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

Results of Activities for Marine Shellfish Propagation

FULL VERSION

Research and Aquaculture Section of Vanuatu Fisheries Department

Japan International Cooperation Agency

IC Net Limited

2014

Project's Target Species

1. Giant Clams (*Natalae*)
2. Trochus Shell (*Troka*)
3. Green Snail (*Grin snel*)

A gigas clam specimen grown up to premature size at the grow-out farm. (Lelepa Island, 2013)

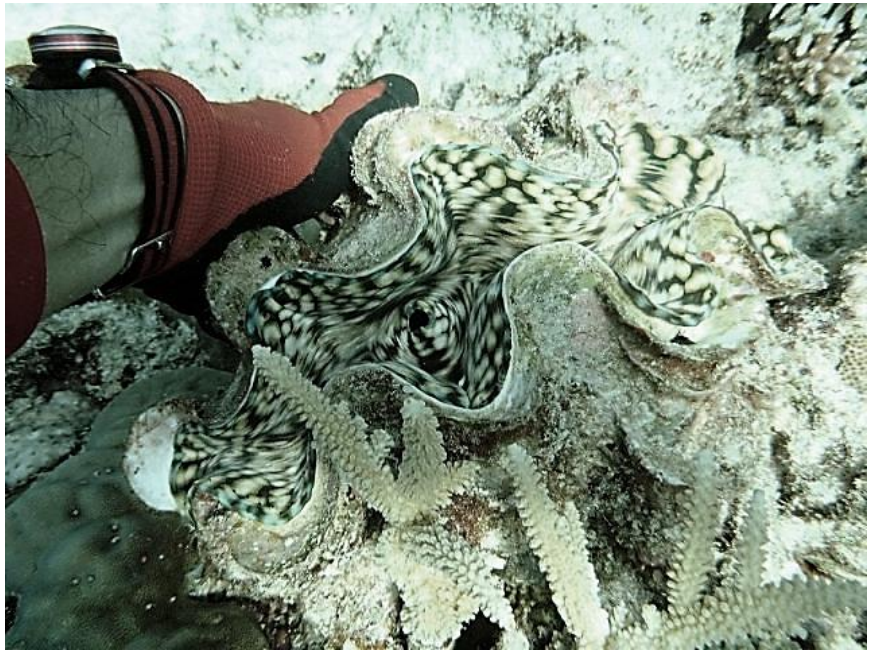
One of the newly recruited young green snails found at Katoa Point. (Mangaliliu, 2012)

Target Species: Giant Clams (*Natalae*) 1: Smaller Species

Tridacna maxima at the shallow reef. (Mystery Island).

Tridacna crocea at the limestone flat. (Lelepa Island)

Target Species: Giant Clams (*Natalae*) 2: Larger Species



Tridacna squamosa at the outer reef slope. (Uripiv Island)

Hippopus hippopus at the shallow sand flat. (Uripiv Island)

Target Species: Giant Clams (*Natalae*) 3: Extinct Species

A pair of fossil *Tridacna gigas* shells embedded in a beachrock. (Uripiv Island)

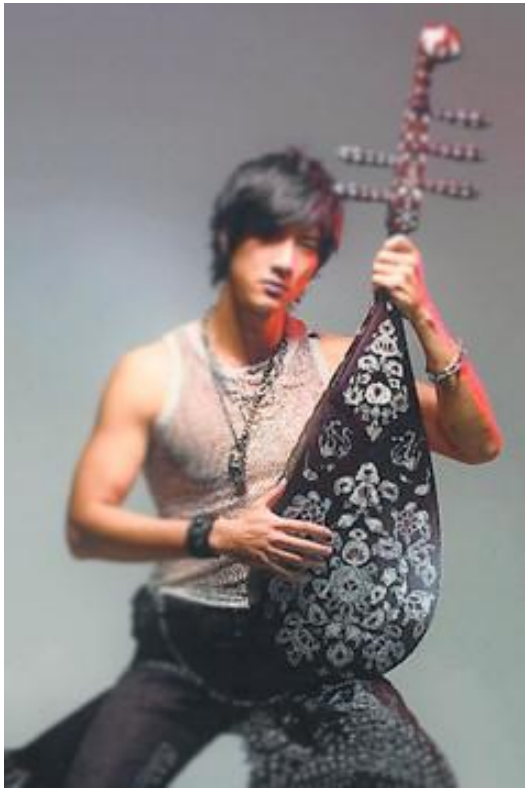
Target Species: Trochus (*Troka*)

World market

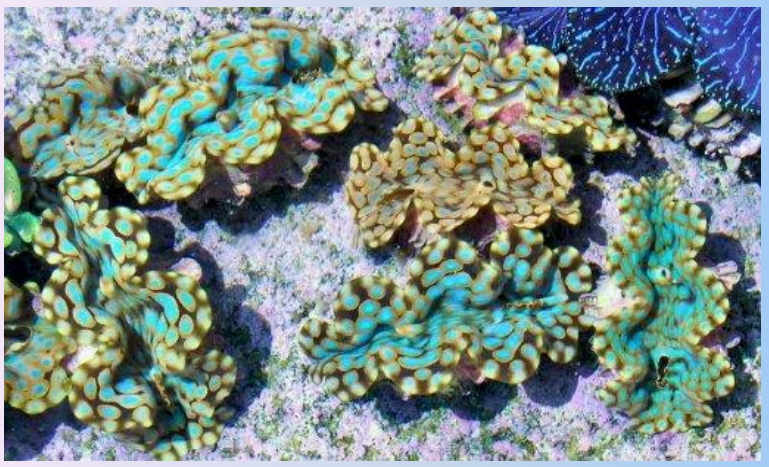
Domestic market

Target Species: Green Snail (*Grin snel*)

Green snail shells have provided quality raw materials for mother-of-pearl work since several thousand years ago in Asia-Pacific.



Activities and Results



The Vanuatu Fisheries Department (VFD) hatchery produces the world renowned *T.squamosa* clam = the Vanuatu Blue-Spotted Squamosa Clam. (2013)

The VFD hatchery mass-produces trochus as tank cleaners. These trochus will be released into the wild when they grow up. (2013)

Some long term resource management activities initiated during the Phase 1 (2006-2009) of the present Project are still on going.

Activity 1: Giant Clam Farming
1) Seed Production

*Spawning trials

Spawning induction trials have been continued to get the fertilized eggs since 2007 at the VFD shellfish hatchery.

Activity 1: Giant Clam Farming
1) Seed Production

*Land cultures

Larval/post-larval culture of *Tridacna squamosa*. (2013)

One (1) year old *Tridacna maxima* spat. Direct on-bottom culture. (2013)

Activity 1: Giant Clam Farming

1) Seed Production

*Seed clams preparation

Tridacna squamosa spat attached on to bricks. Ready to go to the ocean. (2013)

Let the harvested *T.squamosa* spat settle on bricks using clam separator rings. Require 3-4 weeks for the firm settlement. (2013)

Activity 1: Giant Clam Farming
2) Ocean Culture (Standard Method)

*Farming materials transport

Land transport of pre-assembled farming cages by truck. (2012)

Sea transport of farming cages by boat. (Photo: Tassiriki, Moso Island, 2012)

Problem: It is difficult to transport live clam seeds and farming materials at once.

Activity 1: Giant Clam Farming
2) Ocean Culture (Standard Method)

*Clam seeds transport

Land transport of pre-attached live clam seeds by truck. (2013)

Sea transport of live clam seeds by boat. (Photo: Lelepa Island, 2013)

Problem: Since the above reason, this method limits the farming site to Efate Island and its neighboring islands.

Activity 1: Giant Clam Farming
2) Ocean Culture (Standard Method)

*Clam seeds delivery

Seed blocks (=bricks with clam seeds) are deployed one by one at the site. (Photo: Mangaliliu, 2007)

Clam seeds must be transferred as quick but careful as possible. Never leave them under the sun. (Photo: Sunae, 2012)

Problem: Transportation of live seed clams requires time, labor and special skills.

Activity 1: Giant Clam Farming
2) Ocean Culture (Standard Method)

*Giant clam farm

The largest giant clam farm at the moment. (Photo: North Efate, 2013)

Activity 1: Giant Clam Farming

3) Ocean Culture (**Advanced Method**)

*Seeds transfer to remote islands

One year old *Tridacna squamosa* seeds harvested and packed for farming. Now the clams can be sent by air to places remote from Port Vila. (2013)

Healthy clam seeds can survive almost a day without water at a cool and dark place. (2013)

Activity 1: Giant Clam Farming
3) Ocean Culture (**Advanced Method**)

*Seeds transfer to remote islands

On arrival at a farming site, seed clams must be immediately submerged in seawater. If hold the seeds overnight, use a protection material such as a mesh bag to protect them from nocturnal predators. (Photo: Uripiv Island, 2013)

Activity 1: Giant Clam Farming

3) Ocean Culture (**Advanced Method**)

*Farming materials transfer to remote islands

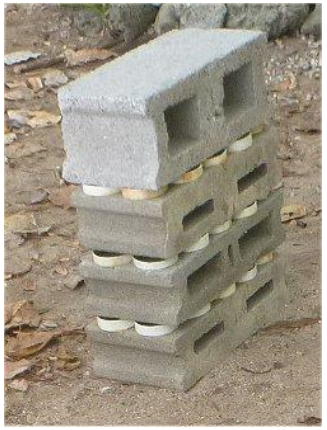
All materials (excluding bricks and clam seeds) required to set up a giant clam farm. The above set shows materials for holding 100 yearling clams. (2013)

A close-up image of the materials and tools. Underwater glue appeared on left top is used to fix PVC rings on top of the bricks at the site. (2013)

Activity 1: Giant Clam Farming
3) Ocean Culture (**Advanced Method**)

*Farming materials assembly at the site

i) Substrate



Concrete bricks may be available in a nearby town as construction supplies. Farmers should prepare only plain bricks prior to receiving farming materials.

Glue the PVC settlement rings on the bricks at the site (left). Put a heavy thing on the rings to press them down and leave them overnight (middle). Bricks ready to submerge in the sea (right). (Photo: Uripiv Island, 2013)

Activity 1: Giant Clam Farming
3) Ocean Culture (**Advanced Method**)

*Farming materials assembly at the site

ii) Farming cage

A giant clam farming cage in a recommendable design. It is easy to assemble but also requiring no special tools. The cage accommodates 5 or 6 bricks. (Uripiv Island, 2013)

Activity 1: Giant Clam Farming
3) Ocean Culture (**Advanced Method**)

*Clam seeds planting

Set up a cage and bricks at the proper farming site. Place baby clams inside the ring one by one and also put some clams inside the ring chain. Vital clams will right their position properly by themselves. (Photo: Uripiv Island, 2013)

Activity 1: Giant Clam Farming

3) Ocean Culture (**Advanced Method**)

*Completion of clam farm installation

One unit of giant clam farming cage (left). All seed clams recovered overnight (right). In practical, periodical checking and cleaning will be required for some months, followed by thinning of the overcrowded bricks. (Photo: Uripiv Island, 2013)

Activity 1: Giant Clam Farming

4) Export for Aquarium Pet Market

A well maintained commercial giant clam farm. It made one shipment successfully from half a year cultivation of the Maxima clam. Demands on aquarium pet giant clams seem high in the markets. (Photo: Sunae, Moso Island, 2013)

<u>The clam farming will provide an opportunity for diversifying villager's income.</u>

Activity 1: Giant Clam Farming

4) Export for Aquarium Pets Market

Farmer's clams brought back to the VFD hatchery. Prepared for shipment. (Photo: Lelema farming trial in 2008)

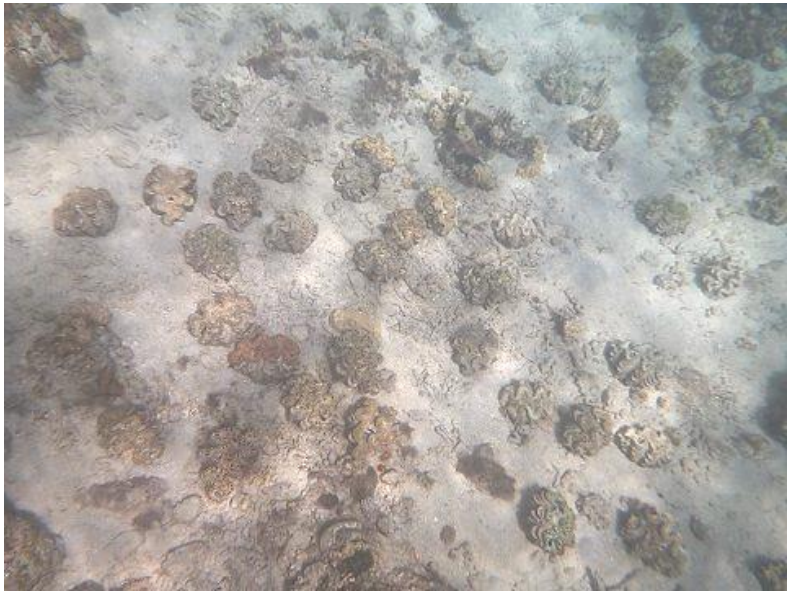
An exporter comes to collect clams and export documents on the day of shipment. (Photo: Moso farming trial in 2013)

The VFD acts as a middleman between farmers and exporters at the moment. However, this system should be reformed for future expansion and privatization.

Activity 1: Giant Clam Farming

5) Giant Clam Garden

Accumulated wild Squamosa clams. The *Giant Clam Gardens* customarily owned by villagers are very common in Vanuatu. To maintain giant clam stock in front of the village is in line with the present project's resources management strategy. (Photo: Tassiriki, Moso Island, 2012)



An example of the *Giant Clam Garden* stocked with artificially bred Squamosa clams (6 years old). This private garden aims to provide a good sight for the tourists who want to swim around. (Photo: Gideon Landing, Efate, 2013)

Activity 1: Giant Clam Farming

5) Giant Clam Garden

The *Giant Clam Grow-out Farm* is renamed to the *Giant Clam Garden* when the clams grow up to adults. It is expected to provide offspring naturally and also contribute to community's economy directly or indirectly as a tourist attraction. (Photo: Natapao and Tassiriki, 2013)

Activity 1: Giant Clam Farming

6) Commercial Giant Clam Farms

*Information from Palau (i)

Net fence enclosures are commonly used for giant clam farming in Palau. Large number of clams are being cultured until shipment, sometimes it takes for several years. The Hippopus clams are locally sold to restaurants and hotels at a good price. (2014)

Disadvantage: There are no big giant clam markets developed in Vanuatu.

Activity 1: Giant Clam Farming
6) Commercial Giant Clam Farms

*Information from Palau (ii)

A larger giant clam species, *Tridacna derasa*, has been cultured in Palau for several decades. The cultured Derasa clams are sold to local hotels and restaurants and also shipped to foreign countries through local aquarium fish exporters. (2014)

Possibility: Squamosa and Gigas can take the place of Palauan Derasa in Vanuatu.

Activity 1: Giant Clam Farming
6) Commercial Giant Clam Farms

*Information from Palau (iii)

Commercial giant clam farms are sometimes set up at the shallow offshore area where the quality environment is available (left). Only fist-sized giant clams are taken into the grow-out phase (right). There is a similar problem to Vanuatu. How to raise the clam seeds until this size? (2014)

Activity 2: Green Snail and Trochus Spawners Group Forming

1) Relocation of Broodstock

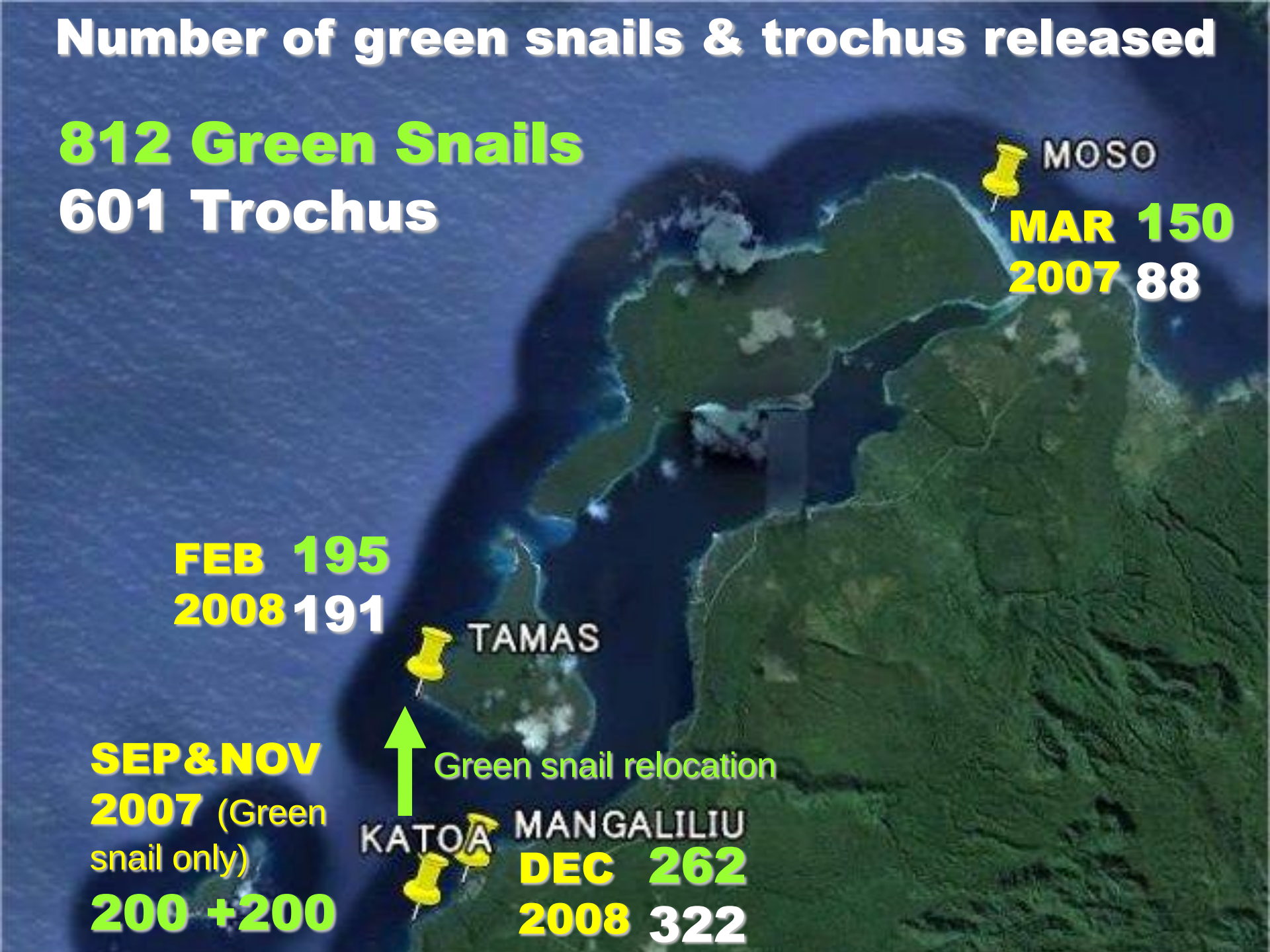
By 4 flights in total, a large quantities of adult green snails and trochus had been transferred from Aneityum to Efate between March 2007 and December 2008 under the Phase 1 of the present Project.

Activity 2: Green Snail and Trochus Spawners Group Forming

1) Relocation of Broodstock

Adult green snails taken to the boat by community members. For releasing at the Katoa Point of Mangaliliu village. (November 2007)

Marking a serial number on a lid before releasing. At the Lakantamas Point, Lelepa Island. (February 2008)


Number of green snails & trochus released
812 Green Snails
601 Trochus
MOSO
MAR 150
2007 88
FEB 195
2008 191
TAMAS
Green snail relocation
SEP&NOV
2007 (Green
snail only)
200 +200
KATOA
MANGALILIU
DEC 262
2008 322

Recruitment confirmed in 2012

Many young green snails were found not only at the adults-releasing sites but also at locations far from those sites. (Yellow pin-pointed places)

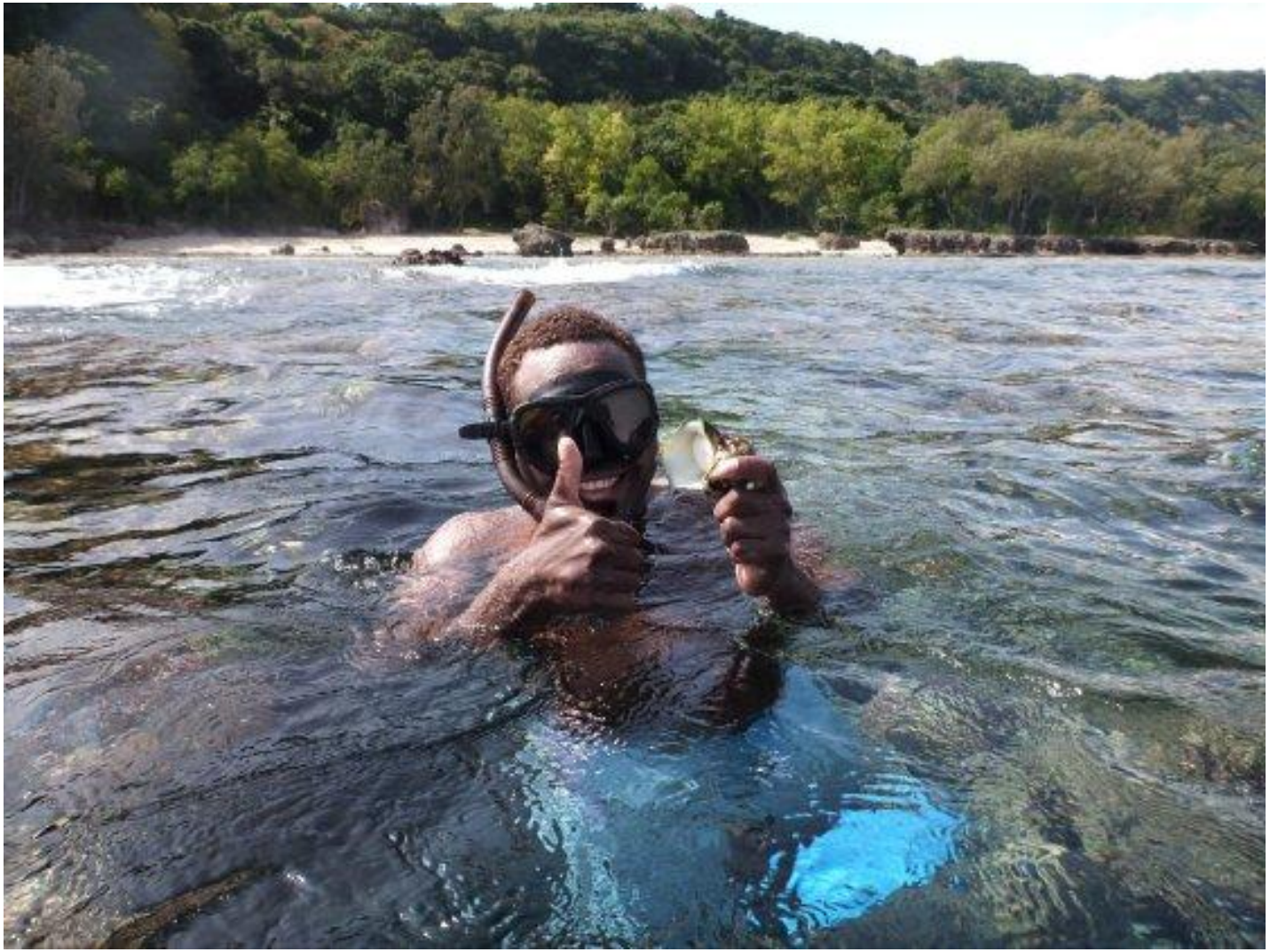
Recruitment confirmed in 2012

At the front reef of Mangaliliu.

At the Katoa Point.

At the western reef flat in Eretoka Island (Hat Island).

Recruitment confirmed in 2012



A very young green snail found at the Lakantamas Point in Lelepa Island.

Activity 2: Green Snail and Trochus Spawners Group Forming

2) Releasing of Artificial Seeds

Hatchery-bred seed green snails and trochus were experimentally released at the Tabu Area of Uripiv Island in August 2012. The released individual was distinguishable by the tag. A trochus with a holed shell lip (left). Green snails with a pencil-marked lid (right).


Uripiv Is.
Releasing Point
Uri Is.
Lakatoro
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2010 Google

Summary of Monitoring Trochus

Overall Summary of the 1-Year-Assessment (as of September 2013)

Released trochus:	**348 shells**
Live trochus:	**0 shells**
Dead trochus:	**55 shells**
Missing trochus:	**293 shells**

*The area of monitoring was 1,000 m^2 around the releasing point.

Summary of Monitoring Green Snails

Overall Summary of the 1-Year Assessment (as of September 2013)

Released green snails:	**299 shells**
Live green snails:	**0 shells**
Dead green snails:	**69 shells**
Missing green snails:	**230 shells**

*The area of monitoring was 1,000 m^2 around the releasing point.

Findings from Monitoring

Heavy mortalities by predation were observed soon after the release. Otherwise, all live trochus and green snails seemed to be moving out from the monitoring site which might be not suitable for living of artificial seeds. Small seeds should be released into the shallow intertidal zone.

Future Directions

Activities for shellfish propagation is almost same as forestry. It is sustainable if young trees are properly planted after cutting down. However, it can take a very long time to recover the forest.

Future Directions 1
Promotion of Giant Clam Gardens

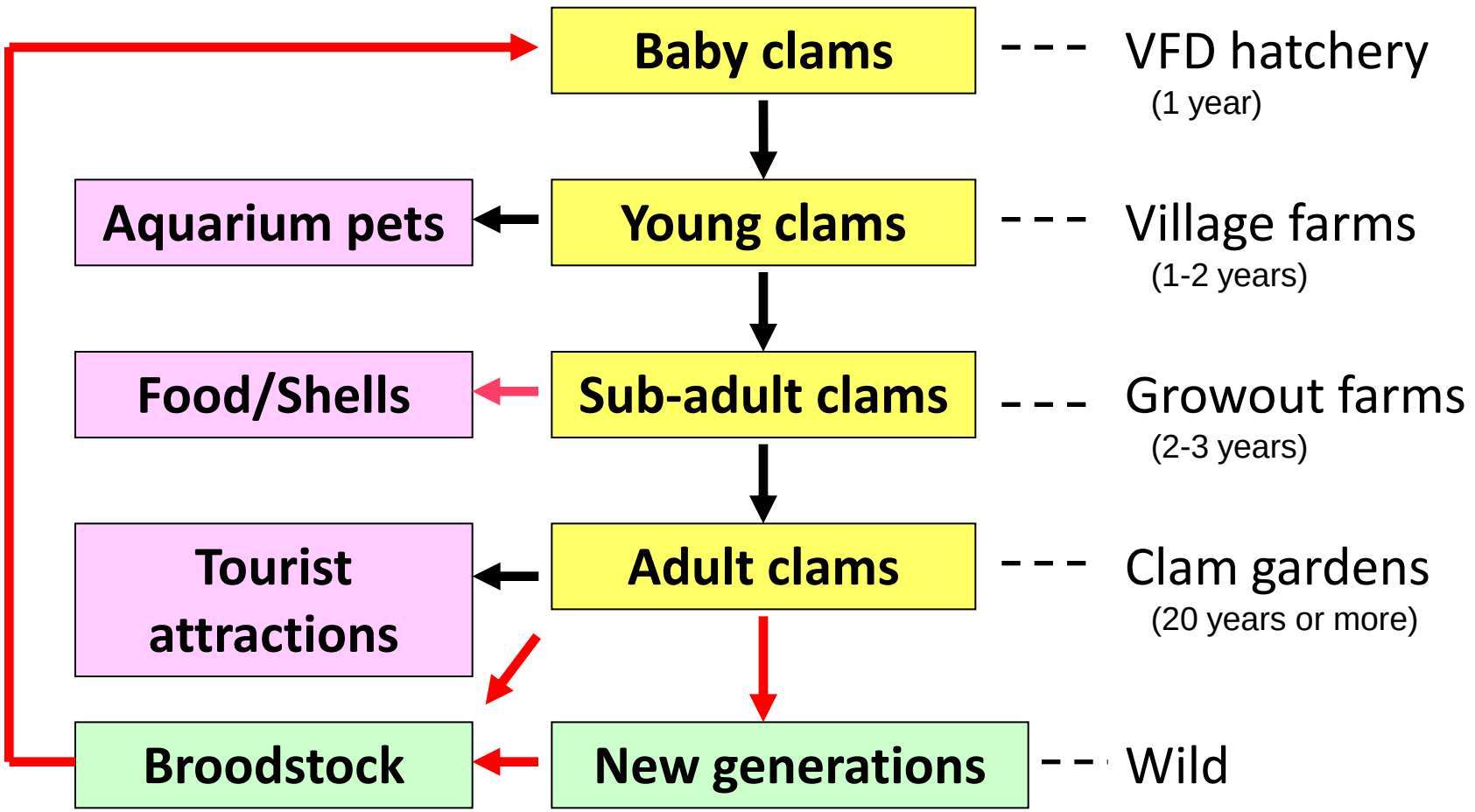
Giant clam gardens: private or public?

A private *Giant Clam Garden* at Suane. (Moso Island, 2013)

Giant clams stocked in a *Public Clam Garden* are not for sale or home consumption. They are just members of a spawners group. Therefore, the garden must be established in a No Take Place such as a Marine Protected Area (MPA) or a Tabu area.

Otherwise, the clams stocked in a *Private Clam Garden* can be harvested by the owner. But it is recommended that the clams are kept in the garden as long as possible.

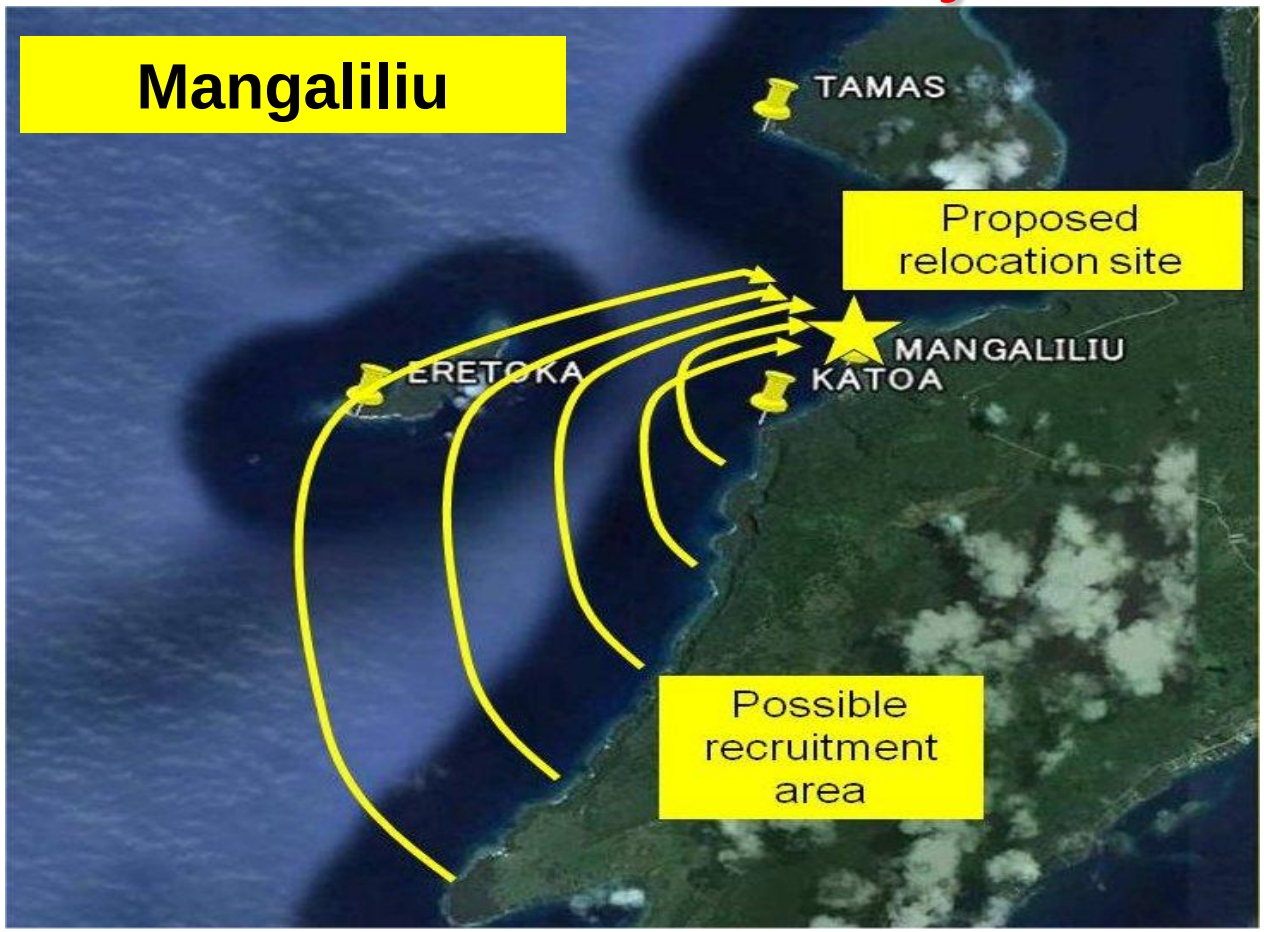
Giant Clam Propagation System in Vanuatu



Target species: Tridacna squamosa and T.gigas.

Future Directions 2

Trochus and Green Snail Spawners Accumulation Project



Collect young green snails and oversized trochus periodically from the western coast where poaching is not controlled. Take them back to the Tabu area.

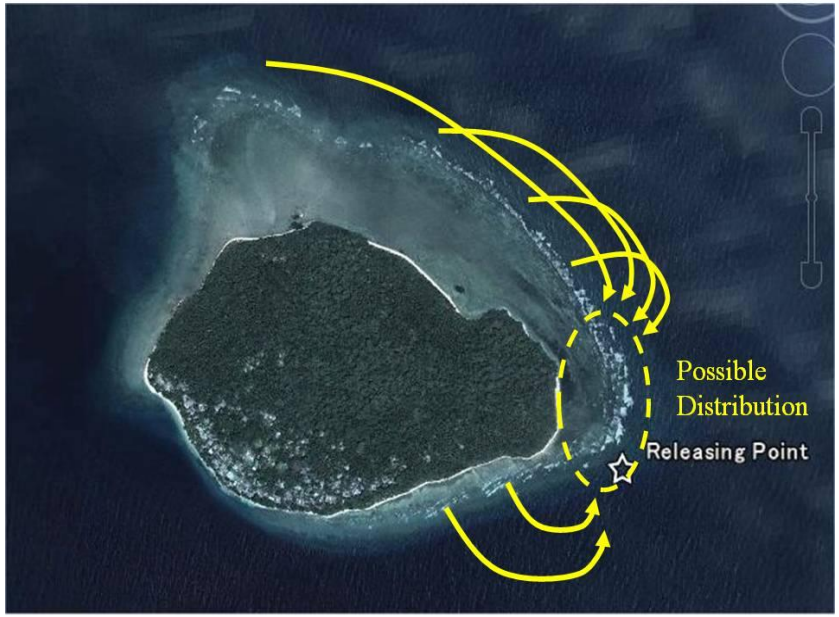
Future Directions 2

Trochus and Green Snail Spawners Accumulation Project

Lelepa Island, the North Efate

The releasing point in Lelepa Island is far from the village. Young green snails and trochus had better relocate to the MPA (Tabu Area) in front of the village.

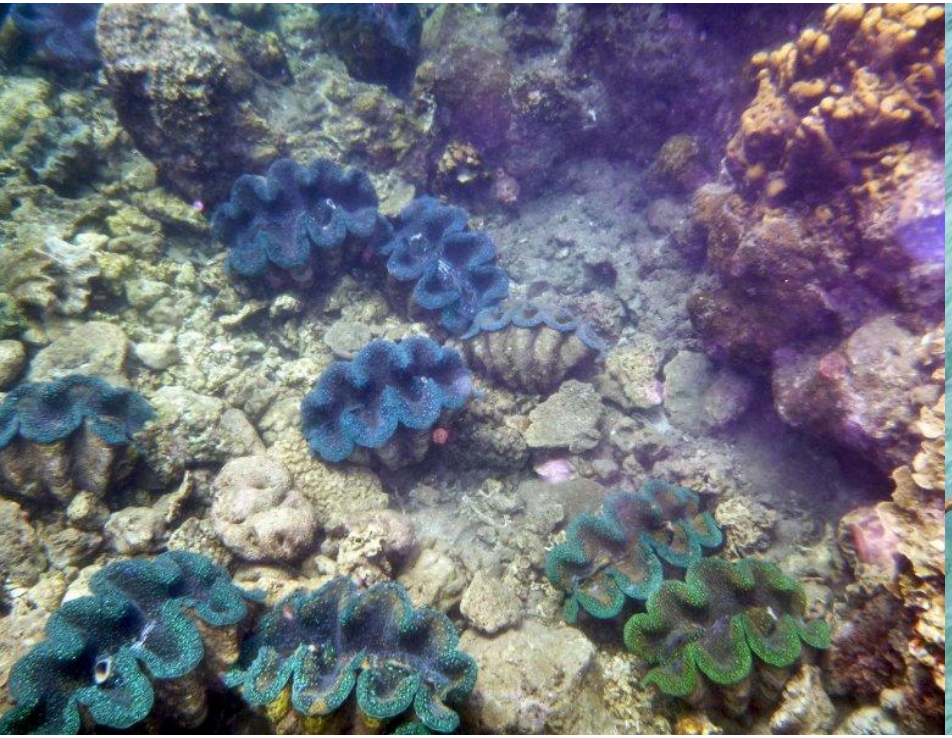
Uripiv Island, Malekula



Green snails and trochus in all sizes found at free fishing areas should be relocated in the MPA (Tabu Area) of the village.

The Project for Promotion of Grace of the Sea in Coastal Villages

Tank yu tu mas.



Results of Activities for Marine Shellfish Propagation, Version 0.1 (Full)
Released on 08th August, 2014.