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TYCHOPLANKTONIC BLOODWORM, *GLYCERA DIBRANCHIATA*, IN SULLIVAN HARBOR, MAINE

The bloodworm, *Glycera dibranchiata*, is distributed from the Gulf of St. Lawrence to the Gulf of Mexico and from central California to lower California and Mexico. It occurs from intertidal water to 402 m depth (Pettibone 1963), but it is more abundant in shallow coastal water. In Maine and Nova Scotia the worms are dug commercially along the coast from the upper layers of the intertidal sand-silt-clay strata (Dow and Creaser 1970; Anonymous 1974; Glidden[1]).

Spawning bloodworms are briefly pelagic occurring in large numbers as they swarm in the afternoon. Creaser (1973) observed swarming in Maine during June. Simpson (1962) reported swarming both in June and November-December, suggesting a biannual spawning in Maryland. Klawe and Dickie (1957) did not observe swarming by bloodworms in Nova Scotia, although other evidence indicated that the worms spawned in mid-May. They suggested that the worms had a short nocturnal swarming period making them difficult to observe. Simpson (1962) checked this possibility

[1]Glidden, P. E. 1951. Three commercially important polychaete marine worms from Maine: *Nereis (Neanthes) virens*, *Glycera dibranchiata*, *Glycera americana*. Rep. to Maine Dep. Sea Shore Fish., Augusta, Maine.

in Maryland by making 40 observations with a night-light between June and November. No worms appeared at the surface under the light.

Individual bloodworms occasionally are pelagic when not spawning. Pettibone (1963), when noting the sightings of others, reported a bloodworm swimming at the surface of Eel pond, Woods Hole, Mass., on the evening of 17 August 1943; another at the surface perhaps at the same pond on 28 January 1876; and another in Delaware Bay on 29 January 1957. No time was given for the two January sightings. On 2 October 1969, E. P. Creaser, Jr. sighted a bloodworm at the surface near a dock on McKown Point, Boothbay Harbor, Maine. The large nonspawner was observed at noon swimming during a flood tide. We have found that nonspawning bloodworms may also occur as fairly abundant members of the tychoplankton—bottom dwellers that are either swept upward with tidal currents or migrate upward at night. This study was originally designed to sample larval Atlantic herring, *Clupea harengus harengus* Linnaeus, and these results will be presented later. The implications of a large incidental catch of bloodworms prompted our writing this note.

Materials and Methods

The site of this investigation, Sullivan Harbor, is an embayment along the eastern coast of Maine. It is divided into northern and southern sectors by a constriction formed by an island, point of land, and ledges (Figure 1). The southern sector opens onto Frenchman Bay, which in turn opens onto the Gulf of Maine. At its upper end, the northern sector constricts into a tidal falls. A narrow channel extends north of the falls eventually bifurcating into broad extensive shallows. Only small streams enter these shallows about 5 km north of the highway bridge. Sullivan Harbor is thus relatively saline (31-32‰).

Six sampling stations were located within the northern sector of the harbor; two in the landward end of the channel (No. 3, 4), two in the seaward end (No. 1, 2), and one at each seaward entrance to the subtidal flats (No. 5, 6). At each station within the channel, four lines of buoyed and anchored nets were set (Graham and Venno 1968). On each line one net fished near the surface and a second at 3 m just above the edge (4 m) of the subtidal channel (Figure 1). A third net fished below the edge at 10 m and a fourth near the bottom (12-20 m). At the entrance to the subtidal flats, one net was suspended near the surface and another at 3 m just above the bottom.

The nets were set at each station at dusk and retrieved at dawn, fishing approximately one tidal cycle. Calibrated meters centered within the nets determined the amount of water strained. The contents of the nets were preserved in the field using a 5% Formalin[2] solution. The sexes of the worms were determined at a later date by inspection of the coelomic contents. Since variable shrinkage of the worms made length measurements unreliable, dry weight was obtained for each worm.

Results

The nets strained 72 bloodworms from tidal currents during 6 of 10 cruises in autumn and winter 1974-75. During 1974, the nets captured 2 worms on 14 October, 7 on 11 November, 2 on 5 December, 51 on 10 December, and 1 on 19 December. During 1975, the nets captured nine worms on 2 December. Only five worms were immature; their weights varied from 0.02 to 0.11 g. Mature females outnumbered mature males about two to one (41:24). The mean weights of the two sexes were similar, 0.57 g, and their range varied from 0.11 to 1.47 g.

Bloodworms were dispersed throughout the water column and over both the channel and subtidal flats. Nets at all stations and depths captured worms. The average number netted was three and ranged from one to seven. Of the 72 worms from all cruises, nets set in the channel contained 58 worms and those over the subtidal flats held 14. Their numbers decreased vertically: 33 near the surface, 17 at 3 m, 15 at 10 m, and 7 near the bottom.

An exceptionally large catch per unit effort was obtained on 10 December. During the 10 cruises the nets strained approximately 8,000 to 20,000 m^3 of tidal water per cruise. Five of the sets yielded catch rates varying from 0.1 to 0.7 worm/1,000 m^3. A sixth set (10 December) yielded 3.38 worms/1,000 m^3. This catch rate was sufficiently large to permit comparison of synoptic catch rates with location and depth. The four lines of nets in the channel strained 39 worms from 10,194 m^3, yielding a catch rate of 3.8 worms/1,000 m^3. Those nets

[2]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

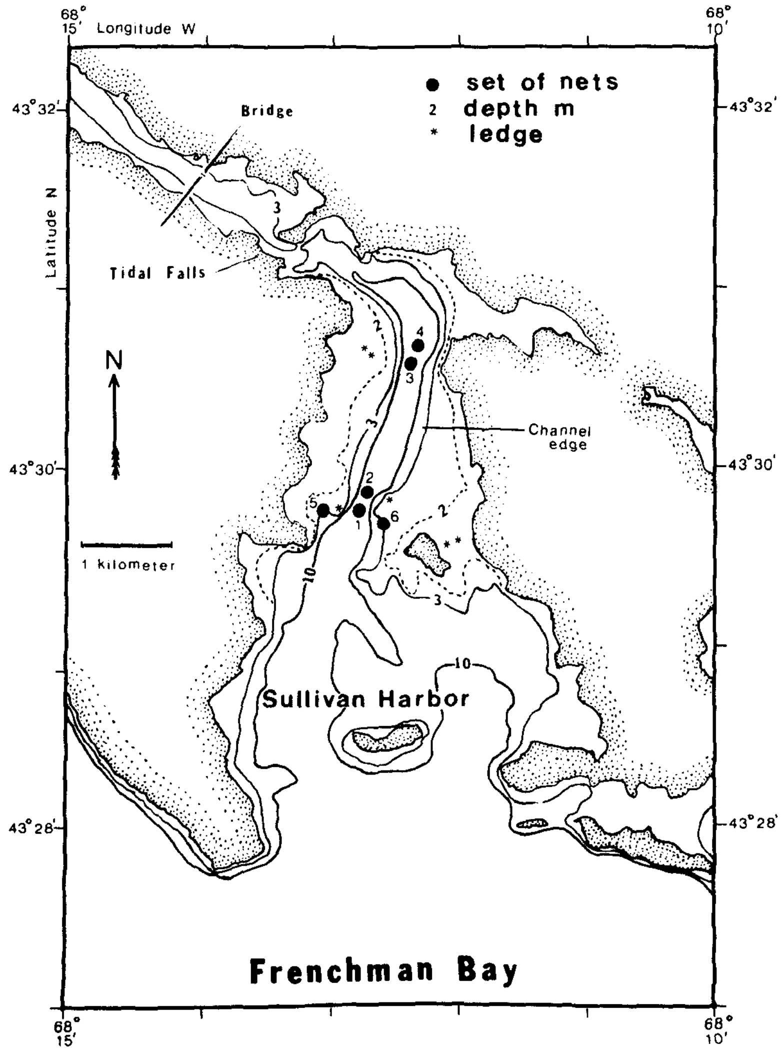

FIGURE 1.—Sampling stations (1-6) for larval Atlantic herring with sets of buoyed and anchored nets in Sullivan Harbor, Maine.

in the flats strained 12 worms from 4,889 m^3, yielding 2.4 worms/1,000 m^3. Shallow nets, above the channel edge and those near the surface of the flats, captured 37 worms by straining 9,614 m^3 for a catch rate of 3.8 worms/1,000 m^3. Deep nets, below the channel edge and those near the bottom of the flats, captured 14 worms by straining 5,469 m^3 for a catch rate of 2.6 worms/1,000 m^3.

The numbers of worms captured in the nets were few when compared with the numbers of smaller tychoplankters, such as amphipods. Each individual weight, however, was relatively large compared with those individuals of more numerous taxa and suggested that a large biomass of bloodworms sometimes enters the water column of the harbor.

Discussion

The mature bloodworms captured during winter in buoyed nets at Sullivan Harbor were not free-swimming spawners. Creaser (1973) sampled a small worm flat at Wiscasset, Maine, from November 1967 to August 1969. During that time, among the many worms dug, only three spawners occurred during winter. Analysis of his collections showed that egg diameters increased somewhat during December and January but ceased growth during the colder months of February and March. Spawning was triggered in June by formation of the epitoke, the growth of eggs to the spawning "range" and a water temperature of at least 13°C. These conditions were not found in the present study. Also, we did not detect any morphological changes that accompany formation of the epitokes as described by Simpson (1962).

Swimming bloodworms at night have also been reported for two other Maine inshore waters. Dean[3] saw 22 bloodworms during observations made between 24 January and 29 March 1977 on 33 nights. The worms were present during five nights in March and 15 were collected under a night-light in the Damariscotta River, Maine—8 on 11 March and 7 on 12 March. The gametes of the worms were not sexually mature and the presence of the worms near the surface at night was not related to spawning. Dean also reported that buoyed and anchored nets set in Montsweag Bay and the Sheepscot estuary between 1970 and present captured 22 glycerids, some of which were *G. dibranchiata*. In contrast, the senior author of this paper did not capture bloodworms in buoyed and anchored nets set in the Sheepscot estuary over the same time period and in the same vicinity. Possibly, the swimming of bloodworms at night is sporadic.

A recent study of residual currents in Sullivan Harbor suggested that the relatively shallow nets above the edge of the channel (Figure 1) and at the surface over the tidal flats strained a residual seaward flow transporting tychoplankters and the relatively deep nets strained a residual landward flow. Distribution of bloodworms throughout the water column would, therefore, insure their wide dispersal by horizontal tidal currents, and it is unlikely that after a tidal cycle they would regain the location of their original burrows.

We hope to study further the bloodworms of Sullivan Harbor and do not wish to speculate on their origin or fate at this time. Rather, it is our purpose to suggest that researchers investigating bloodworms within their bottom habitat should also examine their possible role as tychoplankters for two reasons: populations of this important commercial species in separate flats may become intermixed, introducing problems in their management; and the reestablishment of worm populations previously destroyed by pollution or other environmental catastrophe might proceed more rapidly in those areas where there is winter transport of mature worms, as well as the "normal" dispersion of late spring larvae.

[3]Dean, D. The swimming of bloodworms (*Glycera* spp.) at night. Unpubl. manuscr.

Acknowledgements

We thank C. Adams and D. Clifford of the Maine Department of Marine Resources for collecting the worms, sometimes under severe winter conditions, and for processing the worms in the laboratory. We thank D. Dean for permitting us to cite his unpublished manuscript.

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SIMULATED FOOD PATCHES AND SURVIVAL OF LARVAL BAY ANCHOVY, *ANCHOA MITCHILLI*, AND SEA BREAM, *ARCHOSARGUS RHOMBOIDALIS*

Survival rates of laboratory-reared marine fish larvae often are directly related to prey concentration. Best survival usually has been reported when prey are available at concentrations >1,000/l (O'Connell and Raymond 1970; Laurence