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Larval herring patch study[1]

by

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An intensive international, multiship larval fish study was successfully completed this past fall in the Georges Bank-Nantucket Shoals area. Biologists and physical oceanographers from five countries (US, Canada, Federal Republic of Germany, Poland, and USSR) and eight vessels (ALBATROSS IV, ATLANTIS II, DAWSON, LADY HAMMOND, CANSO CONDOR, ANTON DOHRN, WIECZNO, and BELOGORSK) participated in the coordinated study which took place from October through mid-November. The main objective of the study was to identify and follow a mesoscale patch of recently hatched Atlantic sea herring larvae to provide short-term (hours and days) estimates of growth, mortality, and dispersal of a uniform-age larval population in relation to variation in their physical and biological environment. Such multidisciplinary, intensive patch studies are necessary to identify and measure the relative importance of the physical and biological mechanisms controlling the survival of larvae which is critical to an understanding of the recruitment process. More than two years of careful planning by scientists from the Northeast Fisheries Center (NMFS), Woods Hole, MA, and the Bedford Institute of Oceanography, Dartmouth, NS, were required to develop a strategy for focusing the multidisciplinary studies needed on all scales of sampling. Individual vessels were committed primarily to one of the following activities: (1) Mapping the patch with sufficient resolution to provide short-term population parameters and physical structure of the patch as it dispersed, (2) vertical and horizontal fine scale structure of predator-prey distributions, (3) fine scale primary and secondary productivity measure-

[1] Extract from MARMAP Fisheries Ecosystem Study News, National Marine Fisheries Service, Northeast Fisheries Center, Narragansett Laboratory Reference 79-12, February 1979.

ments, (4) physical processes responsible for the patch dissipation, and (5) broad scale, standard plankton-hydrography surveys of the entire region.

The initial focus for the study was on the northeast part of Georges Bank (Figure 1) which represents the principal historic spawning grounds for sea herring as well as many other valuable species. Three Canadian and three US moored current meter arrays were strategically placed in the intensive study area and a grid of 49 standard plankton stations was occupied at least once every 3-4 days. No herring larvae were found at this site, but a dense chaetognath patch was observed to reside in the southeast corner of this area for more than two weeks, just south of the Gulf of Maine-Georges Bank front, and data from the study appear adequate to explain its stability and retention on the Bank. It has long been suspected that survival of larvae and their associated zooplankton food must be related to their retention on the Bank where productivity is high. However, data on plankton dispersal in relation to water motion have largely been lacking until now. The joint experiment accomplished one of the most intensive studies to-date of the biological community in relation to the dynamics of the frontal water along the northeastern edge of Georges Bank, and it is expected we will be able to infer a good deal about the dispersal of herring larvae on eastern Georges from this patch study.

By the end of October a patch of recently hatched herring larvae was found just east of Cape Cod and mapped five times in five days between 3 and 8 November 1978 (Figure 2). Station spacing of the standard bongo hauls was between 1-2 n. mi. during patch mapping. The initial size of the patch when first surveyed was about 3x10 n. mi., as defined by concentrations of larvae greater than 1S/m^2, with the long axis of the patch oriented east-west. Larvae were mostly between 10 and 14 mm in length and believed to have hatched about 10 days earlier. The patch moved north along the 92 m depth contour at the rate of 1-2 mi. per day; however, the eastern part of the patch appeared to be pulled off into the deeper Great South Channel water, whereas the western part was retained near shore. Evidence for this shearing effect was supported by the drift of a number of drogues placed along the east-west axis of the patch. By the fourth patch mapping it was observed that another higher density patch of younger larvae had moved down from the northwest and merged with the original

patch. The fifth patch mapping confirmed this notion as densities of larvae were observed to be on the order of 3 times that of the original patch and the larvae were significantly smaller in size. ALBATROSS IV returned to the patch study site again during 19-20 November and 12-14 December 1978 to conduct limited patch mapping studies. Although the densities of larvae were considerably lower, as expected, the patch could still be delimited at essentially the same location. It was oriented north-south along the near shore zone between the 18 and 92 m depth contours, and there was further evidence of larvae dispersing from the shoal waters into the Channel east of Nauset Harbor.

Undoubtedly there are many other facets to the study which will be forthcoming when all the data are analyzed, but what seems remarkable so far is the apparent cohesiveness and stability of the plankton patches observed over relatively long periods of time in coastal waters that are generally characterized by their intense variability!

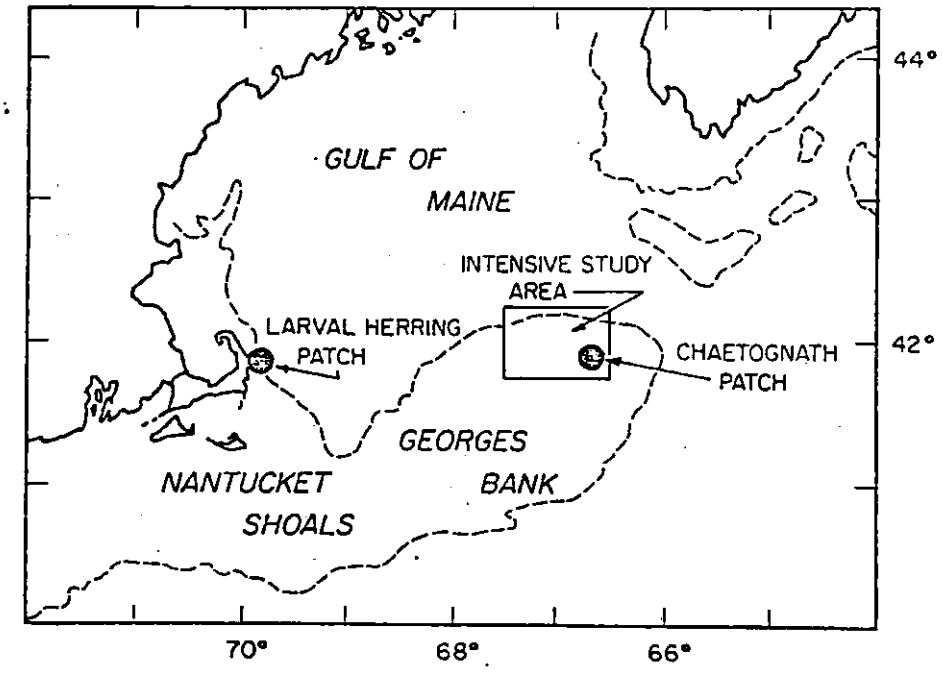

Figure 1. Chart of the Georges Bank-Nantucket Shoals area showing locations of the larval herring and chaetognath patches studied during the International Larval Herring Patch Study.

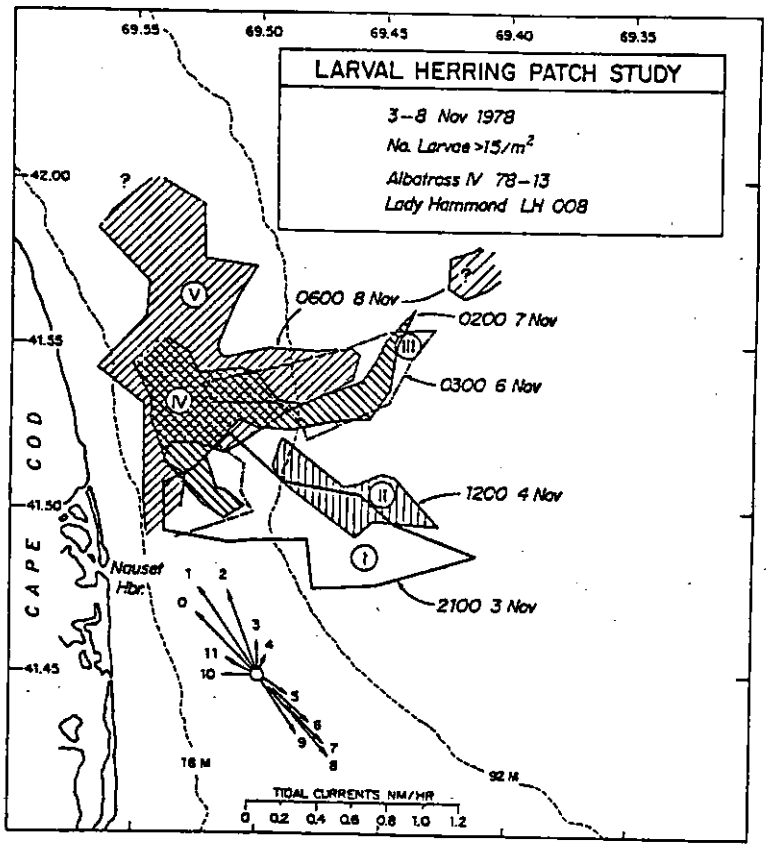

Figure 2. Delineation of the five larval herring patch mappings, 3-8 November 1978, by the vessels ALBATROSS IV and LADY HAMMOND. The patch contours represent areas where densities of larvae were greater than $15/m^2$. Hourly directions and velocities of the tidal currents are shown by arrows. The figures at the arrow heads are the hours after the time of maximum flood at Pollock Rip Channel.