MONTHLY MEASUREMENTS OF SHELL, SOFT BODY, AND DENSITY OF *TELESCOPIUM TELESCOPIUM* L., BONE BAY, SOUTH SULAWESI, INDONESIA

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ABSTRACT

Telescopium telescopium L. were collected monthly along transects at two sites characterised by high and low salinity respectively. The mean shell length of the population was lowest during June-September. The highest mean density was encountered at both sites in August, with a maximum at the highest salinity of 68 ± 5.75 ind. per 4 m^2. *T. telescopium* can live permanently at salinities of 1-2 ppt, which is considerable lower than previously recorded.

INTRODUCTION

The Indo-Pacific snail *Telescopium telescopium* L. inhabits mangrove swamps. The species is often abundant in pools of stagnant water, or in close proximity to such pools. It is able to tolerate a wide range of salinity, ranging from 15-34 ppt (Alexander & Rae 1979). Seasonal variations may affect presence and growth of the species and may give different patterns of population structure (Alexander & Rae 1979). Commonly measured growth parameters are length & width of the shell, and wet & dry weights of the soft body (Wilbur & Owen 1964). These parameters are influenced by environmental factors, above all salinity, water temperature, pH, and dissolved oxygen (Wass 1967).

Several large rivers drain into the northern part of Bone Bay which is fringed by rich mangroves. The mangrove has been cleared along most river banks to give room for a high number of brackish water fish ponds (called tambak in Indonesia) (Fig. 1). A tambak connects to the surrounding water through a gate, which is partially blocked by a grid of bamboo or fine meshed net at the upper part. Hence, the surface layer of tambak water is renewed in accordance with the shifting tides. Salinity is high in the Bone Bay itself (close to fully marine conditions). But a tambak near the mouth of the river will contain water created by a mixture of bay water and river water. Canals along the outside of these tambak connected to the river (Fig. 1). It follows that a tambak near the bay will be more saline than a tambak further up-river.

During surveys of the biotopes of the upper Bone Bay, we noticed dense populations of *Telescopium telescopium* in a tambak near the Pompengan River mouth. However, the species was even more abundant in an upriver tambak. The latter tambak was located about 1 km from the river mouth, and had low salinity. There was no visible algae on the surface of the mud. Some snails crawled on the substratum, but most of the animals were completely buried in the soft, organically rich mud. Buried individuals maintained a funnel from the dorsal shell aperture to the surface whereby the black anoxic mud was oxidised and changed to brown colour. The distribution of snails at the edge of this tambak was obviously clumped. A patch measuring approximately 200 cm^2 might harbour 15 large snails, all buried in the black mud. Snails of this dense population appeared to be smaller than those living closer to the saline bay. We have estimated densities and measured shell and soft body parameters in order to characterise the populations living at high and low salinities. The study presents baseline information about the occurrence of *T. telescopium* in the upper Bone Bay.

MATERIALS AND METHODS

Specimens of *T. telescopium* were collected monthly from May 1994 to April 1995 at Palopo, the Pompengan region, Luwu regency, South Sulawesi. Two study sites (A & B) were selected in ponds (tambak) along the banks of a river (Fig. 1). Site A was close to the Bone Bay and ca. 100 m up-river from the bay. Site B was ca. 1000 m up-river from site A (Fig. 1). At each site, 4 stations were selected (A1-A4) and (B1-B4). Each station encompassed 4 x 1 m^2 fixed along transect lines (Fig. 1). Snails were carefully sampled by hand upon encounter in the mud. The length and width of the shells were measured to the nearest 0.1 mm (Vernier callipers). The shells were broken, the complete soft bodies extracted and weighed, then dried at 105 °C until constant weight, cooled and weighed to the nearest 0.01 g (digital balance). Salinity (refractometer), temperature (mercury thermometer, accurate to 0.1 °C), pH (litmus paper), and DO (Dissolved Oxygen Meter), were measured in the surface water during daytime on each sampling occasion.

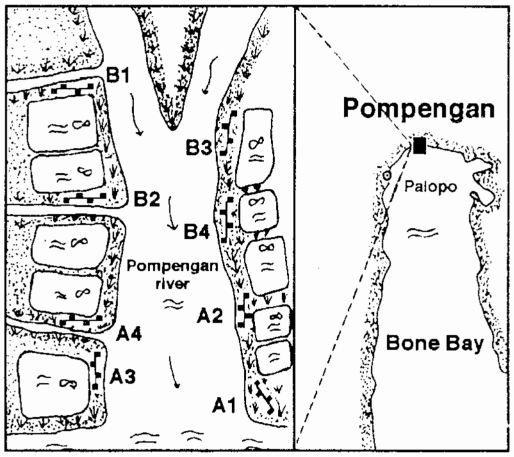

Figure 1. The study area in Bone Bay, South Sulawesi. The location of 4 stations at site A (A1-A4) and the 4 stations at site B (B1-B4) is shown. The map is not to scale.

The density of *T. telescopium* was calculated per station, each measuring 4 m^2. The 16 stations at sites A and B respectively, have been pooled and the shell and soft body data calculated as monthly means. Data for the first 3 months (April-June 1994) were taken from Soekendarsi & Palingi (1995).

RESULTS

Shell measurements

At site A, the population of *T. telescopium* had the smallest mean shell length from May to September (minimum length 6.51 ± 1.10 cm). The largest mean length was measured in March (maximum length 7.83 ± 0.75 cm). The mean shell length was generally slightly smaller at site B (low salinity), but there was no significant difference between the two sites. Measurements of the shell width showed that the width varied in accordance with the shell length, indicating that the shell proportions were unaffected by differences in salinity.

Wet & dry weights of soft bodies

The soft body of snails with a mean length of 7.5 cm weighed 9.43 g w.w. = 2.30 g d.w. (site A in April). In comparison, similar sized snails weighed only 7.15 g w.w. = 1.56 g d.w. at site B in the same month (significantly different). Otherwise, the monthly mean weights followed the same trend at both sites and the values for site A & B were not significantly different. The mean tissue weights were largest at site A in accordance with larger mean shell lengths at this site.

Density

The density peaked in August at both sites (Fig. 2). Site A had a density of 50 ± 2.30 ind. per 4 m^2, while 68 ± 5.75 ind. per 4 m^2 were found at site B. The lowest density was

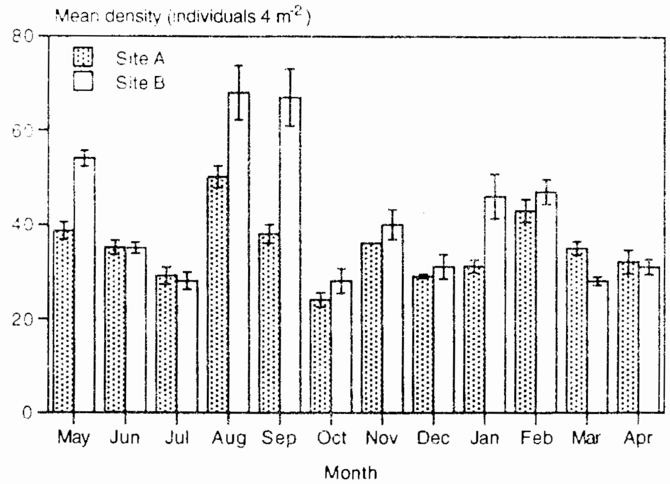

Figure 2. Mean density of *Telescopium telescopium* from May 1994 to April 1995 at site A & B. Standard deviations are shown.

measured in October. Site A had a density of 24 ± 1.46 ind. per 4 m^2, while 28 ± 2.58 ind. per 4 m^2 were found at site B. The density at both sites displayed similar trends, indicating that migration and recruitment affected the populations at high and low salinity in a similar way.

Environmental conditions

The water temperature differed only slightly between the stations on the 12 sampling occasions. It was lowest from June to September at site A (27 °C), and increased slowly to about 30 °C in November. The highest temperature was measured at site A in April (31 °C) (Table 1).

The salinity increased from 10 ppt in May to 16 ppt in August-September at site A. During the following 5 months salinity dropped to about 3 ppt. In comparison the salinity was constantly low at site B, normally 1 ppt, but increased to 2 ppt during August-September (Table 1).

The pH values of the surface water varied little at both sites. The water was always neutral or slightly alkaline at site A, ranging from pH 7.0-7.2, while site B always had slightly acid water ranging from pH 6.0-6.8 (Table 1).

The values of the dissolved oxygen in the surface water differed considerably among sites during March-July, with the highest value recorded at site A in May (15 ppm). Otherwise the values showed similar trends at both sites. The lowest values were recorded from November to March at both sites (about 4-5 ppm) (Table 1).

DISCUSSION

T. telescopium has only local food value. The shell is broken, the flesh extracted, and the muscular part cooked. Because the species is consumed, there will be a selective removal by fishermen, targeting the larger size. This action is bound to influence the size distribution, especially in the outer mangrove, but we have no direct measurements of the effect.

According to Dharma (1988), the normal length of *T. telescopium* is 8-12 cm. In the present study area we did not encounter snails longer than 9.9 cm. The normal shell length was 7-8 cm. The dimensions of shells and the soft body weight, have been referred to as derivatives of the growth rate of living organisms (Wilbur & Owen 1964). These derivatives may correlate with salinity, water temperature, pH, and DO in the

Table 1. Water quality measured from May 1994 to April 1995 at site A & B. Standard deviations (sd) are shown. W.t. = Water temperature (°C); S. = Salinity (‰); DO = Dissolved Oxygen (mg/l).

	W.t.				S.		pH				DO			
	A	± sd	B	± sd	A	B	A	± sd	B	± sd	A	± sd	B	± sd
May	29	0.1	28	0.1	10	1	7	0.3	6	0.5	15	0.1	8	0.1
Jun	27	0	28	0.1	13	1	7	0.3	6	0.5	12	0.1	8	0.5
Jul	27	0	28	0.2	14	1	7	0.5	6	0.3	12	0.3	8	0.3
Aug	27	0	29	0	16	2	7.1	0.3	6.1	0.1	7.2	0.3	9	0.2
Sep	27	0.2	28.5	0	16	2	7.2	0.1	6.2	0.3	8.1	0.4	10	0.7
Oct	28	0	29.2	0.1	12	1	7	0.5	6.2	0.3	8.2	0.3	8	0.3
Nov	29	0.3	30.1	0.2	10	1	7.1	0.1	6.8	0.2	4.9	0.2	6.2	0.1
Dec	30	0.1	29.8	0.2	5	1	7.3	0.1	6.4	0.3	3.8	0.1	4.7	0.7
Jan	29.2	0.2	28.4	0.2	5	1	7.2	0.1	6.4	0.3	4.6	0.5	3.7	0.4
Feb	28.5	0	28.6	0.1	3	1	7.1	0.3	6	0.3	4.7	0.1	4.5	0.1
Mar	28.6	0.2	29	0.2	3	1	7	0.5	6	0.1	5.1	0.1	4.1	0.3
Apr	31	0	28	0.1	8	1	7	0.1	6.1	0.1	9.6	0.2	5.2	0.2

environment (Wass 1967; Purchon 1968). However, we lack information on growth rates, migration and mortality of the snails, so we were not able to analyse these relationships. Salinity might affect the growth and maximum size of *T. telescopium*. But, even if the snails appeared to be smaller at the low salinity site, the mean lengths at sites A & B were not significantly different. We found that *T. telescopium* can live permanently at salinities of 1-2 ppt, which is considerable lower than found by Alexander and Rae (1979).

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