12. Larval and Juvenile Fish

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Background

Larval fish included in this study represent a wide variety of taxonomic groups and growth forms that change with season and location. Although fish larvae are present in all seasons, abundances decrease in fall and winter when the most numerous larvae are elongated clupeid types. During the spring and early summer gadiform and flatfish larvae are at their most numerous. Larval myctophids are numerous and sometimes dominant, although the adults are distributed in deeper water off the continental shelf.

Data Sources & Sampling Procedures

Larval fish biomass was derived from the Marine Resources Monitoring, Assessment and Prediction (MARMAP) sampling program conducted from 1977-87 on the U.S. continental shelf from Cape Hatteras, North Carolina to the Gulf of Maine (Sherman 1980, Morse 1982, Sherman 1986). Double-oblique 61 cm bongo ichthyoplankton and zooplankton sampling tows were taken from the surface to a maximum depth of 200 m or from within 5 meters of the bottom. The sampler was fitted with 0.505 mm mesh nets for ichthyoplankton and 0.333 mm nets for zooplankton. The flowmeter was used as a measure of filtration efficiency for each sample. Ichthyoplankton samples were sorted, identified, and enumerated according to the procedures outlined by Jossi and Marak (1983). Larval fish were identified to the lowest taxon possible and measured to the nearest 0.1 mm standard length (SL). For a summary of MARMAP operations see Sibunka and Silverman (1984, 1989).

Mean-Abundance Procedures

The number of larvae caught was transformed to the number of individuals under 10 m^2 of sea-surface area based on the maximum tow depth and volume filtered by the bongo net:

(EQ. 12.1) $$N = 10 * C * M * B^{-1} * D^{-1}$$

where N represents the standardized abundance; C represents the number of larvae collected in the sample; M represents the maximum tow depth (meters); B represents the aperture of the bongo frame; and D represents the total distance the net was towed in meters from the calibrated flowmeter (Smith and Richardson 1977). The mean abundance and its variance were calculated by Pennington's (1983) method based on the Delta (Δ) distribution. For each station, catch values were standardized to the number of individuals under 10 m^2 surface area. The Delta distribution of catch frequencies (Aitchison 1955) was used to provide unbiased estimates of sample means from mean catch calculations and its variance using zero tows (Berrien, *et al.* 1981; Pennington 1983).

Larval Fish Biomass

Delta mean abundances (number/10 m^2) of all larvae were extracted by 1 mm SL increments. Dry weight was estimated for each 1 mm abundance group averaged over all seasons of sampling using the length to weight relationship:

(EQ 12.2) $$LogDW = -4.152LogSL^{1.186}$$

where DW is dry weight in ug and SL is standard length in mm. The coefficient of SL (1.186) and the intercept are the means of the those parameters from length weight relationships in Laurence (1979) based on laboratory-reared larvae of seven species of fish including a variety of growth forms. Larval weights are rarely given in the literature as wet weight, thus dry weight was assumed to be equal to 10% of wet weight, as were other planktonic forms.

Production and Consumption

For purposes of this study, consumption rates used for larvae are based on the average growth rate observed for larval gadids taken from laboratory studies at the NMFS Narragansett laboratory (Laurence, 1978) and unpublished field observations. Growth (i.e., production) was estimated at 0.04 day^{-1} based on an assumption of growth consistent with that of juvenile cod (Peck *et al.* 2003). These values were then scaled to provide an annual estimate. This produced a P:B ratio of 15, similar to micronekton.

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