

DENSITY, ABUNDANCE, AND DISTRIBUTION OF JUVENILE MOLLUSCS WITH EMPHASIS ON *TROCHUS*, KEI BESAR ISLAND, INDONESIA

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ABSTRACT

A study of the distribution and abundance of the juvenile top shell, *Trochus niloticus* occurring on intertidal flats off the East Coast of Kei Besar Island, Indonesia, was performed. An analysis of two transects collected at low and high tides showed an occurrence of 6 % at low tide and 14 % at high tide of all gastropods sampled. The average density of juvenile *Trochus* was 0.55 ind. m⁻² at one site while juvenile *Trochus* were absent at another site. Adult *Trochus* were found at both sites. A total of 37 species of juvenile molluscs (33 gastropod species and 4 bivalve species) co-occurred with juvenile *Trochus*. Factors regulating the distribution and abundance of *T. niloticus* are discussed.

INTRODUCTION

Kei Besar is one of the many eastern Indonesian islands inhabited by fishermen making most of their income from the utilization of coastal and marine resources. One of those resources is *Trochus niloticus*. But, like everywhere else in the region, the natural stock of *Trochus* has declined. Reseeding of the intertidal zone with juvenile *Trochus* has been considered as a way to improve the situation, but no real attempts have been made in spite of the economic importance of *Trochus* for the local fishermen.

Before a seeding program is initiated, the optimal seeding density of juvenile *Trochus* should be known (Castell 1955). It is likely that dense patches of juveniles may become attractive for predators (Boulding & Hay 1984; Moran 1985) compared to randomly distributed individuals (Ray & Stoner 1994). However, very little is published on quantitative studies of juvenile *Trochus* in natural habitats, *ie* information on habitat carrying capacity (Smith 1987; Castell 1995), or on juveniles of other molluscs co-occurring with *Trochus*, *ie* interspecific competition.

Kei Besar is one of the islands where the natural stock of *Trochus* has declined and the island has accordingly become a potential site for re-seeding of juveniles. We wanted to describe the structure of the mol-

lusc community on two intertidal flats where juvenile *Trochus* occurred. The structure has been characterized by the species composition of juvenile molluscs, their abundance, and their relative frequency along transects. The aim is to provide baseline information for subsequent detailed studies on the distribution.

MATERIALS AND METHODS

Two sites, Mastel and Dead Henoat, of the Sather intertidal zone of Kei Besar were surveyed during November-December 1995 for the presence of juvenile *Trochus*. At each study site, two transect lines were placed 100 m apart and perpendicular to the coast line. Along the lines, a 1 x 1 m quadrat was placed at 10 m intervals. From each quadrat, all the substratum (mostly large rocks) was carefully observed for the presence of juvenile *Trochus*. All gastropods and bivalves of a size up to 20 mm were collected from quadrats. The collected specimens were sorted according to species and counted.

RESULTS

Juvenile Trochus niloticus
 Juvenile *Trochus* were only found at the study site at Dead Henoat. At this site, juvenile *Trochus* were present in 20 % of the

samples: 6 % at low tide and 14 % at high tide (Tab. 1). The average population density of juvenile *Trochus* was 0.55 ind. m⁻² (Tab. 1). The size of the observed juvenile *Trochus* ranged from 4.2 to 12.1 mm with an average of 6.92 mm (SD 1.61).

Co-occurring molluscs

A total of 37 species of juvenile molluscs in 31 families occupied the same habitat as juvenile *Trochus* (Fig. 1; Annex 1). Of those species, 33 were gastropods and 4 were bivalves with a size range from 2.0 to 12.1 mm. Fig. 1 shows the density of species co-occurring with juvenile *Trochus*. The highest density of associated species, in decreasing order, was *Cellana radiata*, *Rissoina spirata*, *Natica* cf. *sertata*, *Mitra* sp., and *Rhinoclavis* sp., while the abundance of species, in decreasing order, was *Mitra* sp., *Natica* cf. *sertata*, *Rhinoclavis* sp., *Notosinister* sp., and *R. spirata*.

DISCUSSION

Local fishermen used to collect adult *Trochus* at two sites, Mastel and Dead Henoat, in Sather, Kei Besar. We also found populations of adult *Trochus* at both sites. However, juvenile *Trochus* were only found at Dead Henoat. This finding may suggest that juvenile *Trochus* are recruited to a particular type of habitat, and migrate to other habitats as they grow larger. We estimated a density of 0.55 juvenile *Trochus* per m² which is high compared to Orpheus Isle Vanuatu (Castell 1995) and Guam (Smith 1987). The high density indicates an ideal habitat, but it is unknown if this is because of reduced predation, good food conditions, the physical-chemical conditions, or combinations of these factors.

The site at Mastel is located in a bay-like environment while Dead Henoat is located in a cape-like environment. At Mastel, the substrata varied with patches of sand, seagrass, boulders, and rocks. No juvenile *Trochus* were found. The substrata at Dead Henoat consisted of boulders and rock throughout the entire shore, and many ju-

Table 1. Density (D) of juvenile *T. niloticus* in each sampling period: NQ = number of quadrats; NQT number of quadrats where juveniles were found; NT number of *Trochus*; T = transect.

Site/period	NQ	NQT	NT	D	
Mastel:					
Low tide	T1	25	0	0	0
	T2	25	0	0	0
High tide	T1	25	0	0	0
	T2	25	0	0	0
Dead Henoat:					
Low tide	T1	25	8	17	0.68
	T2	25	6	12	0.48
High tide	T1	25	2	8	0.32
	T2	25	4	18	0.72

veniles were found underneath those boulders.

We found 37 species of juveniles of other molluscs co-occurring with juvenile *Trochus*. But species interaction, whether in relation to the availability of food, space, coactive patterns, or other biological patterns could not be studied by us. However, it is a very interesting aspect and a great challenge for future studies. Species that may play important roles at this study site are *Mitra* sp., *Cellana radiata*, *Rissoina spirata*, and *Natica* cf. *sertata*. The *Mitra* sp. because of their abundance, the *C. radiata* and *R. spirata* because of their frequency of occurrence, and *N. cf. sertata* because of their high density.

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ANNEX 1

Check list of species co-occurring with juvenile *Trochus* at Dead Henoat. (*) see remarks.

Gastropods:

Agaronia nebulosa (Lamarck, 1811)

Angiola sp.

* *Astrea* cf. *buschii* Philippi, 1844

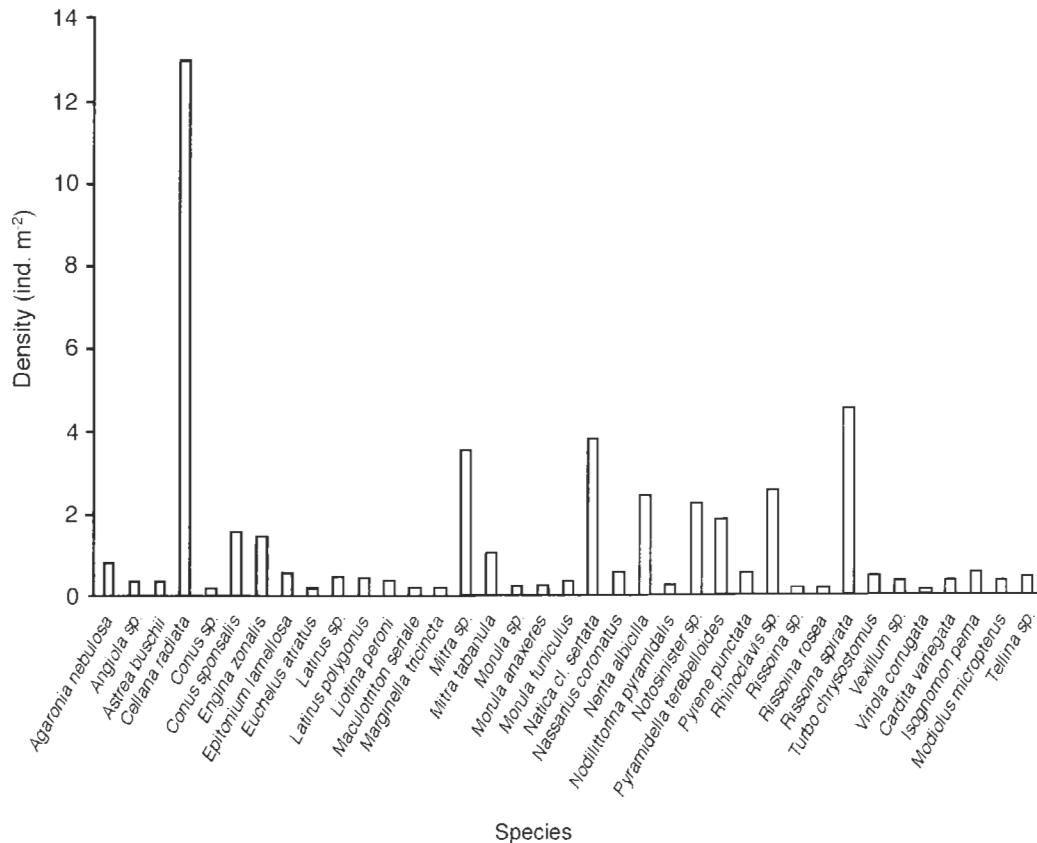


Figure 1. Density of associated juvenile molluscs found in the intertidal zone of Kei Besar.

Cellana radiata (Born, 1778)

Conus sp.

Conus sponsalis Hwass in Bruguière, 1792

Engina zonalis (Lamarck, 1822)

* *Epitonium lamellosa* Bryan, 1915

Euchelus atratus (Gmelin, 1791)

Latirus sp.

Latirus polygonus (Gmelin, 1791)

Liotina peroni (Kiener, 1839)

Maculotriton serriale Deshayes in Laborde & Linant, 1834

* *Marginella tricineta* Hinds, 1844

Mitra sp.

Mitra tabanula Lamarck, 1811

Morula sp.

Morula anaxares (Kiener, 1836)

* *Morula funiculus* (Wood, 1828)

* *Natica cf. sertata* Menke, 1843

Nassarius coronatus (Bruguière, 1792)

Nerita albicilla Linnaeus, 1758

Nodilittorina pyramidalis (Quoy & Gaimard, 1833)

Notosinister sp.

Pyramidella terebelloides (Adams, 1855)

Pyrene punctata (Bruguière, 1792)

Rhinoclavis sp.

Rissoina sp.

* *Rissoina rosea* Deshayes, 1863

Rissoina spirata (Sowerby, 1824)

Turbo chrysostomus Linnaeus, 1758

Vexillum sp.

Viriola corrugata (Hinds, 1844)

Bivalves:

Cardita variegata Bruguière, 1792

Isognomon perna (Linnaeus, 1758)

Modiolus micropterus (Deshayes, 1836)

Tellina sp.

Remarks:

Astrea buschii Philippi, 1844 is from the West coast of South America.

Epitonium lamellosa Bryan, 1915 = *E. perplexum* (Deshayes, 1863) = *Gyroscala lamellosa* (Lamarck, 1816).

Marginella tricineta Hinds, 1844 = *Cryptospira tricineta* (Hinds, 1844).

Morula funiculus is probably a synonym of *Muricodrupa fiscellum* (Gmelin, 1791).

Natica sertata Menke, 1843 is a temperate Australian species.

Rissoina rosea Deshayes, 1863 was described from Reunion.

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