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During the summer of 1956 investigations were made of the movement of fresh-water mussels in the presence and absence of natural food.[1] Classically a sedentary animal, the mussel nevertheless does move about. Marked animals in Lake Okoboji were seen to move up to several meters per day. Obviously, various environmental stimuli could be acting; relatively litte work has been reported for this group of animals, nor indeed has the problem of the local movements of animals in general been critically investigated. The rationale of the investigation reported here was simply to compare distance travelled per mussel per unit time in successive weeks in tanks free of food and tanks continually supplied with natural planktonic food.

The animal used was *Lampsilis siliquoidea* (Barnes), the most abundant shallow water mussel of Lake Okoboji. The species is both a lake and stream form. Its distribution is wide, covering eastern North America from the St. Lawrence through the Great Lakes drainages, to the Canadian Rockies, and south to Kentucky and Texas (Goodrich 1932, Baker 1928). Its ecological tolerance is wide, being reported from lakes of varying depths and substrata and from many streams (Coker 1917, Ortmann 1924, Van der Schalie 1938). It is the common mussel of Wisconsin and found in all streams in Michigan (Baker 1928, Goodrich 1932). Its glochidial hosts are the more common game fish including the blue gill, yellow perch, walleyed pike, crappie, sunfish, and the basses (Coker 1917, Baker 1928).

Churchill and Lewis (1924) report investigations of the feeding and foods of *L. luteola* (synonomy: *L. siliquoidea,* Winslow 1926) taken from Lake Okoboji. Listed as stomach contents were: *Volvox, Pleodorina, Microcystis,* diatoms, fragments of filamentous algae, *Euglena,* rotifers, cladocerans, various Protozoa and organic detritus and sand grains.

The experimental animals were collected in water of less than one meter along the laboratory shoreline. The bottom here is typical for the species, of coarse sand, gravel and rocks, with rooted vegetation being locally dense. None of the animals died in the course of the investigation; they were apparently all healthy individuals.

Experimental Procedure

The three, indoor, experimental tanks were of concrete, measuring four meters in length and three quarters of a meter in width. Five

[1]The work was done in the laboratories of the Iowa Lakeside Laboratory, Lake Okoboji.

centimeters of washed gravel covered the bottom and water depth was maintained at ten centimeters in all tanks. The water, pumped from the lake to the laboratory, was cleared and settled but unchlorinated. Natural daylight was essentially equal in all tanks. Water temperatures varied slightly over the summer, ranging from 17.8° C. to 21.5° C. but never more than one degree between tanks at any one time. Oxygen determinations were made periodically using the Hellige colorimetric technique. The tanks free of plankton remained close to saturation while the feeding tank registered approximately 75% saturation. The discrepancy no doubt was due to planktonic metabolism; it is not likely that the somewhat decreased oxygen content of this tank would affect mussel activity.

Two tanks, free of plankton, were termed "sterile tanks." The other, "feeding tank," had 200 cc of concentrated lake plankton added daily. These were collected in the adjacent waters of Little Miller's Bay and were therefore the normal food of the mussels. The densities of the various organisms varied with successive blooms of certain of the species but over the summer the phytoplankton predominated. The colonial green flagellates were very numerous and included the genera *Volvox, Eudorina,* and *Pleodorina.* Later in the summer these were outnumbered by the blue greens *Gleotrichia* and *Aphanasomina.* Desmids and diatoms were present in lower densities. The zooplankton included the smaller crustaceans, the rotifers and ciliate protozoans. The concentrate had a density ranging from one to two thousand per cc, which when added to the feeding tank maintained a density in the latter many times that of the lake waters.

Four replicate sets of twenty animals were passed through sterile to feeding to sterile tanks on successive weeks. One set of twenty had two weeks in sterile tanks following feeding. The mussels from the lake were scrubbed with a wire brush to remove all algal growth; this eliminated possible food organisms. They were then numbered with lacquer and placed in sterile tanks for three days to insure the absence of food in the mantle cavity or in the gut. Food normally passes through the alimentary tract in about an hour's time (Churchill and Lewis 1924).

Each set was then started in a sterile tank and the position and heading of each individual was recorded on separate tank maps. The position and heading were recorded morning and evening thereafter. Lines were drawn on each animal's map between these positions. In almost every instance trails in the gravel allowed rather accurate courses to be plotted, even in the cases of sharp turns and loops. A rather precise determination of distance covered per week could be made by tracing the course line with a wheeled map reader.

Results and Conclusions

For the total number and in each set of twenty animals, mean activity in the second week (feeding tank) was markedly less than in the first week (sterile tank). Mean movement increased in the third week when they were returned to the sterile tank. However, the mean movement in the third week was not as great as in the initial week. In one set of twenty animals which was kept for a fourth week (sterile tank) a further increase in movement was noted. The data for all individuals are summarized in table 1 and graphed in figure 1.

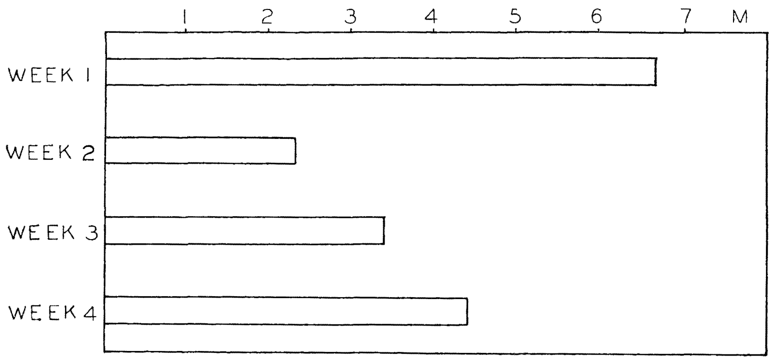

Figure 1.

Table 1

Total and Mean Movement in Meters of 80 Mussels Over Three Successive Weeks in Presence and Absence of Food

Expt.	No.	Week 1 (sterile) Total Distance	Week 2 (feeding) Total Distance	Week 3 (sterile) Total Distance
A	20	94.2	31.0	46.7
B	20	95.8	41.3	54.9
C	20	206.4	59.5	67.7
D	20	143.8	55.3	108.0
Total:	80	540.2	187.1	277.3
Mean:		6.7±.38	2.3±.22	3.4±.28
Stand. dev.		4.3	2.0	2.5

The individual variabilities in total activity were very great, ranging from 0.1 to 19 meters in the initial week; many individuals remained completely motionless during the feeding week. Nevertheless the differences in mean activity are very significant and it would appear that the presence of food is related to reduction in movement or absence of food to increased movement.

One more experimental approach is really needed. While activity increased after removal from the feeding tank, it never reached the level of the initial week in the sterile tank; some expression of acclimatization could have started operating. Further experiments should be done starting with a feeding week, thus inverting the sequence. This would be a critical followup to the experiments reported here.

If movement of mussels is related to plankton density, as these data indicate, then the individual mussel must receive some cue to which response is made. Either of two responses are possible. Lack of food may stimulate activity; presence of food may inhibit activity; one or both could be responsible. The mechanism of this response was not investigated. A specific sensory and reflex apparatus may be present but seems unlikely in such a relatively simple animal. The same would seem to be true of such conditions as hunger or satiety as we know them in vertebrates. Until otherwise demonstrated the most reasonable explanation should be the very basic and simple response of most animals to favorable and unfavorable segments of their environments, remaining in the optimum and moving in the pessimum.

Such activity in general and this activity of the mussel in particular, has obvious survival value. If located in an area low in food, movement is accelerated. Movement in mussels is not directed but quite random; nevertheless from such non-directed movements the animal may come to an area of greater food supply and decrease its movement.

Every organism and population is continuously responding to the entire range of environmental variables, food being but one of these. The response to these factors is a determining force in creating the local distribution. This particular reaction of the mussel to food density would seem to be one of those factors ultimately affecting the horizontal structure and local density of the population.

Literature Cited

Baker, F. C. 1928. The Fresh-water Mollusca of Wisconsin. Wisc. Geol. and Nat. Hist. Survey, Bull. No. 70, II.

Churchill, E. P., and S. I. Lewis. 1924. Food and Feeding in Fresh-water Mussels. Bull. Bur. Fish., XXXIX: 440-471.

Coker, R. E. 1917. Fresh-water Mussels and Mussel Industries of the United States. Bull. U. S. Bur. Fish., 36:13-89.

Goodrich, C. 1932. The Mollusca of Michigan. Mich. Handbook Series No. 5, Univ. Mich. Press, Ann Arbor.

Ortmann, A. E. 1924. Distributional Features of Naiads in Tributaries of Lake Erie. Amer. Mid. Nat. 9, 3:101-117.

Van der Schalie, H. 1938. The Naiad Fauna of the Huron River in Southeastern Michigan. Misc. Pub. Mus. Zool., Univ. of Mich., No. 40.

Winslow, M. L. 1926. A Revised Check List of Michigan Mollusca. Occas. Papers, Mus. Zool., Univ. of Mich., No. 181.

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