

PILSG FIELDWORK

APRIL/MAY 1996

**Full Report
June 1996**

by

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REPORT OF PILSG FIELDWORK APRIL/MAY 1996

Summary

The Pacific Island Land Snail Group (PILSG) field trip to the Society Islands took place between 24th April and 9th May 1996. There were three main objectives. The first was to clear, repair, and restock the *Partula* snail reserve on Moorea. This task was successfully carried out and 320 individuals from three species were released into the reserve on 2nd May. Secondly, informative discussions were held with the Delegation a l'Environnement with regard to ongoing *Partula* research in French Polynesia, and new legislation regarding the protection of native species was made available. Finally, extant populations of *Partula* and *Samoana* were located at different elevations above 1000m on Mt. Marau in Tahiti and a few samples taken for gut flora analysis and for captive breeding.

Introduction

In 1994, a reserve for *Partula* snails was constructed on Moorea in the Society Islands. This was both a conservation effort towards the re-release of these highly important snails, presently extinct in the wild, and an experiment in niche usage for three species of *Partula*. The reserve took the form of an enclosure constructed of galvanised metal sheeting, with an electric fence barrier and chemical trough to keep out the introduced predator *Euglandina* (PILSG 1994/5). Local monitors had been organised for the first 12 months to maintain the reserve and report on the number of snails visible from the enclosure perimeter on a weekly basis. One of the objectives of the PILSG expedition to French Polynesia in 1995 (PILSG 1994/5 Exped. Report 1996) had been a detailed survey of the *Partula* reserve, to report on the progress of the captive bred snails used to stock the reserve the previous year. Unfortunately, during the second half of the experiment the monitoring had not been carried out effectively and shorts in the circuitry had not been repaired, allowing *Euglandina* to encroach with impunity. However, evidence from *Partula* snail shells collected from the reserve in 1995 suggested that the snails were surviving and reproducing in the reserve.

It was therefore decided that the experiment would be continued, with the reserve re-stocked as soon as possible. At the end of the 1995 field mission the reserve was serviced and cleared of predators and the electric fence circuitry simplified and replaced with stainless steel wire and staples. However, there was a delay in restocking due to the time necessary to organise the livestock and to obtain permission to import more snails and arrange their transportation. During this time, the reserve structure suffered some exceptional storm damage which required more serious attention, and created a need to further check for predator snails. The reserve was repaired by staff at the Gump station in early 1996, giving the opportunity to continue the experiment.

The primary aim of the 1996 trip was to restock the reserve with live captive-bred *Partula* snails, after confirming the integrity of the defences and ensuring as much as possible that it had been cleared of *Euglandina*. Plans for the 1996 trip were made following consultation primarily with Professor James Murray of Virginia University, Bryan Clarke of Nottingham University, Dr Georgina Mace of the Institute of Zoology and the Government offices in French Polynesia.

Partula release stock

It was decided that in 1996 a total of 80 specimens of each of the three *Partula* species would be released, given the relatively low numbers of *P. taeniata elongata* in the captive programme, to minimise the threat to the captive population. The proportion of snails released was important for the experimental side of the trial. For contingency the aim was to take to Polynesia 100 specimens of each taxa. Some snails died in transit from Detroit Zoo which resulted in an unexpected drop in the number available for transportation to French Polynesia, but full marking of the snails was delayed until just before the release to allow any necessary adjustments to the stock.

A total of 100 *Partula tohiviana*, 95 *P. suturalis vexillum* (dextral) and 87 *P. taeniata elongata/simulans* were transported from the UK. These snails had been amalgamated into groups of each taxa at the Zoological Society of London together with stock from Bristol Zoo, Chester Zoo, Detroit Zoo (USA), Edinburgh Zoo, Nottingham University, the Endangered Species Breeding Unit (Pat Wisniewski) and London Zoo. Although the Detroit snails were originally labelled as *P. taeniata elongata*, Professor Bryan Clarke believed that they were morphologically more like *P. t. simulans*, but they were still considered suitable for release.

As soon as possible after arrival in Polynesia, the snails were taken to Moorea for establishing in the cool room at the Gump Research Station in Cook's Bay. They were removed from their travelling boxes and settled into the glass type 'B' tanks, two of which were at the station and one of which was brought over from England. The snails had been transported wrapped in tissue, with full import documentation from the Tahitian authorities, USDA customs clearance and with permission for carriage from the airlines.

All snails appeared to survive the journey. Snails were maintained under normal tank protocol while in the research station. One modification was to stand the tanks on a moat of water to prevent the entry of ants, which were a problem throughout the building. Several births occurred before the release - one *P. tohiviana* and one *P. taeniata* were actually born in transit.

Reserve preparation

The first week was spent working directly on the *Partula* enclosure. Workers at the Gump Station had been able to clear the reserve of leaf litter and some predators two days previously. As the original plan was to spend 7 days preparing the reserve for release of snails, this enabled the release date to be brought forward by 2 days.

Although most of the leaf litter had been removed it was still necessary to have a clearance of the remaining leaf litter as well as a thorough and detailed search to look for any live *Euglandina* snails or egg batches. This involved a meticulous search by hand through the ground area of the reserve quadrat by quadrat. In particular, the bases of *Angiopteris* ferns were searched with the aid of a torch, because of *Euglandina*'s propensity to deposit egg batches at the base of this plant. Where possible, great care was taken to avoid damaging any ground level plants within the reserve, in particular stems of Climbing pandanus *Freycinetia* sp., local name Ie-ie. In addition, continued searching below the leaves of plants for any live snails was carried out for any that may have survived from last year - three *Partula* were still alive at the end of the expedition last August.

Clearance of the reserve yielded a number of *Partula* shells as well as live *Euglandina* snails and eggs (Table 1).

During clearing a concious effort was made to look under the leaf surfaces for any surviving snails. This led to the unexpected discovery of a live juvenile Partulid snail, believed to be *Samoana attenuata*, actually inside the reserve. The snail, which was found on the underside of a large *Angiopteris* frond, approximately 1.5 metres from the ground in quadrat 2. The snail was collected, measured and photographed - it was a juvenile, measuring 8mm long and 5mm wide with a 4mm width operculum. The shell was very thin and delicate, with a heavily spotted mantle showing through, and the snail had proportionally long tentacles and a very sticky foot.

Although some juvenile *P. taeniata* can be spotty, the evidence suggests that this snail was a *Samoana*, and it compared favourably with the *Samoana* (believed *attenuata*) collected later from Mt. Marau in Tahiti. Another snail thought to be *Samoana* had previously been collected last year but did not survive at the Gump station, and the shell was sent to Virginia University, but cannot be positively identified. A few very thin shelled remains of Partulids were also found amongst the leaf litter in the reserve. After discussion, the living snail was returned to the reserve when the new snails were released, in the hope that others are present. Although *Samoana* were like *Partula* thought to be extinct on Moorea, this snail appears to indicate a breeding population, however no further snails could be found in the area despite searches in nearby areas.

TABLE 1

Quadrat findings

Data collected from clearing Moorean reserve 1996

Quadrat 1		Partula Shells						Euglandina				Miconia plants	
Date	taeniata		suturalis		tohiveana		unknown		Snails		Egg batches		
	marked	unmarked	marked	unmarked	marked	unmarked	marked	unmarked	Alive	Dead	Alive		Dead
27/4/96	0	8	2	1	1	0	2	4	11	1	3	2	
1/5/96	0	1	1	0	0	0	0	0	2	0	0	2	
Total Q1	0	9	3	1	1	0	2	4	13	1	3	4	

comments: Many presumed Euglandina-eaten Endodontid shells found.

Quadrat 2		Partula Shells						Euglandina				Miconia plants	
Date	taeniata		suturalis		tohiveana		unknown		Snails		Egg batches		
	marked	unmarked	marked	unmarked	marked	unmarked	marked	unmarked	Alive	Dead	Alive		Dead
27/4/96	2	2	0	0	0	0	0	3	12	1	1	2	
1/5/96	0	0	0	1	0	0	0	0	0	0	0	4	
Total Q2	2	2	0	1	0	0	0	3	12	1	1	6	

comments: 1 live Samoana attenuata (?) found 27/4/96. Lots of live Discoidals present.

Quadrat 3		Partula Shells						Euglandina				Miconia plants	
Date	taeniata		suturalis		tohiveana		unknown		Snails		Egg batches		
	marked	unmarked	marked	unmarked	marked	unmarked	marked	unmarked	Alive	Dead	Alive		Dead
28/4/96	0	3	1	0	2	0	1	4	2	0	6	3	
1/5/96	0	0	0	0	0	0	0	1	4	0	0	1	
Total Q3	0	3	1	0	2	0	1	5	6	0	6	4	

comments: Last live Euglandina discovered was a hatchling.

Quadrat 4		Partula Shells						Euglandina				Miconia plants	
Date	taeniata		suturalis		tohiveana		unknown		Snails		Egg batches		
	marked	unmarked	marked	unmarked	marked	unmarked	marked	unmarked	Alive	Dead	Alive		Dead
28/4/96	0	1	1	0	1	1	0	4	6	0	0	17	
1/5/96	0	1	0	0	0	1	0	0	1	0	0	13	
Total Q4	0	2	1	0	1	2	0	4	7	0	0	30	

comments: Unmarked P. tohiveana were juveniles. 3 Euglandina shells had rat damage.

All Quadrats		Partula Shells						Euglandina				Miconia plants	
Date	taeniata		suturalis		tohiveana		unknown		Snails		Egg batches		
	marked	unmarked	marked	unmarked	marked	unmarked	marked	unmarked	Alive	Dead	Alive		Dead
Initial Search	2	14	4	1	4	1	3	15	31	2	10	24	
Final Search	0	2	1	1	0	1	0	1	7	0	0	20	
TOTALS	2	16	5	2	4	2	3	16	38	2	10	44	

Notes:

All unknown Partula were either broken shells or juveniles not attributable to species.
Most Miconia plants were very small seedlings.

Habitat structure

There was concern that in creating the reserve the habitat structure had been adversely affected, in particular by opening up the tree canopy. This could cause changes in micro-habitat for the snails and possibly damage plants favoured by Partulids such as *Freycinetia* and *Angiopteris*, which prefer shaded conditions. There were patches where good regeneration had occurred, but there were also some new herbaceous plants growing in areas where the canopy was more open and tree falls had affected previously covered areas. Generally however, the condition of the reserve was good, every quadrat having at least one dense stand of *Freycinetia*, but two areas were of particular concern.

A mature Purau tree, *Hibiscus tiliaceus*, had fallen across the top left of the reserve at the edge of quadrat 3. This tree was originally wired as part of the edge of the barrier, but had been isolated from the electric fence in simplifying the wiring in 1995. In falling to an angle of about 40 degrees it had taken out some of the surrounding foliage, but appeared to be stable as it was supported by its branches and was still alive. However, heavy rain on the night of 4th May led to further collapse of the tree, stopping short of crushing the barrier with the trunk but bending part of the salt trough with side branches (not causing serious damage). Initial removal of overhanging branches was by machete, but the main part of the tree was eventually skilfully removed with a chainsaw by Tony, a maintenance employee at the Gump Station, without significant damage to the reserve structure. This has left some further gaps in the canopy at the east side of the enclosure, but it is hoped regeneration will occur quickly. It has also left a small gap in the overhang in this part of the barrier, which was to be fixed after our departure (due to lack of time). This does not affect the defences of the reserve against *Euglandina*, other than exposing a small part of the salt barrier.

Between quadrats 1 and 2 a smaller tree had fallen onto the inner barrier, deforming it slightly. Although this tree was left in place in 1995 to aid shading, it was forming a direct bridge between the two quadrats and had been removed during maintenance work before the present field mission. This had left an open area of approximately 3 square metres in the bottom right of quadrat 1. After discussion, it was decided to plant some young trees in this area to provide shade for the *Freycinetia* and encourage regeneration. Although indigenous trees would have been preferable, Jean-Yves Meyer suggested possibly planting some non-native trees at first, as these would grow fastest and replace the canopy, and could be removed if desired later. In the end two suitable native trees were transplanted into this area, from nearby the reserve. These were 2-2.5 metre Mara trees, *Neonauclea forsteri* (Rubiaceae). Additionally a 2 metre cut stem of Purau *Hibiscus tiliaceus* was planted and a small introduced African Tulip tree *Spathodea campanulata*.

The general condition of each quadrat is as follows -

Quadrat 1 (bottom left/north-east): A few mature trees and good *Freycinetia* stand towards top left, but exposed area in bottom right with newly transplanted specimens.

Quadrat 2 (bottom right/north-west): Quite open where arching branches of Purau were cut back in 1995, but young Puraus growing and good stands of low *Freycinetia*.

Quadrat 3 (top left/south-east): Well forested, large mature Mara tree, reasonable *Angiopteris* and *Freycinetia* but had fallen Purau in top left corner which affected canopy.

Quadrat 4 (top right/south-west): Very thick *Freycinetia* at waist height, several young Puraus and very good *Angiopteris* ferns which are adding shade to the lower foliage. This quadrat caused the most concern when the reserve was first constructed but appears to be recovering well.

A large number of *Miconia calvescens* seedlings were removed from the reserve (see Table 1). Although not as yet a direct threat to this patch of forest, this invasive plant should be removed when seen and the reserve provides interesting results on seed spread (there are no mature trees adjacent to the reserve, although plants are now tragically common throughout the forest). All visible plants were removed from the enclosure in August 1995, yet 44 seedlings were removed during this years clearing. A detailed inventory of the plant species both in and around the reserve was compiled (Appendix 1).

Barrier

The only serious damage to the barrier of the reserve was where the fallen tree had deformed the metal corrugation slightly. Rust had developed in small breaks in the galvanising which were treated with rust killer and holes repaired using mastic (silicon glue). Interestingly this was the only portion of the corrugated steel where there was a single layer of metal - elsewhere rust was developing on the outer side, particularly adjacent to the salt trough, but there was no corrosion visible on the inner sheet, proving the value of the double skin. The only other places showing some corrosion were where holes had been made for clips attaching the trough. There were three places where heavy rain had displaced soil from the bottom edge of the corrugated sheeting, and these were filled and in some positions reinforced with rocks or netting.

The electric fence was in good condition, having been simplified and replaced with stainless steel the previous year. However testing along the length of the reserve with a voltmeter revealed small areas where a deposit on the wire was lessening the experienced voltage on one wire of the double line. This was visible only as a slightly "dirty" discolouration of the wire, particularly at the bottom left corner (quadrat 1). Coarse brushing of the wire restored effectiveness of the electrics, but this needs to be inspected regularly. The voltmeter was left at the Gump station to be used as a dedicated unit for the snail reserve. The cloth material in the salt bath was replaced as necessary and fresh sodium chloride added. To replenish all the salt in the trough took 11 kilos of sodium chloride, purchased from the local supermarket.

Some other minor repairs were made to the reserve but basically the structure is still sound and a testament to the original design and construction.

Marking

Marking of adult snails ready for release entailed the drilling of small holes in their shells using a model drill with a 0.8mm dentists drill bit. A marking protocol had been designed such that individuals could be identified with respect to collection origin (which related to Valley population) and release quadrat (see Figure 1). The marks for collection were made in the Invertebrate Conservation Centre at London Zoo a week before the expedition, so that the snail groups could be amalgamated by taxa. The required number of snails for each taxa were derived from three separate collections. A single hole was made in one of two positions, towards or away from the shell spire just in from the lip of the shell, with one group being left unmarked - this allowed identification of the three groups and reduced the number of holes necessary (the collection with the largest number of snails for each taxa was left unmarked so it was only necessary to mark 120 snails out of the potential 300). Practice in marking the snails in the UK for the location within the reserve helped refine techniques for use in Polynesia. A single hole in one of four positions close to the lip of the shell denoted the quadrat into which the snail would be released. This process was carried out in the Gump research station two days before release so that modifications could be made to the numbers in the event of any deaths. This took one day to complete and involved the marking of at least 320 snails, 80 per quadrat. The protocol meant that all snails carried at least one mark so that they could be distinguished from any wild-bred adults that may mature in the reserve.

Difficulties had been experienced in 1994 when drilling the marks in the snail shells. For the present release, a mini electric drill, as used in modelmaking, was purchased together with an adjustable transformer and proved very valuable, particularly when used on a clamp stand. Ordinary drill bits blunted very quickly however, and steel dentist drills were the most effective, especially when brand new. Despite initial concerns, only three fresh dentists drills were necessary in Moorea to mark all the location marks in the three species. Tungsten dental drill bits were not useful, and were possibly not sharp enough to cut into the snail shells. When marking, the soft body was kept out of reach of the drill bit using a tissue wedge, but during the first stages two snails were mortally wounded. Care also had to be taken to avoid excessive heat build up on the shell of the snails. With the thicker shelled species such as *P. tohiveana*, rest periods were sometimes necessary when drilling single holes.

To efficiently mark the snails three people were necessary: one to sort the snails, another to drill the shells, and a third to take careful notes. Extra light from a powerful torch also aided accurate positioning and withdrawal of the bit. Despite all care being taken some snail shells were broken during marking. Several *P. tohiveana*, particularly from Nottingham stock, split along the growth line where the hole was made. Most of the Detroit *P. taeniata* were very thin shelled, and two snails were crushed just when supported in the hand. The total loss during marking in Moorea was 2 snails euthanased and 3 others seriously damaged. Low numbers of suitable *P. taeniata* meant that the last few snails were marked on the morning of the release, but just enough were available for the full 80 of each species to be released (Table 2).

Figure 1

Marks for collection and release quadrat location for Moorean reserve 1996

Positions are approximate

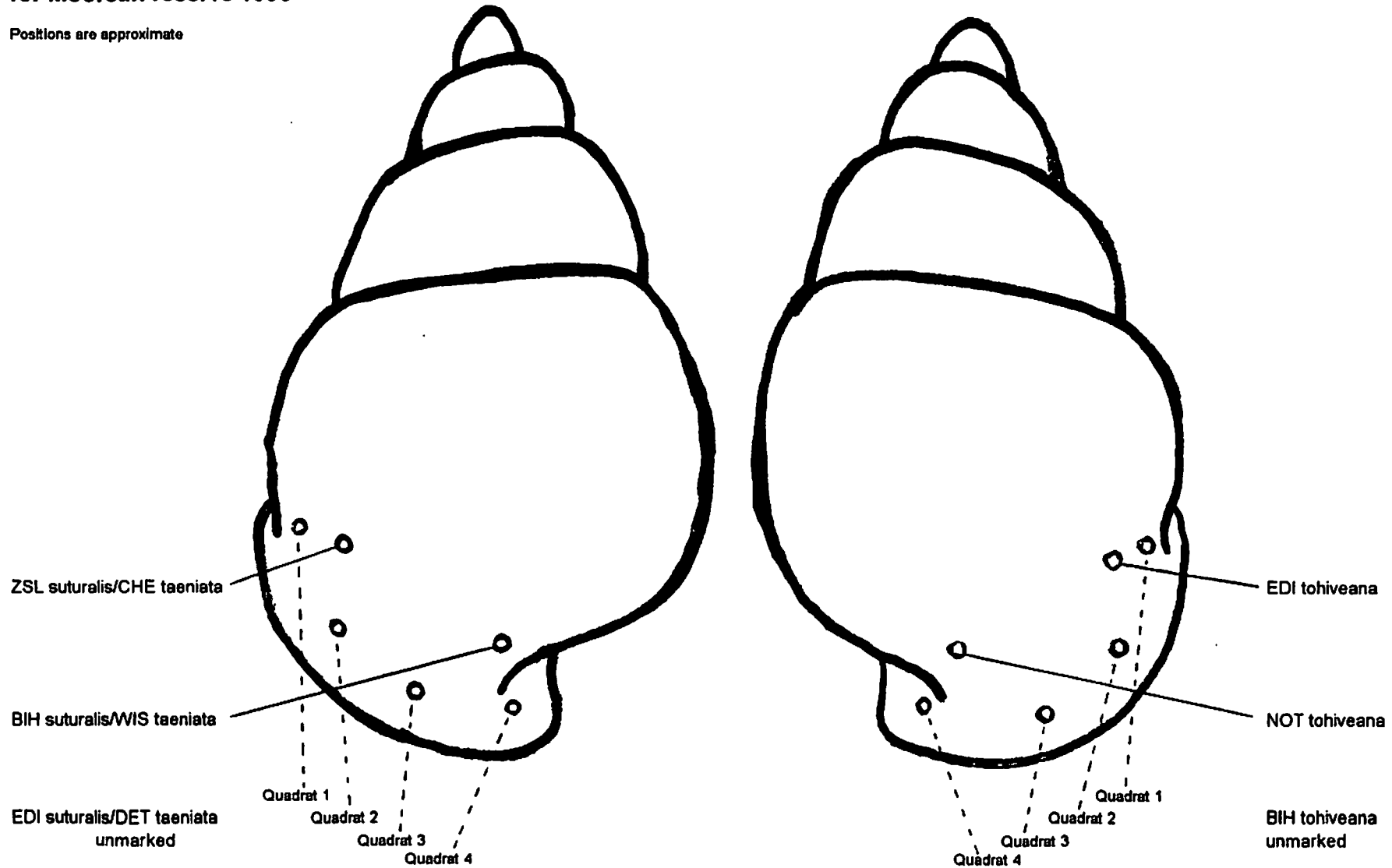


TABLE 2

Markings 96

Partula snails marked for release into Moorean reserve 1996

TO	Collection							Total
	BIH	CHE	DET	EDI	NOT	WIS	ZSL	
Q1	8			5	7			20
Q3	36			11	19			66
								86

TE*								
Q1		4	11				5	20
Q2		7	35				18	60
								80

VD								
Q1	8			8			4	20
Q2	9			47			6	62
								82

Note: 80 snails of each species were actually released into the reserve - the remainder plus surplus unmarked snails were given to the Tahiti museum.

Collections:

BIH = Bristol Zoo, CHE = Chester Zoo, DET = Detroit Zoo, EDI = Edinburgh Zoo, NOT = Nottingham University, WIS = ESBU, Martin Mere, ZSL = London Zoo.

Notes on taxa:

Partula taeniata elongata (TE)

All of plot TEFAR82004 (Fareato valley)*

*(however P. taeniata from Detroit may in fact have been P. simulans).

Partula tohiveana (TO)

All of plot TOFAR82741(Fareato valley)

Partula suturalis vexillum (VD)

All dextral snails - BIH and EDI stock VDHAA86000 (Haapiti valley)

ZSL stock, originally at Jersey Zoo, VDFAR82002 (Fareato valley)

When sorting the release snails, a possible ambiguity in identifying some of the *P. suturalis* snails was discovered due to the proximity of the marks for collection and location. However, this was only with the ZSL Fareato valley snails, which were morphologically distinct from the Haapiti valley snails and it should be possible to distinguish them.

Pre-release

After marking, the clearance and search were repeated for a final time before the release of the live snails. This last clear was made from left to right, in contrast to the initial clearing up or down the reserve, to minimise overlooking any part of the ground. By this time some leaf litter had started to reappear naturally in the reserve, and this was checked but left in and some fresh checked leaf litter added. A further check of the integrity of the reserve barrier was also made.

Release

The release date was 2nd of May and the quadrats were stocked in the same manner as 1994. Importantly Jean-Yves Meyer was present at the release of *Partula* into the reserve as representative of the Delegation de l'Environnement. A total of 80 snails of each of the three species, *Partula taeniata*, *Partula suturalis* and *Partula tohiviana* were put into the enclosure as planned. The release was unhurried to allow time to sort the correctly marked snails into each quadrat. Twenty of each species were released into quadrat 1 first, as this was the most complicated. The snails were concentrated into the most central good stand of Partulid plants in each quadrat. Active snails were carefully placed onto the leaves and where necessary inactive snails were securely placed in leaf axils of *Freycinetia*.

Monitoring

The original person it was hoped would be able to look after the reserve, John McGinnis (who had performed the role of monitor for the first 6 months in 1994/5), was eventually unable to commit to the full monitoring. However, Tony, a local person associated with the American research station who is competent, very keen on the reserve, and lives nearby. Tony aided expedition members in maintaining the reserve and was also present when it was constructed in 1994. We are awaiting imminent confirmation from the Gump station that he will be carrying out the full 1 year maintenance and monitoring of the reserve. We do have a commitment from the research station that the reserve will be maintained satisfactorily. Initial monitoring of the snails in the reserve was undertaken whilst in Moorea (Table 3).

As less animals of each species were released than in 1994, it will be expected that proportionally fewer animals will be visible from the sides of the reserve. Density of the foliage does make it very difficult to see the snails, especially as when first placed in the reserve they were put into the central thicker *Freycinetia* stands. *P. tohiviana* were easiest to see due to their large size, particularly the white-shelled form. *P. taeniata* were very difficult, particularly the Detroit snails which were small and of a middle grey colour form.

TABLE 3

Snail monitoring

Initial monitoring records from Partula reserve 1996.

Date	Temp/Humid. centigrade / %	Weather	Q1 XX	Q2 TE	Q3 TO	Q4 VD	Total
03-May-96	23.6 / 84 (am)	overcast Max/min 21.7-29.2, probe 21.2-27.2	7	0	10	8	25
Comments: Quadrat 1snails - 2 TO, 4 VD, 1 TE All very active. All on Freycinetia except one TO on unid. tree. One VD seen eating decaying fern leaf in Q4.							

Date	Temp/Humid. centigrade / %	Weather	Q1 XX	Q2 TE	Q3 TO	Q4 VD	Total
04-May-96	24.7 / 71 (am)	overcast, some filtered sun Max/min 20.5-28.1, probe 19.2-26.4	4	0	7	5	16
Comments: Quadrat 1snails - 1 TO, 2 VD, 1 TE All on Freycinetia except one (VD) on Angiopteris. 1 dead VD removed from Q4 2 live TE seen in Q2 when carefully checking temperature probe.							

Date	Temp/Humid. centigrade / %	Weather	Q1 XX	Q2 TE	Q3 TO	Q4 VD	Total
07-May-96	-	sunny, some cloud No temp/hum. readings taken.	6	1	5	4	16
Comments: Quadrat 1snails - 5 TO, 1 VD All on Freycinetia except 1 VD on Angiopteris in Q1, TE on Angiopteris Q2, 1 TO on Angiopt. in Q3, & 2 VD on Angiopt. and small fern in Q4.							

Date	Temp/Humid. centigrade / %	Weather	Q1 XX	Q2 TE	Q3 TO	Q4 VD	Total
08-May-96	25 / 74 (am)	sun to overcast Max/min 21.9-29.2, probe 21.3-28.4	5	0	4	6	15
Comments: Quadrat 1snails - 3 TO, 1 VD, 1 TE All on Freycinetia except 4 TO on Angiopteris in Q3 and 1 VD on small tree in Q4. 2 dead TO removed from edge of Q3 on ground (one moved previously to leaf axil).							

Notes:

XX = mixed taxa, TE = *Partula taeniata elongata*,TO = *Partula tohiveana*, VD = *Partula suturalis vexillum* (dextral)

Max/min temperatures are ambient, and probe in Climbing pandanus leaf axil.

Some temperature data were collected from the reserve site. It was the beginning of the dry season in Moorea during the expedition, in contrast to 1994 when the snails were released at the beginning of the wet season. Most days were without rain, but there were some heavy downpours during the two weeks. An accurate electronic thermo/hygrometer was used but found to be giving inaccurate readings on temperature. A smaller max/min thermometer unit was more reliable. This was placed at the centre of the reserve, with the main unit at the side of the barrier and a wired probe placed in a leaf axil of *Freycinetia* 0.7 metres from the ground (approximately where snails might be found) in quadrat 4. The unit was in a position where readings could be taken without disturbing foliage or snails, and removed at the end of the expedition.

A few dead snails were removed from the side of the reserve. Our intention was not to interfere with the snails after release but where obvious deaths were seen the shells were collected. One *P. suturalis* was found on the ground at the top of quadrat 4 on 4th May. Two *P. tohiveana* were removed dead from quadrat 3 on 8th May. These could be linked to the fall of the tree in the top of this quadrat on 4-5 June, as two snails were seen on the ground the next day, very close to where the branches had hit the reserve side.

Survey on Moorea

The area above the Belvedere, a short distance from the reserve, was searched for signs of extant *Samoana* populations. Old *Partula* shells were found, and in 1 square metre there were 5 dead *Euglandina* and 1 *Partula* shell.

A one day climb was undertaken to look at another high altitude area for signs of *Samoana* presence. The route via Haumi up to the south side of Mt Tohivea was taken, and forest up to 800 metres was searched. No live Partulids were seen but some shells were collected, many in surprisingly good condition with some periostrocum remaining - banding on some of the *P. suturalis* was still visible. This could be evidence that the snail shells can persist for over 10 years in the leaf litter. However, there may have been some snails surviving beyond the time that extinction was presumed to have occurred.

A repeat visit was also made to the garden of Mari-Mari Kellam, where a live *P. taeniata* had been found in 1995. No evidence of live *Partula* were found, and Mari-Mari confirmed that she had not seen any for a very long time.

Collection and survey on Tahiti

Acting on the results of the PILSG survey of 1995, and with additional information from Jean-Yves Meyer, good populations of snails were located on Mt. Marau in Tahiti, using a vehicle belonging to the Delegation a l'Environnement. Along the side of the road, at 1050m there were populations of *Samoana* (believed to be *S. attenuata*) on *Coprosma tahitensis* (Fam. Rubiaceae), an endemic tree of Tahiti, *Glochidion tahitensis* (Fam. Euphorbiaceae), an endemic of Tahiti, and *Weihmannia parviflora* (Fam. Cunoniaceae), an endemic of the Society Islands. With permission, 11 *Samoana* were taken for breeding, thus doubling the captive population.

At 1300m, where in 1994 and 1995 a thriving population of *P. otaheitana* had been found, snails were again found in reasonable numbers, largely on the leaves of *Asplenium* and *Marattia salicina* ferns and banana, though this time no *Euglandina* were present. Eleven *P. otaheitana* snails were collected for gut flora analysis.

Both species of snails were again seen on endemic plant species close to the road at 1000m. However, a short way down the road at 900m, the first *Euglandina* shell was seen, as well as the dead shell of a Partulid, probably *Samoana*. In addition, the vegetation had changed at this point, and so it seems likely to be the lower limit of Partulid populations.

Meetings with Tahitian officials

It was hoped that if possible expedition members could liaise with government officials on Tahiti who had already expressed an interest in forming an agreement with the PILSG with regard to our continuing research on Polynesian tree snails in the territory. Productive meetings were held with Terii Vallaux, the new chief of the Delegation of the Environment and Jean-Yves Meyer, plant ecologist with the Ministry of the Environment. Jean-Yves is now our official government representative in French Polynesia.

The current activities of the PILSG were outlined to the representatives of the Delegation, in particular the status and reestablishment of the reserve. It was understood that the results from a full year's monitoring of the Moorean reserve were required before a further reserve on Tahiti could be considered. The new legislation regarding native species, in particular those species that are endangered, was made available to us. This is the first time that a wide-ranging policy for the protection of Polynesian wildlife has been produced in French Polynesia. Though still to be ratified by government, this will include in the list of endangered species all the Partulids of the islands, as well as information on protected areas. They are very interested in liaising with the PILSG on species identification and distribution.

In addition, discussions were held about the joint production of educational material about *Partula* and the control of *Euglandina* and *Achatina*. We were shown examples of material prepared for the protection of marine turtles, which provided a good example of what could be done for Partulids. Permission was given at that time for the collection of a few live animals from Tahiti for gut analysis work and breeding.

The spare snails from the release stock, approximately 30 adults and associated newborns representing all three species, were taken to the Musée de Tahiti et des Îles in Punaauia, Tahiti, where they plan to create a live exhibit. These are the first live snails in a Polynesian (or indeed French) institution. The husbandry of the snails will be the responsibility of Manouche Lehartel, the Director of the Museum.

Additional information

On 30th April a talk about the work of the PILSG and the *Partula* reserve was given at the Gump Station to a group of visiting students from the University on Tahiti.

During visits to the central market in Papeete, Tahiti, it was found that lei (shell necklaces) made with *P. varia* shells were still available.

Conclusion

The recent field trip to Polynesia was successful in meeting its objectives and the reserve is now fully operational. Thanks to the earlier clearing of leaf litter by staff at the Gump research station, PILSG team members were able to carry out a thorough check of the area for *Euglandina*, and are reasonably confident of having removed all live predators from the now secure enclosure. The continued existence of remnant populations of Partulids on Mt. Marau has been confirmed.

Further liaison with the Delegation a l'Environnement, together with new endangered species legislation, heralds a new era of cooperation between the PILSG and local government towards the protection of native Polynesian snails.

Appendix I

Flora of the Partula reserve on Moorea 1996 PILSG Field Report

Compiled by Jean-Yves Meyer,
Plant Ecologist
Delegation a l'Environnement
French Polynesia.

RELEVÉ BOTANIQUE de la "Réserve à Partula" (20 m x 20 m)
MOOREA, Domaine d'Opunohu, en contrebas de la route du
Belvédère, à environ 180 m

Série de végétation :
forêt humide de moyenne altitude à *Neonauclea forsteri*-
Angiopteris evecta

STRATE ARBORESCENTE

Int

Neonauclea forsteri (RUBIACEAE)
Hibiscus tiliaceus (MALVACEAE)
Morinda citrifolia (RUBIACEAE)
Cananga odorata (ANNONACEAE)
Spathodea campanulata (BIGNONIACEAE)

Ext

Inocarpus fagifer (LEGUMINOSAE)
Psidium guajava (MYRTACEAE)
Ficus prolixa (MORACEAE)
Arbre indéterminé (RUBIACEAE)

STRATE ARBUSTIVE ET LIANESCENTE

Int

Angiopteris evecta (MARATTIACEAE)
Freycinetia impavida (PANDANACEAE)
Coffea arabica (RUBIACEAE)
Syzygium malaccense (MYRTACEAE)
Cyclophyllum barbatum (RUBIACEAE)
Neonauclea forsteri (RUBIACEAE) plantés !

Ext

Meryta lanceolata (ARALIACEAE), endémique rare
Miconia calvescens (MELASTOMATACEAE)
Piper methysticum (PIPERACEAE)

STRATE HERBACEE ET EPIPHYTIQUE

Int

Zingiber zerumbet (ZINGIBERACEAE)
Oplismenus hirtellus (GRAMINAE)
Geophila repens (RUBIACEAE)
Bolbitis sp. (ASPLENIACEAE)
Davallia solida (DAVALLIACEAE)
Davallia epiphyllum (DAVALLIACEAE)
Diplazium arachnoides (ASPLENIACEAE)
Pityrogramma calomelanos (ADIANTACEAE)
Rubus rosifolius (ROSACEAE)
Merremia peltata (CONVOLVULACEAE)
Ageratum conizoides (COMPOSITAE)
Neonauclea forsteri (plantules)
Spathodea campanulata (plantules)
URTICACEAE ind.

THELYPTERIDACEAE ind.

Ext

Asplenium nidus (ASPLENIACEAE)
Procris pedunculata (URTICACEAE)
Elaphoglossum sp. (ASPLENIACEAE)

**Collections holding Partulid snails
and contributing funds to the Moorean reserve monitoring**

University of Virginia, USA
Jersey Wildlife Preservation Trust, UK
Royal Zoological Society of Scotland, UK
North of England Zoological Society, Chester, UK
Zoological Society of London, UK
Bristol, Clifton and West of England Zoological Society, UK
Conchological Society of Great Britain, UK
Endangered Species Breeding Unit, c/o Martin Mere Wildfowl Trust, UK
Poznan Zoo, Poland
John G. Shedd Aquarium, USA
Detroit Zoo, USA
Henry Doorly Zoo, USA
Birmingham Zoo, USA
St Louis Zoo, USA
Memphis Zoo, USA
Folsom Children's Zoo, USA

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Further information

- PILSG Action Plan for the Family Partulidae, 1994
- PILSG 1995 Expedition to French Polynesia, Report
[both available from Invertebrate Conservation Centre, ZSL]