ESTIMATION OF AN APPARENTLY SUDDEN POPULATION BUILD-UP IN THE SNAIL, *MACROCHLAMYS INDICA* BENSON IN CALCUTTA

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I—INTRODUCTION

The Dhakuria Lake, Calcutta is a freshwater lake, created about fifty years ago by the excavation of a previously existing marshy area. It is about 1.7 km. long, about 250 m. wide at its broadest point and has three islands in a line. The public is not allowed to visit these islands and approach is only by boat. The middle island is roughly S-shaped and is about 135 m. long. The northern side is about 50 m. and southern side about 35 m. off from the mainland.

Ecologically, this island could be divided into three distinct zones. Zone No. I, forming the eastern part of the island has little vegetation. A few tall trees grow here which afford roosting for cormorants and darter birds. The soil is dry, covered over by dry litter and bird dropping which emits a strong ammoniacal odour. Undergrowth is absent. The snail population in this zone is very small, constituted by a few wandering animals which apparently do not survive for long periods. Zone No. II is the middle one, covered over by a thick mat of creepers all the year round. The soil is moist with decomposing foliage. This zone is at a lower elevation than the two other zones and most of it is either sodden or partially submerged during the monsoon rains, when the level of water in the lake rises by as much as a metre or more. But for a few shrubs, this zone is open. Almost the entire population of *Macrochlamys indica* aggregates here. Most of the marking and recapture of snails were done in this zone. Zone No. III is elevated, with a thick growth of tall shrubs and many trees. The undergrowth is little and the soil is dry with litter and bird droppings. The trees provide roosting places for herons and cormorants. In this zone also, snails are very few and restricted to fringes.

The middle island was being visited for the last two years in connection with the study of certain aquatic littoral populations during the course of which abrupt fluctuations of the snail population have

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been noticed. The present paper is the outcome of an effort to estimate the size of this population.

The principle involved (Lincoln, 1930) is to mark and release in the same area a known number of animals. After a suitable interval, a sample of the population is taken and the proportion of the marked to unmarked individuals is noted. From this, the total population is estimated on the simple proportion

$$\frac{M}{X} = \frac{m}{x}$$

where M, represents the number of animals marked and released; X, represents the total population; m, represents the marked animals recaptured and x, unmarked animals captured together with the marked ones. The total population thus is calculated from the formula

$$X = \frac{Mx}{m}$$

Jackson (1936, 1939) developed this method further, extrapolating backwards from the date when tsetse flies were recaptured to the date when they were released. For this he recaptured flies on a number of occasions instead of only one (positive method) and alternatively marked on a number of occasions and recaptured once (negative method). These methods have been cited and supported by Andrewartha (1961). The positive method of approach has been made use of in the present study.

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II—Observations and Results

After marking the snails with a red shade of waterproof nail varnish, they were released at the points of capture. Sometime before the commencement of the marking experiments, a few snails were marked differently and released at one spot. After a week, the adjoining area of about three metres was scoured. Only one out of the seven marked ones was recaptured from this area which shows that the snails were sufficiently active and cruised over fairly wide areas and a marked snail has a good chance of mixing at random with the rest of the population within a period of seven days.

The study was started in October 1966 when, soon after the few showers, the snails are very abundant and active. On October 19th, 24 stations were selected at random, the creepers cleared to open up an area of one metre across and all the snails of the area were marked and released and the clearing covered up. The number of snails collected for marking from these 24 stations ranged from 11 to 117, with an average of 57 snails per station. A total of 1370 snails were marked and released in all. Five recaptures were made at intervals of seven days. On the 35th day of marking, there were signs of abrasion of the nail varnish and further recaptures were not made thereafter. The recapture data are given in the table.

TABLE I—*Total number of capture with number of marked and unmarked examples of* Macrochlamys indica

Date	*Total captured*	*No. of marked*	*No. of unmarked*
26-10-1966	430	10	420
2-11-1966	593	6	587
9-11-1966	487	6	481
16-11-1966	501	6	495
23-11-1966	355	4	351
TOTAL	2366	32	2334

As is evident from the table, from a total of 1370 snails marked on 19-10-1966, the number of recaptures on various dates varied, these being 430, 593, 487 etc. These figures could be simplified and corrected as if 100 snails were originally marked and the same number recaptured on all successive dates. This corrected figure of recapture on 26-10-1966 which is called y_1 will be

$$\frac{10 \times 100 \times 100}{1370 \times 430} = 0.1698$$

The similar corresponding corrected figure for date 2-11-1966 or y_2 will be

$$\frac{6 \times 100 \times 100}{1370 \times 593} = 0.0739$$

The other figures will be

$$y_3 = 0.0899$$
$$y_4 = 0.0874$$
$$y_5 = 0.0822$$

By extrapolation from this series, we require to find y_0, the corrected figure that would have been recaptured on 19-11-1966, had we been able to recapture immediately after releasing. Jackson (1939) calls this figure a. In order to calculate a, $\frac{y_n}{y_{n-1}}$ or r has to be first calculated, this being the weighted or average ratio of each value of y to the value preceeding it. When k is more than 4, Jackson calculates it from the formula

$$r = \frac{y_3 + y_4 + \ldots\ldots\ldots\ldots + y_n}{y_1 + y_2 + \ldots\ldots\ldots\ldots + y_{n-2}} = \frac{y_3 + y_4 + y_5}{y_1 + y_2 + y_3}$$

Applying the present value for snails, this is

$$\sqrt{\frac{0.0899 + 0.0874 + 0.0822}{0.1698 + 0.0739 + 0.0899}} = 0.8820.$$

now a is calculated from r as follows:

$$a = \frac{y_1 + y_2 + \ldots\ldots\ldots + y_{n-1}}{r} - (y_1 + y_2 + \quad \ldots y_{n-2})$$

$$= \frac{0.1698 + 0.0739 + 0.0899 + 0.0874}{0.8820} - (0.1698 + 0.0739 + 0.0899)$$

$$= 0.1437$$

By these calculations, we have the corrected values of y and a for 100

snails marked and 100 snails recaptured every time. Now, we can estimate the population by the Lincoln Index formula,

$$X = \frac{100 \times 100}{a} = \frac{100 \times 100}{0.1437} = 69{,}589.42$$

Hence the total population of the snail, *Macrochlamys indica* on 19-10-1966 on the island is estimated at 69,600. This high peak of snail population is attained in October-November, but by the end of December, most of them close the mouth of the shell with a white epiphragm and enter hibernation. During the warm months of the year, very few snails are found. The factors controlling the sudden increase and subsequent mortality would be a very interesting study.

III—Summary

A population study of the snail *Macrochlamys indica* Benson in an island in the Dhakuria lake, Calcutta was undertaken during 1966. A total of 1370 snails were marked and released from 24 stations on an average of 57 snails per station. The total population on 19-10-1966 was estimated as 69,600 with a high peak during October-November.

IV—References

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