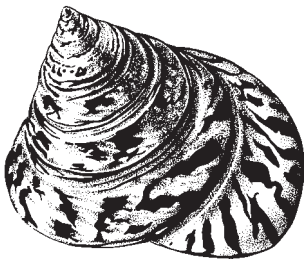
I wish to thank all contributors, but also to appeal to those who have not yet sent in any material. We are anxious for information on prices and resource management measures in producing countries and on the problems encountered in trochus exploitation. Has the trochus market recession started to bottom out? Is the debate on reseeding closed? Many queries remain unresolved and require further information. So, please, pick up your pens!!

This issue also contains a feature which is called Out of the Past, where we reprint articles which first came out some decades ago. It is striking to realise that some of the problems met in the past remain topical today.

I will finish this editorial by saying that articles for most other SIG bulletins are prepared for publication by an editor external to the SPC. Amongst our readers I am sure there is some slumbering editorial talent just waiting for an opportunity to be released. If you think you can be of assistance, please do not hesitate to get in touch with us.

Jean-Paul Gaudechoux

TROCHUS INFOS



Some aspects of the ecology of juvenile *Trochus niloticus* relevant to population enhancement

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Reseeding of reefs using hatchery-reared juveniles is one of the options proposed to increase depleted stocks of fished species such as *Trochus niloticus.* Its feasibility as a management tool is still under investigation and there is a major need to identify the right procedures to follow when 'planting' juveniles, and the post-planting processes occurring in the community.

Most reseeding experiments with *T. niloticus* have used juveniles larger than 15 mm shell diameter (Hoffschir 1990; Amos 1991), although there is at least one example of the use of 8 mm size trochus (Shokita et al. 1991).

Using very young hatchery-reared juveniles (shell diameter < 5 mm) is a desirable alternative because reduced grow-out means many of them can be produced at relatively low cost and effort, and because it would minimise the problems of inappropriate behaviour patterns potentially associated with cultivation (Schield & Welden 1987). So far, this option has not been explored intensively, perhaps because of the difficulty in tagging and tracking such small individuals.

Here I present a brief summary of some results from a study of the mortality of hatchery-reared juvenile *T. niloticus* released into rubble with its associated fauna. The experiment was done in the laboratory but it aimed to replicate as far as possible the arrangement of species (predators, prey and their interactions) found in the natural environment.

Methods

Juvenile *T. niloticus* reared in tanks, ranging between 3 and 14 mm maximum shell diameter, were used in the experiment. Rubble from the intertidal reef flat at Orpheus Island (70 km north of Townsville) was collected in plastic bags. The area was assumed to be a favourable habitat for *T. niloticus* because of the relatively high density of adults.

In the laboratory, the rubble was treated in two different ways: half was treated with anaesthetic solution 1 per cent (v / v) ethanol in seawater (Prince & Ford 1985) and left for approximately 10 minutes. The rubble was then shaken and removed from the solution.

With this process most of the fauna associated with the rubble was removed. The other half of the rubble was left as collected. Both treated and non-treated rubble were then left with continuous water flow for two days to recover from the handling

process. The rubble treated with anaesthetic solution is referred to hereafter as 'Reduced Density of fauna' treatment, and the non-treated rubble as 'Natural Density of fauna' treatment.

Approximately equal amounts of rubble were put in plastic containers 30 x 27.5 x 14 cm with approximately 8.25 l of fresh filtered seawater (25 µ mesh) supplied continuously at a rate of 800 ml per minute. Twelve containers were assigned to each treatment and were distributed randomly on a bench in shaded space. After six hours, 15 *T. niloticus* individuals of <5 mm and 5 individuals of >5 mm shell diameter were introduced into each container and observed to attach themselves to the rocks.

The experiment ran for four days to decrease the chances of 'tank artefacts' building up. I made daily observations (early morning and late afternoon) of the position of juveniles on the rocks and any indication of mortality or predation activity. On Day 4 I scrutinised each container, first picking up all *Trochus* observed and any other animals, and then treating the rubble with the anaesthetic solution as above. All material was collected with a sieve (200 µ mesh), and fixed in 10 per cent formalin. It was subsequently sorted under a dissecting microscope to quantify all fauna present (crustaceans, worms, molluscs and echinoderms).

A contingency table was used to compare the frequencies of live, dead and missing juveniles between the two treatments. The null hypothesis was that the density of fauna had no effect on these frequencies.

Results

A total of 36 juveniles was found dead in the Natural Density of fauna treatment, compared to 5 individuals in the Reduced Density of fauna treatment (see table). The Chi-square analysis revealed a significant difference between the two treatments, indicating that the presence of fauna had an effect on the survival of juveniles ($X^2 = 25.3$ $p<0.0001$). This effect seems to be accentuated by the few cases where mortality of juveniles was particularly high (as for containers 7, 8 and 11 for the Natural Density of fauna treatment – see table), since, for most of the cases, the number of trochus surviving was comparatively high in both treatments.

Stomatopods and / or crabs (likely predators of juvenile *T. niloticus (*Shokita et al. 1991) were present in those containers where mortality was found to be high, but they were also present in seven of the containers where mortality was very low. Identification of these species is presently in process.

Using the number of dead juveniles from the Natural Density treatment (mean 2.75 ind / 4 days; 95% C.I.), the estimate of mortality rate is 0.18% per day (95% C.I.).

Discussion

Mortality rate of juvenile *Trochus* in the Natural Density treatment varied considerably, with some containers showing high mortality and others very low or nil mortality, even in the presence of recognised predators.

Although many variables, such as the effect of large mobile predators and of tides and wave exposure, cannot be included in a laboratory study, the results of this study suggest that in the natural habitat the probability of a juvenile surviving is highly variable in space and time. Based on the estimates of mortality rate obtained in this study, if 20,000 juvenile *Trochus* between 5 and 14 mm shell diameter are released on a reef, assuming a constant mortality rate, after six months we would expect a **mean** survival of 26 individuals.

Number of alive, dead and missing juvenile *Trochus niloticus* after four days exposure to rubble with two different densities of fauna

Fauna	Container	Alive	Dead	Missing
Reduced density	1	17	0	3
	2	19	0	1
	3	18	1	1
	4	17	0	3
	5	18	0	2
	6	15	2	3
	7	20	0	0
	8	18	2	0
	9	17	0	3
	10	17	0	3
	11	18	0	2
	12	19	0	1
Natural density	1	19	1	0
	2	19	0	1
	3	19	1	0
	4	20	0	0
	5	18	0	2
	6	19	1	0
	7	15	5	0
	8	12	11	0
	9	19	0	1
	10	20	0	0
	11	3	17	0
	12	20	0	0

Although this number seems discouraging, the amplitude of the 95% confidence interval (0 to 20,000 individuals surviving) suggests that there is space for obtaining better results. The ecological effect that reseeding has on the community needs investigation. Manipulating the availability of potential prey may have significant effect on the intensity of predation upon them (see Fairweather 1987, 1988 for examples).

The predatory whelk *Morula marginalba* forms aggregations that seem to be a response to stressful environmental conditions. Planting juveniles in areas close to these refuges could have disastrous effects on their survival. I did not examine the effect of juvenile density since only one was arbitrarily chosen, but density of juveniles is likely to be an important factor in survival if it affects the probability of predator-prey encounter. It is possible that reseeding has more potential than has been shown to date, but the study of simple (although not necessarily easily answered) questions about the ecology of juvenile *Trochus* in the wild, such as density, distribution on the shore, desirability as a prey within the natural assemblage, all seem relevant in designing reseeding programmes.

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Notes on trochus (Lola) production in Maluku Province, Eastern Indonesia

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It is well-known that Indonesian trochus shell is considered by international buyers to be of excellent quality. Since Indonesia is not directly involved with the South Pacific Commission, there is a gap in our knowledge of trochus shell production from this part of this gastropod's natural range. The following is a brief description of trochus shell production in Maluku Province, eastern Indonesia.

The Provincial Government Fisheries Department (Dinas Perikanan – Ambon) produces annual statistical records for Maluku Province. Figure 1 is based on these records from 1991. The considerable decrease (62 per cent) in shell production from 1989 to 1990, and the identical level of production in 1991 indicate a drastic reduction of stocks available for harvest, or a lack of information by Dinas Perikanan. There were no limits put on the fishery during these years. Dinas Perikanan suggested that perhaps villages in the islands made their own arrangements with buyers from Java and so complete records could not be obtained. There is no information to determine the cause of the trend for certain.

One of us had the opportunity to see the start of the **buka sasi** (open collection period) for trochus in early December 1992 at one island (Hatta) in the Banda Island group. There were perhaps 100 **parahus** (outrigger canoes) over the excellent reef; a wide reef area (to 10 m depth at the steep reef slope drop-off) provided considerable habitat for the trochus. Most parahus were laden with *Trochus niloticus*, 5 cm shell base diameter and larger. The season was to be open for only about 10 days.

At the same island, we had letters of permission from the **Bapa Raja** or **Camat** (king) of the Banda Islands and from the University in Ambon to pur-