Project for Promotion of Grace of the Sea in Coastal Villages, Phase 2

REPORT ON
TROCHUS AND GREEN SNAIL RESEEDING EXPERIMENT
IN URIPIV ISLAND
DRAFT ONLY

31 OCTOBER 2013

Introduction

Trochus, *Trochus niloticus* and green snail, *Turbo marmoratus* have been heavily exploited all over Vanuatu by people who live in coastal villages. Generally said, resource of trochus is decreasing badly and that of green snail is scarce or locally extinct. These shell species used to be good income sources for the people. Vanuatu Fisheries Department (VFD) took up a challenge to restock those depleted resources with various approaches.

The present project made an approach to establishing spawners groups to maintain and enhance natural reproduction in the field. For building up a spawners group, three methods are usually applied. 1) Release of hatchery produced population, mainly young ones = seeds. 2) Release of adult population collected from the wild. 3) Combination of 1) and 2). The animals should be put in a well secured place called customary TABU area or Marine Protected Area (MPA).

There are many biological issues on release of animals but we do not discuss much about these. Here just presented the results of releasing experiment conducted in a TABU area at Uripiv island in Malampa province of Vanuatu. Uripiv island is a small island belongs to the big island, Malekura island, which is one of the project extension sites for fisheries resources management.

Site selection survey

Two surveys were conducted on 16 June 2012 and 07 July 2012 to investigate the condition of reef areas which were a part of every TABU area (Picture 1). Survey team could not find any live trochus shells or green snails during these surveys. But it was found in a casual workshop held after the first survey that the island used to be abundant of those shellfish species. It was assumed that over-harvest had obviously occurred there in the last few decades.

Picture 1. Surveyed areas which were all a part of every TABU area of Uripiv island.

Finally surveyed area #2 was selected as the most suitable releasing site for green snail and also trochus. The site had three advantages, namely 1) inside a TABU area (good management), 2) the former major fishing ground for green snail (qualified environment for the species) and 3) mostly windward of the island (good opportunity for larval dispersion along the coast). According to these aspects, project team started formalities for restocking program of trochus and green snail.

1. Seed releasing at TABU area in Uripiv island

1.1 Preparation of seeds

Trochus shells were born naturally in rearing tanks at the Port Vila hatchery therefore they were in a mixed batch consisting of several deferent age groups. It is assumed that the majority were around 2 years old (Bour et Grandperrin, 1985). Prior to releasing, individuals which had a shell of more than 2 inch (about 5 cm) in maximum diameter were selected as the seeds then tagged with a 7 mm hole (Picture 2). The spcimens were at mature and expected to function as wild spawners in few years after the release.

Green snails were produced artificially in 2007 therefore all of them were belonging to one batch (GS07). The batch was actually left over from the former releasing events done in Efate in 2009 and being kept on land for several years. Although some seemed too small to survive in the wild, the release might be better than the mortality in the tank. Their operculum were tagged with pencil mark (=Tattoo) (Picture 3).

Picture2. Hole-tagged trochus juvenile. The hole will be repaired soon by trochus itself but the mark is tracable for several years.

Picture 3. Pencil-tagged green snails. As same as tattoo, the number will be permanently inlayed.

Picture 4. Greensnail seeds packed with old newspaper and sea algae in a Styrofoam box for transportation.

1.2 Transport

On 15 August 2012, 348 trochus and 299 green snails were transferred to Uripiv island. Dry packing method was used for throughout the transportation. The seeds were put in a waterproof container together with moisturizing/packing materials such as wet old newspaper and/or a bunch of sea algae (see Picture 4). Packing started 2 hours prior to check-in time of air carrier in Port Vila. The seeds were received at Norsup airport of Malakula island then taken to the releasing point at Uripiv island by truck and speedboat without delay.

1.3 Seed releasing point

Seed releasing of trochus and green snail was carried out on 15 August 2012 at the point of 16* 4' 25.71" S, 167* 27' 37.77" E in one of the three TABU areas of Uripiv island (Picture 5-7). The animals both trochus and green snails were put together in one place, hereafter, the releasing point.

Picture 5. Releasing point of trochus and green snails in Malampa province.

Picture 6. Releasing point of trochus and green snails at Malakula Island.

Picture 7. Releasing point of trochus and green snails at Uripiv island.

1.4 Number of seeds released

Trochus (TRM): 348 pcs

Mean Shell Diameter: 51.7 mm
Mean Body Weight: 51.1 g
Hole-tagged on Shell Lip
(350pcs-2pcs, one died after tagging and the other was carelessly left in tank)

Green Snail (GS07): 299 pcs

Mean Shell Diameter (Width): 56.3 mm
Mean Body Weight: 55.5 g
Pencil-marked on Lid
(Serial number started from 1, ended to 300, #49 died in tank before transfer)

Picture 8. Released animals at the releasing point on the following day.

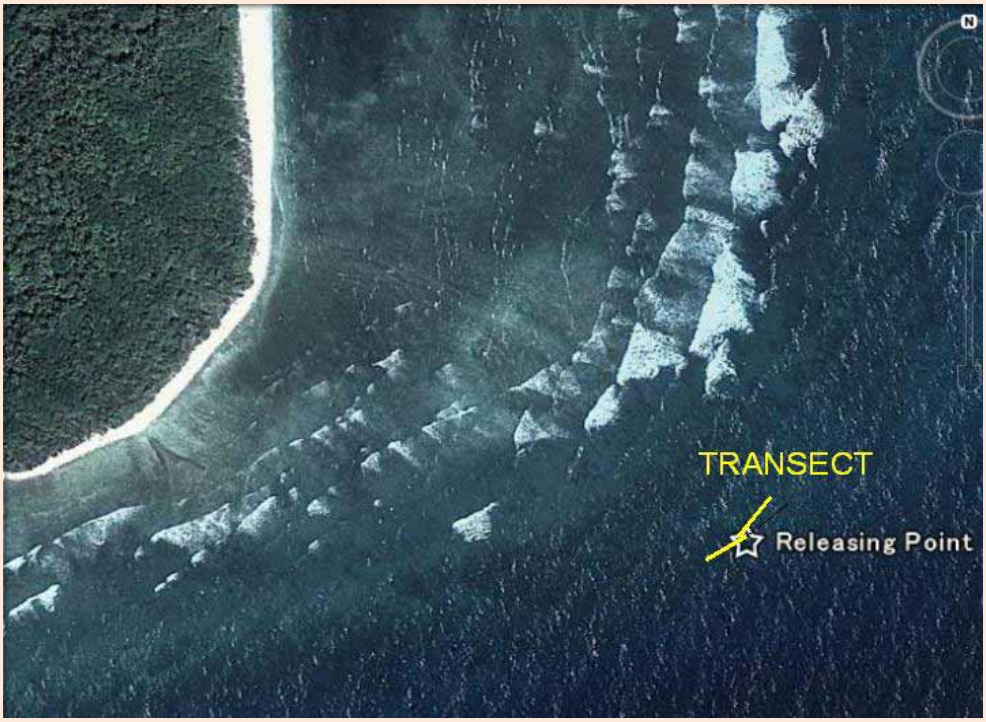
2. Monitoring on the released seeds

2.1 Monitoring schedule

According as the standard protocol, monitoring surveys were conducted periodically by researcher staff of VFD and Uripiv villagers as follows.

Day-0 (the day of release=15 August 2012)
Month-1 (one month after release: actually conducted on13 September 2012)
Month-3 (three months after release: actually conducted on 12 November 2012)
Month-6 (six months after release: actually conducted on 05 February 2013)
Month-12 (twelve months after release: actually conducted on 26-28 September 2013)

2.2 Location of monitoring site



Picture 9 Map of releasing point and transect line for monitoring.

2.3 Monitoring method

A 50m transect line was set across the releasing point and parallel with the coast (see Picture 9). Five 10m x 10m (=100 square meters) quadrats were made on both sides of the line. Hence, the monitoring station covered for 1,000 square meters' area around the releasing point. It consists of 10 sections (Fig. 1). On 4 February 2013, permanent point markers made of iron rods were set up (Picture 10). Free divers thoroughly searched for the released animals every quadrat and surrounding area. Only for the September 2013 monitoring scuba tanks were used.

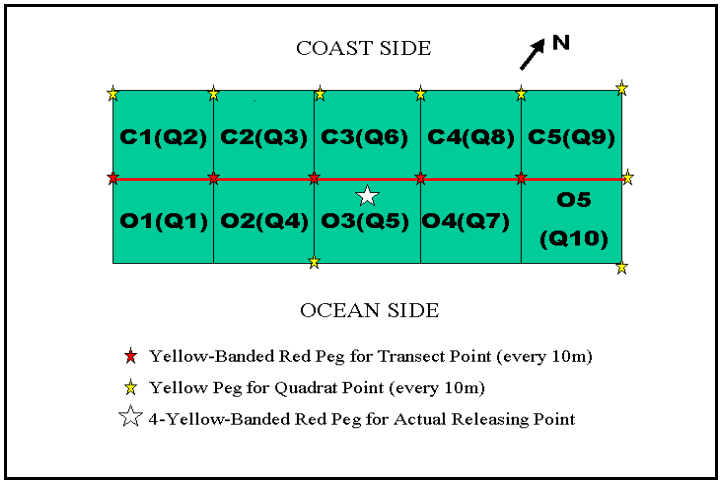


Fig. 1 Layout of quadrats at the monitoring station.

Picture 10. Settled transect line along the permanent markers.

3. Monitoring results

3.1 Summary of trochus monitoring

3.1.1 Trochus recapture (live)

Table 1 and Fig. 2 summarize number of recaptured live trochus during monitoring surveys. Outside area means the adjoining 5-10m area in width. Within one year, almost all trochus seemed to be moving out from the monitoring station.

Table 1 Number of trochus found alive

Time after release/ Survey date	0 month 15-Aug-2012	1 month 13-Sep-2012	3 months 12-Nov-2012	6 months 5-Feb-2013	12 months 26:28-Sep-2013
Inside area	348	162	34	1	0
Outside area	0	17	32	No data	0
Total	348	179	66	1	0

Note 1: All animals were returned into the same place where they were found.

Note 2: No survey was conducted outside the station on 5 Feb.2013.

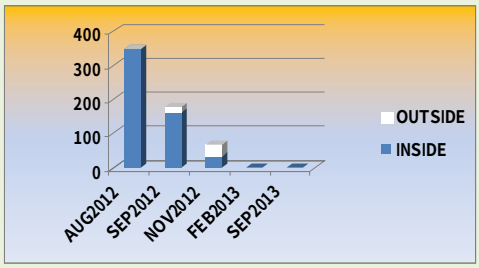


Fig. 2 Number of trochus shells found alive inside and outside the monitoring station area. (No outside data in Feb2013)

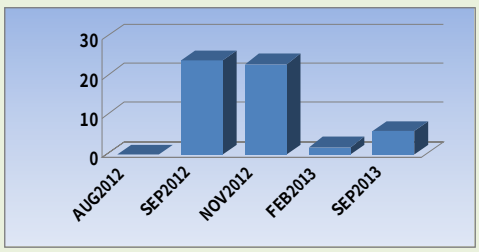


Fig. 3 Number of trochus shells found dead inside and outside the monitoring area. (No outside data in Feb2013)

3.1.2 Trochus recapture (dead)

Table 2 and Fig. 3 summarize the number of dead trochus (empty or crushed shells) found during monitoring surveys. The total of 55 dead shells had been collected.

Table 2 Number of trochus found dead (inside & outside the station)

Time after release/ Survey date	0 month 15-Aug-2012	1 month 13-Sep-2012	3 months 12-Nov-2012	6 months 5-Feb-2013	12 months 26:28-Sep-2013
# dead shells	0	24	23	2	6
# dead shells accumulated	0	24	47	49	55

3.1.3 Missing trochus (estimate)

Table 3 compiles the number of live specimens and dead shells obtained from the monitoring surveys. The number of recovered shells was decreasing (Fig. 4), in the meantime estimated number of missing ones was increasing more and more (Fig. 5). By September 2013, 84.2% of the released trochus shells had disappeared from the monitoring station.

Table 3 Number of trochus found missing

Time after release/ Survey date	0 month 15-Aug-2012	1 month 13-Sep-2012	3 months 12-Nov-2012	6 months 5-Feb-2013	12 months 26:28-Sep-2013
Total # live shells	348	179	66	1	0
Total # dead shells accumulated	0	24	47	49	55
Total # missing shells	0	145	235	298	293

Note 1: All live animals were returned into the same place where they were found.

Note 2: All dead animals were removed from the area every survey.

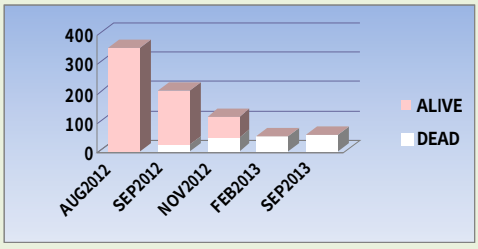


Fig. 4 The number of trochus shells (dead & alive) found inside and outside the monitoring station.

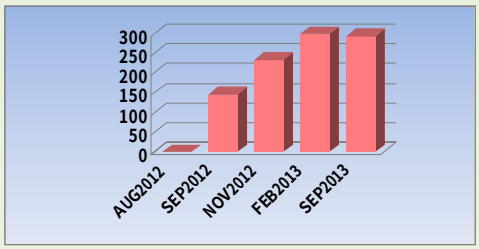


Fig. 5 Estimated number of trochus shells disappeared from the monitoring stationon.

3.1.4 Trochus distribution in the monitoring station

Chronological changes in distribution of trochus shells in the monitoring station are shown in Fig. 6-10.

On Day-0, all shells were getting together around the releasing point in the O3 quad (Fig. 6). On Month-1, trochus shells seemed starting migration, however, many of them were still staying around the releasing point (Fig. 7). On Month-3, the number of recaptured shells decreased at most of the quadrats (Fig. 8). On Month-6, only one shell was recovered in the O4 quad (Fig. 9). After one year all trochus seemed to be moving out from the monitoring area.

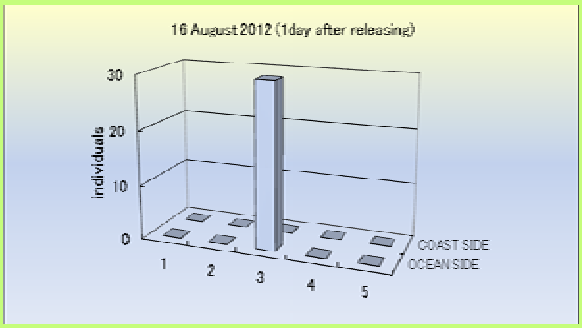


Fig. 6 Number of trochus shells released in the monitoring station. Actual bar at O3 must be ten times longer than the showed one.

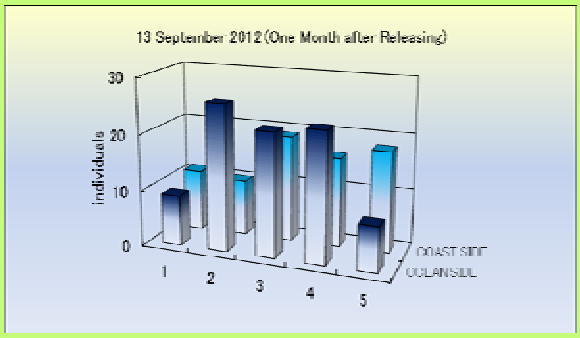


Fig. 7 Number of trochus shells recaptured in the monitoring station area after one month.

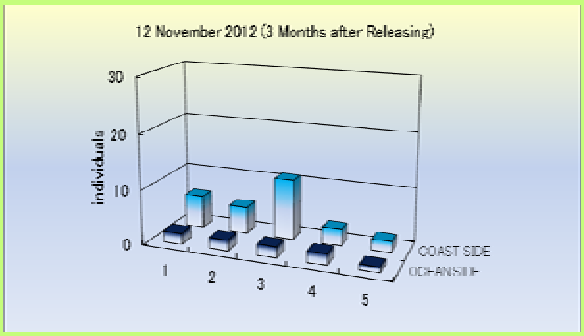


Fig. 8 Number of trochus shells recaptured in the monitoring station area after three months.

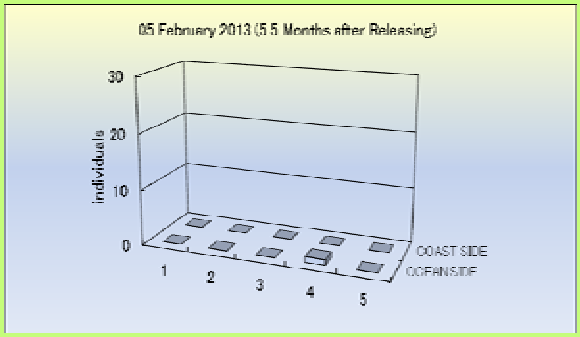


Fig. 9 Number of trochus shells recaptured in the monitoring station area after 6 (5.5) months.

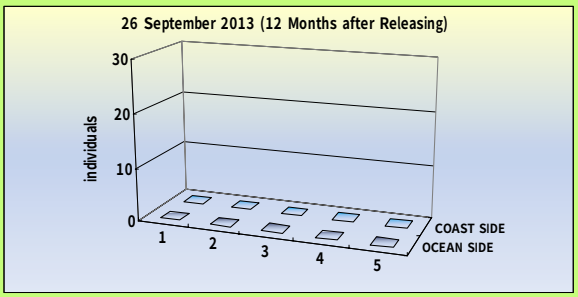


Fig. 10 Number of trochus shells recaptured in the monitoring station area after twelve month (=one year).

3.2. Summary of green snail monitoring

3.2.1 Green snail recapture (live)

Table 4 and Fig. 11 summarize number of recaptured live green snails during the surveys. As same as trochus, most of the green snails seemed to be moving out from the monitoring station by February 2013.

Table 4 Number of green snails found alive

Time after release/ Survey date	0 month 15-Aug-2012	1 month 13-Sep-2012	3 months 12-Nov-2012	6 months 5-Feb-2013	12 months 26:28-Sep-2013
Inside area	299	143	17	0	0
Outside area	0	12	28	No data	0
Total	299	155	45	0	0

Note 1: All animals were returned into the same place where they were found.

Note 2: No survey was conducted outside the station on 5 Feb.2013.

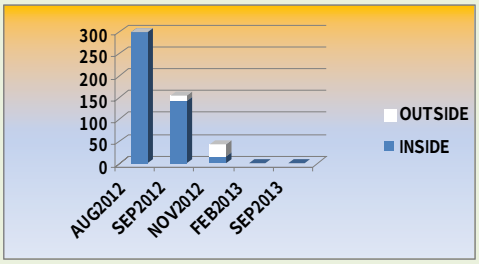


Fig. 11 Number of green snails found alive inside and outside the monitoring station area. (No outside data in Feb2013)

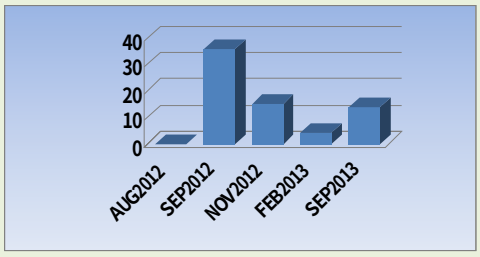


Fig. 12 Number of green snails found dead inside and outside the monitoring area. (No outside data in Feb2013)

3.2.2 Green snails recapture (dead)

Table 5 and Fig. 12 summarize the number of dead green snails (empty shells) found during monitoring surveys. On Month-1, 36 dead shells were collected but the number decreased in the following surveys. In September 2013, the total of fourteen dead (crashed) shells were recovered from the deeper area, outside of the station.

Table 5 Number of green snails found dead (inside & outside the station)

Time after release/ Survey date	0 month 15-Aug-2012	1 month 13-Sep-2012	3 months 12-Nov-2012	6 months 5-Feb-2013	12 months 26:28-Sep-2013
# dead shells	0	36	15	4	14
# dead shells accumulated	0	36	51	55	69

3.2.3 Missing green snails (estimate)

Table 6 compiles the number of live specimens and dead shells obtained from the monitoring surveys. The number of recaptured shells was decreasing (Fig. 13), otherwise estimated number of missing ones was increasing more and more (Fig. 14). 81.6% of the released green snails had disappeared from the monitoring station area by Month-6. The number of missing ones decreased a little as same as trochus because some dead ones were collected during the Month-12 monitoring survey.

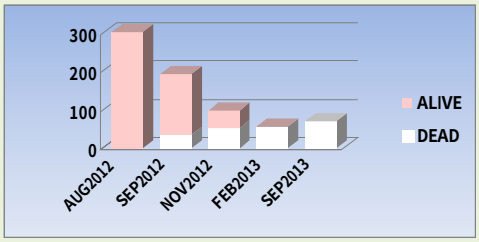


Fig. 13 Number of green snails (dead & alive) found inside and outside the monitoring station.

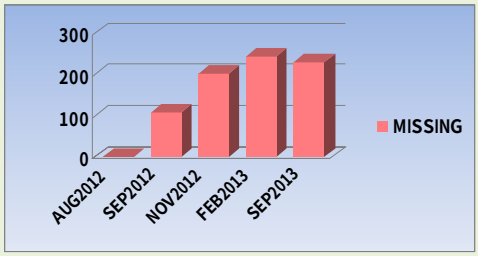


Fig. 14 Estimated number of green snails disappeared from the monitoring station.

Table 6 Number of green snails found missing

Time after release/ Survey date	0 month 15-Aug-2012	1 month 13-Sep-2012	3 months 12-Nov-2012	6 months 5-Feb-2013	12 months 26:28-Sep-2013
Total # live	299	155	45	0	0
Total # dead accumulated	0	36	51	55	69
Total # missing	0	108	203	244	230

Note 1: All live animals were returned into the same place where they were found.

Note 2: All dead animals were removed from the area every survey.

3.2.4 Green snail distribution in the monitoring Station

Chronological changes in distribution of released green snails in the monitoring station are shown in Fig. 15-19.

On Day-0, all individuals were staying around the releasing point in the O3 quadrat together with trochus shells (Fig. 15). On Month-1, green snails started migration, however, many of them were still residing around the releasing point (Fig. 16). On Month-3, the number of recaptured shells was getting decrease at most of the quadrats, especially those of ocean side (Fig. 17). On Month-6 and Month-12, no more live shell was recovered inside the station (Fig. 18 & 19).

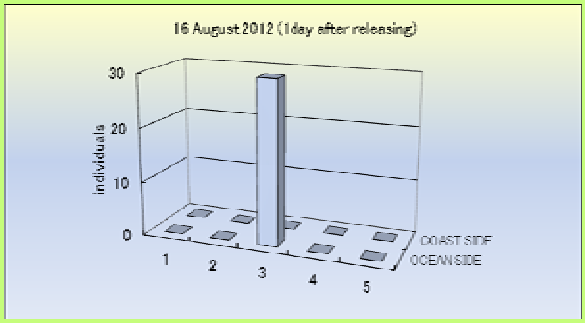
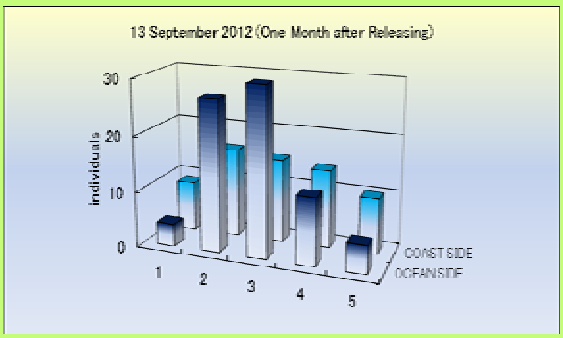


Fig. 15 Number of green snails released in the monitoring station. Actual bar at O3 must be ten times longer than showed one.



Fig, 16 Number of green snails recaptured in the monitoring station after one month.

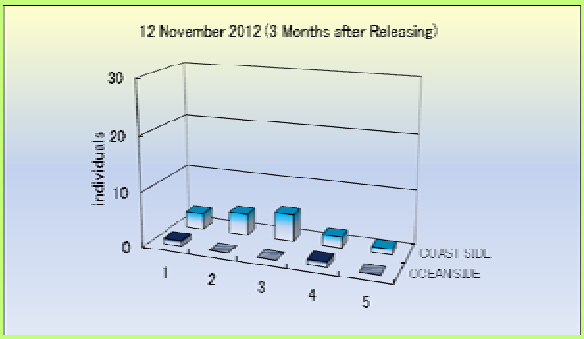


Fig. 17 Number of green snails recaptured in the monitoring station after three months.

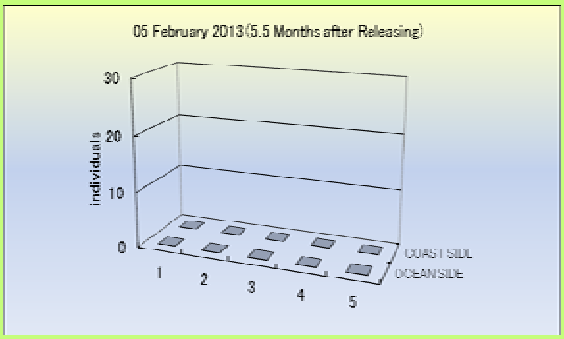


Fig. 18 Number of green snails recaptured in the monitoring station after twelve months.

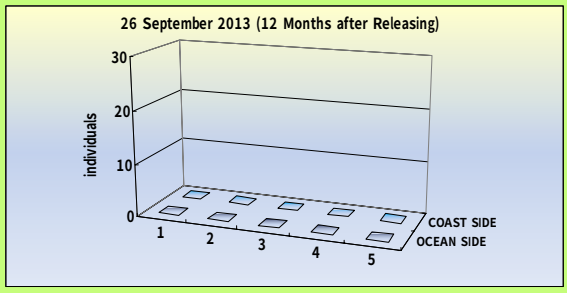


Fig. 19 Number of green snails recaptured in the monitoring station after twelve months.

4. Additional (experimental) releasing

During the Month-6 survey, it was confirmed that almost all animals were disappeared from their releasing site. Accordingly an additional releasing experiment was carried out on 26 September 2013.

4.1 Materials and methods

Live 10 trochus and 28 green snails were transported and released at the same point that the first release was conducted in the previous year. At the same time of the monitoring survey, behavior of additionally released animals was examined.

Trochus (TRM): 10 pcs

Mean Shell Diameter: over 80 mm/ No tag

Green Snail (GS07): 28 pcs

Mean Shell Diameter (Width): Group B (n=20): 78.8 mm, Group S (n=8): 60.1 mm
Mean Body Weight: 55.5 g: Group B: 153g, Group S: 66g
Pencil-marked on Lid

4.2 Results

4.2.1 Behavior of trochus

Numbers of trochus found dead were given in table 7. Trochus were disappeared soon from the releasing point. Preyed shells were not many, found only one shell per day. One shell was found crashed and the other was just being eaten by a hermit crab. Mortality of the released trochus was 20% after 2 days from the release.

Table7 Number of trochus shells found dead

Time after release/ Survey date	0 day 26 Sep 2013	1 day 27-Sep-2013	2 days 28-Sep-2013
Total # found dead	0	1	1
Total # found dead accumulated	0	1	2
Total # live (est.)	10	9	8

Note 1: All live animals were returned into the same place where they were found.

Note 2: All dead animals were removed from the area every survey.

4.2.2. Behavior of green snails

Numbers of green snails found dead were shown in table 8. Green snails seemed to be staying near by the releasing point. Live ones were still standing in a small area.

Some preyed shells were seen on the exposed limestone flat. It was assumed someone took them to that place, maybe octopus. All dead shells showed the same pattern of shell-break. Actually one octopus was caught near the releasing point. Mortality of the released green snails was 46% after 2 days from the release.

Table 8 Number of green snails found dead

Time after release/ Survey date	0 day 26 Sep 2013	1 day 27-Sep-2013	2 days 28-Sep-2013
Total # found dead	0	7	6
Total # found dead accumulated	0	7	13
Total # live (est.)	28	21	15

Note 1: All live animals were returned into the same place where they were found.

Note 2: All dead animals were removed from the area every survey.

5. Discussions

NOW UNDER PREPARATION

5.1 Movement of the released animals

5.2 Predators

Picture 11. Half smashed trochus (left) and top-chopped trochus (right).
Possible predators: Crabs, Hermit crabs, fishes

Picture 12. A piece of broken trochus shell.
Possible predators: Puffer fish (Balloon fish), Mantis crabs

Picture 13. Green snail shells typically broken by unknown predators.
Possible predators: Larger crabs, Octopus

6. Recommendation

NOW UNDER PREPARATION