



1950

**International Commission
for the
Northwest Atlantic Fisheries**



1970

RESTRICTED

Serial No.2416
(B.g.7)

ICNAF Res.Doc.70/71ANNUAL MEETING - JUNE 1970

DISTRIBUTION AND ABUNDANCE OF LARVAL HERRING
(CLUPEA HARENGUS HARENGUS L.) ON GEORGES BANK
AND ADJACENT WATERS IN 1962 to 1969

by
H. C. Boyar
Bureau of Commercial Fisheries Biological Laboratory
W. Boothbay Harbor, Maine 04575

Evidence from meristic studies (Anthony and Boyar, 1968) and biochemical studies (Ridgway, Lewis and Sherburne, 1970) indicates that herring (Clupea harengus harengus L.) from the coastal Gulf of Maine and southern Nova Scotia are from populations distinct from those of Georges Bank. Investigations of the seasonal and spatial distribution of larval herring within these areas should provide further evidence concerning the discreteness of these populations.

Investigations to determine the distribution of larval herring in the Bay of Fundy and Gulf of Maine were conducted in the late 1950's (Tibbo, Legare, Scattergood and Temple, 1958 and Tibbo and Legare, 1960) and the 1960's (Boyar, 1966 and Das, 1968). Tibbo et al. (1958) reported the occurrence of newly hatched larvae to demonstrate that considerable spawning occurred on Georges Bank and along the southern coast of Nova Scotia. They also found spawning on a lesser scale along the inshore waters of the Gulf of Maine, and suggested that larvae from spawnings on Georges Bank could eventually be carried into the Gulf of Maine-Bay of Fundy area. Tibbo and Legare (1960) reported that almost 90 percent of the larvae collected in October and November of 1958 and 1959 were found on the Northern Edge of Georges Bank and in the Bay of Fundy. They postulated that the stocks of herring in the Bay of Fundy were from Nova Scotia spawnings.

In 1962 the U.S. Bureau of Commercial Fisheries Biological Laboratory, Boothbay Harbor, Maine initiated additional surveys to obtain information on the distribution of larval herring on Georges Bank and adjacent waters (Boyar, 1966). I reported that larval and immature herring from Georges Bank appear to be restricted to the vicinity of the Bank and that additional studies on the fate of larvae on the Bank could provide information as to the possible discreteness of the population. Das (1968) confirmed the findings of Tibbo et al. (1958) and Tibbo and Legare (1960) that there were major spawning areas off the southwest coast of Nova Scotia and Georges Bank, and suggested that larvae spawned in the autumn in Nova Scotia were the major contributors to the populations of herring in the Bay of Fundy area. He also suggested that some larvae spawned in the late autumn on the Northern Edge of Georges Bank might drift into the Bay of Fundy.

Drift bottle studies suggested that the progeny of the Georges Bank spawning were carried principally southward and westward during late fall and early winter (Day, 1958 and ~~Mumpus~~, 1960 and 1961). Colton and Temple (1961) claimed that the non-tidal drift would be unlikely to carry larvae from Georges Bank into the Gulf of Maine. Generally, the studies in the 1950's and 1960's suggested that the majority of larvae from Georges Bank were carried southward. The ultimate fate of these larvae, however, was not known.

This document reports the distribution of larval herring on Georges Bank and adjacent waters and offers evidence that some of the larvae spawned on the Bank remain there, at least to the juvenile stage.

METHODS

Larval herring were collected on Georges Bank in September of 1964, 1965 and 1968; October of 1964 to 1969; November of 1963 to 1965; December of 1962 and 1963; April of 1965 to 1967 and June of 1965, 1967 and 1969.

Oblique plankton tows of 15-minute duration (5 minutes at 20 meters, 5 minutes at 10 meters and 5 minutes at the surface) were made with an one-meter #0 mesh net towed at 2 to 3 knots. Boat time was limited so that we were unable to study the temporal distribution of larvae for each year. In addition, the cruises were designed for other research and the plankton tows were made only when time was available. During the cruises in October 1964 and April 1966, in addition to the plankton tows on Georges Bank, transects were made between the Bank and the coastal waters of the Gulf of Maine.

RESULTS

The dates, locations of capture, number of tows, mean length and range in length of larval herring collected from Georges Bank and adjacent waters in 1962 to 1969 are presented in Table 1. Yolk-sac larvae were obtained from September through December; their presence as late as December is not unusual, for Boyar (1968) reported that spawning on Georges Bank may begin in early September and last until December. Despite the extended spawning season and our inability to study the temporal distribution of larvae for each year, the data do indicate the seasonal growth of larvae on Georges Bank. Larvae from September spawning (4 to 9 mm in length) may increase to a length of 65 mm (juvenile herring) by June. There is a definite increase in the length of the larvae from September through December, but most of the growth occurs during the spring (April through June).

Although the presence of larval herring on Georges Bank in April had been previously reported (Marak and Colton, 1961; Marak, Colton and Foster, 1962; and Marak, Colton and Miller, 1962) the number of larvae they obtained was considerably less than we obtained in the same waters with similar gear: the maximum number they obtained in the 1950's was 39 larvae per 10 to 15 minute surface tow. Our maximum number was 3100 per 15 minute tow.

In the transects between Georges Bank and the coastal waters of the Gulf of Maine in October 1964 and April 1966 we failed to obtain larvae in the middle of the Gulf of Maine, but did collect larvae from Jeffreys Ledge and the Isles of Shoals.

In our cruises conducted in June 1967 and 1969 we collected post-larvae. The larvae were not obtained with the plankton net, but were found meshed in the twine of the otter trawl. The number of post-larvae we caught was small (Table 1).

DISCUSSION

Slight differences in mean length occurred between the larvae we collected in 1962 to 1969 and those obtained by Tibbo et al. (1958) and Tibbo and Legare (1960) within a specific month during the autumn. In addition, there were also slight differences in the mean lengths of samples of larvae we obtained during a given month in the same year. These differences are to be expected, however, for as already stated, spawning occurs from September to December and consequently yolk-sac larvae are obtained during these months. The peak of spawning on Georges Bank is usually during the second and third week of October, but may vary from year to year. For a given year, however, I have found that the peak of spawning on Georges Bank, coastal Gulf of Maine and Nova Scotia occurs at approximately the same time (Boyar, 1968). Consequently, larvae from Georges Bank are, as would be expected, similar in length to larvae caught at the same time of year in the inshore waters of the Gulf of Maine (Graham and Boyar, 1965 and Graham and Venno, 1968) and in the waters of Nova Scotia-Bay of Fundy (Tibbo and Legare, 1960 and Das, 1968).

As already stated, post-larvae were collected in June. We are unable to determine whether these post-larvae were part of a large concentration still living on the Bank or whether they were the remnants of post-larvae which had already left the Bank. We cannot catch post-larvae with one meter #0 mesh plankton nets. Marak and Colton (1961), Marak, Colton and Foster (1962) and Marak, Colton and Miller (1962) also failed to catch post-larvae in June with identical nets, but they did catch a few post-larvae with a Hardy continuous plankton recorder, a high speed plankton gear. The post-larvae were obtained from Pollock Rip (south of Cape Cod, Massachusetts) and from 13 miles southwest of Brier Island, Nova Scotia. Apparently, the post-larvae, if present, are either capable of avoiding the slow moving meter net or during the day may be deeper than 20 meters. To collect these larvae we need to use high speed plankton gear such as Isaacs-Kidd trawls, Boothbay Depressor trawls or Bongo nets and make oblique tows of 15 to 30 minutes from a depth of 50 meters to the surface.

References

- Anthony, V. A., and H. C. Boyar. 1968. Comparison of meristic characters of adult herring from the Gulf of Maine and adjacent waters. Int. Comm. Northw. Atlant. Fish., Spec. Publ. 5: 61-98.
- Boyar, H. C. 1966. Distribution and abundance of larval herring on Georges Bank. ICNAF Res. Doc. 66-62: 1-4.
- Boyar, H. C. 1968. Age, length and gonadal stages of herring from Georges Bank and the Gulf of Maine. Int. Comm. Northw. Atlant. Fish., Spec. Publ. 5: 40-61.
- Bumpus, D. F. 1960. Sources of water contributed to the Bay of Fundy by surface circulation. J. Fish. Res. Bd. Canada, 17: 181-197.
- Bumpus, D. F. 1961. Drift bottle records for the Gulf of Maine, Georges Bank and Bay of Fundy 1956-1958. U.S. Fish and Wildl. Serv., Spec. Sci. Rep. Fish. 378: 1-125.
- Das, N. 1968. Spawning, distribution, survival, and growth of larval herring (Clupea harengus L.) in relation to hydrographic conditions in the Bay of Fundy. Fish. Res. Bd. Canada, Tech. Rept. 88: 1-129.
- Day, C. G. 1958. Surface circulation in the Gulf of Maine as deduced from drift bottles. U.S. Fish and Wildl. Serv., Bull. 141: 443-472.
- Graham, J. J., and H. C. Boyar. 1965. Ecology of herring larvae in the coastal waters of Maine. Int. Comm. Northw. Atlant. Fish., Spec. Publ. 6: 625-634.
- Graham, J. J., and P.M.W. Venno. 1968. Sampling larval herring from tidewaters with buoyed and anchored nets. J. Fish. Res. Bd. Canada 25(6): 1169-1179.
- Ridgway, G. J., R. D. Lewis, and S. W. Sherburne. 1970. Serological and biochemical studies of herring populations in the Gulf of Maine. Int. Council for Exploration of the Sea. Committee Memorandum No. 24: 1-13.
- Tibbo, S. N., J. E. H. Legare, L.W. Scattergood, and R. F. Temple. 1958. On the occurrence and distribution of larval herring (Clupea harengus L.) in the Bay of Fundy and the Gulf of Maine. J. Fish. Res. Bd. Canada 15: 1451-1469.
- Tibbo, S. N., and J.E.H. Legare. 1960. Further study of larval herring (Clupea harengus L.) in the Bay of Fundy and Gulf of Maine. J. Fish. Res. Bd. Canada 17(6): 933-942.

Table 1. Seasonal distribution of larval herring on Georges Bank and adjacent waters in 1962 to 1969.

Month	Year	Location	Number of tows	Number of larvae	Mean length (TL in mm)	Range in mm	
Sept.	1964	Northern Edge	19	41	6	4-7	
	1965	Northern Edge	5	391	7	5-17	
		Southeast Part	2	8	7	6-8	
	1968	Northern Edge	1	3100	7	5-10	
		Northeast Peak	1	52	8	7-9	
		Winter Fishing Ground	4	585	9	7-17	
		Southeast Part	1	14	15	12-17	
		Corsair Canyon	2	7	13	8-15	
Oct.	1964	Northern Edge	15	299	11	6-17	
		Cultivator Shoals	3	31	13	9-16	
		Georges Shoals	2	5	14	7-28	
		Jeffreys Ledge	1	1	11	11	
		Isles of Shoals	1	1	19	19	
	1965	Southeast Part	3	2	13	12-14	
	1966	Northern Edge	3	43	13	7-18	
		Georges Shoals	2	23	10	6-23	
	1967	Cultivator Shoals	2	673	11	7-17	
		Northeast Peak	1	3	12	11-12	
		Winter Fishing Ground	2	140	10	7-17	
		Little Georges	1	96	13	9-20	
		Cultivator Shoals	2	207	12	8-24	
		East of Cultivator	2	12	13	11-17	
		Georges Shoals	1	128	12	9-16	
		Georges Basin	1	7	13	10-18	
		Southeast Part	3	199	11	6-20	
		Oceanographer Canyon	2	21	8	5-11	
		Cape Cod	1	2	16	15-18	
	1968	Cape Cod Bay	1	7	12	10-15	
		Northern Edge	7	235	10	7-17	
		Northeast Peak	2	68	13	7-18	
		Cultivator Shoals	1	105	11	8-13	
		Southwest Part	1	2	14	13-15	
	1969	Georges Basin	2	174	12	8-19	
		Northern Edge	2	32	8	5-17	
		Cultivator Shoals	2	3	13	9-20	
	Nov.	1963	Northern Edge	5	32	16	10-21
Cultivator Shoals			2	1	14	14	
1964		Northern Edge	5	89	14	7-28	
		Southwest Part	1	1	18	13	
1965		Northern Edge	2	39	19	12-25	
		Southeast Part	1	1	20	20	
Dec.		1962	Northern Edge	6	115	16	14-32
	Cultivator Shoals		5	112	20	15-29	
	Georges Shoals		2	175	12	5-32	
	Little Georges		3	76	16	5-28	
	Southeast Part		3	17	11	5-28	
	Great South Channel		4	37	22	15-27	
	Cape Cod Bay		2	2	19	16-22	
	1963	Jacques Swell	1	5	22	19-29	
		Northern Edge	1	7	26	23-31	
	Apr.	1965	Northern Edge	7	344	39	27-52
			Cultivator Shoals	3	70	36	29-49
			Southeast Part	10	34	38	28-47
			Southwest Part	1	1	29	29
1966		Northern Edge	5	5241	40	30-57	
		Cultivator Shoals	2	400	37	31-50	
		Little Georges	3	609	39	30-46	
		Isles of Shoals	2	55	41	30-48	
1967		Southeast Part	1	1	39	39	
		Little Georges	7	108	38	17-45	
June		1965	Northern Edge	8	1	40	40
	Northern Edge		4	6	43	36-48	
	1967	Cultivator Shoals	1	8	54	49-57	
		Winter Fishing Ground	2	26	59	50-65	