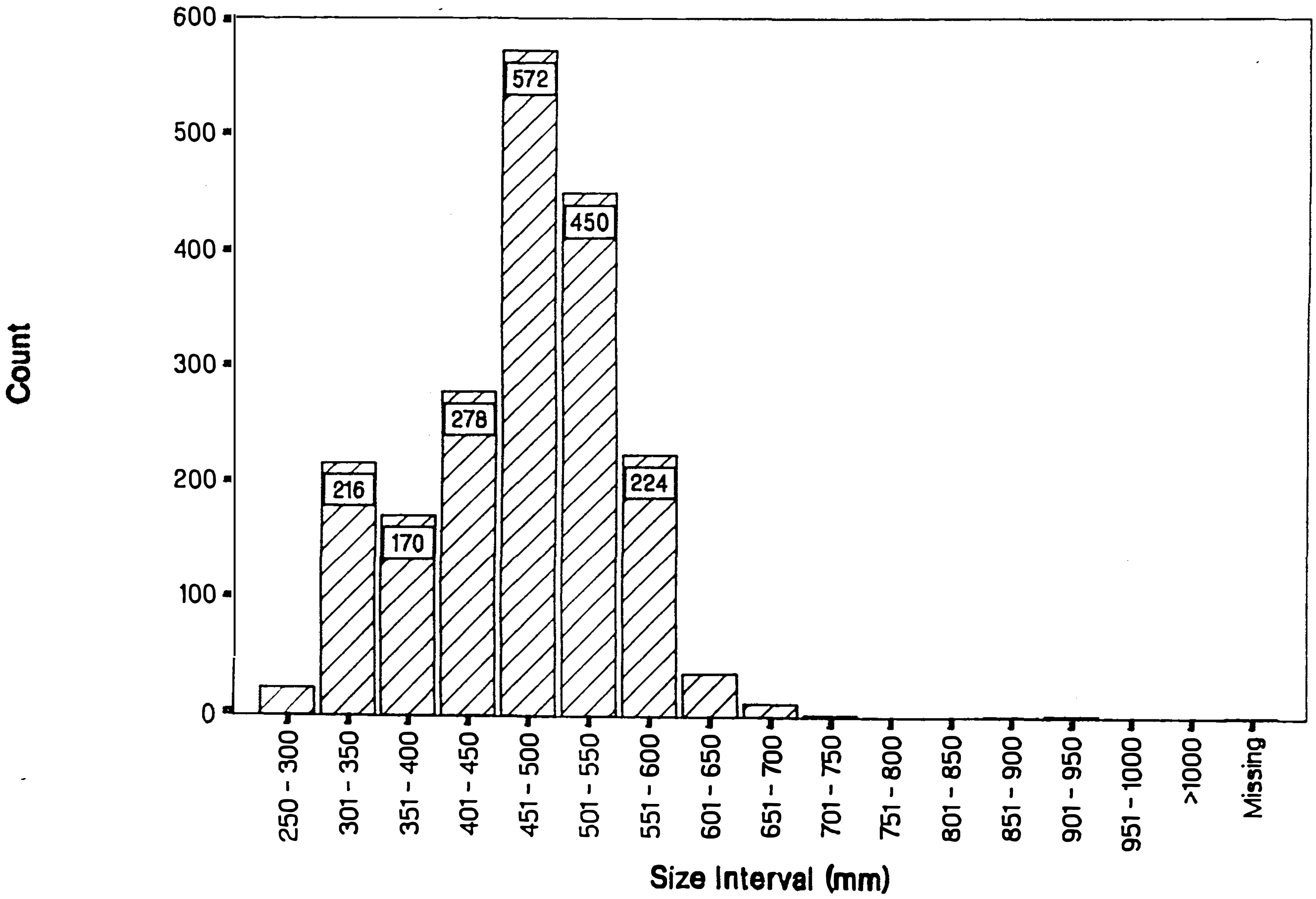
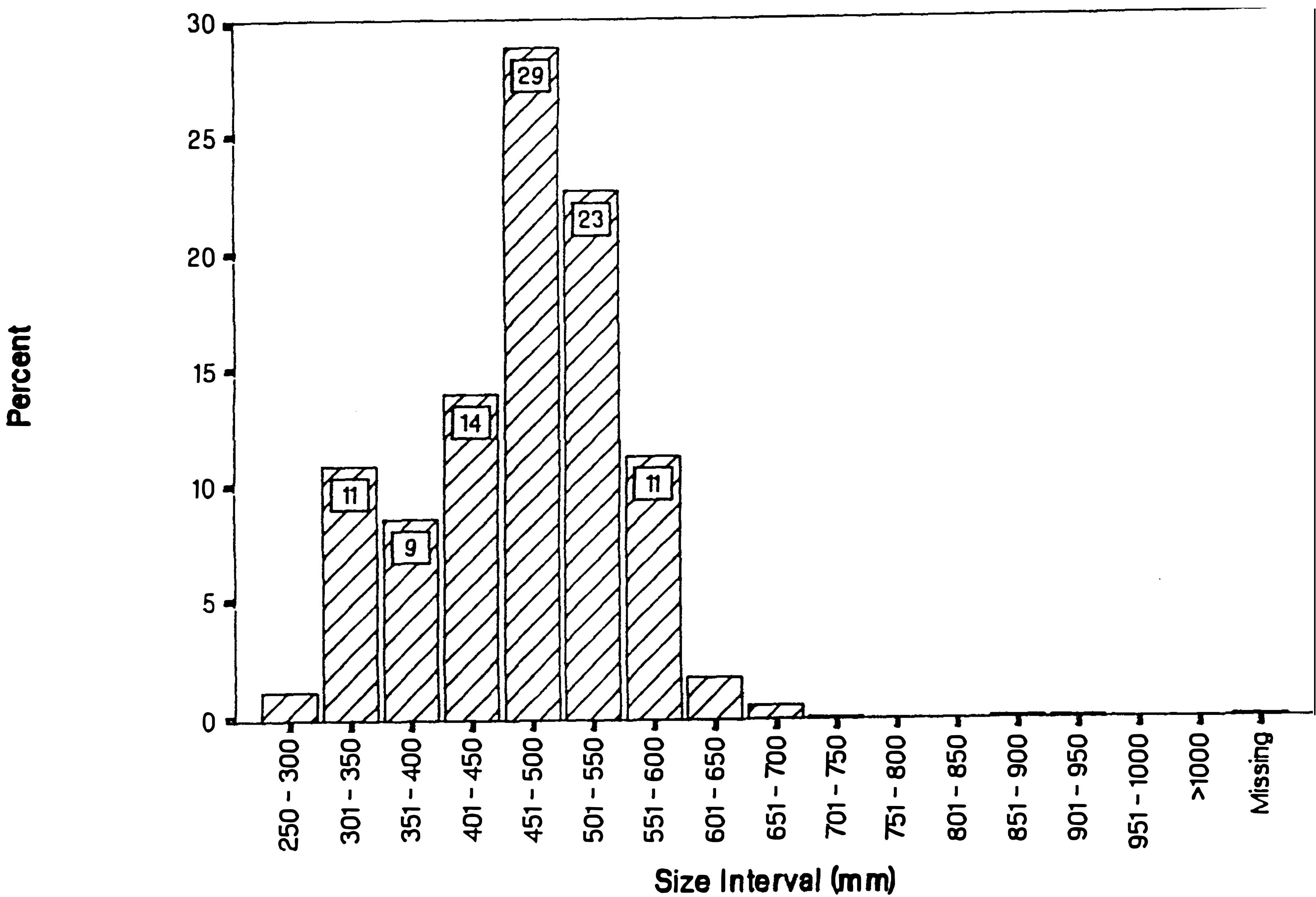

James River
Queens Creek
Herring Creek
Kittewan Creek
Sturgeon Point
Powell Creek
Ward Creek
Upper Chippokes Creek
N
Latitude
3722.0
3721.0
3720.0
3719.0
3718.0
3717.0
3716.0
3715.0
3714.0
3713.0
3712.0
Longitude
7710.0
7709.0
7708.0
7707.0
7706.0
7705.0
7704.0
7703.0
7702.0
7701.0
7700.0
7659.0
7658.0
7657.0
7656.0
7655.0
7654.0

Figure 3. Size frequency by count for striped bass tagged in the James River in Spring 1987.


600
500
400
300
200
100
0
Count
572
450
278
216
170
224
250 - 300
301 - 350
351 - 400
401 - 450
451 - 500
501 - 550
551 - 600
601 - 650
651 - 700
701 - 750
751 - 800
801 - 850
851 - 900
901 - 950
951 - 1000
>1000
Missing
Size Interval (mm)

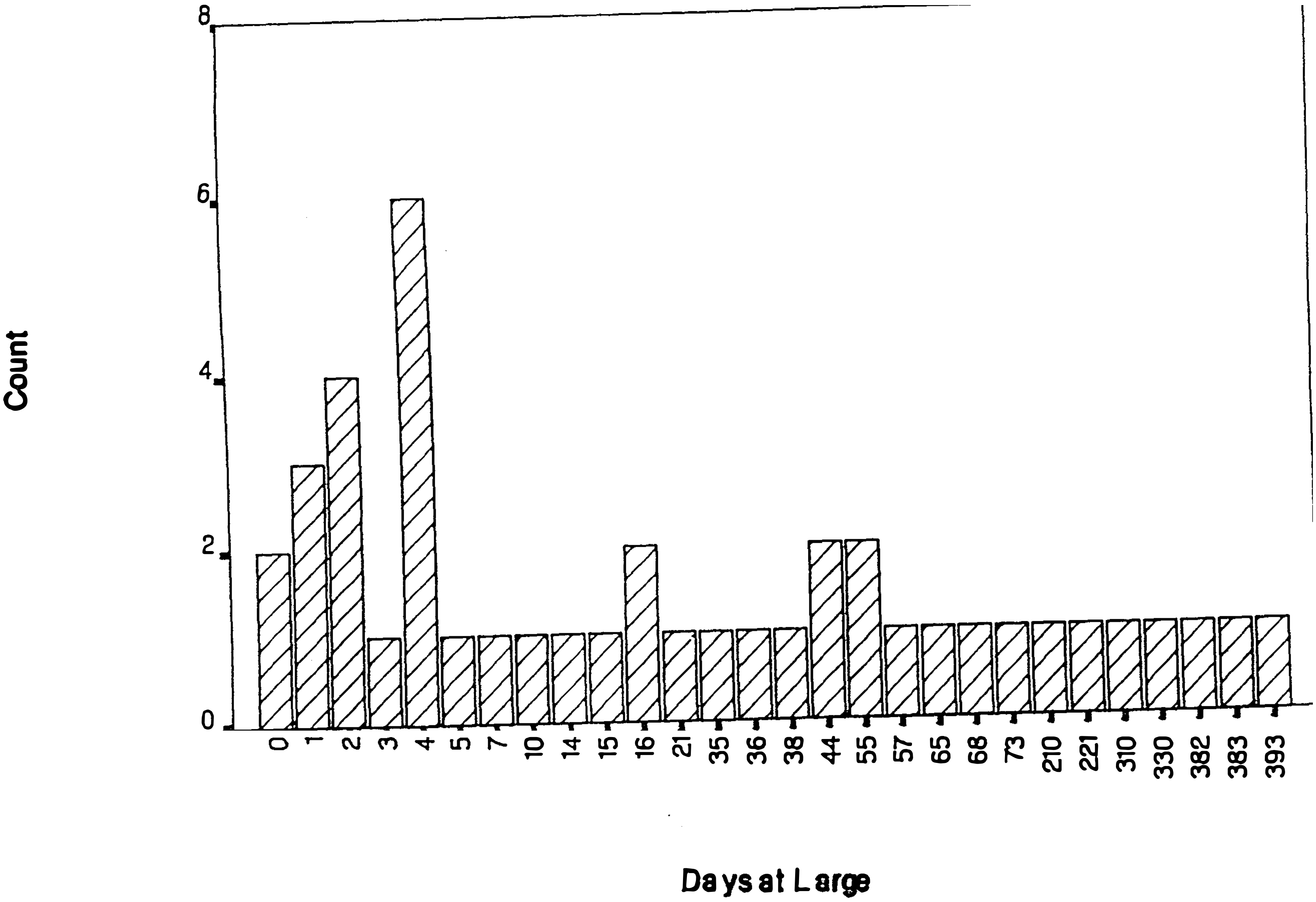
Fork Length

Figure 4. Size frequency by percent for striped bass tagged in the James River in Spring 1987.


Percent
30
25
20
15
10
5
0
29
23
14
11
9
11
250 - 300
301 - 350
351 - 400
401 - 450
451 - 500
501 - 550
551 - 600
601 - 650
651 - 700
701 - 750
751 - 800
801 - 850
851 - 900
901 - 950
951 - 1000
>1000
Missing
Size Interval (mm)

Fork Length

Figure 5. Days at large for striped bass tagged in the James River in Spring 1987.



Count
8
6
4
2
0
0
1
2
3
4
5
7
10
14
15
16
21
35
36
38
44
55
57
65
68
73
210
221
310
330
382
383
393
Days at Large