

Occurrence of Pollock, *Pollachius virens*, and Sand Lance, *Ammodytes* sp., Larvae in the Bay of Fundy

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Abstract

A plankton survey of the Bay of Fundy in March 1979 revealed for the first time the occurrence of pollock and sand lance larvae. Distributions of numbers per tow and length composition of catches indicated that the pollock larvae originated outside the Bay and dispersed from the south toward the inner part of the Bay. Similar data for sand lance indicated two spawning areas, one near Cape Chignecto from which the larvae dispersed toward the mouth of the Bay, and the other near Long Island, western Nova Scotia, with apparent mixing at the mouth of the Bay of larvae from both spawning sites.

Introduction

One of a series of routine larval herring surveys of the Bay of Fundy was carried out in March 1979, covering the whole of the Bay from the entrances to Chignecto Bay and Minas Basin to the eastern part of the Gulf of Maine (Fig. 1). Examination of fish larvae caught during the survey indicated the presence of significant numbers of pollock, *Pollachius virens* L., larvae and sand lance, *Ammodytes* sp., larvae, previously unrecorded for this area. The occurrence of these larvae suggested the possibility that spawning populations of pollock and sand lance were present in

the Bay or its vicinity. The distributions and size compositions of the larvae were examined with a view to identifying possible spawning sites within the Bay.

Materials and Methods

The Bay of Fundy larval herring surveys consist of sampling a standard set of 116 stations, at each of which an oblique tow is made with a bongo sampler consisting of a pair of plankton nets of 0.505 and 0.333 mm mesh. The contents of each net from each tow are preserved separately in a sea-water solution of 5% formalin and subsequently examined by experts of the ichthyoplankton sorting and identification unit at the Huntsman Marine Laboratory, St. Andrews, New Brunswick, Canada. Fish larvae are sorted, identified by species where possible, counted, and measured to the nearest millimeter. The notochord length is measured prior to the formation of the caudal fin and the standard length thereafter.

This paper presents information on the distribution and size composition of 159 pollock and 395 sand lance larvae caught during a plankton survey of the Bay of Fundy in March 1979. Because of difficulties with identification, sand lance larvae were identified to genus, *Ammodytes* sp., only. The numbers of larvae caught in each net were so few and the length ranges so similar that mesh selection was considered insignificant, and the catches of both nets for each tow were combined. Contoured distributions of pollock and sand lance larvae were derived from plotting the numbers per tow at positions of capture, and the length frequencies were combined for the various sectors into which the Bay of Fundy was

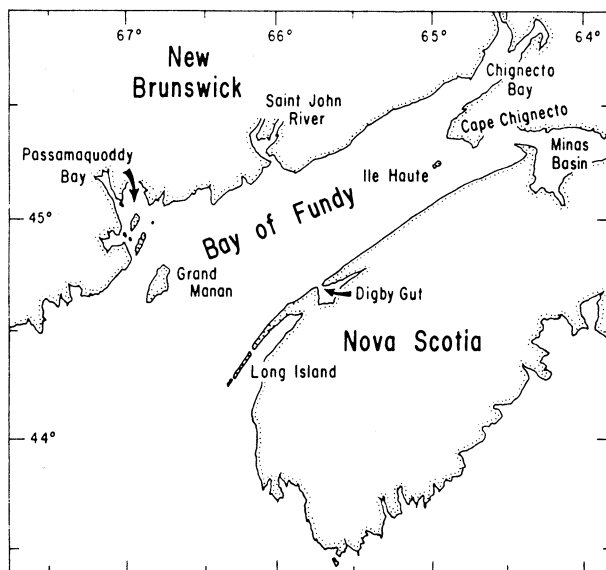


Fig. 1. Map of Bay of Fundy with place names mentioned in the text.

arbitrarily divided, with a view to determining any differences that might indicate larval dispersion.

Results

Pollock

The number of larvae per tow ranged from 0 to 15, and the greatest concentration was found at the southwest extremity of the survey area in the eastern part of the Gulf of Maine (Fig. 2). Although some larvae (1-4 per tow) were taken in a large area of the Bay of Fundy, particularly on the southern (Nova Scotia) side, they were absent in the inner reaches of the Bay from

Minas Basin westward to the entrance of Passamaquoddy Bay.

The length composition of the total catch of pollock larvae (Fig. 2) shows a wide range in size (4-31 mm), with a principal mode at 10-12 mm, a secondary mode at 20-22 mm, and a mean length of 14.2 mm. Examination of length frequencies by sector indicates a slight increase in mean length from the sectors of relatively high concentration at the mouth of the Bay (13.4 and 13.0 mm in sectors A and B respectively) to the area of low concentration within the Bay (15.0 mm in sector C). The modes of the length frequencies do not show the trend to any great extent except for a higher proportion of 10 mm larvae in sector B and a greater proportion of larger larvae (>20 mm) in sector C than in the other sectors.

Sand lance

In contrast to pollock larvae, sand lance larvae were well distributed throughout the survey area except for some stations in Chignecto Bay, between the Saint John River estuary and Passamaquoddy Bay, and south of Grand Manan Island at the mouth of the Bay of Fundy (Fig. 3). Number per tow ranged from 0 to 66, with the highest concentrations extending from Cape Chignecto along the Nova Scotian coast to Long Island. In general, the number per tow decreased from the inner part of the Bay toward the mouth and also from the Nova Scotian side toward the New Brunswick side.

The length composition of the total catch of sand lance larvae (Fig. 3) shows considerable skewness with a single pronounced mode at 6 mm, reflecting a preponderance of young larvae. Lengths ranged from 4 to 17 mm with the mean at 8.5 mm. However, there was considerable variation in the length frequencies and the mean lengths by area, with sectors A and F showing pronounced modal groups around 6 and 7 mm respectively. Sector B shows a pronounced mode at 6 mm, with strong representation of larvae up to 12 mm in length. The trend towards larger larvae continued in sectors C and D with 10 and 11 mm larvae being well represented in the former and 10 mm larvae being dominant in the latter. The distribution in sector E was bimodal with a major mode at 6 mm and a secondary mode at 12 mm. The mean length increased from 7.3 mm in sector A to 9.9 mm in sector D and decreased to 8.0 mm in sector F.

A small number of juvenile sand lance (35) were taken on the Nova Scotia side of the Bay, 22 specimens in a single haul just north of Digby Gut (Fig. 1). Lengths ranged from 6 to 12 cm, with a mean at 8.3 cm and mode at 7 cm.

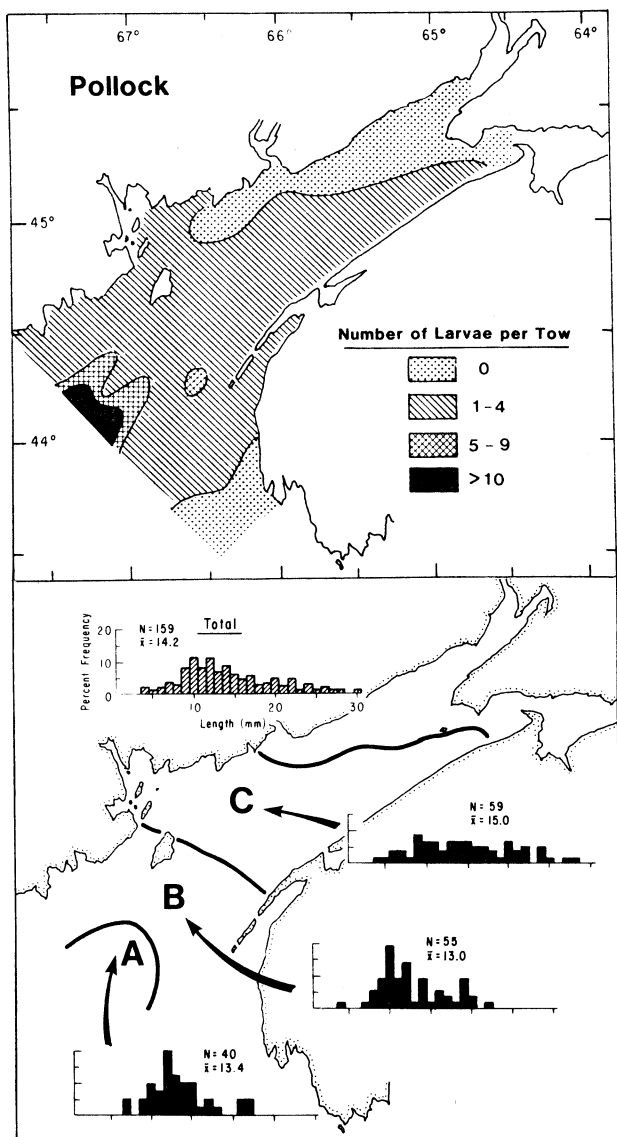


Fig. 2. Distribution (above) and length frequencies (below) of pollock larvae in the Bay of Fundy, March 1979.

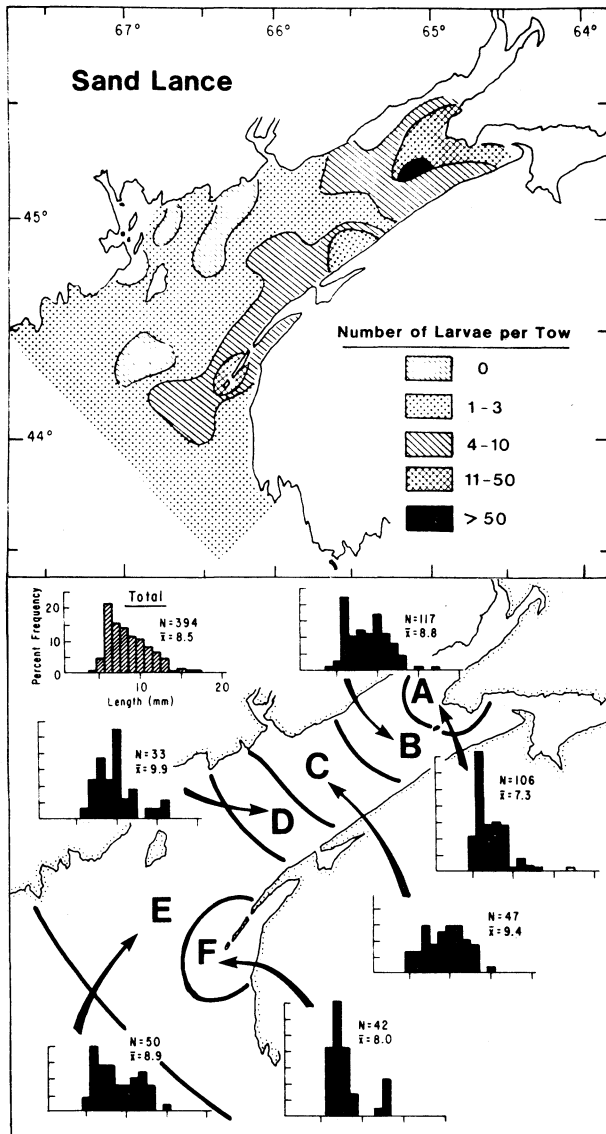


Fig. 3. Distribution (above) and length frequencies (below) of sand lance larvae in the Bay of Fundy, March 1979.

Discussion

The spawning seasons of pollock and sand lance extend over considerable periods of time (Bigelow and Schroeder, 1953), and there is time for the larvae hatched early in the season to disperse from the spawning area and grow as late-season larvae are still hatching. Increase in size of larvae with distance from a given area may therefore be used to identify the area as a possible spawning area from which the larvae originated.

Pollock

The concentrations of larvae at the mouth of the Bay of Fundy and the decline in abundance, together

with the gradation of increasing mean length, towards the inner parts of the Bay indicate that the spawning grounds of pollock are outside the Bay. This agrees with the observations of Steele (1963), who, on the basis of a few small larvae (≈ 4 mm long) taken off Southwest Nova Scotia in 1959–60, suggested that Bay of Fundy pollock originated from the southern Gulf of Maine and possibly the Scotian Shelf, although he had no evidence of spawning in the latter area. Colton *et al.* (1979) also identified the principal spawning area of pollock off the USA Atlantic coast as being in the southern part of the Gulf of Maine (Massachusetts Bay, Stellwagen Bank and South Channel). The smallest larvae taken in the Bay of Fundy in March 1979 were 4 mm long, but this does not conflict with Steele's (1963) suggestion that spawning occurs outside the Bay. The bimodality of the length compositions from the survey indicates that the larvae may originate from two spawning areas, possibly the Gulf of Maine and the Scotian Shelf.

The occurrence of pollock larvae within the Bay of Fundy early in 1979 may be unusual. The fact that they have not been previously reported and that noticeably large numbers of pollock fry have been observed in Passamaquoddy Bay in 1979 and 1980 indicate that 1979 was a year of high larval and juvenile abundance and, presumably, extensive distribution.

Sand lance

Of the three major areas of concentration of larvae in the Bay of Fundy, the catches per tow were high in the vicinity of Cape Chignecto, the highest value being found near Ile Haute. The increase in mean length of fish from Cape Chignecto towards the center of the Bay indicates dispersion of larvae from spawning grounds at the head of the Bay, presumably the area around the Cape, where the length frequency distribution was dominated by 6-mm larvae and the mean length of larvae was lowest, rather than around Ile Haute. The second area of high concentration of larvae north of Digby Gut (sector C) is probably not a spawning area in view of the dominance of 9–12 mm larvae in the length frequency (Fig. 3).

The third area of high concentration in the vicinity of Long Island (sector F) shows similar mean larval length (8.0 mm) and principal modal length (7 mm) to those of the Cape Chignecto area (sector A), indicating a possible spawning area around Long Island. Dispersion from this area into the Bay is indicated by the increase in mean size of larvae in sectors C, D and E. It is possible that the length frequencies for these sectors represent mixing of larvae from the Long Island and Cape Chignecto spawning areas. Although sand lance larvae were dispersed throughout the Bay of Fundy, the presence of some juveniles mixed with larvae suggests that subpopulations of sand lance,

presumably fish of all ages, are established in certain parts of the Bay.

The surficial geology of the Bay of Fundy (Fader *et al.*, 1977) shows that the seabed at the bottom of the Bay consists mainly of "Sambro sand", a mixture of sand, silt and clay with varying amounts of gravel, built up into sand waves by tidal action. Sand lance require soft sandy areas in which to bury themselves, and their distribution in the Bay will be limited to such sandy patches or beaches. The seabed of the central and outer parts of the Bay and shoreline consist mainly of coarser material not suitable as a substrate for sand lance. However, "Sambro sand" reappears off St. Mary's Bay and Sable Island sand and gravel, which is prevalent off southwest Nova Scotia, presumably extends to the St. Mary's Bay-Long Island area, providing suitable substrate for sand lance spawning.

Although Huntsman (1922) noted the occurrence of sand lance at the mouth of the Bay of Fundy (Eastport, Grand Manan and St. Mary's Bay) and in Passamaquoddy Bay and considered this as uncommon due to the lack of suitable sandy shoreline, the species has not previously been recorded in the

middle and inner parts of the Bay. The evidence presented in this paper indicates that sand lance is more widespread in the Bay of Fundy than previously believed and that breeding populations are established in at least two localities within the Bay.

Acknowledgements

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