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## MOVEMENT OF 1970 YEARCLASS STRIPED BASS BETWEEN VIRGINIA, NEW YORK, AND NEW ENGLAND

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*Abstract:* Striped bass (*Morone saxatilis*) were tagged in Virginia beginning in 1968. The 1970 yearclass of striped bass was tagged both in Virginia and New York in 1972. Fish tagged in Virginia were returned from New York to Maine while fish tagged in New York were returned from the Maryland portion of the Chesapeake Bay and the Potomac River. These data indicated that fish migrate from rivers in which they were spawned at different ages and that fish that migrate as 2 year olds remain together as a group until they are 3+ years. Therefore, within the Chesapeake Bay area there are distinct river populations at least until these populations are 3+ years old.

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Numerous tagging studies have been conducted to determine the migratory patterns of striped bass along the Atlantic coast. Merriman (1941) concluded that there was a northward migration of striped bass in the spring and southward migration in the fall with much of the movement occurring between Virginia and Massachusetts. Austin and Custer (1977) found that striped bass tagged in Long Island Sound in the spring and summer either remained in the sound or moved northward until fall. Fish then began a migration southward to the Chesapeake Bay area and North Carolina. Chapoton and Sykes' (1961) tag returns showed an offshore population to be off the coast of North Carolina in late fall and early winter, entering Chesapeake Bay to spawn in spring and then migrating up the coast in late spring and early summer. Based on tag returns from small fish (2-3 years old) Mansuetti (1961) concluded that there is relatively little movement by these small fish either inter-river or intra-bay. He also suggested that large striped bass returned to their river of origin to spawn.

Mansuetti (1961) and Vladykov and Wallace (1938) suggested that there were separate populations of striped bass within the Chesapeake Bay, but that most of the movement of these fish occurs within the bay and its tributaries. Studies by Massmann and Pacheco (1961) agreed with Mansuetti (1961) and Vladykov and Wallace (1938) for small fish (less than 305 mm) but indicated that larger fish (above 305 mm) may migrate along the coast.

All of these studies were conducted independently and most tagging was done from a single locality. The extent of these migrations (both numbers of fish and distance) and the verification, using tagging data, of separate populations within the Chesapeake Bay population remained unanswered.

In this paper we approach the above questions by analyzing data sets from the extremities of the striped bass migratory range, using the 1970 yearclass tagged by the Virginia Institute of Marine Science and the New York Ocean Science Laboratory. Data from earlier years are presented to emphasize movement of the 1970 yearclass.

We are indebted to J. B. S. Davis and M. A. Hennigar for their assistance in compiling the tag return data. We would also like to thank all persons who participated in the field tagging programs in Virginia and New York for the data their field work provided. We also thank our typist, B. J. Taylor. This paper is VIMS Contribution No. 876.

### MATERIALS AND METHODS

Tagging operations were conducted in 1968 and 1969 in the James, York, and Rappahannock Rivers and in 1970-1973 in the York and Rappahannock Rivers in

Virginia. In New York, striped bass were tagged in the Gardiner's Bay area (Long Island Sound) in 1972 and 1973 and in the Amagansett, Long Island area (oceanside) in 1973-1975. Virginia released 17,595 tagged fish and New York released 1,475 tagged fish during the respective dates.

Initial tagging in Virginia was done with Petersen disk tags while subsequent tagging employed the Floy Tag Co. FD-67 tag. In New York, Floy tags FD-68B and FW-5 were used.

Fork length of each fish tagged was recorded in all cases. A scale sample was collected from each fish for yearclass determination in Virginia; however, scales from only a random selection of fish were examined for age determination in New York. Sexes were not determined in either Virginia or New York tagging.

In Virginia, tagging was restricted to the winter and early spring except in 1968 when some tagged fish were released during the summer months. Tagging in New York was accomplished during April, May, June, October, and November.

## RESULTS AND DISCUSSION

Since there were only 2 years in common for the tagging data (1972, 1973), release and recapture data are presented chronologically by area of tagging; only those releases that were assumed to be truly migratory were considered in the analyses. Initial analyses showed little exchange of fish between areas except for the 1970 yearclass, the most abundant yearclass observed during these tagging programs.

Seventy-five percent of all fish tagged in Virginia were less than 300 mm in length and 73% were 2 years old when tagged. Most of the returns came from within the river of release. From the 1968 tagging, there were 2 returns (0.02%) from north of Chesapeake Bay, 8 (1.9%) from 1969, 4 (1.0%) from 1970, 2 (0.4%) from 1971, 26 (4.9%) from 1972 and 10 (6.7%) from 1973 (Table 1, Fig. 1).

The relatively few returns from states north of Chesapeake Bay in the 1968-1971 Virginia tagging may be attributed to the fact that the fish tagged were small (150-300 mm), and the population was not crowded. In 1972, however, the number of returns from states north of Chesapeake Bay increased measurably (Table 1), probably due to the extremely strong 1970 yearclass. Ninety-five percent of the fish tagged in 1972 and 55% of the fish tagged in 1973 were the 1970 yearclass.

Ninety-two percent of all fish tagged in New York in 1972 were less than 300 mm, while 92% of all fish tagged during 1973-1975 were greater than 300 mm.

Insufficient numbers of fish were aged from the 1972 New York tagging effort to determine percentages of yearclasses tagged. However, based on size range of fish tagged and the relative strength of the 1970 yearclass, it is assumed that between 90-95% were 1970 yearclass. In 1973, 100% were 1971 yearclass; in 1974, 6% were 1970 yearclass; 68% were 1971 yearclass and 26% were 1972 yearclass. No aging was conducted in 1975; however, it was concluded that 67% were 1972 yearclass based on age determination study of the same size range fish by the New York Department of Environmental Conservation.

From the 1972 New York tagging effort, 10 returns (71%) were from the Chesapeake Bay area, 2 (25%) from 1973, 2 (9%) from 1974 and 2 (40%) from 1975 tagging (Table 2, Fig. 1).

The number of returns from New York tagged in Virginia and vice versa established a link in the migration pattern between the 2 areas. However, to answer questions of how and when, the 1972 and 1973 tagging efforts were examined closely.

Tagged fish released in the York River but recaptured outside Chesapeake Bay represent 2.8% of all York River tag returns while the 19 returns from fish tagged in the Rappahannock River represent 1.2% of the returns from that river (Table 1). The percentages are small, but it must be remembered that the fish tagged were not expected to leave the river system in which they were tagged.

Table 1. Returns from north of Chesapeake Bay area, from Virginia releases by location of release, by year released.

Location of Release	Year and Number Tagged	Total Number of Returns	Location of Return							Totals	
			NJ	NY	CT	RI	MA	NH	ME		NS
James River	1968 ( 638)	114									
	1969 ( 845)	108		$\frac{2}{2}$			$\frac{1}{1}$				$\frac{3}{3}$
York River	1968 (2326)	298				1					2
	1969 ( 885)	123			2				1		4
	1970 (1020)	113			1						
	1971 (1785)	236		1							1
	1972 (1840)	218		2		1		6	1	5	15
	1973 ( 373)	72		$\frac{2}{3}$	$\frac{2}{2}$	$\frac{1}{5}$	$\frac{3}{4}$	$\frac{6}{6}$	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{7}{30}$
Rappahannock River	1968 (2672)	505									
	1969 (1161)	195		1							1
	1970 ( 751)	272		2		1					3
	1971 ( 809)	229				1					1
	1972 (2025)	308		1	3	1	3	1	2		11
	1973 ( 465)	78		$\frac{1}{5}$	$\frac{1}{4}$	$\frac{2}{2}$	$\frac{3}{5}$	$\frac{1}{1}$	$\frac{2}{2}$		$\frac{3}{19}$
		Total		5	4	2	5	1	2		19

Fish tagged in Virginia in January-March 1972 were returned from northern waters in May, the month that tagging commenced in New York that year. Fish tagged in the York River went farther north and in greater numbers than did the fish tagged in the Rappahannock River. In 1972, 6.9% and 9.7% in 1973 of all York River returns were from states north of the Chesapeake Bay. Rappahannock River tag returns from north of Chesapeake Bay represent 3.6% and 3.8% of the 1972 and 1973 returns, respectively.

Fish tagged in New York in May-June 1972, remained in Long Island Sound as evidenced by returns from that area during summer and fall. No more tags were received until March 1973, and these came from the Chesapeake Bay area. Fifty percent of those returned from the Bay area were from the Maryland portion of the Chesapeake Bay, 40% from the Potomac River and 10% from the York River (Table 2, Fig. 1).

Returns from Virginia fish released during February-April 1973 occurred from New York to Maine beginning in June and continued through the summer. As in 1972, a greater percentage and number from the York River were returned from states north of Chesapeake Bay than those tagged in the Rappahannock River. In both years the greatest percentage of returns came from Massachusetts and Maine (Table 1).

For fish released around Long Island, tag returns in the Chesapeake Bay area during 1973-1975 were too few (2 each year) to demonstrate migration patterns. However, they do represent a significant proportion of the returns in 1973 (25%) and 1975 (40%).

Several conclusions may be drawn from the data: (1) during years of average abundance only an insignificant portion (<3%) of 2 year old striped bass join the offshore migrating population; (2) in years of abundant yearclasses >3% of the 2 year old fish join the offshore migrating population; (3) striped bass which migrate as 2 year olds probably remain as a distinct unit until they are 3+ years, at which time they mix with other adult fish; (4) striped bass tagged in the York River leave the Chesapeake Bay area in greater numbers than fish tagged in the Rappahannock River; and (5) therefore, within the Chesapeake Bay area, there may be distinct river populations of striped bass at least until the populations are 3+ years old.

This last conclusion is supported in part by Morgan et al. (1973) on northern Chesapeake Bay populations of striped bass. Utilizing electrophoretic determinations, they concluded that distinct populations existed in the Elk River, Choptank-Nanticoke Rivers and Patuxent-Potomac Rivers, Maryland.



Table 2. Returns from Chesapeake Bay area, from New York releases by location of release, by year released.

Location of Release	Year and Number Tagged	Total Number of Returns	Location of Return					Totals	
			Mohjock Bay	York River	Piankatank River	Potomac River	East. Shore VA		Ches. Bay MD
Ft. Pond Bay (Montauk) Gardiner's Bay Area	1972 (470)	14		1		4		5	10
	1973 ( 18)	3							
		Total		1		4		5	10
Amagansett Area	1973 (146)	4				1			1
	1974 (703)	23	1				1		2
	1975 (137)	5	1		1				2
		Total		2	1	1	1		5
Shoreham-Herod Point	1973 ( 1)	1							
		Total						1	1

Thus data from both north and south Chesapeake Bay suggest distinct river populations of striped bass. A working knowledge of the races or populations of striped bass in Chesapeake Bay would be a useful management tool.

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