A NOTE ON SHRINKAGE OF ATLANTIC HERRING LARVAE PRESERVED IN FORMALIN

NATIONAL MARINE FISHERIES SERVICE

WOODS HOLE, MASSACHUSETTS

by

Clarence W. Davis

National Marine Fisheries Service
Northeast Fisheries Center
Woods Hole, Massachusetts 02543
Laboratory Reference No. 78-43
August 31, 1978

Introduction

Enumeration of numbers of recently hatched herring larvae may be used to delineate spawning grounds and in part to estimate the size of the spawning population (Parrish and Saville, 1962). Therefore, it is important to separate recently hatched larvae from older individuals in plankton catches. Blaxter (1971) has shown that herring larvae shrink considerably in length from the effect of preservation in formalin, so larvae considered older than recently hatched may be incorrectly grouped as such if this factor is not accounted for.

This would result in an overestimate of the spawning population and egg production if the basis of grouping was determined from live or unpreserved larvae. This would also occur if shrinkage increased with preservation time and corresponding later measurements are used for the basis of grouping. Of course, if the recently hatched group size was originally determined from preserved larvae and the duration of fixation has no effect on size, no error would result.

The purpose of this study was to determine the amount of shrinkage at various times after preservation in our standard formalin solution on larvae obtained during joint ICNAF surveys in the western North Atlantic and to compare these results with those of Blaxter (1971) on European herring.

Materials and Methods

I conducted tests on aquaria and sea-caught larvae to determine the shrinkage effects of formalin for fish preserved from one day up to two years.

Three groups of larvae, two from recently hatched aquaria fish and one preserved sea catch, were used for all calculations. Standard fixative consisted of a 5% formalin-raw sea water (about 32 o/oo salinity) solution. Larvae were removed from containers by pipette, placed on waxed paper under low power of a binocular microscope, and measured (total length) with a micrometer to the nearest 1/10 mm. Excess water was absorbed by tissue paper which resulted in the live larvae being easily measured as they lay immobile from this procedure. Larvae were then placed individually in vials containing fixative for subsequent measuring.

Twenty larvae were measured three different times during one day to calculate measuring consistency; nearly all values were $\pm$ 0.1 mm on larvae of 8.0 to 19.1 mm total length. All measurements were made by the author.

Results and Discussion

The results of preserving and storing herring larvae in 5% formalin solution summarized in Tables 1 and 2, are very similar to those of Blaxter (1971) when he used 4% formalin in 34 o/oo S. sea water on reared fish. The values in Table 1 are means since the recently hatched larvae were about the same length. Individual larvae shrunk from 5 to 14 percent.

Assuming that 10 percent is a reasonable shrinkage value and not accounted for, a large error would result in our typical length-frequencies of catches made shortly after hatching. Modal length is often 9 or 10 mm and we measure to the nearest whole millimeter. A larvae designated as 9 mm was 10 mm before

fixation, etc. Fortunately, shrinkage beyond one day in fixative is small; thus it is not necessary to examine catches at particular dates or else make separate adjustments for every analysis.

We place larvae less than 10 mm in the "recently hatched" category, as do many other researchers, so the importance of shrinkage and its accountability is apparent. It is not explicit in the literature whether the cut-off point for placing larvae in the recently hatched category is based on preserved or fresh specimens, or how long after cap-ure they are processed. Parrish and Saville (1962) state that by using herring larvae less than 9.5 mm for production analysis, the result will be a serious underestimate because the youngest stages are not sampled in their true abundance for various reasons. Therefore, shrinkage (if applicable) in this instance would tend to reduce the error, the amount depending on the size distribution in the sample.

The good agreement between the results in Table 1 with those of Blaxter (1971) suggest that a 10% shrinkage of larvae after the first day of preservation is a reasonable estimate. The decrease in shrinkage after the first day makes it possible to measure larvae up to at least two years after preservation without in-roducing an error in measurement. However, determinations of the effect of capture in the field on shrinkage, as suggested by Blaxter (1971), should be made and measurements made to at least the nearest 1/2 mm for better interpretation of growth and the influences affecting measurements.

References

Blaxter, J. H. S. 1971. "Feeding and condition of Clyde herring larvae." Rapports et Proces-Verbaus, 160:128-136.

Parrish, B. B., and A. Saville. 1962. "The estimation of fishing mortality rate for Bank spawners, from larval abundance data." ICES, Herring Committee, C.M. 1962, Mimeogr. Paper No. 40.

Table 1. Effect of fixatives on shrinkage of live, recently hatched herring larvae.

Test	Fixative	No. of larvae	$\bar{X}$ length (range)	Percent shrinkage from live $\bar{x}$ length					
				1 day	1 wk.	1 mon.	3 mon.	1 yr.	2 yr.
Blaxter (1971)	4% formalin in 34% S.	20	8.42 (?)	9	12	12	13	-	-
Davis	5% formalin in 32% S.	20[1]	8.4 (7.9 - 8.9)	10	11	11	11	11	11
Davis	5% formalin in 32% S.	15[2]	8.0 (7.4 - 8.8)	9	10	9	9	9	10

[1]Post yolk sac larvae
[2]Yolk sac larvae included

Table 2. Shrinkage of preserved sea-caught herring larvae (original preservation was one week in 5% formalin - 32% S).

No. of larvae	$\bar{X}$ length (mm)	Size range (mm)	Percent shrinkage from original preserved $\bar{x}$ length				
			1 wk.	1 mon.	2 mon.	1 yr.	2 yr.
40	12.9	7.9 - 18.5	1.7	2.1	1.9	1.5	1.9