

- Gerking, S. D. 1964. Timing and magnitude of the production of a bluegill sunfish population and its food supply. *Int. Assoc. Theor. & Applied Limnol., Proc.*, XV(1):496-503.
- Howell, H. H., H. S. Swingle and E. V. Smith. 1941. Bass and bream food in Alabama waters. *Ala. Cons.*, 1(4):3.
- Huish, M. T. 1957. Food habits of three Centrarchidae in Lake George, Florida. *Southeastern Assoc. Game & Fish Comm., Proc.*, 11th Ann. Conf., p. 293-302.
- Katz, E. E. 1967. Effects of the chemical eradication of water hyacinths on associated aquatic fauna. M. S. Thesis, Stetson Univ. 52 p.
- Lynch, J. J., J. E. King, T. K. Chamberlain and A. J. Smith, Jr. 1947. Effects of aquatic weed infestation on the fish and wildlife of the Gulf States. *Dept. Interior, Fish & Wildlife Spec. Sci. Rept.* 39:1-29.
- Pennak, W. T. 1953. *Freshwater invertebrates of the United States.* Ronald Press, New York. 769 p.
- Schneider, R. F. 1962. Seasonal succession of certain invertebrates in a northwest Florida lake. *Quart. J. Fla. Acad. Sci.*, 25(2):127-141.
- Usinger, R. L. 1963. *Aquatic insects of California.* Univ. Calif. Press, Berkeley and Los Angeles. 508 p.

## DISTRIBUTION OF JUVENILE RIVER HERRING IN THE POTOMAC RIVER

By J. E. WARINNER, J. P. MILLER and J. DAVIS

*Virginia Institute of Marine Science  
Gloucester Point, Virginia*

### INTRODUCTION

This report concerns the distribution of juvenile alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) in the tidal portion of the Potomac River as determined in 1968. The river courses for 100 nautical miles from the Lower Falls at Washington, D. C. to empty into the Chesapeake Bay some 60 miles from the Virginia capes. It is second only to the Susquehanna River in freshwater input to the bay, contributing 18% of the total. The salinity at the mouth is approximately 18 ppt., and salt water intrudes 70 to 75 miles. The upper tidal portion is heavily polluted by domestic wastes from the Washington Metropolitan area. Although much of the sewage is treated, overenrichment causes massive algal blooms.

### METHODS

The distribution of juvenile river herring was determined by sampling at five-mile intervals with two types of trawl gear, a 30 foot semi-balloon bottom trawl and a 10 by 10 foot Cobb midwater trawl which was fished at the surface and at 15 feet of depth. The bottom trawl consisted of 1-1/2 inch mesh except that the cod end was lined with 1/2 inch mesh nylon netting. The midwater trawl had a body of 3/4 inch stretch mesh knotless nylon netting and a cod end of 1/2 inch stretch mesh knotless nylon. It was equipped with 1 1/2 inch galvanized pipe spreader bars, the lower one weighted to improve the mouth opening.

The fish from each catch were sorted by species, counted, and the fork length measured to the nearest millimeter. When catches were large only 50 of a species were measured at random. Extremely large catches were subsampled before sorting.

## RESULTS

Spawning herring were taken in all the tributaries on the Virginia side of the Potomac from mile 35 to the falls at Washington with the alewife spawning run beginning in March, about a month earlier than the blueback run. Juvenile alewife were caught in the Cobb trawl in June; bluebacks first entered the catch in July (Fig. 1).

Both species tended to move upstream in fresh water during the nursery period until the fall migration toward the sea. The largest catch of alewife was taken at mile 70 in June, at mile 75 in July, and mile 85 in August and September (Fig. 1). In October the distribution was more general, suggesting that the seaward migration had begun. Most of the alewife had left the river by November (Table 1). In July, when bluebacks first appeared in the samples, they were concentrated at mile 65. In August they were more evenly distributed in the 20 mile reach from mile 65 to 85. By September, 72% of the bluebacks caught were at station 85. Bluebacks, like alewife, had started their seaward migration in October and occurred further downstream than in previous months. By November, desertion of the nursery was virtually complete. Bluebacks were taken at only eight stations in November and, of the 36 specimens taken, only three were from fresh water, the migration coincided with a rapid cooling of water during October and November. The mean surface water temperature was 29.2°C in mid-August, 24.8°C in mid-September, 19.6°C in mid-October, and fell to 9.0°C in November.

Juvenile blueback herring far outnumbered alewife, constituting 95% of the herring catch, as shown in Table 1.

The vertical distribution of river herring was investigated by trawling at three levels at each station: surface, 15 feet, and bottom. Since two different types of trawl gear were used, midwater and bottom catches were not strictly comparable. Although the mouth openings have approximately the same area, the mesh sizes in the two trawls are different, and experience has shown that the 30 ft. bottom trawl is less efficient at taking juvenile river herring than is the finer mesh midwater trawl.

During daylight hours juvenile alewife remain near the surface during the summer months, but seek deeper water as the season progresses and are found at the bottom during the fall migration. Juvenile blueback herring, like alewife, seek deeper water during the fall, but were never found in any quantity near the bottom.

Table 2 shows the percentage of juvenile herring caught at each depth from July through November. The catches indicate that juvenile alewife tend to remain near the surface until September when over half were taken at the 15 ft. depth. In October over half were taken in the bottom trawl, and in November only six alewife were caught, five of them in the bottom trawl.

In contrast with alewife, over half of the blueback herring were caught in the surface trawl during September and October. Of the almost 10,000 juvenile bluebacks taken in October 64% were taken at the surface and the remainder at the 15 foot level. Only 36 bluebacks were taken in all trawls in November, 33 of which were from mid-depth and none from the bottom.

Juvenile river herring exhibit a diel vertical migration, toward the surface in daylight hours and toward the bottom in darkness. Vertical distribution of juvenile river herring was studied more intensively during a 24 hour period in which surface, midwater, and bottom trawls were made in the channel and surface and bottom trawls made in shoal water with the same gears. The trawls were made at low slack, mid-flood, high slack, and mid-ebb for two tidal cycles.

Most juvenile bluebacks were taken in the surface or midwater trawls during the day, but over half were taken in the bottom trawls at night (Fig. 2). In fact the average number of bluebacks caught per tow in the bottom trawls was 4.5 times greater at night than during the day. The last series of samples, taken between 0430 and 0520, shows some

indication of movement toward the surface. As it is still quite dark at this time in late October, there is a question as to what could elicit this response.

The distribution of juveniles between shoal and channel is shown for day and night trawls in Table 3. The catch per tow was somewhat greater in the shoal water during daylight, but the reverse was true at night. The data in Table 3 shows that nighttime catches were considerably smaller than daytime catches. This perhaps is due to the lower efficiency of the bottom trawl.

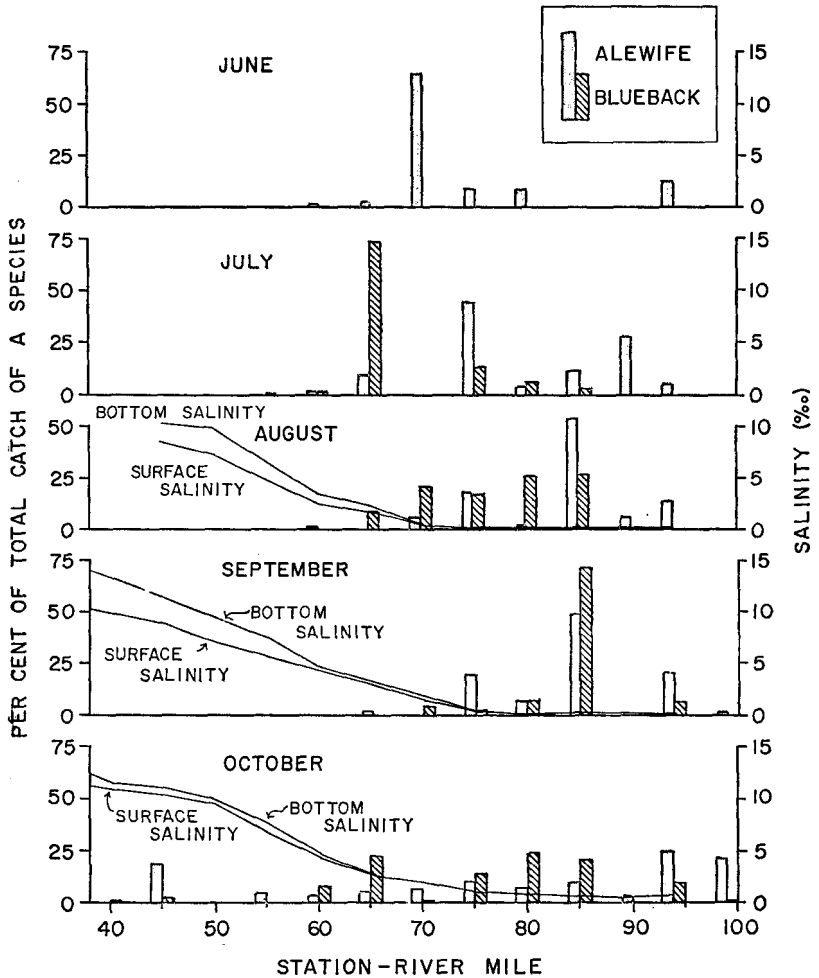


FIGURE 1. Seasonal distribution of juvenile river herring by river mile

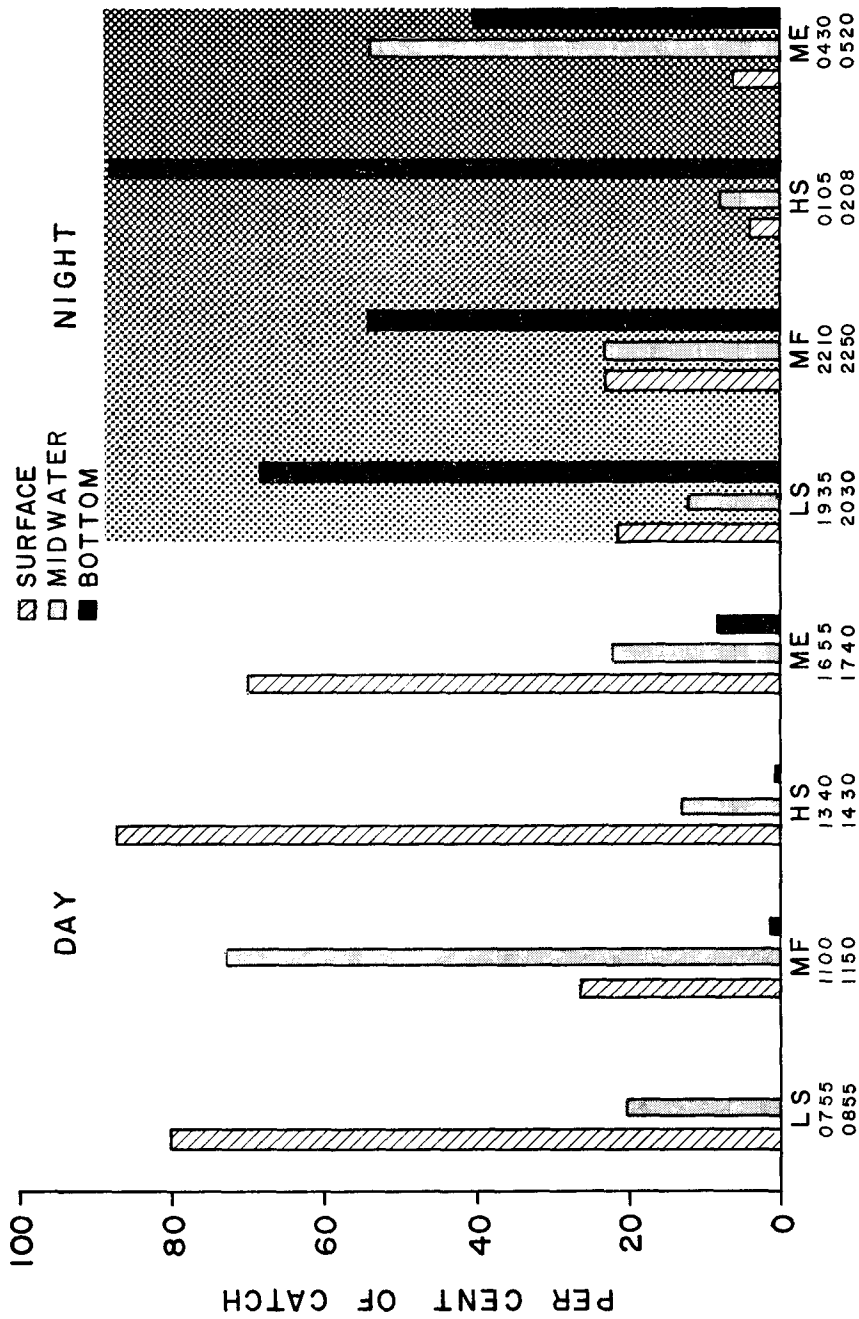


FIGURE 2. Vertical distribution of blueback herring in the Potomac River—October, 1968

TABLE 1. Numbers of juvenile alewife and blueback herring taken by trawling at 5 mile intervals in the Potomac River in 1968

	Alewife	Blueback
June .....	200	0
July .....	449	8646
August .....	96	1491
September .....	200	2967
October .....	207	9989
November .....	6	36
Totals .....	1158	24287

TABLE 2. Vertical distribution of river herring in the Potomac River in per cent of monthly catch

ALEWIFE			
Month	Surface	Midwater	Bottom
July .....	.96	4	0
August .....	.73	22	5
September .....	.11	66	23
October .....	.12	36	52
November .....	0	17	83

BLUEBACK			
July .....	.65	35	0
August .....	.55	41	4
September .....	.92	7	1
October .....	.64	35	1
November .....	.8	92	0

TABLE 3. Catch of juvenile alewife and blueback herring in channel and shoal water during daylight and darkness, October 28-29, 1968

	Daylight		Darkness	
	Shoal	Channel	Shoal	Channel
Total fish .....	7687	7170	538	1927
Avg. no. per tow .....	961	598	67	160
Total of alewife .....	81	66	20	32
Avg. no. per tow .....	10	6	3	3
Total of bluebacks .....	7603	7098	517	1894
Avg. no. per tow .....	633	592	65	158

## A MANAGEMENT SURVEY OF PUBLIC FISHING IN DELTA REGIONS OF EASTERN ARKANSAS

By RICHARD W. BROACH

*Arkansas Game and Fish Commission*

### ABSTRACT

Intensive agricultural endeavor and accompanying environmental degradation have virtually eliminated the native fishery of eastern Arkansas' delta regions. Unsatisfied public demands for outdoor recreation have, of course, increased as corresponding opportunities have been reduced.