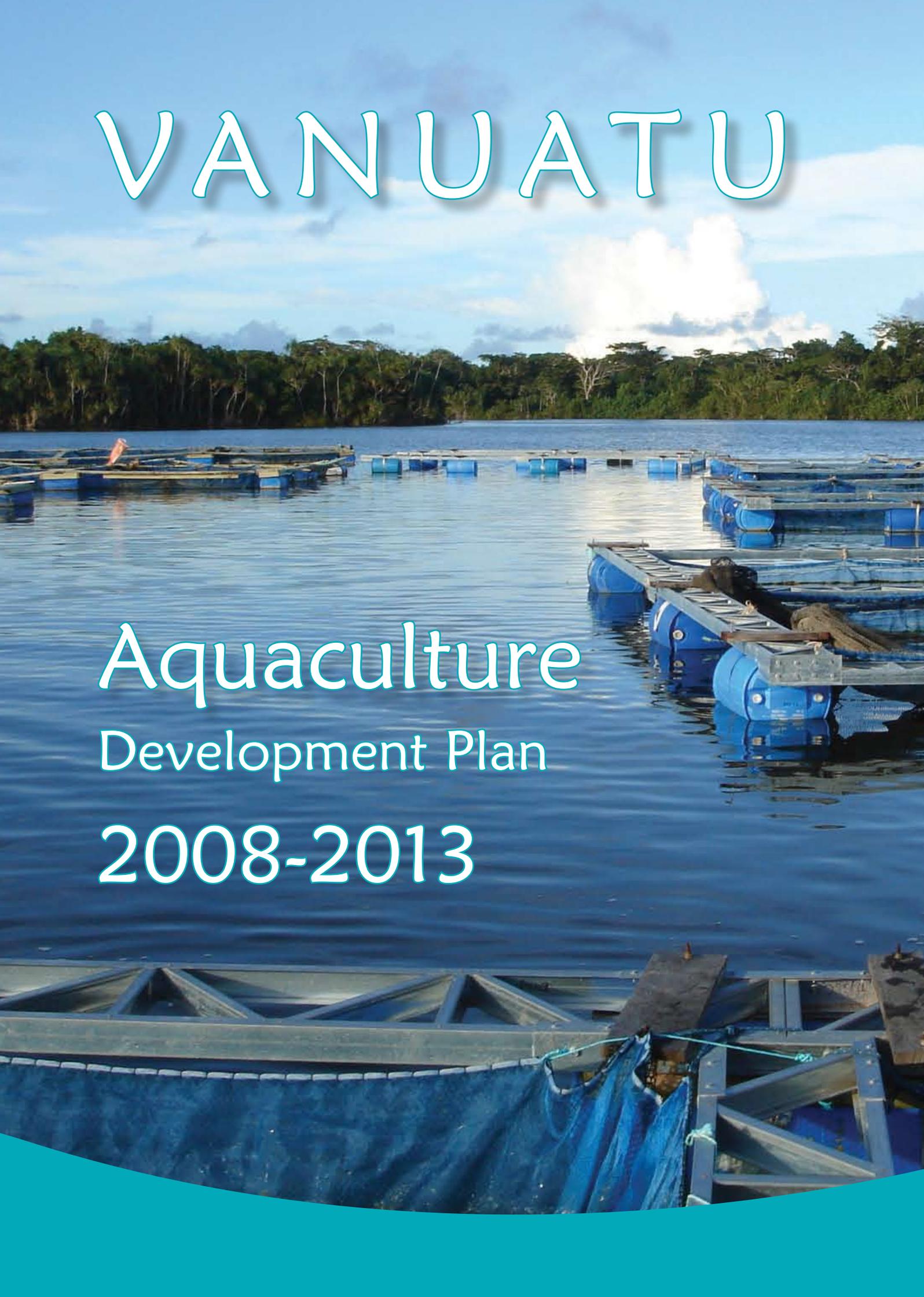


VANUATU



Aquaculture Development Plan 2008-2013



VANUATU

Aquaculture

Development Plan

2008-2013

produced by the Vanuatu Department of Fisheries

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ACRONYMS & ABBREVIATIONS

ACIAR	Australian Centre for International Agricultural Research
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization (United Nations)
FSPI	Foundation of the Peoples of the South Pacific International
GIFT	Genetically Improved Farmed Tilapia
JICA	Japan International Cooperation Agency
MAQFF	Ministry of Agriculture, Quarantine, Forestry and Fisheries
NGO	non-governmental organisation
OIE	World Organisation for Animal Health (Office International des Epizooties)
PL	post-larvae
REDI	Rural Economic Development Initiative
SPC	Secretariat of the Pacific Community
USD	US dollar
USP	University of the South Pacific
VEU	Vanuatu Environment Unit
VFD	Vanuatu Fisheries Department
VT	vatu

FOREWORD

In Vanuatu, the national economy has been highly dependent on agriculture for decades. In more recent years, tourism has developed at a fast pace and has contributed substantially to Vanuatu's gross domestic product. Nevertheless, agriculture, forestry and fisheries continue to feature highly among the country's 80% rural-based population for household staple food and income. The government intends to facilitate more resources towards aquaculture development. This will help supplement current fisheries production and at the same time relieve pressure on natural fisheries resources. The ultimate aim is to optimise fisheries sector production to alleviate food security situations and impact positively on the country's balance of trade.

The development of the fisheries sector is relatively recent, and the sector is considered underutilised. It consists of deepwater, coastal and reef sub-sectors. Aquaculture, mainly targeting Tilapia, marine shrimps, *Macrobrachium lar* and trochus, is starting to attract the interest of the government, the private sector and communities alike. The main emphasis of aquaculture up to now has been to research its feasibility, including the suitability and economics for each commodity. The Fisheries Department now has sufficient information to take Vanuatu aquaculture forward into commercialisation.

The Vanuatu Aquaculture Development Plan is a five-year strategic plan that represents a significant step in outlining the aquaculture road map for Vanuatu for the near future. It highlights the main components, including research and development, extension, infrastructure, credit and finance facilities, and environmental management. The plan is to help the government allocate scarce resources and assist investors in making concise decisions on what type of aquaculture development they should pursue. It will also assist communities to access the most appropriate resources required to set up smallholder operations.

The government recognises that for the plan to work, it requires all stakeholders to put their hands and heads together and work alongside the Fisheries Department to realise the country's potential for aquaculture.



Jeffrey Wilfred
Director General
Ministry of Agriculture, Quarantine, Forestry & Fisheries



BACKGROUND

I. General

Overall, the fisheries sector makes a relatively small contribution to Vanuatu's formal economy, contributing an estimated 1% to overall gross domestic product and 5.5% to the primary production sector. However, the domestic fishery – in particular the reef and coastal fishery – plays an important role in the rural economy by providing nutrition and income-earning opportunities to some 60% of rural households. The total production from the reef and coastal fishery is estimated to be around 2400 tonnes per year. The principal offshore fishery is tuna, with an allowable catch estimated to be around 8250 tonnes, exploited mostly by foreign longline and purse-seine vessels operating under permit in Vanuatu waters.

Perhaps the greatest natural constraints for the sector are the limited fishery resources and high population growth compared to productive sector growth over recent years. To rationalise the sector's production, aquaculture development is seen as a potential sub-sector for increasing fisheries production and ensuring that the resources of the wild fisheries are more consciously exploited so that the different fisheries sub-sectors are sustainable.

II. Aquaculture

The principal focuses for the fisheries sector are to improve the industry's efficiency so it can supply a larger proportion of the protein needs of a rapidly growing population from local fish stocks, and to sustain limited fisheries resources.

In the past, aquaculture development has mostly involved feasibility trials and an unregulated active interest in specific niches – for example, growing oysters for the tourism industry. However, in more recent years investors have taken an interest in the sub-sector and commercialisation has begun. The Teouma marine shrimp farm is the most significant commercial farm in operation; it harvested its first crop in 2005. Numerous prospecting activities are now taking place. Farming of freshwater red tilapia commenced in 2006 and it is proving to be an acceptable food fish in the local market. GIFT tilapia and freshwater prawns are also making the transition to full small-scale operation among rural communities.

One of the most extensive aquaculture activities in Vanuatu is the induced spawning, rearing and reseedling of trochus. Trochus shell was an important export commodity, along with green-snail shells and sea cucumber, prior to 1990. Trochus shell is used for furniture inlay decorations, buttons and ornamental wares. Due to high demand, it has been overexploited. The Vanuatu Fisheries Department

(VFD), with the assistance of development partners, started operating a trochus hatchery and reseedling programme in early 1990. Juvenile trochus are planted on community reefs to help replenish stock and sustain a long-term reef fishery regulated through community management systems.

More recently, aquaculture of ornamental commodities, such as giant clams and coral, has attracted the interest of local and private investors and shown significant growth.

Table 1: Aquaculture statistic in Vanuatu 2005–2007

	2005		2006		2007	
	Volume	Value (USD)	Volume	Value (USD)	Volume	Value (USD)
Cultured commodities for export						
Cultured clams (pieces)	0	0	1,310	6,550	11,883	36,767
Cultured coral (pieces)	815	4,401	1,205	6,507	6,543	35,892
Wild-caught commodities with potential for aquaculture or stock enhancement						
Aquarium fish (pieces)	211,065	606,015	137,238	83,836	175,283	99,103
Live rocks (kg)	18,715	12,358	27,180	53,145	17,464	24,240
Sea cucumber (kg)	9,000	79,200	8,000	70,400	15,400	135,810
Giant clams (pieces)	2,202	13,768	8,409	32,358	0	0
Freshwater eels (kg)	0	0	2,720	5,250	n/a	n/a
Trochus shell (kg)	36,000	509,803	36,000	700,000	55,200	781,050
Cultured commodities for local market						
Red tilapia (kg)	0	0	0	0	12,800	34,877
GIFT Tilapia (kg)	0	0	2,000	10,000	n/a	n/a
Freshwater prawns (kg)	0	0	10	200	n/a	n/a
Marine shrimps (kg)	0	0	16,000	232,515	18,000	261,580

III. History of Vanuatu aquaculture development

1972

Mangrove oysters are introduced from Japan and the USA. Farming of the species later stops due to pests from US-imported spats that infest the oysters and eventually destroy the stock.

1980s

Mozambique tilapia (*Oreochromis mossambicus*) is introduced to control mosquito larvae. The species is introduced into lakes and other water bodies in the country by local health authorities. (It is now accepted as a food fish, mainly for inland communities.)

Propagation of imported freshwater prawns (*Machrobrachium rosenbergii*) is trialled on Efate. However, the development later stops due to land dispute problems and a lack of technical expertise. No successful production is achieved.

1985

Trochus (*Trochus niloticus*) are produced at the VFD hatchery to assess the potential of reseeding to enhance the wild fishery on the reefs. The Australian Centre for International Agricultural Research (ACIAR) has funded three phases of research concentrating mostly on seed production and community participation in stock management. The annual production from the hatchery is 20,000 seeds, which are supplied to communities for restocking purposes.

1996

VFD establishes a turtle holding facility in response to regional concern about the vulnerability of turtles. (Several juveniles have since been held to adult size and released.) The turtle programme is an educational and community awareness activity that is promoted by the Vanuatu Government through VFD and the Environment Unit (VEU) in partnership with non-governmental organisations (NGOs) such as Wan Smol Bag Theatre and the Foundation of the Peoples of the South Pacific International (FSPI).

The potential for black pearl (*Pinctada margaritifera*) culture is investigated at Peskarus in the Maskelyne Islands in a joint collaboration between VFD and a Tahitian pearl company. The study concludes that while stocks of blacklip pearl oysters are present in the area, the numbers are not sufficient to support a commercial farm. As a result, the pearl farming trials are abandoned.

2000

Cottonii seaweed (*Kappaphycus alvarezii*) farming trials begin in Vanuatu as a result of a regional effort to promote seaweed as an alternative commodity for small island developing states. VFD injects approximately VT 4 million to investigate the feasibility of seaweed farming in the country, and trials are carried out on Efate, Malekula and Santo. While favourable growth is obtained at all sites tested, communities lose interest due to a lack of revenue generated from the seaweed harvest.

2002

Giant clams (*Tridacna* spp.) are successfully produced at VFD to assess the potential for restocking and marketing. Hatchery-produced clams are sold live to aquarium operators. This comes about after restrictions on wild harvesting of giant clams for the aquarium trade are enforced in Vanuatu.

2003

Green snail (*Turbo marmoratus*) seed production in the VFD hatchery begins. The objective is to assess the potential for propagation and reseedling to enhance the wild fishery on the reefs, where stocks have been heavily depleted due to overfishing. Further trials are undertaken in 2007 through the coastal resource management project funded by the Japan International Cooperation Agency (JICA), in which green snail is identified as a priority commodity.

Ornamental coral culture of several species of hard and soft corals is initiated by two aquarium operators in Vanuatu. These initiatives and a ban on the wild coral trade encourage operators to pursue coral culture as the best way to minimise impacts of coral reefs.

2004

GIFT tilapia (*Oreochromis niloticus*) is introduced to Vanuatu from Fiji to investigate its potential for farming. The species gains popularity as an important food fish, with small-scale community farms being set up on Santo, Tanna and Efate and a semi-commercial farm on Efate (ERAPO). In November 2005, the Tanna and Santo pilot farms harvest 80 kg and 50 kg fish respectively. (To date, more than 1.5 tonnes have been harvested by ERAPO since it began operations.)

2005

VFD conducts a native freshwater prawn feasibility study in Sarete village, South Santo, on the potential of *Machrobrachium lar*. Juveniles trapped in nearby rivers and streams are monocultured in earthen ponds and fed with high-quality prawn feed supplemented with kitchen waste. The cultured prawns are successfully reared to market size in four months, and 10 kg of cultured prawns are harvested and sold at the Luganville market in November 2005.

Marine shrimp (*Litopenaeus stylirostris*) farming is first carried out at Teouma Prawns Ltd (Efate), and yields its first successful harvest in November 2005. Cultured shrimps are sold at local market outlets in Vila and Santo and export trials are conducted.

2006

Red tilapia (*Oreochromis* sp.) farming commences at Vate Ocean Gardens in Lake Manuro, yielding its first successful harvest in mid-2007. Cultured red tilapia are sold at local market outlets in Port Vila. The fry is imported from Thailand.

PART I



STATUS OF AQUACULTURE IN VANUATU



Trochus & Green Snails

Trochus (*Trochus niloticus*) is primarily targeted for its shell, which is processed locally into blank buttons and exported to China and Hong Kong for the fashion industry. Trochus shells are sold to button factories for VT 350–450 per kg. In 2007, the total processed trochus exported was 55 tonnes, contributing more than VT 70 million in foreign exchange.

Vanuatu's involvement in trochus research commenced in the mid-1980s and its involvement in the ACIAR-funded trochus project has proceeded for 10 years, encompassing three phases. Phase 1 of the project involved nutritional aspects of trochus, Phase 2 concentrated on hatchery seed production and reef reseeding, and the final phase concentrated on broodstock enhancement with community-based management. The continuous involvement of Vanuatu in trochus research demonstrates the importance of this resource to the economic and social well-being of the rural communities of the country.

VFD is the sole institution operating a trochus and green-snail hatchery in the country. The emphasis is on seed production, to supply seeds to coastal areas where stocks have been depleted due to overfishing. Some trochus and green-snail breeder populations have been established on the reef off Efate and protected so as to increase natural seed production.

One of the major challenges has been the deteriorating water quality of Port Vila harbour, where the trochus hatchery is located. Poor water quality resulting from frequent inter-island boats and fishing vessels docking at the government wharf is affecting juvenile trochus survival and seed production. This is evident from the low number of seeds raised to suitable release size on an annual basis (15,000–20,000). The hatchery was renovated in 2007 with financial assistance from JICA. This work reduced water-quality problems and will enhance the survival of seeds produced in the hatchery.





Giant Clams

Giant clam farming targets both the live aquarium trade and stock enhancement. Methods for all phases of giant clam aquaculture have been developed and are readily accessible in manuals and through experienced personnel. The techniques for rearing larvae and seeds use relatively simple technology compared to other shellfish and finfish.

In Vanuatu, four giant clam species (*Tridacna maxima*, *T. squamosa*, *T. crocea* and *Hippopus hippopus*) have been harvested and exported. Wild harvest of giant clams for the aquarium trade was high between 2000 and 2001, with exports worth VT 4–7 million in foreign exchange. However, this has since drastically reduced due to more stringent controls being enforced by local authorities after a decline in wild stock. On Efate and its outer islands, harvesting of all giant clam species is prohibited, and harvest of *T. crocea* from the wild for export is banned throughout the whole archipelago. In October 2007, VFD decided to ban the wild harvest of all species of giant clams.

The main market for culture clams is live aquarium clams, which are sold for high retail prices in the overseas market (USD 20–300 per piece); the local aquarium market sells them for VT 500 (USD 4.50) per piece starting at 4–5 cm. There is also a lucrative market for the adductor muscle.

In 2002, VFD carried out the first successful spawning and rearing of *T. crocea* in its land-based hatchery. More than 100 pieces, valued in excess of VT 100,000, were sold live to aquarium operators. In 2005, Reef Life (a private aquarium operator) conducted its first successful spawning of *T. crocea*.

There is potential to engage communities in giant clam farming, but there would need to be hatchery production of juveniles for this to be feasible. Although mass seed production of giant clams in the hatchery for grow-out targeting the aquarium industry is yet to be proven on a commercial basis in Vanuatu, VFD is currently working on producing seeds for grow-out in rural coastal areas.

In 2007, 400 pieces of the extinct *Tridacna gigas*, were introduced from Tonga. VFD hopes to be able to propagate those and reseed the spat around the reefs of Vanuatu.





Coral

Coral farming of species mainly from the scleractinian group primarily targets the aquarium (live) and curio (dead) trades, reef restoration, and enhancement of snorkelling trails for ecotourism activities. VFD has prohibited wild harvest and export of coral, placing more emphasis on cultured corals. According to the Convention on International Trade in Endangered Species (CITES), which includes regulation of coral, cultured coral is only certified as such if it is grown from second-generation cultured stock.

The export of cultured coral from Vanuatu was highest in 2007, with over 6000 pieces exported valued in excess of VT 3 million. While the culture technique is relatively simple and can be conducted using low-cost technology, and the market is well established, the involvement of communities in this trade is yet to be realised.

At present, two aquarium operators have commenced small-scale coral farming, although one of the companies (Reef Solution) is farming on a larger scale than the other. There is a need to promote coral farming and create more awareness about cultured coral as a viable commodity. The existing aquarium operators could be utilised by having coral farmers sell products to them for export. However, risks such as cyclones, bleaching during warm-water events and the absence of herbivorous fish resulting in algae overgrowing the cultured coral can affect field culture of coral.





Marine shrimps

Commercial farming of penaeid shrimps has been conducted in Pacific Island countries for more than 30 years, with varying degrees of success. Development has been slow due to lack of suitable technologies, traditional skills in aquaculture, capital, infrastructure and research and development support from national governments.

In Vanuatu, Teouma Prawns was the first large-scale shrimp farm to be established. After nearly four years of building and setting up, its first successful harvest of marine shrimps (*Litopenaeus stylirostris*) was carried out in November 2005. As a result, the Port Vila and Luganville markets were flooded with fresh cultured shrimps. The shrimps were sold for between VT 2000 (Port Vila markets) and VT 2200 (Luganville market) and trial export shipments were made to Australia and New Zealand. The main market for shrimps from the farm will be the export market.

The Vanuatu Government, through the departments of Fisheries and Quarantine, has assisted the privately owned Teouma Prawns with importation of post-larvae (PL) from Brunei, inspection of PL for potential diseases and providing exemption from importation of farm equipment. Teouma Prawns has qualified staff who are trained in all aspects of shrimp farming and husbandry.

Teouma Prawns has a production capacity of 85 tonnes of shrimps per year and is planning to produce species such as *Penaeus monodon* and *Litopenaeus vannamei* (SPF) in its hatchery. The company also plans diversification to other species, such as marine finfish.





Tilapia

The improved Nile tilapia strain known as GIFT tilapia, *Oreochromis niloticus*, has been accepted in the region as an important candidate species for aquaculture due to its ease of production, hardiness, high survival rate, and moderate to high economic value. In Vanuatu, the species fetches prices per kg of VT 450 (Port Vila), VT 400 (Tanna) and VT 350 (Luganville market, Santo).

Since its introduction into the country in mid-2004 due to joint efforts between Fiji Fisheries and VFD, a semi-commercial pilot farm (ERAPO) has been set up to trial tilapia fish farming. Over 5000 fingerlings were imported from Fiji Fisheries and stocked in two 50 m x 20 m ponds at ERAPO. The farm has so far produced over 1 tonne of fresh tilapia fish averaging 400 g for the local market. In 2005, new pilot subsistence farms were set up in Sarete (South Santo) and Middle Bush (Tanna). Both sites have successfully reared fish to market size after four months of farming, each producing 50–80 kg fresh fish that were sold to the local market.

GIFT tilapia farming is proving to be an acceptable fish for Vanuatu and is particularly favourable for large islands, where it can become an important protein source for inland communities. A lot of interest is being shown by communities wishing to venture into tilapia fish farming. The species is relatively easy to culture and women are commonly involved in its production. However, broodstock management is important to ensure that healthy fingerlings are guaranteed to farmers. VFD must ensure that it acquires its own holding site where broodstock management can be ensured and healthy fingerlings produced. There is a need to acquire a pelletiser to effectively produce pellets for farmers. Currently, a simple mince grinder is being used and the capacity is insufficient. Farmer training and awareness need to be maintained to prevent any escape of cultured fish into natural water bodies, which may impact on native fish and other aquatic life.

Large-scale production of red tilapia was commenced by Vate Ocean Gardens in Efate in 2006. The fingerlings are imported from Thailand and cultured in floating cage systems in Lake Manuro. In mid-2007, cultured red tilapia entered the local market for the first time, fetching VT 400–650 per kg. Approximately 500 kg per week is harvested to meet the local demand and it is intended to increase production to 2.5 tonnes per week. This initiative has proven that red tilapia is acceptable as a valuable food fish for both the local market and the high-end restaurant and hotel market. VFD is interested in promoting GIFT tilapia in rural communities in the future in collaboration with Vate Ocean Garden.





Freshwater prawns

Investigation into the potential of farming native freshwater prawns (*Macrobrachium lar*) began in Vanuatu in mid-2005. The species was already known to have been reared on a subsistence basis (in conjunction with water taro) mainly on the northern islands of the country, such as Maewo, North Pentecost and some parts of Santo. The species fetches a market price of VT 1000–1500 per kg and is sold mainly to restaurants and hotels in Vila and Santo.

In the trials, juvenile prawns were trapped using nets from nearby streams, then sorted and reared in two 10 m x 4 m ponds. They were fed with high-quality prawn feed supplemented with kitchen waste. Market size was reached after four months of culture and over 10 kg of fresh quality prawns worth VT 10,000 were harvested and sold in the Luganville market.

Recent successful trials of freshwater prawn culture have proved this species to be a viable candidate for aquaculture. However, acquisition of juveniles from the wild may be a problem in some parts of the country due to land ownership, especially in areas where a river or stream passes through different land boundaries. The technique of artificially producing juveniles in a land-based hatchery is yet to be demonstrated commercially.

M. rosenbergii is also being considered as a strong candidate for aquaculture in Vanuatu because its production in hatcheries is well understood and this would allow the production of a regular supply of PL without relying on natural recruitment. However, there is currently no broodstock of *M. rosenbergii* available in Vanuatu but Vate Ocean Garden who is a private farm is willing to develop *M. rosenbergii* production for community based farm.





PART II



AQUACULTURE PROSPECTS

I. Potential and opportunities

Attractive pristine environment for land and water

The conditions are favourable for availability of land and water. In Vanuatu there are a good number of islands suitable for intensive aquaculture development, including Santo, Efate and Malekula. Other water-provisioned islands, such as Maewo, Pentecost and Tanna, could initially focus on community-based aquaculture development.

High local market demand for fresh fish

Fresh fish demand is high in the urban as well as the rural population. People eat canned fish because it is readily available. Fish from farms could easily supplement fish from the wild. Wild-caught fish regularly fetch VT 1000 and above on the local market.

Market demand for aquaculture products by the expanding tourism industry

Tourism is likely to continue to grow into the next decade. Aquaculture products targeting the tourism industry would feature well in satisfying consumer preferences in restaurants and hotels as well as supermarkets.

Demand by the aquarium industry

There has been a surge in demand for aquarium fish, but only non-edible aquarium fish caught from the wild are allowed for exports. Harvesting coral from the wild is currently prohibited. Harvesting of all species of giant clams is now prohibited throughout Vanuatu. Two companies are taking the initiative to begin aquaculture for the lucrative aquarium trade. If this is done with care so that it does not affect local industry and livelihoods, it could be a successful niche business.

Declining natural fisheries stocks

Reef systems in Vanuatu are not as extended as in other areas and presently the wild fish stocks are being fished uncontrollably. Aquaculture may directly or indirectly assist to relieve fishing pressure.

Improved food security

The accessibility of protein in the local diet would be improved with fish farm operations. In rural communities, some forms of aquaculture can be easily adopted by women, who are often responsible for meeting basic family needs on a day-to-day basis.

Ciguatera fish poisoning

Fish poisoning caused by ciguatera is present in Vanuatu. Aquaculture products are safe from ciguatera. This could be a strong marketing asset for farmed commodities.

II. Challenges

Relatively high utility costs

A common challenge to any investment in Vanuatu is the high cost of electricity, telephone services and, to some extent, water. In these circumstances, the Government of Vanuatu must consider ways in which it can provide incentives and development stimuli to get commercial aquaculture up and running. Providing assistance such as duty exemptions on aquaculture machinery, particularly at the initial stages of development, would be beneficial to investors and encourage large-scale commercial aquaculture developments.

No specific provision for aquaculture development in the current Fisheries Act

Aside from CAP 158 within the general section of the Act, under which the Minister can make regulations on aquaculture development, there is no specific provision for aquaculture development in the current Fisheries Act. It is believed that environmental and quarantine legislation should also have some aquaculture elements included. These Acts are currently not comprehensive enough to properly regulate aquaculture development in Vanuatu.¹ Legislation should be harmonised and strengthened to influence a clear policy framework and determine the principal enforcement agency. Although aquaculture falls within the technical remit of VFD, there are other agencies that can provide advisory and technical input to aquaculture development.

Fisheries personnel and resource capacity to support and regulate the industry

VFD is one of the few government departments that generates more revenue than it receives. Unfortunately, none of the revenue is used to improve the department's capacity; rather, it is paid into the government's general revenue. VFD is managed by a director through four sections: Resource Management and Enforcement, Rural Fisheries Development and Extension, Research and Information, and Corporate Services. The department has 20 staff, including three qualified biologists working in the Research and Information section. To be able to provide a minimum core staff to support the transition phase from piloting to commercialising aquaculture, the department would need two full-time biologists assigned to the aquaculture sub-sector plus two technical and one administrative support personnel. This would see an increase in recurrent expenditure to cover salary for the additional staff.

¹ Other legislation that affects aquaculture development includes the Environment Act of 2002, which subjects the establishment of aquaculture development to bio-prospecting regulations, especially for EIAs, and close monitoring for environmental, social and customary impacts. Relevant legislation is also housed within the Vanuatu quarantine jurisdiction, which includes the Animal Importation and Quarantine Act No. 7 of 1997 for animal imports and the Plant Protection Act No. 14 1997 for plants, including aquaculture feed. For the export of 'dead' fish, the Meat Industry Act No. 5 of 1991 is applied. The Animal Disease Control Act No. 29 of 1991 gives the Quarantine Service the power to intervene in cases of 'fish' disease, although generally the legislation was designed for farm livestock and not aquaculture products.

Product marketing linkages

The development of aquaculture will be driven by reliable market demand. Two main commercial markets are anticipated. One is the export market for high-value products that may be beyond the average ni-Vanuatu household's spending capacity. Its success depends on private operators' ability to secure market outlets and government assistance in curtailing the bureaucracy involved in meeting export conditions. The other market is local demand. This is considered to be more of a challenge for VFD because it may involve more stakeholders, especially the provincial council administration, in providing the capacity for farmer training and market information support.

Land tenure system

Land in Vanuatu belongs to traditional owners and is identified as one of the areas delaying the transformation of Vanuatu from a subsistence to a commercial economy. On the main islands legitimate leases are now possible, but land remains an issue that needs to be taken into consideration for aquaculture development. The government, through the Department of Lands, is in the process of reviewing land legislation to enhance social and economic development, especially for the 80% of the population who live in rural areas.

Biosecurity and health issues

Despite aquaculture's positive attributes, its potential negative impacts cannot be neglected. Several aquaculture species under culture are not endemic to Pacific Island countries. Proper management systems must be put in place to minimise the risks and impacts on native flora and fauna.

PART III



THE PLAN

A national consultation workshop to draft an aquaculture plan was convened in Port Vila in November 2005 by VFD and the SPC Aquaculture Programme. The workshop brought together representatives from the government and the private sector.

I. Objectives

The plan is a guide to aquaculture development in Vanuatu. It highlights the main commodities considered as having high potential for the Vanuatu situation, and identifies strategies, resources and key stakeholders required for the plan's implementation. It highlights the need for all stakeholders to make a concerted effort to promote the development of aquaculture as complementary to wild fisheries production.

II. Priority commodities

One of the critical tasks of the workshop was to identify a list of priority commodities that would deliver the maximum return to Vanuatu in terms of livelihoods, food security and the environment. Working from a wider list of commodities, an order of priority was scored based on two main criteria: firstly, the potential for the commodity to make an impact (i.e. potential benefits and suitability), and secondly, the feasibility (i.e. deliverability and capacity to utilise aquaculture 'tools') of the commodity to deliver the results envisioned.

The high-priority category includes high-technology and capital-intensive commodities such as marine shrimps and giant clams. In contrast, low-technology and low-investment commodities such as native freshwater prawns (*Macrobrachium lar*) were of equal priority. Tilapia, which can address the local commercial market as well as household food security, was also ranked high. Commodities for restocking culture fisheries, such as trochus and green snail, were also accorded high priority. Ornamental commodities for export, such as coral and giant clams, are included in the high-priority category.

The medium-priority category comprises commodities where the technology for culture has not been very well developed or tested in Vanuatu. However, should this bottleneck be overcome, then these commodities may be of tremendous potential. In the medium term it is quite likely that advances in technology will see the techniques for aquaculture of these commodities being applied in Vanuatu (e.g. sea cucumber, eel, mud crab).

The low-priority category tends to include commodities for which natural seed supply, existing technologies, market access or cultural perceptions in Vanuatu place it at a relative disadvantage for producers. However, commodities such as marine finfish have high potential for Vanuatu, and with increasing skills and available technology they are likely to be ranked higher in the near future.

Based on local knowledge and technical expertise, the national workshop produced a starting list of 18 commodities for prioritisation (see Figure 4). These commodities cover marine, brackish and freshwater systems and can be farmed in oceanic, coastal and inland areas.

Table 2: Commodities in priority order

HIGH priority	MEDIUM priority	LOW priority
Marine shrimps	Edible oysters	Tropical abalone
Marine ornamentals (giant clams, corals and aquarium fish)	Sea cucumber	Live reef fish (e.g. grouper)
Tilapia	Mud crab	
Freshwater prawns	Freshwater eels	
Trochus	Pearl oyster	
Green snail	Sponge	
	Milkfish	
	Cottonii seaweed	

III. Aquaculture Development Plan 2008–2013

After reviewing the challenges facing Vanuatu, a five-year plan was designed. It identifies seven critical areas that need to be addressed in order to produce the development framework required to bring the high-priority commodities to fruition. These critical areas are:

- putting in place appropriate aquaculture policy and legislation;
- establishing credit and finance schemes for the public and private sector;
- ensuring that adequate infrastructure is in place, including basic utilities and transportation;
- instigating research and development that will address bottlenecks in farming, marketing, etc.;
- ensuring that environmental management and biosecurity programmes maintain development within limits and at an acceptable level of risk;
- providing adequate extension support to farmers and communities; and
- undertaking human resource development to ensure that the public and private sector have the necessary skills and training for aquaculture.

The five-year plan is tabulated in the following pages.

I N F R A S T R U C T U R E

Objective	Strategy	Indicators
Appropriate equipment and tools available for farmers	Sales assistance in purchasing of equipment/tools provided	Equipment procurement lists produced by mid-2008
	Logistical support provided where appropriate for procurement of equipment and tools	Logistical support provided by the end of 2008
	Most appropriate equipment/tools for aquaculture in Vanuatu continually assessed	Field reviews of performance of tools and equipment conducted by VFD staff
	Duty exemption on specific aquaculture equipment sought	Finance and Customs departments approached by VFD to review and expand the X9 Duty Exempt list to include aquaculture by December 2008
	Costs of hiring equipment reviewed to ensure that 'fair deal' is being provided to farmers	Costs of hiring equipment reviewed and applied by the end of 2008
	Critical machinery needs acquired by VFD to support farm construction	Proposal for acquiring critical machinery (donor assistance, etc.) submitted by VFD by 2008
Electricity, water and road works developed to cater for farmer needs, especially rural inland farmers	Logistical support for infrastructure development provided to cater for farmer operations	Logistical support for farmer infrastructure provided when and as needed
	Liaison conducted with infrastructure agencies – Public Works Department, Road Works Service, etc. – to provide reports on requirements of farmers for basic infrastructure	Timely reports submitted to infrastructure agencies
Reliable and affordable transport and freight linkages available to farmers	Current freight networks assessed for opportunities and constraints	Report on freight networks and systems completed by December 2008 Continue to liaise with national business forum committee at 2008 business forum to address shortcomings
	Government support to subsidise transport costs (in kind) investigated	X9 list expanded to cater for fish farmers by 2009

R E S E A R C H A N D D E V E L O P M E N T

Objective	Strategy	Indicators
High-quality and cost-effective feed developed and made available to farmers	Effective feed based on local ingredients formulated	Trials on feed formulation begin to be reported by end 2008
	Applied feed research trials undertaken	Trials on feed formulation begin to be reported by end 2008
	Regional collaboration with other national research programmes carried out where appropriate	VFD liaises with and provides a regular forum for regional agencies (SPC, FAO, USP) to investigate opportunities for collaboration
	Feed production machinery relevant to Vanuatu tested and available	Feed machinery acquired and production tested
Viable and high-quality seeds available to meet production targets	Hatchery facility or network of hatcheries to cater for national seed demand established	Model hatcheries equipped and operating by 2008/2009 National training programme in place to provide hatchery training for outlying/satellite hatcheries
Model hatchery/facilities established to cater for future commodity development	Multi-purpose facilities (freshwater, mariculture) in place to cater for multiple species	VFD continues pursuing government and donor support to establish model sites/facilities Possible support/links to upcoming/ongoing projects (e.g. JICA Comprehensive Coastal Resources Management Project) established
Highest-possible standard of research conducted in Vanuatu	Research programmes facilitated by expert agencies (e.g. SPC, FAO) and donor organisations (JICA, ACIAR)	VFD ensures coordination of all agencies supporting research
	Inter-regional collaboration supported where mutual benefits can be accrued	Collaboration between countries instigated on a case-by-case basis
Marketing potential for targeted species assessed	Domestic and international marketing demand identified for target species	Comprehensive marketing study produced and distributed to appropriate producers
	Promotional activities carried out to assess/generate market demand	VFD and government marketing agencies promote aquaculture products
	Market research conducted where required	Market research carried out on a timely basis
	Potential for joint regional marketing strategies and opportunities sought where appropriate	Regional agencies (SPC, Forum Secretariat) facilitate marketing opportunities in a timely manner

ENVIRONMENTAL MANAGEMENT AND BIOSECURITY

Objective	Strategy	Indicators
Aquaculture developed within environmentally acceptable limits	Aquaculture Advisory Committee established to facilitate environmental best practices	Advisory Committee established with VFD as focal point
	Environmental Impact Assessments (EIAs) conducted	Model EIA reports in place
Strong biosecurity programme in place to protect natural biodiversity of Vanuatu	National aquaculture quarantine capacity strengthened	Ongoing collaboration between Quarantine and VFD to continue in order to develop/ share capacity
	Appropriate quarantine protocols developed for target species that may be introduced	Quarantine protocols developed and tested prior to species introduction Import risk analyses carried out on target species prior to introduction
	Disease management and veterinary support in place	National, regional (SPC) and international (OIE) linkages on aquaculture disease and health management expertise in place by end 2008

EXTENSION SUPPORT

Objective	Strategy	Indicators
Local awareness raising and ongoing awareness programmes provided to communities	Awareness programmes relevant to target audience organised	Local needs for awareness raising assessed and resources for promotion campaigns in place by 2008
	Skills of extension staff in awareness raising improved	Training in awareness-raising skills of extension staff begin in 2008
	Appropriate information materials disseminated to potential farmers	Funding for publication and distribution of materials provided by 2009
	Extension materials developed	Extension material developed during 2008, onwards
All stakeholders involved and educated in aquaculture issues	Interdepartmental, private sector and NGO collaboration encouraged to address multi-stakeholder needs	Regular forums provided by VFD (minimum of one per annum) for all stakeholder organisations to identify issues for awareness raising

HUMAN RESOURCE DEVELOPMENT

Objective	Strategy	Indicators
Staffing requirements for government assessed	Agencies consulted on staff requirements	Needs assessment survey completed by first quarter of 2008
	Staff roles and activities outlined	Staffing needs assessment completed by first quarter of 2008
	Staff restructuring and additional recruitment assessed	Proposal for staff structure assessed by end 2008 Revised organisational structure in place by 2008
Government staff and technicians trained	Training provided to VFD staff in aquaculture hatchery, grow-out, marketing and site selection	Staff trained in key species by December 2009 Programme of staff attachments to commercial farms fully under way by 2008 Regional agencies (SPC) to support training programmes
	SPC manuals translated into Bislama and new manuals developed	Manuals translated by mid-2008 New manuals completed by 2009 Pamphlets and information targeting species distributed by December 2008 Regional agencies (SPC, USP) to facilitate production of training materials/manuals
Farmers provided with necessary skills in aquaculture	Training provided to farmers in aquaculture technology and management	Basic information (at a minimum) provided to all prospective farmers VFD continues farmer training programmes, targeting at least one major workshop per year Training opportunities available to cater for farmers wishing to upgrade skills
Formal training programmes in place	Staff-specific training needs identified and training programmes facilitated	Training needs assessed and training programmes in place by 2009 Regional agencies provide training support when required
Aquaculture development/extension service developed by government	Funding and administrative support provided for Aquaculture Development Section	Section established by 2010 if approved



PART IV



KEY STAKEHOLDERS

All stakeholders must recognise their respective roles and responsibilities to engage in aquaculture in the most sustainable and effective manner.

I. Government bodies involved in aquaculture

- VFD in the Ministry of Agriculture, Quarantine, Forestry and Fisheries (MAQFF) is the principal agency responsible for policy formulation and enforcement and coordinating aquaculture development in Vanuatu.

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- Quarantine and Inspection Services in MAQFF is responsible for controlling the movement of plant and animal materials, which is essential for aquaculture development.

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Director
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and Quarantine
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- VEU in the Ministry of Lands and Natural Resources (MLNR) is charged with providing advice on environmental considerations in relation to ecosystem management and sustainable resource use.

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Other government agencies with a secondary role in aquaculture are:

- Department of Lands – land use and acquisition
- Department of Public Works – earth moving, roads and utility access

- Department of Agriculture – integrated farming potential
- Department of Cooperative and Ni-Vanuatu Business – funding and advice
- Vanuatu Investment Promotion Authority (VIPA) – foreign investment
- Chamber of Commerce and Industry (CCI) – training
- National REDI Unit/Department of Provincial Affairs – community funding and provincial economic development coordination
- Provincial councils (6) – local coordination and institutional support

II. Aid project and NGOs currently operating in the field of aquaculture

‘Promotion of the Grace of the Sea in Coastal Villages’ is a JICA-funded three-year project that started in March 2006. It is likely to be extended for another three years. The project’s objectives are to: (i) produce seeds of key aquaculture species, such as giant clams, green snail, trochus and sea cucumber; (ii) develop management plans for each species and implement grow-out farms for giant clams in coastal areas; and (iii) carry out educational programmes targeting schoolchildren and communities.

The project is housed in VFD and the principal investigators are Sompert Rena Gereva and Kenichi Kikutani.

JICA Project for Promotion of the Grace of the Sea in Coastal Villages
 Fisheries Department
 Government of Vanuatu
 PMB 9005 Port Vila
 Email: graceofthesea@vanuatu.com.vu

The Vanuatu Aquaculture and Fisheries Association of Vanuatu is in the process of being implemented, it will be based at the Fisheries Department. Its aim is to assist the Department with Aquaculture regulations and development.

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 Email: paul@southpacificoceangardens.com

Other NGOs and volunteer organisations – such as Japan Overseas Cooperation Volunteers (JOCV), the Peace Corps, Wan Smol Bag and FSPI Vanuatu, to list a few – have been involved in aquaculture and other related activities, such as coastal resources management.

III. Private sector

There is a growing number of private commercial aquaculture operators that must be included in consultations. The main companies in existence at the time of the national consultation workshop included:

- Teouma Prawns Ltd – marine shrimps SPF (*L. stylirostris*, *P. Monodon*, *L.vannamei*)
Facilities: 20 ha of ponds located on Efate at Teouma flat plain area; operation of a hatchery producing *L. stylirostris*
Manager: Paul Christian Ryan
Email: teoumaprawns@vanuatu.com.vu
- Vate Ocean Gardens Ltd – red tilapia
Facilities: Floating cage set-up in Lake Manuro, in the southeast of Efate Island
Manager: Paul Christian Ryan
Email: paul@vateoceangardens.com
- Pacific Aquaculture Ltd – freshwater eels
Facilities: Basic freshwater eel holding facility established at Tagabe Area in Port Vila; collects glass freshwater eels from rivers around the islands of Vanuatu and exports them
Manager: Ben Brookman
Email: paq@vanuatu.com.vu
- Reef Solution Vanuatu Ltd – farmed corals and wild-caught ornamental invertebrates
Facilities: Has a land flowthrough system and sea cage set-ups at Pangona
- Reef Life Ltd – cultured giant clams and marine ornamentals
Facilities: Mariculture hatchery and rearing facility for giant clams and fish at Pango on Efate
Manager: Kalmet Kaltabang
Email: reeflifevanuatu@vanuatu.com.vu
- ERAPO Aquaculture Ltd – tilapia
Facilities: Two earthen ponds of 1000 m² and four ponds of 400 m²
Manager: Felix Nguyen
Email: fnguyen@vanuatu.com.vu
- Sarete Small Freshwater Farm – freshwater prawns
Facilities: Four ponds of 30 m²
Manager: Aru Ase, c/o Fisheries Extension Office, Luganville, Santo
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