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# A Mark-recapture study of striped bass in the Rappahannock River, Virginia Annual Report 1987-1988

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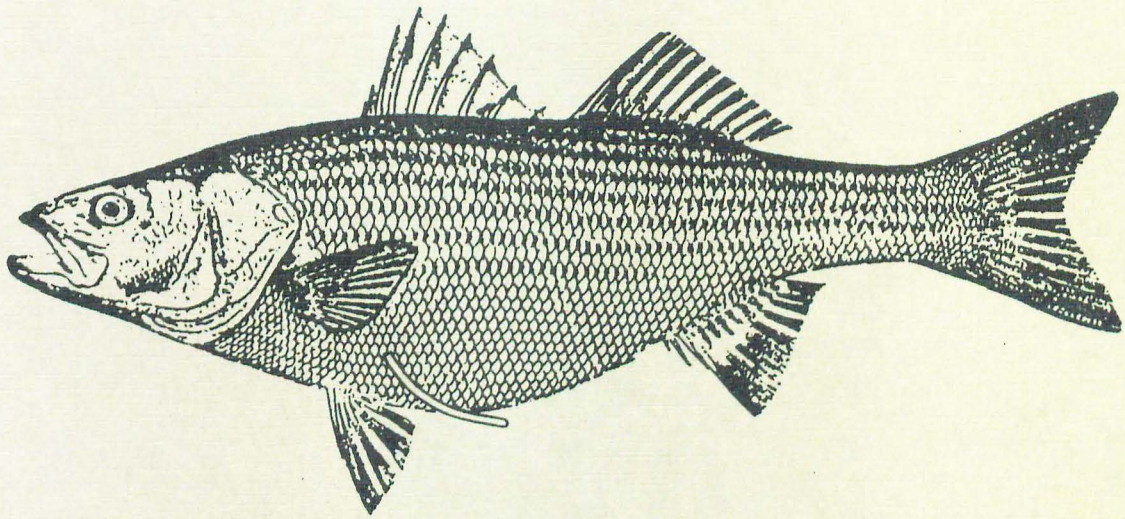

## ANNUAL REPORT 1987/1988

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

# A Mark-Recapture Study of Striped Bass in the Rappahannock River, Virginia

Annual Report 1987/1988

Contract Number: F77-R

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Principal Investigator: Joseph G. Loesch

Prepared by

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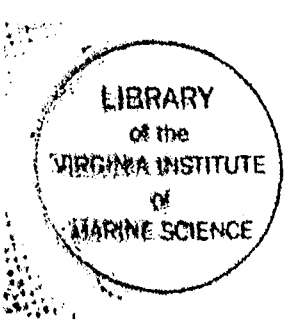

TABLE OF CONTENTS

## PREFACE

Financial support for this project was provided by the Virginia Marine Resource Commission, Research Grant F77-R.

## ACKNOWLEDGMENTS

We are indebted to the following commercial fishermen on the Rappahannock River for the use of mooring facilities and the capture of striped bass for tagging in Fall 1987 and Spring 1988: Messrs. Allen Ingraham, Ned Morris & Son Seafood, Oliff Brothers Seafood, and S. & A. Oliff. All personnel of the VIMS Anadromous Program, and many others from within and outside of VIMS assisted in the tagging program.

LIST OF TABLES

LIST OF FIGURES

## EXECUTIVE SUMMARY

Internal anchor tags with external tubes were used to tag 3,319 striped bass in the Fall of 1987 and 2,024 in the Spring of 1988 in the Rappahannock River. The total number tagged was adjusted to 3,170 and 1,973 by removing from consideration all fish that were at large less than a week. 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 was responsible, in part, for a low exploitation rate of 0.038. During the fall tagging a larger number of the striped bass tagged were the smaller resident fish which led to a higher exploitation rate of 0.34.

# INTRODUCTION

The need for studies of striped bass (Morone saxatilis) in Chesapeake Bay were discussed by Loesch et al. (1987). For succinctness, we quota from the introduction of their report.

> 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; and 3) assess the degree of fidelity to the rivers of capture by mature, migrant fish in subsequent spawning seasons. Herein is an account of the striped bass tagging program in the Rappahannock River for Fall 1987 and Spring 1988.

## METHODS

Striped bass were obtained from cooperating commercial fishermen. Fish were captured with pound nets at river km 39 to 50 during Fall 1987 (Fig. 1) and river km 42 to 50 during Spring 1988 (Fig. 5). 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 350 mm in fork length, and a Floy internal anchor tag 5 mm X 20 mm, with a 85 mm external tube for fish greater than or equal to 250 mm and less than 350 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. The fisherman would lower one side of the head of the pound net and pull his skiff inside the head. He would then grab the bottom of the head, gradually pulling the bottom of the net into the boat, working backwards and concentrating the fish in one area. Next the fisherman would start dipping his catch into the boat. If he discovered a striped bass he would place a "live car" (floating pocket) into the river and transfer the striped bass into it. The tagging vessel would approach the pound net after the fisherman has fished his net, and retrieve the live car. 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 with a lead line attached on the bottom seam. Taggers would retrieve a fish from the live car, implant a tag, and record its fork length (FL), total length (TL) if the fish was greater than 600 mm in length, 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 Floy 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, as well as its anchor, 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 during Fall of 1987 on the Rappahannock River commenced on 24 September and ended on 29 October. A total of 3,319 striped bass were tagged and released. The maximum number of fish tagged in a day was 592 (5 October) and the fewest was 142 (29 October). Tagging of striped bass during Spring of 1988 commenced on 18 April and ended on 2 June. A total of 2,024 were tagged and released. The maximum number of fish tagged in a day was 540 (25 April) and the fewest was 57 (19 May).

The striped bass tagged in the Rappahannock River in Fall 1987 ranged in fork length (FL) from 249 mm to 668 mm and had a mean length of 384.0 mm (SE = 1.55 mm). Length frequency histograms by count and relative frequency (Figs. 2 and 3) show that 25% of the tagged fish were between 250 to 300 mm FL. The striped bass tagged in the Rappahannock River in Spring 1988 ranged in fork length from 250 mm to 1175 mm and had a mean length of 495.0 mm (SE = 2.22 mm). Length frequency histograms by count and relative frequency (Figs. 6 and 7) show that 31% of the tagged fish were between 501 to 550 mm FL.

The total of 3,319 tagged striped bass, for Fall 1987 was (for the present) adjusted to 3,170 and the total of 2,024 tagged striped bass for the Spring 1988 was adjusted to 1,973 by removing from consideration all fish that were at large less than a week. With this adjustment, the number of fish recaptured was reduced from 1,242 to 1,092 (34%) for the Fall 1987. With the same adjustment to the Spring 1988 tagging data the number of fish recaptures was reduced from 125 to 74 (3.8%). Pound nets have been the principal method of recapture. Pound nets accounted for 69.9% and 54.8% of the recaptures during the Fall 1987 and Spring 1988 programs,respectively (Tables 1, 2). The number of days-at-large for striped bass tagged in the Fall 1987 program range from zero (day of tagging) to 273, as of 1 September 1988 (Fig. 4 and Table 3). In the Spring 1988 program days-at-large ranged from one to 84, as of 1 September 1988 (Fig. 8 and Table 4). There were 451 recaptures during the five weeks of tagging in Fall 1987 but only 86 in the Spring 1988 (Tables 5, 6).

## DISCUSSION

Due to the high retention rates of anchor tags in other studies, we did not conduct a tag-retention experiment. Minton (1984), in overnight studies of phase II striped bass fingerlings tagged with an anchor tag (5 mm x 15 mm x 69 mm), 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. 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. Past data of striped bass landings indicate that from 60% to 90% of commercial catch in Virginia occurred in this six month period, In addition, escapement of striped bass is enhanced during the legal fishing season by a 610 mm (24 inch) TL minimum size. This minimum size has eliminated the small-mesh gill net fishery for "pan size" striped bass.

The tagging program in progress is expected to continue for several more years. It is expected that reliable estimates of mortality and exploitation rates will then be made and will be available for use in production and yield models. Such analyses will be of assistance in formulating rational management plans.

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Table 1. Number of recaptures by gear for striped bass tagged in the Rappahannock River, Fall 1987.

| Gear | Number | Percent |
|---|---|---|
| Anchor Gill Net | 176 | 14.2 |
| Combination of Stake and Anchor Gill Net | 12 | 0.9 |
| Pound Net | 867 | 69.9 |
| Sport Fishery | 32 | 2.6 |
| Stake Gill Net | 154 | 12.4 |
| Unknown | 1 | 0.1 |
| Total | 1,242 | 100 |

Table 2. Number of recaptures by gear for striped bass tagged in the Rappahannock River, Spring 1988.

| Gear | Number | Percent |
|---|---|---|
| Combination of Stake and Anchor Gill Net | 2 | 1.6 |
| Pound Net | 68 | 54.4 |
| Sport Fishery | 30 | 24.0 |
| Stake Gill Net | 17 | 13.6 |
| Unknown | 8 | 6.4 |
| Total | 125 | 100 |

Table 3. Days at large for striped bass tagged in the Rappahannock River, Fall 1987.

| Days at Large | Number | Percent |
|---|---|---|
| 0 - 7 | 149 | 12.0 |
| 8 - 14 | 187 | 15.1 |
| 15 - 21 | 124 | 10.0 |
| 22 - 28 | 99 | 8.0 |
| 29 - 35 | 73 | 5.9 |
| 36 - 42 | 42 | 3.4 |
| 43 - 49 | 41 | 3.3 |
| 50 - 56 | 38 | 3.1 |
| 57 - 63 | 27 | 2.2 |
| 64 - 70 | 19 | 1.5 |
| 71 - 77 | 36 | 2.9 |
| 78 - 84 | 12 | 1.0 |
| 85 - 91 | 14 | 1.1 |
| 92 - 98 | 17 | 1.4 |
| 99 - 105 | 9 | .7 |
| 106 - 112 | 14 | 1.1 |
| 113 - 119 | 15 | 1.2 |
| 120 - 126 | 15 | 1.2 |
| 127 - 133 | 20 | 1.6 |
| 134 - 140 | 23 | 1.9 |
| 141 - 147 | 17 | 1.4 |
| 148 - 154 | 23 | 1.9 |
| 155 - 161 | 20 | 1.6 |
| 162 - 168 | 20 | 1.6 |
| 169 - 175 | 18 | 1.4 |
| 176 - 182 | 13 | 1.0 |
| 183 - 189 | 15 | 1.2 |
| 190 - 196 | 11 | .9 |
| 197 - 203 | 12 | 1.0 |
| 204 - 210 | 22 | 1.8 |
| 211 - 217 | 18 | 1.4 |
| 218 - 224 | 14 | 1.1 |
| 225 - 231 | 15 | 1.2 |
| 232 - 238 | 9 | .7 |
| 239 - 245 | 15 | 1.2 |
| 246 - 252 | 13 | 1.0 |
| 253 - 259 | 6 | .5 |
| 260 - 266 | 4 | .3 |
| 267 - 273 | 3 | .2 |
| Total | 1242 | 100 |

Table 4. Days at large for striped bass tagged in the Rappahannock River, Spring 1988.

| Day at Large | Number | Percent |
|---|---|---|
| 0 - 7 | 51 | 40.8 |
| 8 - 14 | 10 | 8.0 |
| 15 - 21 | 18 | 14.4 |
| 22 - 28 | 9 | 7.2 |
| 29 - 35 | 9 | 7.2 |
| 36 - 42 | 12 | 9.6 |
| 43 - 49 | 4 | 3.2 |
| 50 - 56 | 10 | 8.0 |
| 57 - 63 | 1 | .8 |
| 78 - 84 | 1 | .8 |
| Total | 125 | 100 |

Table 5. Number of recaptures by gear in the Rappahannock River during the Fall 1987 tagging program, 24 September through 29 October.

| Gear | Number | Percent |
|---|---|---|
| Pound Net | 449 | 99.6 |
| Sport Fishery | 2 | 0.4 |
| Total | 451 | 100 |

Table 6. Number of recaptures by gear in the Rappahannock River during the Spring 1988 tagging program, 18 April through 2 June.

| Gear | Number | Percent |
|---|---|---|
| Combination of Stake and Anchor Gill Net | 2 | 2.3 |
| Pound Net | 52 | 60.5 |
| Sport Fishery | 10 | 11.6 |
| Stake Gill Net | 17 | 19.8 |
| Unknown | 5 | 5.8 |
| Total | 86 | 100 |

Figure 1. Locations of pound nets employed to capture striped bass in the Rappahannock River in Fall 1987.

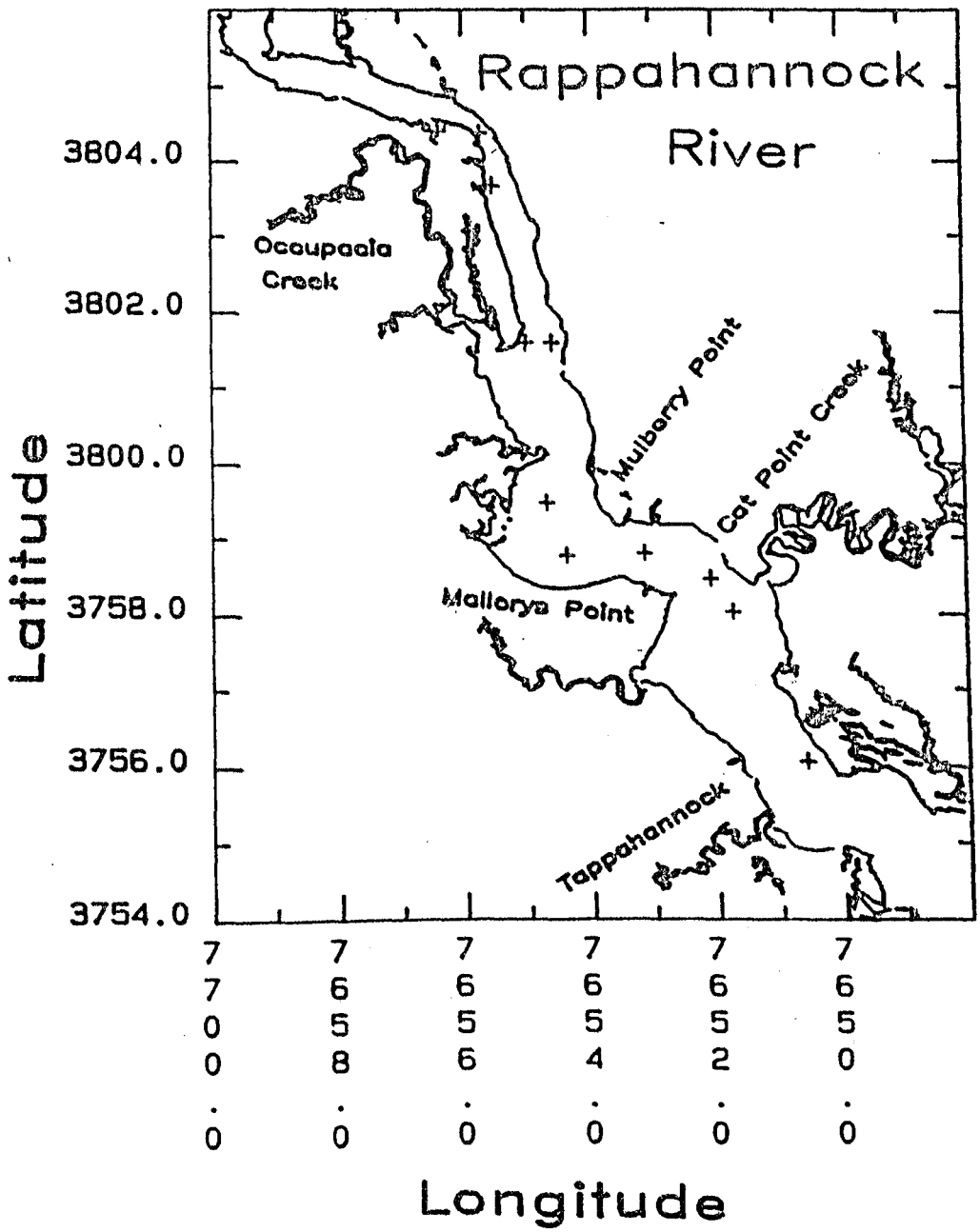

Rappahannock
River
Occupacia
Creek
Mulberry Point
Cat Point Creek
Mallorys Point
Tappahannock
Latitude
3804.0
3802.0
3800.0
3758.0
3756.0
3754.0
77 07 00.0
76 58 00.0
76 56 00.0
76 54 00.0
76 52 00.0
76 50 00.0
Longitude

Figure 2. Size frequency by count of striped bass tagged in the Rappahannock River in Fall 1987.

Count
1000
800
600
400
200
0
817
498
537
637
386
319
99
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 3. Size frequency by percent of striped bass tagged in the Rappahannock River in Fall 1987.

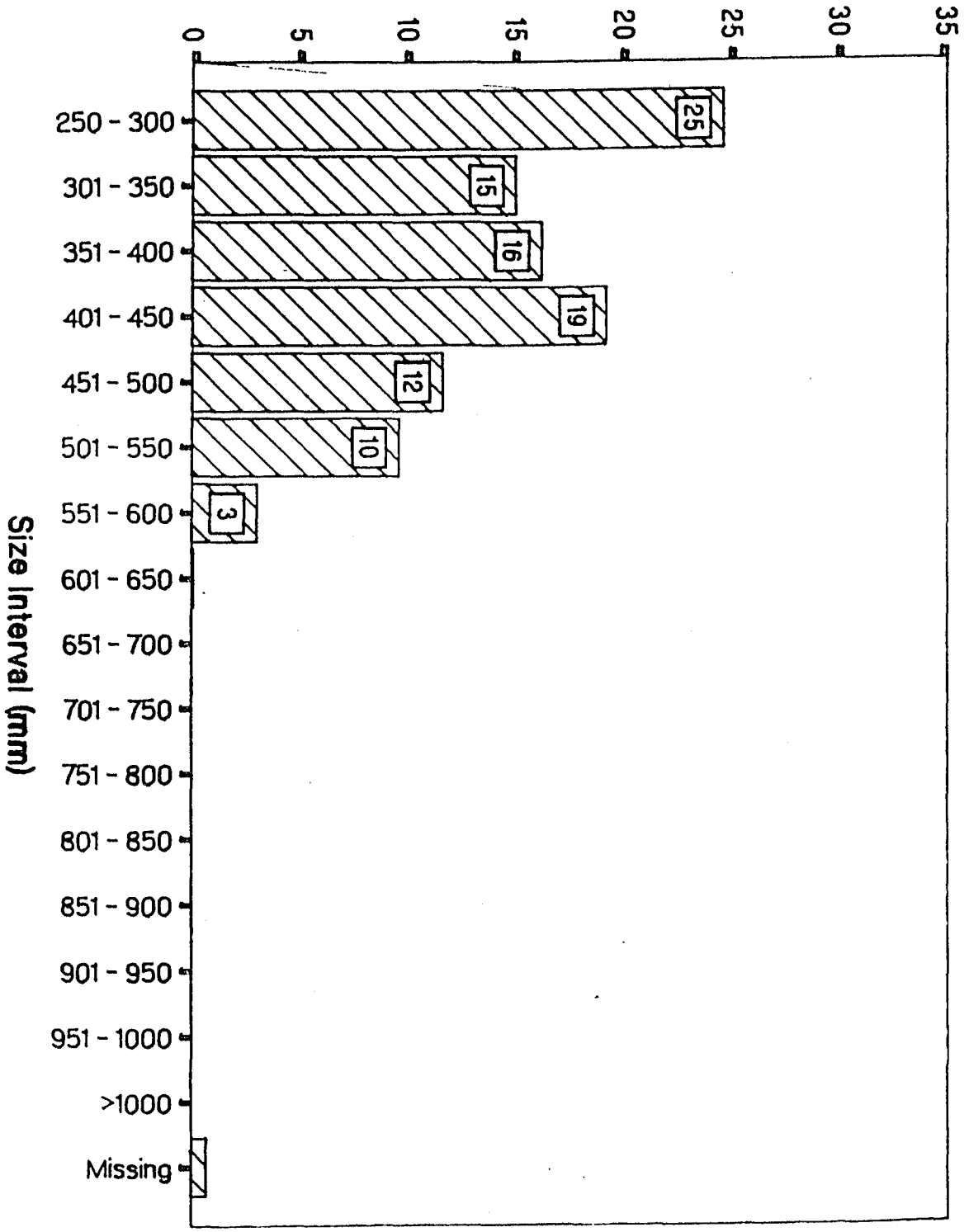

Percent
0
5
10
15
20
25
30
35
Size Interval (mm)
250 - 300
301 - 350
351 - 400
401 - 450
451 - 500
501 - 550
551 - 600
601 - 650
651 - 700
701 - 750
751 - 800
801 - 850
851 - 900
901 - 950
951 - 1000
>1000
Missing
25
15
16
19
12
10
3
Fork Length

Figure 4. Days-at-large of recaptured striped bass tagged in the Rappahannock River in Fall 1987.

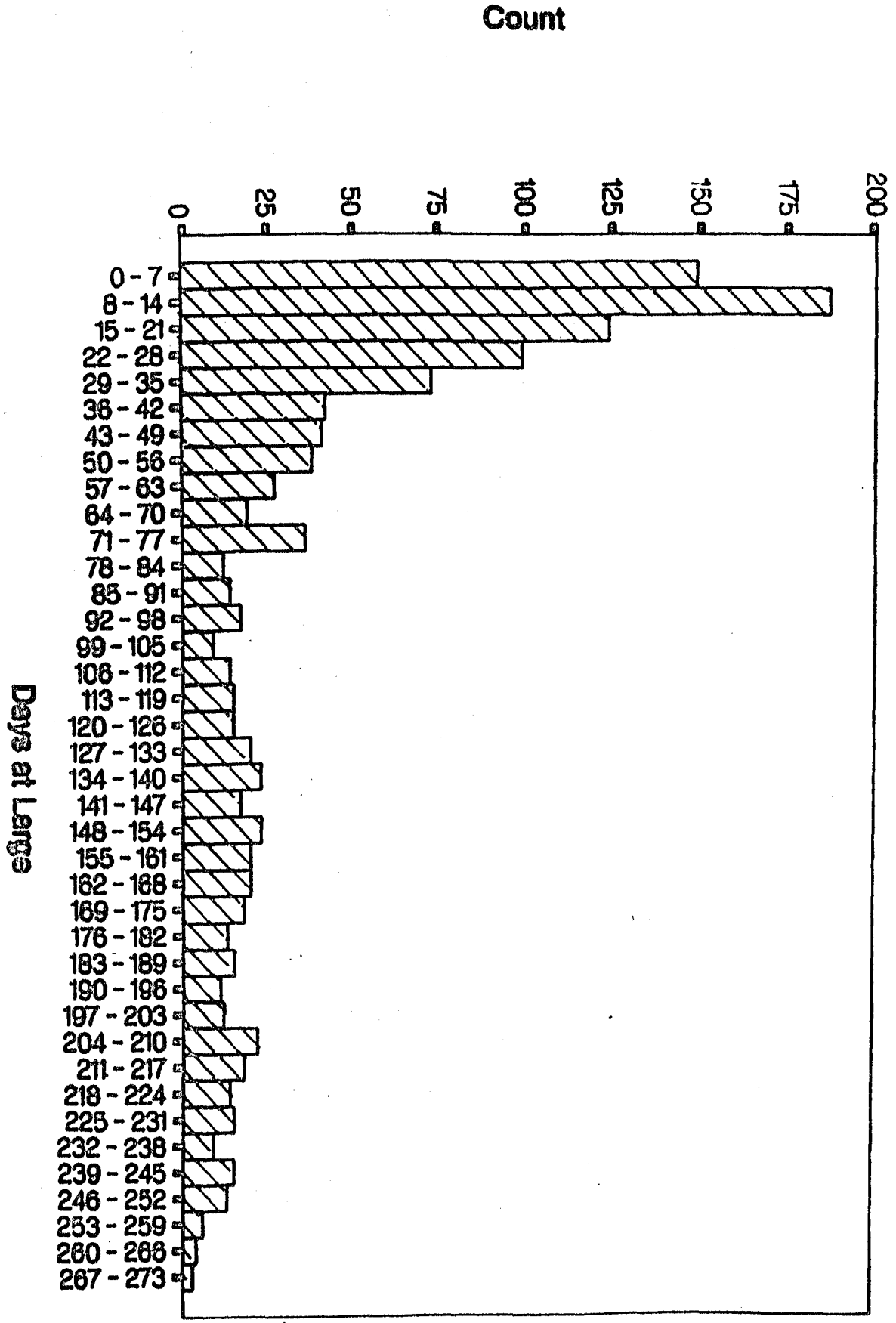

Count
0
25
50
75
100
125
150
175
200
Days at Large
0 - 7
8 - 14
15 - 21
22 - 28
29 - 35
36 - 42
43 - 49
50 - 56
57 - 63
64 - 70
71 - 77
78 - 84
85 - 91
92 - 98
99 - 105
106 - 112
113 - 119
120 - 126
127 - 133
134 - 140
141 - 147
148 - 154
155 - 161
162 - 168
169 - 175
176 - 182
183 - 189
190 - 196
197 - 203
204 - 210
211 - 217
218 - 224
225 - 231
232 - 238
239 - 245
246 - 252
253 - 259
260 - 266
267 - 273

Figure 5. Locations of pound nets employed to capture striped bass in the Rappahannock River in Spring 1988.

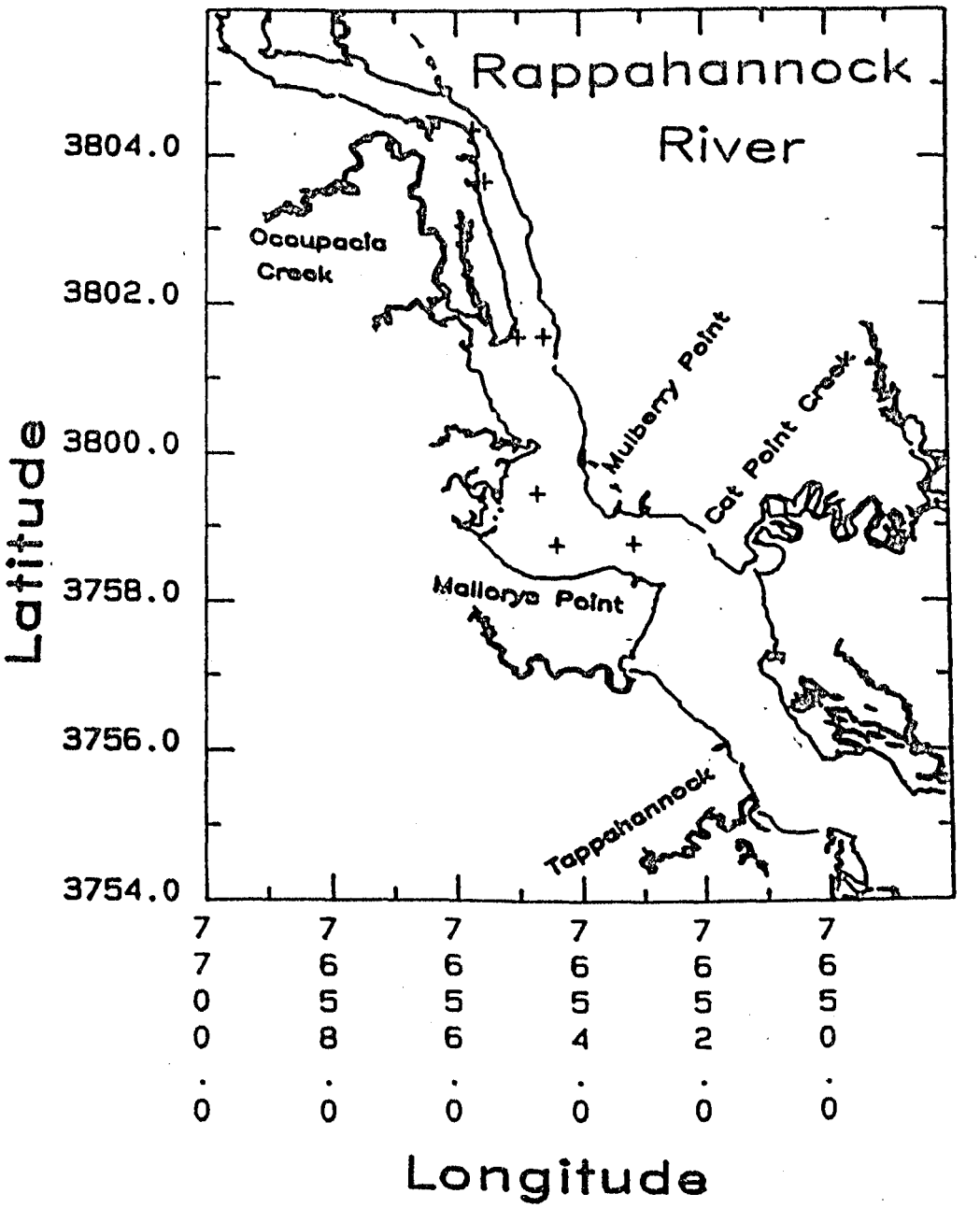
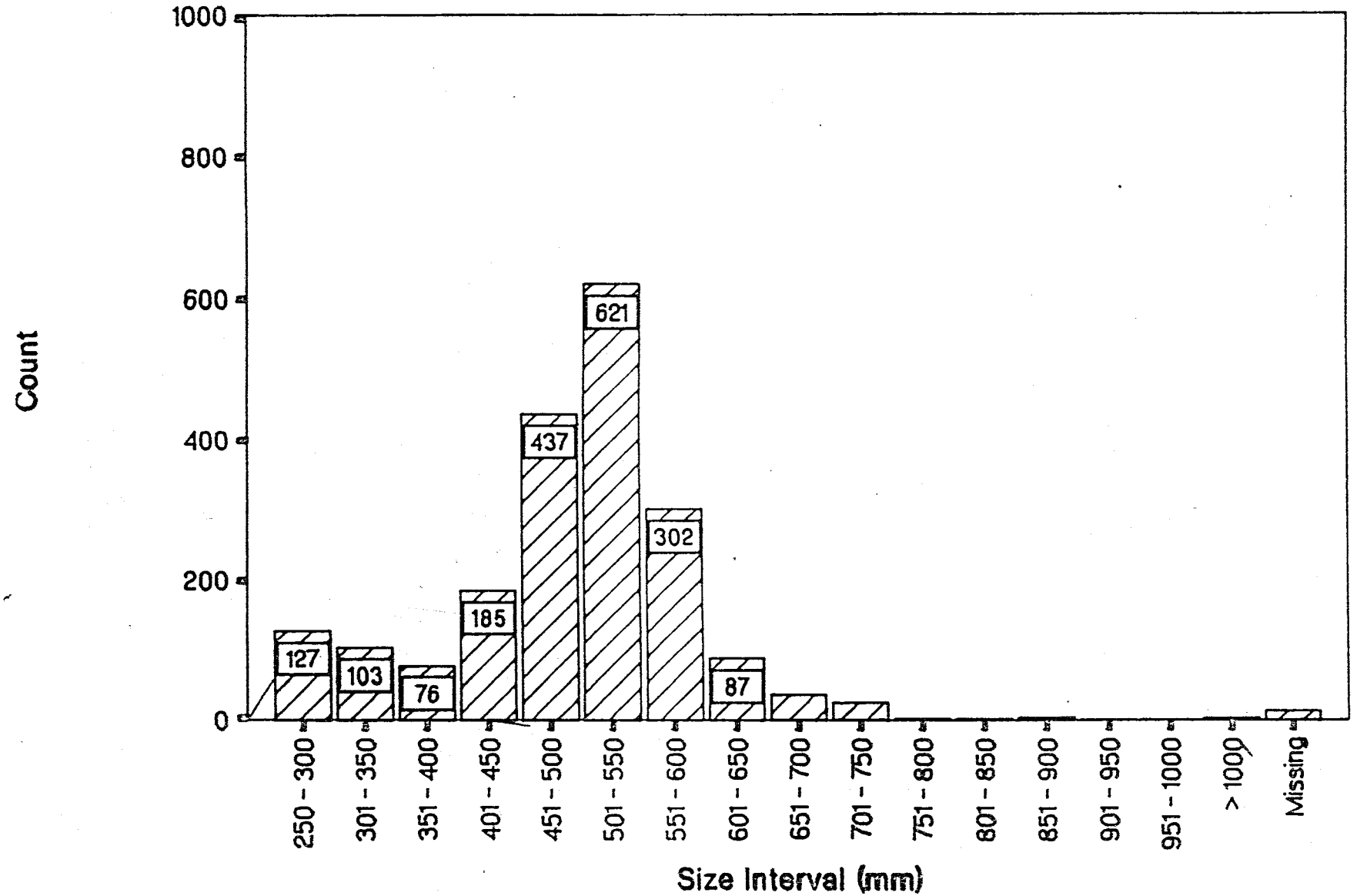

Rappahannock
River
Occupacia
Creek
Mulberry Point
Cat Point Creek
Mallorys Point
Tappahannock
3804.0
3802.0
3800.0
3758.0
3756.0
3754.0
Latitude
77 00.0
76 58.0
76 56.0
76 54.0
76 52.0
76 50.0
Longitude

Figure 6. Size frequency by count of striped bass tagged in the Rappahannock River in Spring 1988.


Count
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800
600
400
200
0
127
103
76
185
437
621
302
87
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)

Figure 7. Size frequency by percent of striped bass tagged in the Rappahannock River in Spring 1988.

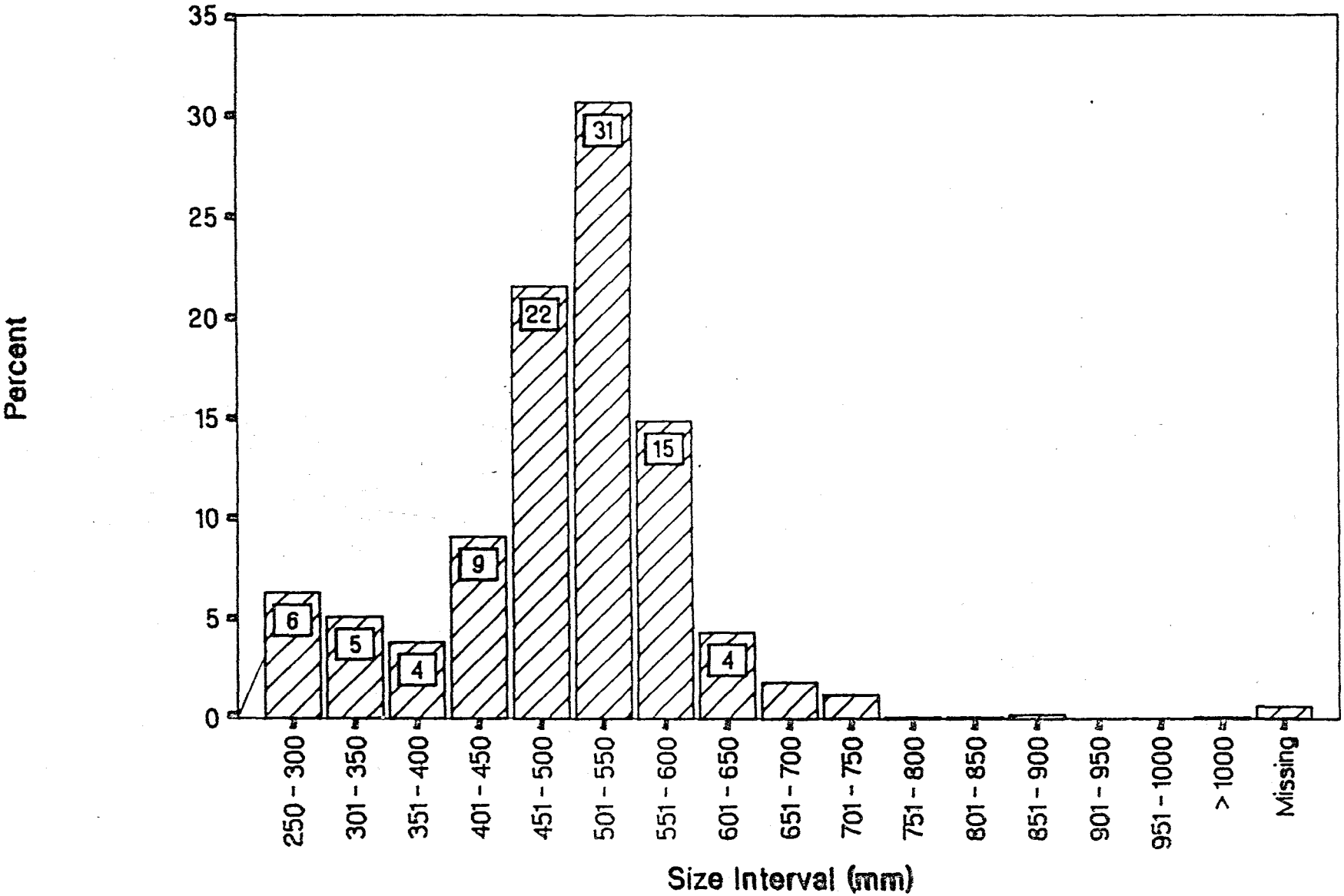
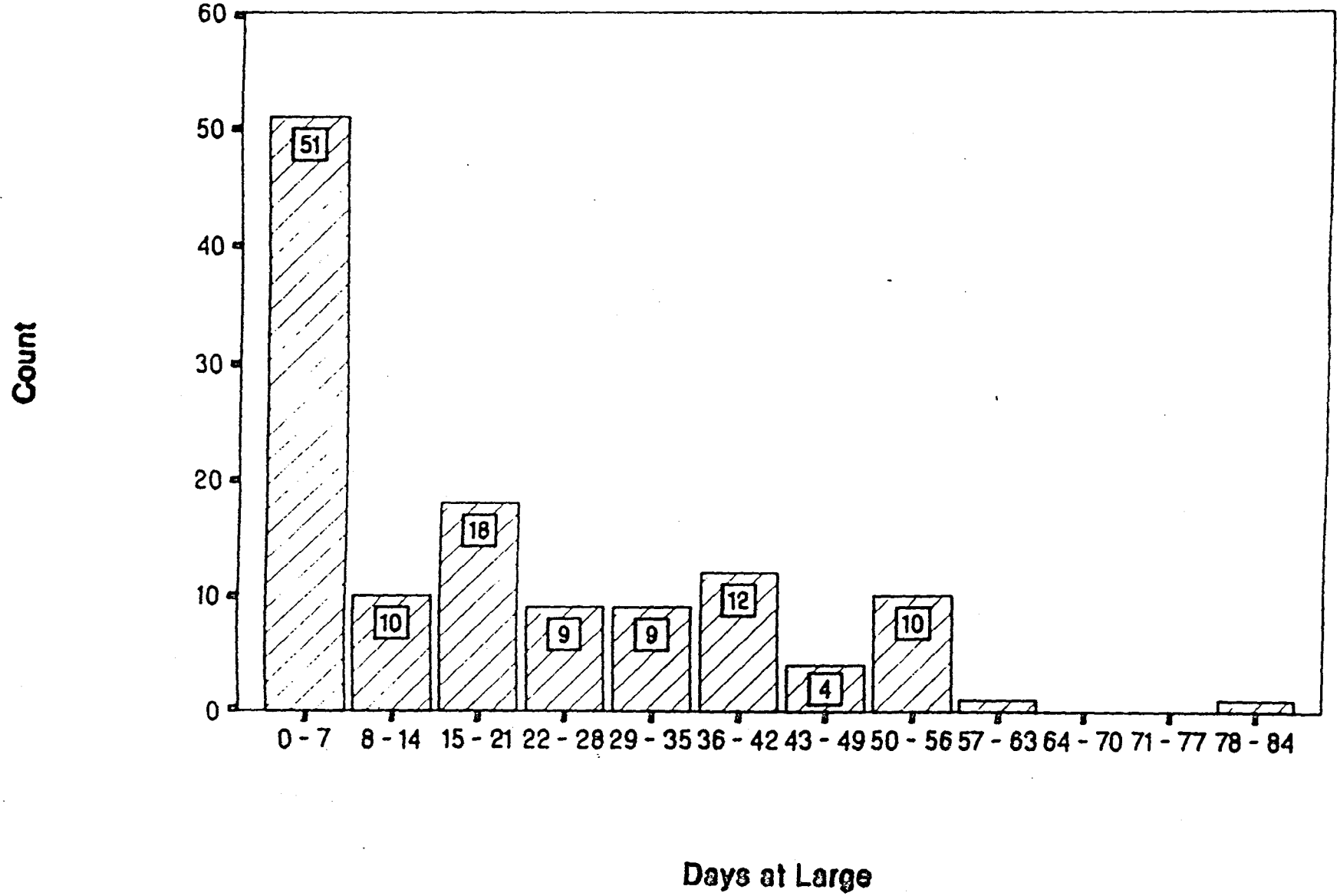

Percent
35
30
25
20
15
10
5
0
6
5
4
9
22
31
15
4
250 - 300
301 - 350
351 - 400
401 - 450
451 - 500
501 - 550
551 - 600
601 - 650
651 - 700
701 - 750
751 - 800
801 - 850
851 - 900
901 - 950
951 - 1000
> 1000
Missing
Size Interval (mm)

Figure 8. Days-at-large of recaptured striped bass tagged in the Rappahannock River in Spring 1988.


Count
60
50
40
30
20
10
0
51
10
18
9
9
12
4
10
0 - 7
8 - 14
15 - 21
22 - 28
29 - 35
36 - 42
43 - 49
50 - 56
57 - 63
64 - 70
71 - 77
78 - 84
Days at Large