OBSERVATIONS ON THE LOCAL MOVEMENTS OF *LITTORINA LITOREA* (L.) AND *THAIS LAPILLUS* (L.)

By RALPH W. D. DEXTER

Kent State University, Kent, Ohio

In connection with an ecological study of intertidal marine communities, preliminary experiments on snail movements were conducted during the summer of 1936. The purpose was to determine the general direction, rate, and range of movements of individual snails in their dispersal over the shore in order to understand more fully their role in community dynamics. *L. litorea* (L.), the English periwinkle, and *T. lapillus* (L.), the common rock snail, were chosen for study because they are the most significant of the herbivorous and carnivorous snails respectively of the intertidal hard-surface communities investigated. While many studies have been made on these species, nothing seems to have been published on their local movements.

When the tide was low, the snails were marked with a quick-drying red enamel paint without removing them from the rocks, and their locations were then mapped. During each succeeding day for a period of one week, and at irregular intervals thereafter, the distance travelled by each snail was measured in a straight line from the previous location, which represents the minimum radial distance travelled. After submergence in salt water over a period of several days the red paint lost its brilliant color, but it retained enough pigmentation to enable one to find and identify the marked individuals. In some cases they were found with difficulty and occasionally one was lost for a day or two. They were selected originally in small groups. Two groups of 5 individuals of *L. litorea* and two groups of 4 individuals of *T. lapillus* were marked. The groups were clustered on separate rocks at about the half tide level. The tidal interval is 11 hours and 14 minutes at the location of the experiment along the shores of a tidal inlet at Gloucester, on Cape Ann, Massachusetts.

During exposure the snails of both species were inactive, remaining attached in position with little or no movement. After submergence they became active and wandered about in various

directions and for varying distances. Their movement is very pronouncedly rhythmical, being controlled directly by the tidal flow and ebb, and for the most part is concerned with their feeding activities.

The specimens of *L. litorea* moved a daily average minimum distance of 22.2 inches. In recording directions of travel, each snail was plotted at the intersection of 4 equal sectors designated as upshore, downshore, left, and right quarters, the directions being those of the observer facing upshore. Averages are based upon the daily records of the first week of observation. The marked specimens of *L. litorea* moved in all directions. Those moving upshore averaged 23.3 inches each day. Downshore movements averaged 23 inches each day. Those moving to the left and right averaged 10.2 and 26.3 inches respectively. Four individuals at one time or another did not move at all over a period of at least 24 hours. Five days after one set of 5 had been marked (July 4), four individuals were 38, 49, 114, and 142 inches from their original locations. At that time, nine days after the other set had been marked, three individuals of the second group were 13, 39, and 56 inches away from their original positions. Nine days later (July 13), 4 snails of this set were 50, 52, 94, and 151 inches away from the original locations, and 17 days still later (July 30) the only individual which could be found was at a distance of 124 inches. The periwinkles did not follow any pattern, given direction, or uniform rate movement. Many reversed their directions at various intervals of time, and their movements seemed to be entirely fortuitous.

At the time of spring tides great quantities of *L. litorea*, especially small specimens, were observed to move upshore and literally coat the rocks between the neap and spring high-tide lines. Following the spring tides they migrated downshore again.

T. lapillus averaged 10.4 inches of total movement per day. Upshore movements averaged 19 inches while those moving downward averaged 10.5 inches. Snails moving into the right sector averaged 7 inches; none was observed to move into the left quarter.

Five individuals at one time or another remained stationary over a period of 24 hours. Eighteen days after one set was

marked (July 13), two individuals were 22 and 34 inches away from the original location. Sixty days later (September 11), or eleven weeks after the beginning of the experiment, one snail was 62 inches from its original position. Twenty-six days after the other set was marked, (July 30) two individuals were 22 and 28 inches away. Twenty-five days later (Aug. 24) two were 10 and 18 inches away; another eighteen days later (Sept. 11), or nearly eleven weeks after the snails were marked, three were only 6, 7 and 30 inches away respectively.

T. lapillus, which feeds principally on *Balanus balanoides* (L.) and *Mytilus edulis* L., showed a tendency to remain on barnacles, in crevices, and under seaweeds for long periods and to remain within a restricted locality. In general it did not travel as much nor as extensively as *L. litorea* which feeds chiefly on algae, both microscopic and macroscopic.

LIFE CYCLE OF LYMNAEA STAGNALIS COMPLETED AT ROOM TEMPERATURE WITHOUT ACCESS TO AIR

By LOWELL E. NOLAND and ELEANOR REICHEL

University of Wisconsin

It has been known for some time that pulmonate snails may, under certain conditions, become water-breathing. In fact *Planorbis cristatus* is said to have its lung permenently filled with water (Willem, 1895; von Buddenbrock, 1924); and *Planorbis corneus* is reported to have developed accessory gills in its lung cavity (von Buddenbrock, 1924). It has been further claimed by Precht (1939) that *Lymnaea stagnicola* assumes purely cutaneous, aquatic respiration at a temperature of 5° C. or below. According to Cheatum (1934) *Helisoma campanulatum smithii*, *H. antrosum percarinatum*, *Lymnaea emarginata angulata* and *Physa sayi crassa* are probably able to complete their life cycles and reproduce normally without coming to the surface for air. Forel and Du Plessis (1874) and Brot (1874) reported *Lymnaea abyssicola* living at depths of 25 to 250 meters in Lake Geneva, Switzerland. When collected, their lung cavities were filled with water and, living at such depths, they could