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BRIEF NOTE

SOME ASPECTS OF LIFE HISTORY AND ECOLOGY OF THE ISOPOD *ASELLUS R. RACOVITZAI* IN WESTERN AND CENTRAL LAKE ERIE[1]

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Aquatic isopods of the genus *Asellus* have long been known as a characteristic component of the pollution fauna of streams and lakes (Moon 1957, Ellis 1961, Keup *et al* 1966, Klein 1957). Few studies, however, have made more than passing reference to isopods or have attempted to correlate their distribution with environmental parameters. Life history studies are similarly lacking and, as a result, little is known about the life history and ecology of many species.

The objectives of this study were to investigate the distribution and density of *Asellus racovitzai racovitzai* Williams in western and central Lake Erie, to delineate some of the physical-chemical parameters affecting this distribution, and to document some aspects of life history, ecology, and population dynamics.

Samples were taken at 52 stations in western and central Lake Erie during four cruises in 1975: Cruise 1, March 29 to April 25; Cruise 2, June 9 to June 16; Cruise 3, July 13 to July 24; and Cruise 4, August 27 to September 5, 1975. Two samples per station were taken using a Ponar grab sampler which sampled 0.055 square meters. Samples were washed through a sieve with 0.425 mm mesh and preserved in 5%–10% formalin.

In the laboratory, samples were stained with rose bengal, rewashed through a U.S. soil series #40 sieve, and placed in white enamel pans. Organisms were hand picked and preserved in 70% ethanol. Mounting and identification techniques used were those recommended by Williams (1970). Glycerin mounts were found to be superior to water or alcohol mounts. Length determinations were made using an ocular micrometer calibrated with a stage micrometer. Organisms were straightened and measured ventral side down from the anterior margin of the cephalothorax to the posterior margin of the telson exclusive of the uropods. Relaxation and contraction of specimen intersegmental muscles limited measurement accuracy to 0.1 mm. Sex determination was carried out by examination of the second pleopods and first paraeopods of specimens greater than 4 mm in length. Egg and immature counts were made at 9x and 27x under the dissecting microscope by carefully teasing open the marsupia of undamaged specimens. Specimens that had partially shed their young were not incorporated into the results.

Asellus r. racovitzai was the only species of isopod collected during this study and was predominantly found in the central basin of Lake Erie. Only small numbers of isopods were found in the western basin and these were generally restricted to the Bass Island area and areas south of Point Pelee. Near shore areas were not sampled and consequently leave a gap in the data.

Highest densities of *Asellus* (100–1200/m^2) were consistently found in the area northeast of Fairport harbor and west of Ashtabula at an average depth of approximately 21 m. The most probable reason for this is food supply. Ellis (1961) noted that *A. intermedius* was most abundant where concentrations of sewage were the highest in a one mile stretch of stream below a sewage outfall. Moon (1957) stated that *A. aquaticus* has been noted in Europe as a characteristic animal in areas of fairly severe organic pollution. This suggests that or-

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ganic matter associated with sewage is a likely food source for isopods. Sampling stations between Ashtabula and Fairport consistently had the highest numbers of *Asellus* and were close enough to shore to experience a littoral drift of domestic sewage. This area characteristically supports large numbers of Oligochaeta, which further indicate organic enrichment.

The reason for the lack of *Asellus* in the western basin is unclear but may be related to an excess of wave orbital energy acting upon the sediment of that basin. High inputs of fine grained sediment and mixing and resuspension may make the substrate of this basin unsuitable for permanent isopod colonization. The food source of this deposit feeder, namely the surficial sediments, is in a constant state of turnover and flux which may render it partially unavailable to the organism.

Oxygen concentrations were found to have a significant effect upon isopod distributions in central Lake Erie. Each year, during the summer, the central basin of the lake stratifies and is gradually depleted of oxygen. This depletion generally starts in the southwestern portion of the basin and spreads eastward (Herdendorf 1973). This same portion of the central basin was conspicuously lacking in *Asellus*. There are no data available to indicate the tolerance of *A. r. racovitzai* to low level oxygen conditions. Experiments conducted with *A. aquaticus*, however, have shown that that isopod could survive from 22 to 48 hours in the absence of oxygen (Birstein 1951). It is extremely unlikely that *A. r. racovitzai* could tolerate a month or more of anoxia such as that which occurs in central Lake Erie. It is, therefore, reasonable to conclude that *Asellus* is effectively extirpated from anoxic areas in the lake each year. When the cumulative distribution of isopods during cruises 1–4 was mapped in comparison with oxygen concentrations taken during the summer of the same year, anoxic exclusion was further indicated. Isopods were found, however, in large numbers at dissolved oxygen concentrations of 3 to 4 mg/liter.

Reynoldson (1961) suggested a strong correlation between *Asellus* distribution and the presence of calcium and total dissolved solids in English lakes. In Lake Erie, the central basin is homogeneous with respect to the major ions and total dissolved solids. Average values in Lake Erie are much higher than the preferred levels cited by Reynoldson. Exclusion by low levels of calcium and total dissolved solids in Lake Erie is, therefore, highly unlikely.

Analysis of isopod gut contents re-

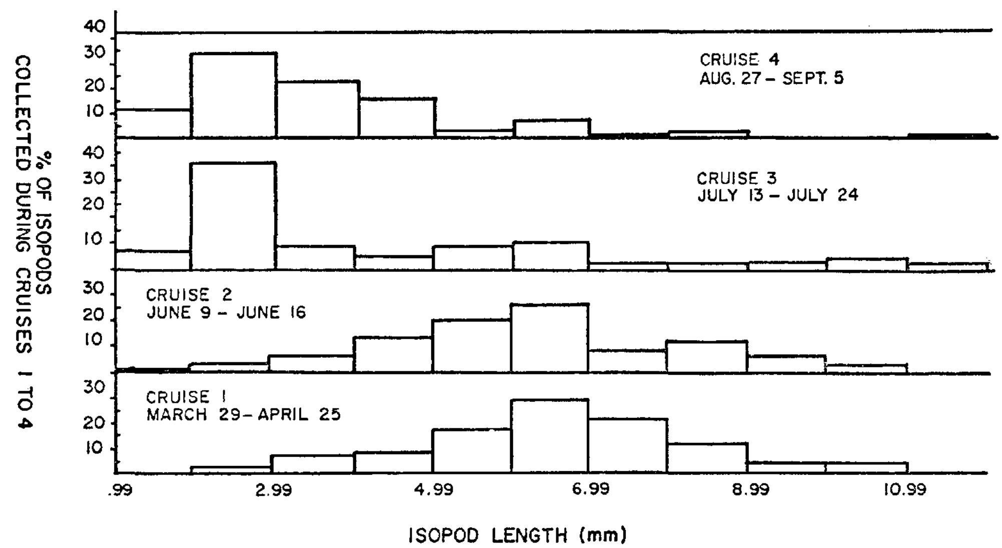

FIGURE 1. Isopod size frequency distribution in western and central Lake Erie during March to September, 1975.

vealed that the desmid *Tetraedron*, the chlorophycean *Pediastrum*, pieces of cladocerans, and unidentifiable organic debris were the most commonly noted food items. It was surprising that diatom frustules were rarely found in gut contents, since other investigators (Birstein 1951) have noted that diatoms are a favorite food item of isopods.

The histogram shown in figure 1 represents isopod length data for all four cruises. An analysis of these data revealed the following: *Cruise 1* (March 29–April 25): Females with marsupia were found to have an average length of 6.1 mm. The highest number of organisms was found in the 6–7 mm size interval. There were no organisms noted in the 1–2 mm size interval, thus indicating low reproduction in the preceding winter months. Eggs were irregularly rounded and approximately 0.3 mm in diameter.

Cruise 2 (June 9–June 16): The majority of organisms (26.2%) again fell within the 6–7 mm size interval. An average length of 5.8 mm was noted for females with marsupia. Eggs, embryos, and young were noted in the marsupia. Well developed young approximately 1.1 to 1.2 mm in length were found to be still in the marsupia.

Cruise 3 (July 13–July 24): There was a radical change in size frequency from June to July. The majority of organisms (41.3%) now fall within the 2–3 mm size interval. The number of isopods in the 1–4 mm size range increased from 9.6% and 9.0% in cruises 1 and 2, respectively, to 55.9% and 67.7% in cruises 3 and 4. This was obviously due to the emergence of a large number of young which must have taken place in mid-June to July and lasted until late August or early September. The number of females with marsupia declined to only 7.3% of the total population.

Cruise 4 (August 27–September 5): The number of females with marsupia dropped to only 3.3% of the total population. Reproduction has slowed appreciably but young are still emerging. The number of larger organisms (7–12 mm) has significantly decreased. This may indicate a die off of the preceding generation of isopods.

Regression analysis of the number of eggs versus female size showed a predicted value of 59 eggs for a 6 mm organism and 89 eggs for a 7 mm organism. The largest male and female specimens collected were 11.9 and 9.9 mm long, respectively. Field growth rate was estimated to be 10% to 12% per month from July to September and 5% per month from October to March. The reproductive season of the isopod was found to be from mid-March to late June. During this time period, 40% or more of female isopods were gravid. A more detailed discussion of the life history and ecology of this species of isopod may be found in Kerr (1976).

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