Solomon Islands

Aquaculture development plan

2009-2014

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Produced by Ministry of Fisheries and Marine Resources
Solomon Islands

SPC
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LIST OF ACRONYMS

AASI:	Aquarium Arts Solomon Islands
CoSPSI:	Commercialization of Seaweed Production - Solomon Islands
EU:	European Union
FAO:	Food and Agriculture Organization of the United Nations
FSPI:	Foundation of the Peoples of the South Pacific International
FSPSI:	Foundation of the Peoples of the South Pacific - Solomon Islands
ICLARM:	International Center for Living Aquatic Resources Management (now the WorldFish Center)
GIFT:	Genetically improved farmed tilapia
MAC:	Marine Aquarium Council
MFMR:	Ministry of Fisheries and Marine Resources
MOP:	Mother of pearl
NGO:	Non governmental organisation
PCC:	Post larval capture and culture
SIME:	Solomon Islands Marine Exports
SPC:	Secretariat of the Pacific Community
RFEP:	Rural Fisheries Enterprise Programme
USP:	The University of the South Pacific
WWF:	World Wildlife Fund for Nature

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FOREWORD

It is my privilege to present the Solomon Islands Aquaculture Development Plan, 2009-2014.

I am confident that this plan will provide a way forward for the government and the people of the Solomon Islands to address the many issues faced by this sector.

Aquaculture is relatively new to the Solomon Islands compared to other countries. But being a newcomer should not be an excuse to simply sit and watch. The tide of overexploitation of resources is slowly creeping against us. If there is a time that we need to join hands together and act, it is today. This is both important and urgent.

Aquaculture has the potential to contribute to our people in terms of food security and livelihoods. This plan provides a central platform for aquaculture programs that the country wishes to undertake now and in the future. I believe that you will find that its objectives are simple, realistic and adoptable for those that needed it most – our people.

Furthermore, it is for our people that the government puts emphasis on rural development. This is our challenge, and aquaculture's contribution will not go unnoticed.

Please join with my government as we begin a journey down a path that will see the realization of aquaculture in the Solomon Islands.

Hon. Minister Nollen C. Leni
MINISTER FOR FISHERIES AND MARINE RESOURCES

1. INTRODUCTION

By 2010, the population of Solomon Islands will have reached 550,000 and the amount of fish required for food will be around 10,000 tonnes per year. It is also estimated that 20,000 people will be seeking to obtain some level of income from the sale of fisheries products by 2010.

The Ministry of Fisheries and Marine Resources (MFMR) aims to meet these needs by re-examining how best to allocate the national fisheries resources to food security, livelihoods and national revenue. As part of this process, the ministry is developing an aquaculture development plan for Solomon Islands. Aquaculture of inshore resources offers opportunities to create new livelihoods and export commodities. Freshwater aquaculture can supply fish for food in areas where inshore fisheries are limited and tuna are difficult to access.

Figure 1: Map of Solomon Islands: land area 27,556 km²; freshwater area 910 km²; exclusive economic zone 1,340,000 km². There are six major islands in Solomon Islands: Choiseul, New Georgia, Santa Isabel, Guadalcanal, Malaita and Makira, plus 992 smaller islands. The capital, Honiara, is on Guadalcanal.

2. PURPOSE OF THE AQUACULTURE PLAN

The purpose of this aquaculture development plan is to identify the coastal and freshwater commodities that can be produced most easily, and profitably, to help meet food and income requirements in Solomon Islands. The plan identifies the roles of partner agencies that can assist in meeting these needs and indicates how many households could be engaged in aquaculture by 2010, 2015 and 2020 if the sector is successfully developed.

The plan is consistent with the objectives of Solomon Islands' Medium Term Development Strategy 2008–2010, particularly the targets for the economic and productive sectors. It falls within the framework of Solomon Islands' National Biodiversity Strategies and Action Plans (NBSAP) and provides a development pathway that will guide MFMR's corporate strategy and the Solomon Islands and Secretariat of the Pacific Community's joint country strategy for (JCS) 2009-2012.

3. AQUACULTURE GOALS OF SOLOMON ISLANDS

- Identify and prioritise the aquaculture commodities required to meet the national need for food and livelihood
- Establish viable aquaculture enterprises and provide the training necessary to expand the sector
- Strengthen the national capacity to establish and manage aquaculture at all levels
- Attract investment in aquaculture
- Develop competition (especially for export markets)
- Provide technical support for key industry stakeholders, e.g. farmers, private sector, NGOs and donors
- Develop responsible policies for aquaculture and gazette the supporting regulations

Seaweed farmer from Vaghena Island

4. BACKGROUND OF AQUACULTURE IN SOLOMON ISLANDS

4.1 General information

Advantages for the development of aquaculture in Solomon Islands:

- Availability of resources, broodstock and raw material or local feed ingredients
- Large areas of coastline and freshwater bodies with diverse opportunities
- Relatively skilled labor force with experience in primary production
- Low labour costs
- Pristine environment and access to good quality water
- Relatively closeness to export markets (e.g. Fiji and Australia) and an emerging domestic market

Constraints to development of aquaculture in Solomon Islands:

- Unstable government with no clear policies for aquaculture
- Difficulties in gaining access to suitable land (land disputes and traditional and custom inheritance)
- Lack of appropriate technical, business and management skills
- Lack of technical aquaculture know how and access to good information
- Lack of infrastructure and communication technology (existing services may be expensive and unreliable)
- Lack of 'in country' competition
- Lack of encouragement for private investment
- Geographical barriers create difficulties for transportation between commodity production centres and markets

4.2 Brief history of aquaculture development in Solomon Islands

Aquaculture is relatively new in Solomon Islands. However, some developments have been undertaken, mostly by the private sector:

1. Farming of *Macrobrachium* by the South Pacific Aquaculture Company in 1986
2. Farming of Penaied prawn, e.g. by the Ruaniu Prawn Farm Company in 1994
3. Seaweed research (*Kappaphycus*) also in 1986

4. Establishment of the WorldFish Center (formerly known as ICLARM) and subsequent research and development of giant clams and pearl oyster from 1986 to 2000

In 2000, the Solomon Islands Government established the Aquaculture Division (AD) of the Ministry of Fisheries and Marine Resources in response to growing national interest and increasing regional development of this sector. The primary role of the AD is to support the development of aquaculture through the goals described above.

Both population growth and depletion of wild stocks of aquatic resources have helped promote the importance of aquaculture as an alternative means of supplying food and livelihoods in rural areas.

Aquaculture will also contribute to helping Solomon Islands to build economic growth through export commodities.

Most of the aquaculture activities in Solomon Islands stopped during the height of the ethnic tension in 1999-2000. For example, the Coastal Aquaculture Centre operated by the WorldFish Center was destroyed along with the small prawn industry that had recently been established. The effects of ethnic tension crippled rural-based industries and have discouraged foreign investors. Further setbacks were experienced during the latter years of the ethnic crisis (2000–2003) until law and order were restored by the international force (RAMSI) in 2003.

4.3 Organisations/partners involved in the aquaculture sector

4.3.1 Key government agencies with statutory roles in aquaculture

Ministry of Fisheries and Marine Resources (MFMR)

MFMR is the lead government agency for statutory management of fisheries and aquaculture in Solomon Islands. The ministry issues licences to harvest fish commercially and monitors and regulates fish harvesting activity. Draft regulations for commercial aquaculture are under development. MFMR also has R&D and community extension/capacity-building functions. The Aquaculture Division (MFMR AD) has qualified and experienced staff with knowledge of a range of aquaculture commodities. AD currently focuses on seaweed, and is collaborating with other institutions (see next section) on several aquaculture initiatives involving commodities such as pearl, giant clam and marine ornamentals.

Ministry of Agriculture and Ministry of Lands, Department of Environment, Ministry of Environment, Conservations and Meteorology
The Ministry of Agriculture supports the rural agrarian sector, for which aquaculture is a potential alternative land use. The Ministry of Lands oversees land survey and land tenure. These are key issues for aquaculture ventures, which require a sound legal basis for occupying coastal or marine sites and developing farm infrastructure. Any environmental assessment work will require the assistance of the department of environment.

4.3.2 International agencies and NGOs

WorldFish Center (WFC)

General information:
The WorldFish Center has been present in Solomon Islands since 1986. Two field stations were originally established, the main one outside Honiara and another in the Western Province. The WorldFish Center and MFMR have initiated most giant clam and pearl oyster research and development in Solomon Islands. WorldFish works closely with MFMR and when possible, the private sector, with the aim of developing livelihoods for rural Solomon Islanders.
WorldFish maintains an office in Honiara and aquaculture operations are carried out from its field station at Nusa Tupe in the Western Province. Since 2005, a hatchery has been operating at Nusa Tupe, primarily for giant clam culture.

Current aquaculture projects:

- Commercialisation of blacklip and whitelip pearl oysters
- Hatchery-reared clams and village grow-out with possibilities for restocking
- Post-larval capture and culture of fish and invertebrates
- Sponge farming trials
- Coral farming for the ornamental market
- Rabbitfish cage culture in partnership with SPC and MFMR

WorldFish is also working with WWF and has previously worked with MAC on supporting livelihood opportunities through environmentally sustainable forms of aquaculture. Much of this work has been funded under the New Zealand assistance programme (NZAID). In 2007/2008 the EU funded WorldFish and MFMR to assemble all the information needed by investors to make decisions about launching pearl farming in Solomon Islands.

Link with MFMR Aquaculture Development Plan:
WorldFish is a close partner of the MFMR aquaculture programme and has the capacity and facilities to carry out experimental studies on relevant commodities. The longstanding working relationship between WorldFish and MFMR is continually being improved to support the industry on a long-term basis.

Foundation for the Peoples of the South Pacific – Solomon Islands (FSPSI)

General information:
FSPSI is based in Honiara and currently has three permanent staff. They operate in areas such as the Central Islands Province in Gela, Marau Sounds in Guadalcanal Province and Langa Langa Lagoon in Malaita Province. FSPSI is one of a group of NGOs that operate under the supervision of FSPI in Fiji.

Current projects:
FSPSI has been very supportive of reef management and conservation and active in coral farming for the aquarium trade and restocking. They have the technical capacity to carry out community-based work in rural areas of Solomon Islands and recently published a study on the economic viability of producing farmed and wild corals for the aquarium trade.

Links with MFMR Aquaculture Development Plans:
FSPSI have a good track record of community-based marine resource management. They are experienced in coral farming and have good linkages with MFMR and the communities they work with.

World Wide Fund for Nature (WWF)
Whilst aquaculture is not a primary objective of WWF, the organisation has assisted the development of aquaculture in Solomon Islands. In recent years, WWF has been an active partner of WorldFish in identifying and training rural communities in types of aquaculture techniques that they believe provide sustainable alternative livelihoods.

Marine Aquarium Council (MAC)
MAC does not have an office in Solomon Islands but has provided input on occasion. WorldFish and WWF work closely together on setting up farming and handling protocols according to MAC guidelines so that exporters and producers understand how to acquire certification for use of best environmental practices and quality control standards.

Solomon Islands Locally Managed Marine Areas (SILMMA)
Solomon Islands Locally Managed Marine Areas network promotes a network of marine protected areas established through participatory processes within communities as a response to the depletion of marine resources at local levels. Aquaculture has the potential to provide alternative sustainable livelihoods as one part

of the overall marine resources management 'tool-kit' developed by participating communities in the SILMMA network.

Secretariat of the Pacific Community (SPC)

General information:

SPC is an inter-governmental organisation that provides technical support and policy advice to member governments. MFMR is the main Solomon Islands counterpart for SPC's fisheries and aquaculture programmes. The SPC Aquaculture Section based in New Caledonia includes specialists in freshwater and marine aquaculture who provide technical assistance to MFMR through desk work and in-country field work.

Current projects:

SPC's aquaculture programme has supported the development of aquaculture projects in Solomon Islands in various capacities. It was involved in the rejuvenation of the seaweed industry in the early 2000s and has been active in disseminating information and providing training and technical assistance to MFMR and industry players. SPC has also contributed to other activities such as the PCC (post-larval capture and culture) and sponge projects.

At a strategic level, SPC assists MFMR to formulate national aquaculture strategies and more broadly assists the government to develop the institutional capacity required to meet its obligations. SPC organises regional forums and mechanisms that enable Solomon Islands to share information and collaborate with other Pacific Island countries and territories, expert agencies and donors.

Links with MFMR Aquaculture Development Plans:

SPC was commissioned by MFMR to assist the AD to complete the Aquaculture Development Plan. SPC also has roles in helping to ensure the MFMR's development strategies are relevant and achievable, providing communication links between projects and aquaculture bodies, and providing in-country training and specialist assistance where requested

4.3.3 Current relevant projects in Solomon Islands

Commercialisation of Seaweed Production, Solomon Islands (CoSPSI)

The CoSPSI Project, funded under the EU Stabex Fund, is being implemented by Gillet Preston and Associates under a contract with the Solomon Islands government. CosPSI has offices in Honiara (at MFMR) and in Gizo (near the Provincial Fisheries Center). The purpose of the CoSPSI project is to sustain seaweed production in rural areas of Solomon Islands by providing materials, training and extension services.

SIMROS

SIMROS is a New Zealand funded institutional strengthening project. Based at MFMR, it is aimed at consolidating MFMR's strategy and includes a review of the Fisheries Act. SIMROS may assist the development of aquaculture through appropriate legislation, regulations and licensing laws, assisting private sector development, and addressing other institutional issues.

4.3.4 Private companies currently operating in the aquaculture sector

Solomon Seaweed

In 2007, Solomon Seaweed was the only holder of a license allowing the export of raw seaweed. The company is active in extension services and has buying agents stationed in production areas, who assist farmers with quality control and buy their product. These agents are paid a commission based on production.

Aquarium Arts Solomon Islands (AASI)

AASI has been in Solomon Islands for over 15 years and is the only holder of a license allowing export of aquarium products. The company ships fish, corals, clams and other invertebrates and has been active in selling products from projects implemented by WorldFish and FSPSI (farmed corals, clams, PCC lobsters and fish). AASI is a branch of Aquarium Arts, an aquarium wholesale company in the United States, and has actively promoted the development of cultured ornamentals, especially in Marau Sound, Guadalcanal.

Solomon Islands Marine Export (SIME)

SIME mostly ships wild corals, but occasionally receives farmed coral products. The company has been shipping its products together with AASI to the same buyer. SIME is interested in becoming more active in the aquaculture of ornamentals.

Small-scale local entrepreneurs

In 2008, there were 26 growers involved in producing giant clams and corals and grow-out of wild post-larval lobsters, shrimp and fish (PCC) in Western Province. There were also several coral growers in Marau Sound and the Ngella Islands (Sandfly).The number of rural households involved in aquaculture production of seaweed for income generation is currently unknown as some sites move in and out of production depending on the need for cash or the commodity price. Seaweed farmers are mostly in Waghina, Gizo area, Temotu, Ontong Java and North Malaita.

Community stakeholders in subsistence-level aquaculture

Aquaculture for food security is attracting much interest from rural households and from institutions such as boarding schools. Three-quarters of all enquiries to MFMR about aquaculture are from people interested in establishing household-level ponds to produce fish for their own consumption. It is government policy that inshore fisheries management should be devolved to communities, which will be assisted to develop their own management plans. Aquaculture provides alternative local sources of fresh fish and could thus be a useful tool in implementing such plans.

Post larval capture and culture trial

5. CRITERIA FOR SELECTION OF COMMODITIES

- *Does it require low capital costs?*
- *What is the potential for uptake of farming by the private sector or rural communities*
- *Is the species present locally?*
- *Are the technical components of farming viable for development?*
- *Is a domestic or international market available?*

Using this regional format for commodity prioritisation, the following list (Table 1) of commodities was initially assessed for Solomon Islands (as the prioritisation process continued additional species were added to the list). All of the commodities listed are technically feasible for development in the Pacific Islands context with research work having established the technology required.

Table 1: List of aquaculture commodities initially assessed for prioritisation.

Commodity/species name	Capital cost	Locally Present	Market
Seaweed: *Kappaphycus alvarezii*	Low	Yes•	Export (large)
Pearl oyster: *Pinctada* spp.	Medium/high	Yes	Export (large)
Nile tilapia: *Oreochromis sp*	Low/medium	No◊	Local (food)
Mozambique tilapia: *Oreochromis sp*	Low	Yes•	Local (food)
Commodities for the aquarium trade: Soft and hard coral species	Low	Yes	Export (niche)
Giant clam: *Tridacna* spp.	Low	Yes	Export (niche)
Crustaceans and fish	Low	Yes	Export (niche)
Marine penaeid shrimp	High	Yes◊	Local (restaurant) Export (large)
Freshwater prawn: *Macrobrachium rosenbergii* *Macrobrachium lar*	 Medium Medium	 No◊ Yes	 Local (restaurant) Local (restaurant)
Sponges: *C. matthewsi*	Low	Yes	Export (niche)
Ornamental fish	Medium/high	Yes	Export (niche)
Eels: *Anguilla* spp.	Low/medium	Yes	Export (niche)
Milkfish: *Chanos chanos*	Low/medium	Yes	Local (food and bait)
Trochus: *Trochus niloticus*	Medium	Yes	Local (stock enhancement)
Sea cucumber	High	Yes	Local (stock enhancement)
Mud crabs: *Scylla* spp.	High	Yes	Local (restaurant)

• Introduced species that are locally present and widespread.
◊ Species that may require the introduction of breeders or seed stocks to maintain production.

The commodities that were identified as suitable for aquaculture in the Pacific in general, and the Solomon Islands in particular, then underwent a second prioritisation process in Honiara in September 2008 based on two criteria:

- impact (potential of the commodity to make a positive impact)
- feasibility (feasibility of successfully developing a commodity)

This second prioritisation process was aimed at selecting a small number of highly feasible priority commodities that would generate incomes or food for Solomon Islanders. Scoring each commodity according to these criteria resulted in high ratings for the following four commodities:

1. Seaweed
2. Tilapia
3. Sea cucumber
4. Marine ornamentals

However, out of the commodities identified in Table 1, additional commodities (for example, crocodile) were identified as possible candidates for development in Solomon Islands in the future. Some of these commodities have not been ranked and are not expected to be an immediate priority for the MFMR Aquaculture Division.

Figure 2 and Table 2 below illustrate the process and outcomes for ranking priority commodities in Solomon Islands.

Figure 2: Process for prioritising relevant aquaculture commodities for Solomon Islands based on two criteria: potential impact and feasibility

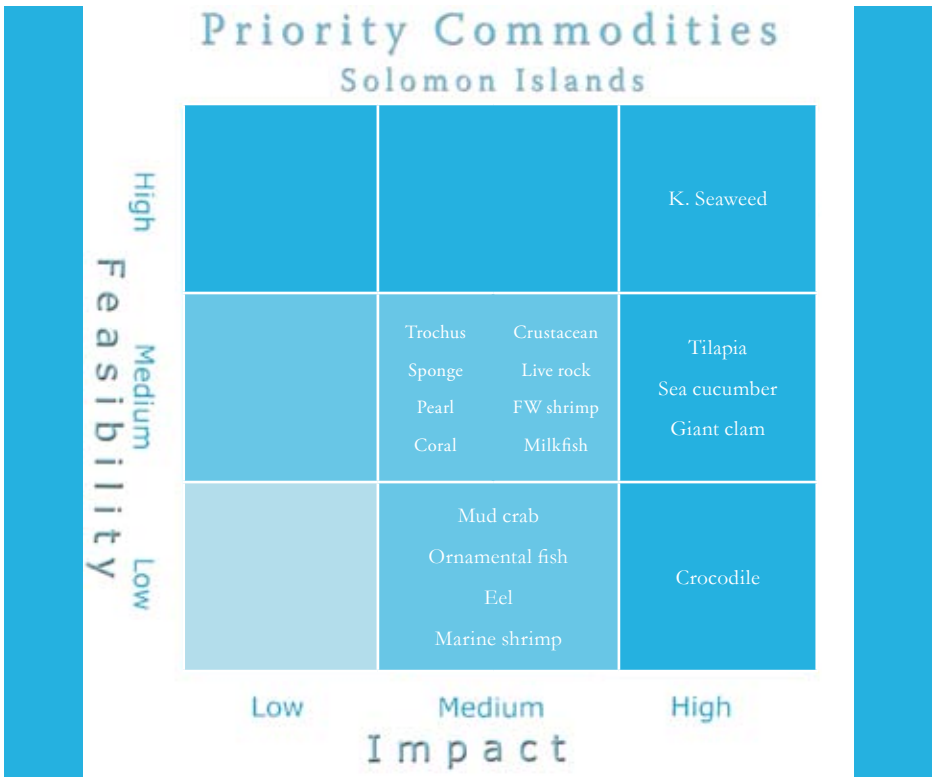


Table 2: Outcome of prioritisation process – commodity rankings

Commodity	Potential impact (potential to make a positive impact)	Feasability (feasability of successfully developing the commodity)
Kappaphycus seaweed	High	High
Tilapia	High	Medium
Sea cucumber	High	Medium
Giant clam	High	Medium
Crocodile	High	Low
Trochus	Medium	Medium
Sponge	Medium	Medium
Pearl	Medium	Medium
Coral	Medium	Medium
Crustaceans	Medium	Medium
Live rock	Medium	Medium
Freshwater shrimp	Medium	Medium
Milkfish	Medium	Medium
Mudcrab	Medium	Low
Ornamental fish	Medium	Low
Eel	Medium	Low
Marine shrimp	Medium	Low

6. PRIORITY COMMODITIES

6.1 Seaweed (Kappaphycus alvarezii)

6.1.1 Background information

An initial project to determine the feasibility of seaweed farming in Solomon Islands was launched in 1988 by MFMR. Grazing by fish was a limiting factor at that time. In 2002 a second attempt to farm seaweed was launched under the EU RFEP diversification program. Cottonii stocks (introduced from the 1988 trials) were consolidated in Rarumana from reefs in and around Vona Vona Lagoon in the Western Province. These stocks became the basis of a rejuvenated seaweed farming programme.

6.1.2 Current situation

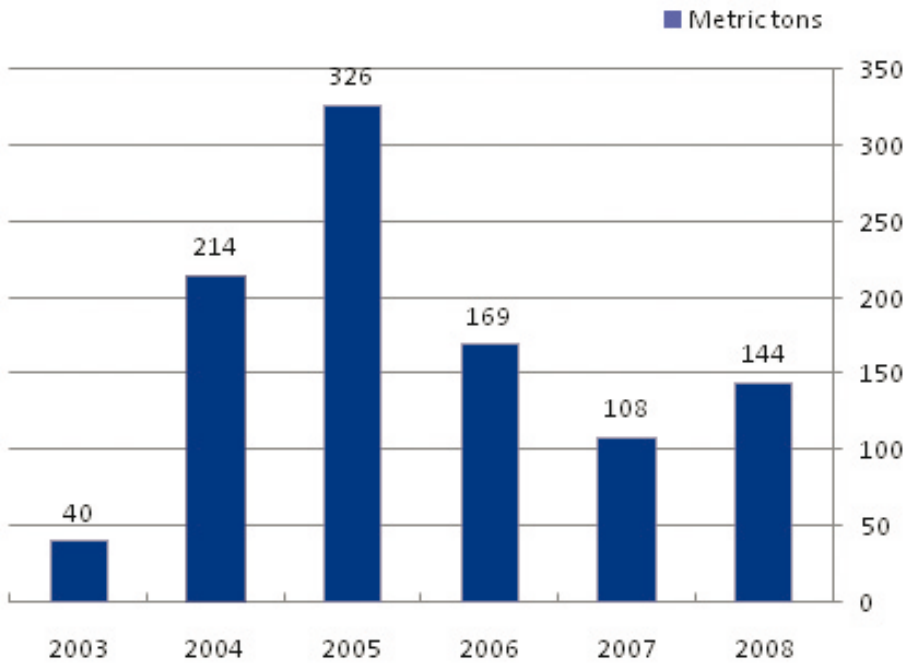
Successful grow-out trials were established at seaweed farms in Rarumana under the RFEP project. When it finished in 2003, the remaining funds of SBD 1.5 million were allocated to support the development of the seaweed industry for one year (April 2003 to April 2004). A feasibility study for EU funding was undertaken in 2004. As a result, in July 2005 a new EU project (CoSPSI) was established with funding of SBD 15 million to support the development of seaweed farming for another three years.

The objectives of CoSPSI are:

- *To expand seaweed farming activities to other locations in Solomon Islands (Ontong Java Atoll, Reef Islands, Malaita, other locations in the Western Province)*
- *To continue to assist seaweed farming in existing sites (Waghina and Rarumana)*
- *To increase seaweed production to reach sustainable export figures (>500 mt) through training and extension work*
- *To create competition by allowing more licenses in Solomon Islands*

In early 2006, the seaweed 'beach price' paid to farmers, previously fixed at SBD 2.00 a kilo, dropped to SBD 1.50. This fall, which appears to have been due to the high freight costs involved in shipping the seaweed on domestic and international routes, has contributed to a decline in production since 2006. However, increased international demand for dried cottonii throughout 2008 boosted export prices and the beach price now stands at SBD 3.10. Farmer interest in growing seaweed has revived and production is again increasing.

Figure 3: Seaweed production in Solomon Islands began in 2002 and peaked in 2005 with 320 tons exported.



6.1.3 Proposed actions by MFMR

- Assist in negotiating or putting in place regulations for fair freight practices and negotiate better transport prices for domestic shipping
- Stimulate competition for purchase and export, including direct marketing opportunities for communities
- Provide continuous extension support to rural communities
- Assist projects such as CoSPSI in carrying out trials in new seaweed farming areas
- Ensure technology transfer to help sustain industry when projects come to an end

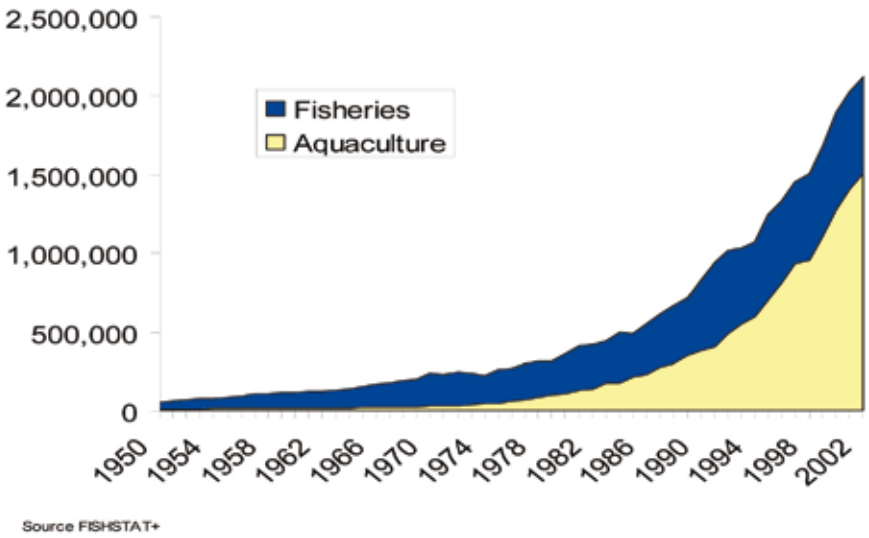
Seaweed farm in Malaita

*6.2 Tilapia (*Oreochromis *spp.)*

6.2.1 Background information

Tilapia is a tropical freshwater fish with such good farming potential that it is known as 'aquatic chicken'. It is suitable for family subsistence, extensive, semi-intensive or intensive farming. Tilapia can provide a source of protein to help meet future food security needs and its production can help generate livelihoods for the increasing populations of developing countries.

Figure 4: Production of tilapia between 1950 and 2002 (source FAO).



Two tilapia species are of interest to the Solomon Islands. Mozambique tilapia (*O. mossambicus*) is already present and widely distributed within the country, but internationally this species not preferred for aquaculture because of its slow growth and early breeding habits. Ninety-seven per cent of the tilapia farmed globally is Nile tilapia (*O. niloticus)*. This species has been introduced for aquaculture in some other Pacific Island countries and territories (Fiji Islands, Guam, Papua New Guinea, Commonwealth of the Northern Mariana Islands, American Samoa, Samoa, Vanuatu and French Polynesia) but is not present in Solomon Islands. Genetically improved farmed tilapia (GIFT) is an improved strain of Nile tilapia and is widely used by farmers in Asia and some Pacific countries. This strain grows 80% faster than unselected strains and also has a brighter color and better taste.

6.2.2. Current situation

Mozambique tilapia presently inhabits rivers, streams and swamps in the country, and already there are many attempts being made to farm it in ponds at the household level. People are now looking to tilapia to help provide affordable food for growing populations in urban/peri-urban areas, particularly as the requirements for farming tilapia are readily available (e.g. fresh water, cheap labor, and local feed ingredients) and capital costs are low. A potential problem, however, is that Mozambique tilapia is likely to hybridise with Nile tilapia (if introduced) thus reducing the growth potential of the latter. Responsible introduction and careful broodstock management of Nile tilapia will be key to the long-term success of tilapia aquaculture in Solomon Islands.

6.2.3 Proposed actions by MFMR

- Carry out an assessment of the suitability of Mozambique tilapia for small-scale community-level aquaculture for food security
- Carry out an import risk analysis (IRA) and develop quarantine protocols for the importation of GIFT Nile tilapia

If the IRA recommends the introduction of Nile tilapia, the following actions can be taken:

- Establish a hatchery
- Identify trial sites for fish farming
- Develop cost-effective local feed formulations
- Maintain the genetic quality of adult brood stock
- Promote awareness of the benefits of Nile tilapia and provide training in subsistence and livelihood farming methods
- Carry out promotion and marketing of tilapia

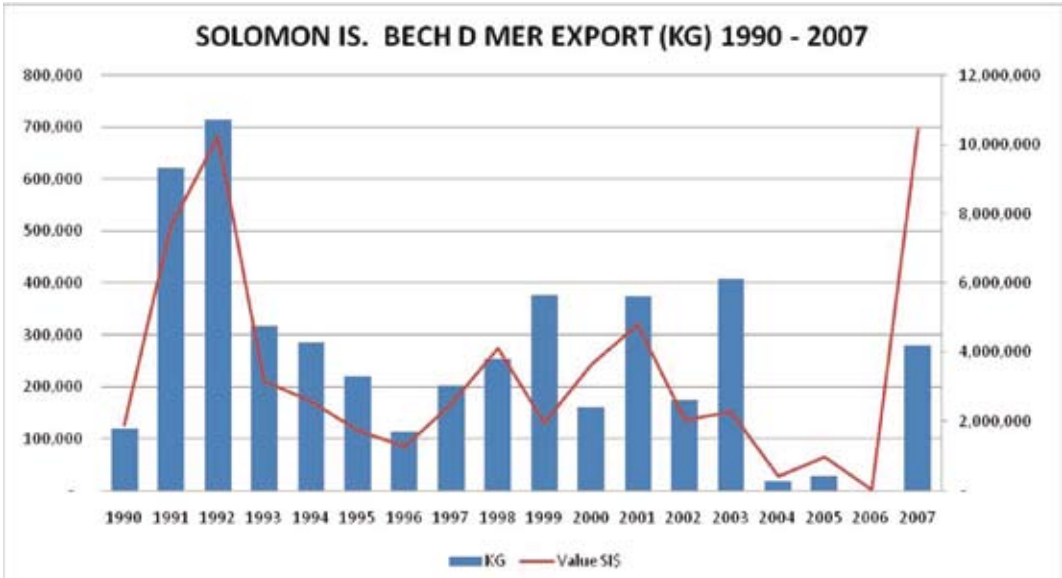
Tilapia

6.3 Sea cucumber

6.3.1 Background information

Sea cucumber has played an important role in providing livelihoods for Solomon Islands' coastal communities. However stocks have been subject to unsustainable levels of fishing, the impact of which is best shown by the decline in exports. Between 1991 and 2001, landings of sea cucumber dropped from a record level of 622 tonnes (dried) to 240 tonnes (dried) in 2001. Moreover, the bulk of exports in 2001 were derived from species of medium to low commercial value, suggesting that high-value species such as sandfish (Holothuria scabra) were so severely overfished that catch effort was shifting to more abundant but less valued species.

Figure 5: Sea cucumber exports from the Solomon Islands from 1990 to 2007. In 2006 a moratorium on harvesting was imposed but this was lifted in 2007.



6.3.2 Current situation

Because MFMR was unable to apply fisheries management controls on sea cucumber harvesting, in 2006 it imposed an outright ban on fishing as a measure of last resort. However, in the aftermath of the tsunami of February 2007 the fishery was temporarily opened to provide relief for affected communities.

Sea cucumber aquaculture is mainly confined to sub-temperate species in China. Hatchery techniques for the spawning and early grow-out of juveniles have been

proven for sandfish species. There is little empirical information on the viability of commercial ranching; however, the release and grow-out phase is likely to involve many biological and social challenges.

6.3.3 Proposed actions by MFMR

- Develop Solomon Islanders' expertise in sea cucumber restocking and ranching
- Encourage private sector investment in responsible sea cucumber aquaculture
- Encourage the development of models for equitable community participation and benefits
- Support efforts to conserve and protect wild stocks of sea cucumber

Sea cucumber

6.4 Marine ornamentals — giant clam, coral and crustaceans

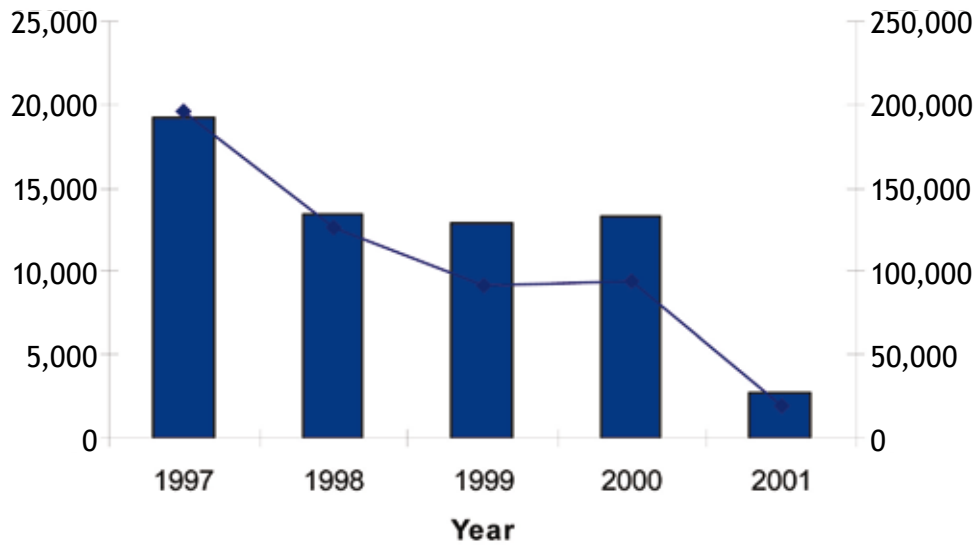
6.4.1 Background information

Giant clam

Methods for farming and restocking giant clams (*T. gigas, T. derasa, T. squamosa, T. maxima, T. crocea* and *H. hippopus*) were developed by WorldFish and MFMR in the 1990s. During that time, spat was supplied to farmers in the provinces, who raised clams for sale to AASI in Honiara. Most were shipped to the US.

A total of 61,531 clams worth SBD 526,361 were exported between 1997 and 2001 from 25 farms (Fig. 5). However, this activity ceased once the hatchery operated by WorldFish was destroyed during the ethnic tension.

Figure 6: Export of juvenile giant clams from 1997 to 2001.



Coral

The harvest of wild corals for the ornamental trade started in 1995 and is still a source of cash income for rural households. Wild coral fragments are also purchased by SIME from villages around the Honiara area. Villagers (especially from the Central Province) are sent a stock list by SIME and they then collect species accordingly. Commonly harvested species of hard and soft corals belong to the following genera: *Acropora*, *Montipora*, *Euphyllia*, *Lobophyllia*, *Sarcophyton* and *Sinularia*. There are over 40 exploited genera. Coral collectors also often harvest invertebrates such as anemones and starfish.

In Solomon Islands, corals are also harvested for the curio trade. Over 10 species from the following genera are bleached and shipped overseas: *Acropora*, *Pocillopora*, *Turbinaria*, *Seriatopora* and *Heliopora*.

The harvest of corals (*Acropora* sp.) for lime production has been occurring in Solomon Islands for a long time. Traditionally, people would move live corals (mostly *Acropora* sp.) close to their village and cultivate these as a base stock that was then harvested for production of lime.

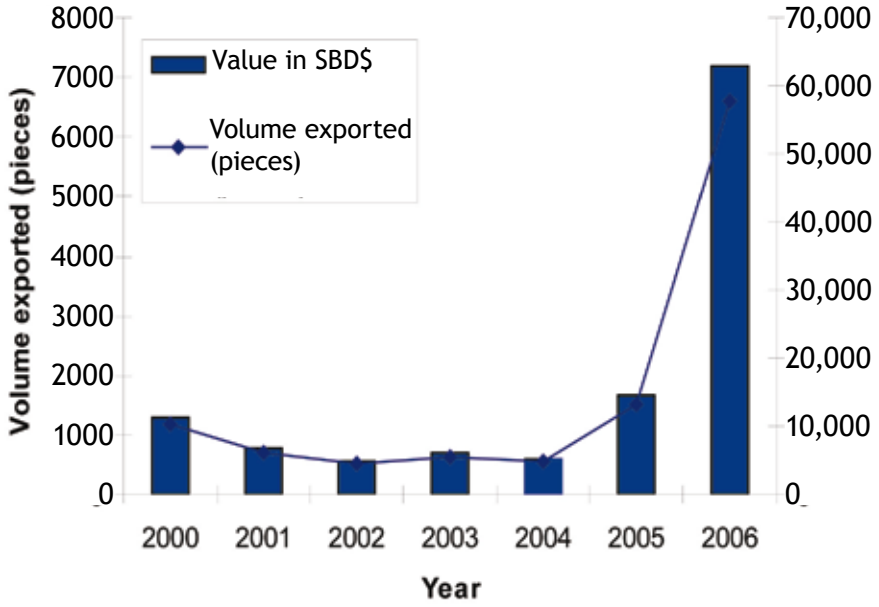
Over the past 10 years, there have been various attempts to culture coral fragments for the ornamental market. Most of this work has been in Marau, Sandfly and the Western Province (Gizo area). The principal instigators of the activity were NGOs and the private sector (Aquarium Arts SI, FSPSI and WorldFish). The main company involved in exporting farmed corals is Aquarium Arts.

Government statistics on the coral trade are only available for up to 2004 (Table 3). Until then, the quantity of farmed corals being exported was not significant. However, according to statistics from the private sector, there has been an increase in exports since 2004 (Fig. 6).

Table 3. Number of farmed corals (pieces) vs. number of wild corals exported from Solomon Islands since 2000.

Year	No. of farmed corals	No. of wild corals	Percentage of farmed coral in total coral exports (%)
2000	1299	51,417	2.46
2001	766	33,250	2.25
2002	567	40,750	1.37
2003	686	51,627	1.31
2004	439	71,017	0.61

Figure 7: Export of farmed corals (in pieces) from Solomon Islands since 2000.



Cultured corals in Western Province

Post-larval Capture and Culture of crustaceans

PCC techniques were developed in French Polynesia. A private company with financial assistance from the government was established in the Tuamotu islands. The company's primary purpose is to produce various fish for the marine aquarium trade. They have developed suitable techniques for this activity but face strong competition from wild-caught aquarium fish operations in the region.

Between 2000 and 2004, a PCC project was carried out by WorldFish and the Queensland Department of Primary Industry and Fisheries (QDPI&F) in the Western Province, using low technology and low capital investment to supply marine ornamental exporters in Honiara. One of the most promising results of this project involved the collection of cleaner shrimp (*Stenopus* spp.) and spiny lobsters (*Panulirus* spp.) Both the shrimp and the lobsters have been well received by the aquarium market, although there are only a handful of PCC farmers in Western Province currently supplying the market. For growers, PCC crustaceans have yielded better prices than PCC fish because the fish are not priced competitively in relation to the wild aquarium fish that are commonly harvested by rural Solomon Island communities in the Western Province, Sandfly and Marau.

6.4.2 Current situation

Giant clam

The WorldFish Center is once again supporting giant clam farming in Solomon Islands through a project funded by NZAID. Hatchery production of *T. derasa* is occurring at the Nusa Tupe field station. The initial focus is on *T. derasa* because this giant clam is fast growing and hardy and considered to provide farmers with the best returns. However, other species are due to come into production in 2009.

The objectives of current giant clam farming activities are:

- *To create livelihoods for rural communities*
- *To supply spat to farming communities*
- *To train giant clam farmers*
- *To target a high-value commodity in a growing market (ornamental trade)*

All provincial fisheries officers have been trained in hatchery and grow-out practices for giant clam by staff at the WorldFish Center. It is likely that once this commodity is again being produced, it will meet the 1997 level of 15,000–20,000 pieces exported annually. The current farm gate price is SBD 10.00 per 3' clam.

Coral

A 2005 review of coral farming entitled 'Financial assessment of the marine trade of corals in Solomon Islands' (Lal and Kinch 2005) compared the trade of wild and farmed corals. The review found that in 2004, there was one active coral farmer in Sandfly Island and two coral farmers in Marau. Recent work by WorldFish has encouraged sustainable farming of corals in the Western Province following MAC guidelines and there are currently more than 20 active growers operating in Western Province.

There are only two exporters of aquarium fish/corals in Honiara. Both supply the same wholesaler in the US and only a fixed amount of farmed corals can be shipped in the limited weekly air-cargo freight space, although this is changing with more airlines flying to and from Honiara.

Wild harvesting of coral no longer seems to be an attractive activity in Solomon Islands because of the low prices paid per fragment (SBD 2.00). The number of farmed corals (SBD 8.00 per fragment) that can be shipped has been limited, partly by the volume constraints of the existing overseas buyer. However, the increased number of flights and recent increase in export of farmed products, and the potential for finding other buyers, suggest that this trend may change.

The market demand for ornamentals is growing worldwide and it is MFMR's opinion that coral farming should be further developed and encouraged throughout the Solomon Islands. Even so, the number of households that could benefit from this activity is limited.

Crustaceans

Currently, PCC operations in the Western Province are targeting juvenile lobster and other crustaceans; the lobsters are sold for SBD 7.00 to the aquarium exporters in Honiara (Tables 4 & 5). They are easily grown to market size (a few cm) within a few weeks and the pueruli are relatively easy to collect (using coconut tree log methods) if located in the right area.

Table 4: Number of aquarium species sold by Mbabanga Island and Rarumana village in each year of commercial PCC operations between 2004 and 2006.

Species	2004		2005		2006		Total	
	Mbab	Raru	Mbab	Raru	Mbab	Raru	Mbab	Raru
Cleaner shrimp	200	60	601	40	279	54	1080	154
Painted lobster	165	104	434	15	491	203	1090	322
Anemone shrimp	-	-	291	-	170	-	461	0
Other shrimp	-	-	3	-	1	-	4	0
Fish	24	1	2	-	2	2	28	3
Total no.	**389**	**165**	**1331**	**55**	**943**	**259**	**2663**	**479**

Species	2004		2005		2006		Total	
	Mbab	Raru	Mbab	Raru	Mbab	Raru	Mbab	Raru
Cleaner shrimp	1400	420	3835	252	1758	340	6993	1012
Painted lobster	1155	728	2785	95	3093	1279	7033	2102
Anemone shrimp	-	-	1884	-	1071	-	2955	0
Other shrimp	-	-	2	-	6	-	8	0
Fish	32	4	1	-	1	5	34	9
Total no.	**2587**	**1152**	**8507**	**347**	**5930**	**1624**	**17,024**	**3123**

Ornamental crustaceans (cleaner shrimp)

6.4.3 Proposed actions by MFMR

Giant clam

- Encourage giant clam farming extension services by provincial officers should the market prove to be able to sustain an increase in production
- Attract private sector investment and assist development with export and documentation for CITES
- Maintain a ban on the export of wild giant clams, unless scientific evidence suggests otherwise
- Assist the WorldFish Centre and other agencies in establishing sustainable giant clam farms

Coral

- Assist the private sector to obtain permits and encourage sound policies
- Develop policies to replace sale of wild corals with farmed corals for easily cultured species
- Encourage farming of fast growing coral species (*Acropora*, soft corals)
- Improve coral farming skills of provincial officers, particularly those based within a close proximity of Honiara (Sandfly/Nggela)

Crustaceans

- Encourage aquarium fish collecting communities to diversify their activity to farmed/PCC commodities
- Trial PCC techniques in areas closer to the aquarium market in Honiara, such as the Nggela group.
- Assist NGOs and international organisations to provide training on PCC

Actions relevant to all three aquarium trade commodities

- Determine how many households can derive livelihoods from these commodities (according to the size of the international market)
- Encourage competition at the level of exporters
- Identify suitable additional overseas buyers
- Assist representation of Solomon Islands industry at international conventions and trade shows
- Encourage the market to promote these products as farm-raised and label them as eco-friendly and sustainable
- Assist industry in Solomon islands to establish certification that its products are eco-friendly
- Lobby for relief of withholding tax for small-scale rural farmers

Giant clam

6.5 Household participation

Part of the development of this plan is to estimate the number of households that could be involved in priority aquaculture activities by 2020. The Solomon Islands population is growing at a rate of 2.8% per annum (as per the 1999 census), which means that the total population is around 510,000 in 2007 and could reach 730,000 in 2020.

Data from 1999 showed the number of people per household (~ 6 people) and per capita fish consumption (~30 kg). The estimated national need for fish for food alone will be 10,000 t in 2010, 11,500 t in 2015 and 13,500 t in 2020. For livelihoods, ~16,000 households were involved in selling fish at some level in 1999. For fisheries to remain an activity of comparable importance in 2010, an additional 4000 income earning opportunities based on fisheries resources (including inland aquaculture) will need to be created by 2010. The following table (Table 6) shows how the four priority commodities could contribute to providing food (tilapia) and livelihoods (seaweed, sea cucumber, aquarium trade) for up to 4,000 household by the year 2020.

Table 6: Number of households that could potentially be involved in aquaculture of the four commodities by 2020.

Commodity/date	2007	2010	2015	2020
Seaweed	150	500	1000	1500
Tilapia	n/a	10	100	500
Sea cucumber	n/a	100	500	1700*
Commodities for the aquarium trade	30	75	100	150
Clams	10	15	20	30
Corals	15	50	65	100
Crustaceans	5	10	15	20
Total no. of households	210	760	1800	4000

*Estimate based on three scenarios:
(1) 25% of wild fishery is farmed (i.e. 150 dry tonnes/yr). Assumptions: 100 kg/household/yr = **1,500 households.**
(2) 10 ha area per community farm. Assumptions: 25 g/m2/yr; 40 communities; 50 households/community = 100 dry/tonnes/yr, **2,000 households.**
(3) 10% of 16,000 households involved in selling fish (1999 statistics) are involved in sea cucumber = **1,600 households.**

6.5.1 Proposed actions by MFMR

- Explore with relevant government departments the best means to gather aquaculture statistics and performance indicators
- Explore mechanisms for national meetings and exchange of experiences

7. OTHER COMMODITIES

7.1 Production of commodities for stock enhancement - trochus and giant clam

Hatchery technology is now available to produce juveniles for release into the wild for three purposes:

1. To restore severely depleted spawning biomass to a level where it can once again provide regular, substantial yields (**restocking**).
2. To augment the natural supply of juveniles and optimise harvests by overcoming recruitment limitation (**stock enhancement**).
3. For release into unenclosed marine environments for harvest at a larger size in 'put and take' operations (**sea ranching).**

However, MFMR does intend to apply this technology actively in Solomon Islands for three reasons:

1. Stock enhancement and sea ranching are not appropriate management interventions for Solomon Islands at this stage.
2. Large investment is required to produce juveniles in hatcheries for restocking.
3. MFMR and partners do not have the resources to embark on restocking programmes, except in the case of giant clams, where some restocking can be 'piggybacked' at relatively low cost on the village-based giant clam farms supplied with juveniles from the WorldFish Center's hatchery.

The coastal fisheries management section of MFMR will strive to ensure that stocks of valuable inshore species do not reach such chronically low levels that restocking needs to be considered. In cases where stocks are already overfished, e.g. several species of sea cucumber, other management measures to restore spawning biomass, such as no-take zones and minimum size limits, will be implemented.

Proposed actions by MFMR

- Apply the 'clam circle' concept to clam, trochus and sea cucumber species in conjunction with participatory approaches to inshore fisheries management (e.g. SLMMA, MPAs)
- Maintain a ban on clam exports, and link this measure to community-based fisheries management plans.

7.2 Sponge

Recent work on culturing sponges (*Coscinoderma matthewsi*) was carried out by WorldFish in Nusa Tupe. There have been only a few successful attempts at sponge farming in the Pacific. Federated States of Micronesia (Pohnpei State) has successfully trialed, farmed and marketed bath sponge, although it is facing economic problems in sustaining the industry.

Sponges are sought after for several niche markets (e.g. bath/beauty markets) but competition with other countries can be difficult, especially given the geographic constraints of Solomon Islands. However, it is a well-adapted commodity that requires low capital/technical input and is relatively easy to process and ship. Table 7 shows the WorldFish Center's recent estimates of the technical/economic feasibility of sponge farming.

Table 7. Reality check on what would be required to make an annual income of SBD 10,000 for a Solomon Island sponge farmer selling into the retail trade.

Target sponge size (mm)	Value of sponge (SBD)	50mm cuttings per year	Grow-out time (y)	Total stock	No. of frames
200	6	1700	3.5	6000	300
100	3	3300	2	6600	330
75	2	5000	1	5000	250

At this stage of developing the commodity, it is recommended that MFMR only assist the WorldFish Center in expanding trials and marketing the product overseas. Once the activity is shown to be sustainable, MFMR AD could have stronger involvement in the development of the new industry.

Cultured sponge

*7.3 Pearl oyster (*Pinctada *spp.)*

7.3.1 Background information

Both black-lip (*P. margaritifera*) and white-lip (*P. maxima*) pearl oysters occur naturally in Solomon Islands and pearl shells have been harvested for income over many years (Figs 7 & 8). Pressure on wild stocks from this harvesting reached such a level that the trade was closed and export of shells was banned in 1994, though illegal harvesting has continued.

Figure 7: Export of black-lip pearl oyster MOP from 1990 to 1994

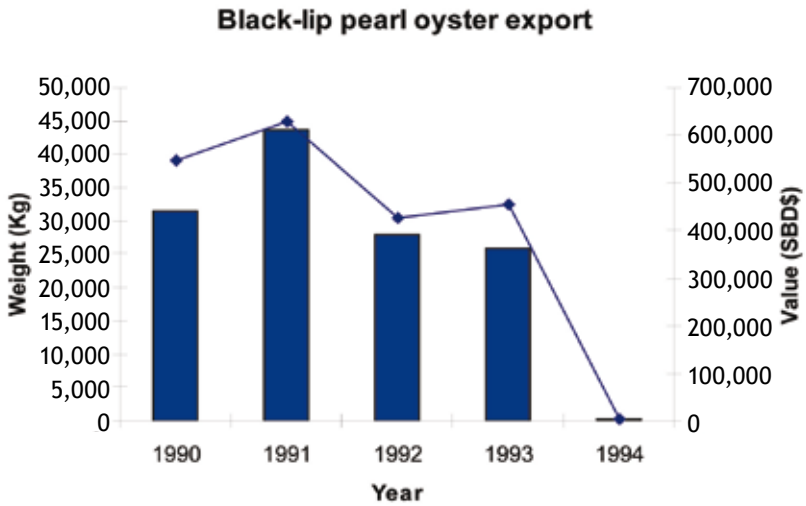


Figure 8: Export of gold-lip pearl oyster MOP from 1990 to 1993

Between 1994 and 1997, the Fisheries Division of the (then) Ministry of Agriculture and Fisheries and the WorldFish Center operated a project to assess the potential for establishing village farms for black-lip pearl oysters based on the collection of wild spat. The results showed that wild spat could be successfully collected and farmed for sale:

- Collections of spat at some locations in the Western Province were greater than 4 spat per collector, enough to support commercial farming activities
- A small-scale farm at Nusa Tupe (Western Province) proved the technical feasibility of the concept by producing the first cultured pearls
- Harvests of four small crops of pearls and auction sales in 2000, 2004 and 2005 showed economic potential
- Farmed pearl oysters in the Solomon Islands displayed a high growth rate

These results suggest that there is good potential for pearl farming in Solomon Islands and MFMR is interested in promoting its development.

7.3.2 Current situation

Since its establishment, the MFMR Aquaculture Division has received a number of requests from rural communities regarding the farming of pearl oysters. However, it is MFMR's view that the implementation of a pearl industry should be driven by the private sector. MFMR could assist rural communities in spat collection and grow-out techniques through training and awareness programmes. These communities would need strong linkages with a commercial operator, either by being directly employed by the operator or being subcontracted to carry out spat collection and grow out.

Black-lip pearl oyster at Nusea Tupe

The WorldFish Center has been carrying out research on pearl oysters on behalf of MFMR and in 2007 the EU commissioned WorldFish to implement a project to stimulate investment in pearl farming of both black-lip and white-lip pearl oysters. The objectives and outcomes of this project are summarised below.

1. *Summary of information available on potential for farming black-lip pearls*
2. *National survey of location, abundance and quality of white-lip pearl oysters*
3. *Environmental advantages/limitations of Solomon Islands for pearl farming*
4. *Policy guidelines for sustainable investment in pearl farming supporting small-holder community involvement*
5. *Business climate for investment in pearl farming*
6. *High-level contacts within offshore pearl companies most likely to consider investing in pearl farming in Solomon Islands.*
7. *Presentations to potential investors on the pearl oyster resources of Solomon Islands, results of research on culture methods and the advantages and risks of investment, and policies for development of aquaculture and pearl farming in Solomon Islands.*
8. *Recommendations to government concerning licensing conditions for pearl farming to provide opportunities for smallholders to supply large farms, and to ensure that the industry operates in an environmentally sustainable way.*

The culture of pearls from black-lip pearl oysters (*P. margaritifera*) has brought substantial economic benefits to French Polynesia, Fiji and Cook Islands. This success is partly due to the strong involvement of the private sector. Pearl farming is a long-term and capital intensive investment and a successful farm may only be profitable after 6 to 8 years. Therefore, it is MFMR's opinion that small-scale pearl farming at the community level is impractical. In the future, it may be feasible as a satellite operation in partnership with a larger experienced operator with the appropriate business acumen and financial resources.

7.3.3 Proposed actions by MFMR

- Collaborate with WorldFish Center and EU to attract private investors in Solomon Islands
- Maintain the ban on the wild shell trade
- Implement the policies and licensing conditions developed by the EU funded project
- Provide extension services through provincial fisheries officers to promote participation by local communities after the establishment of private farms
- Promote value-added pearl oyster products particularly for rural communities, e.g. shell carvings or mabe pearl handicrafts.

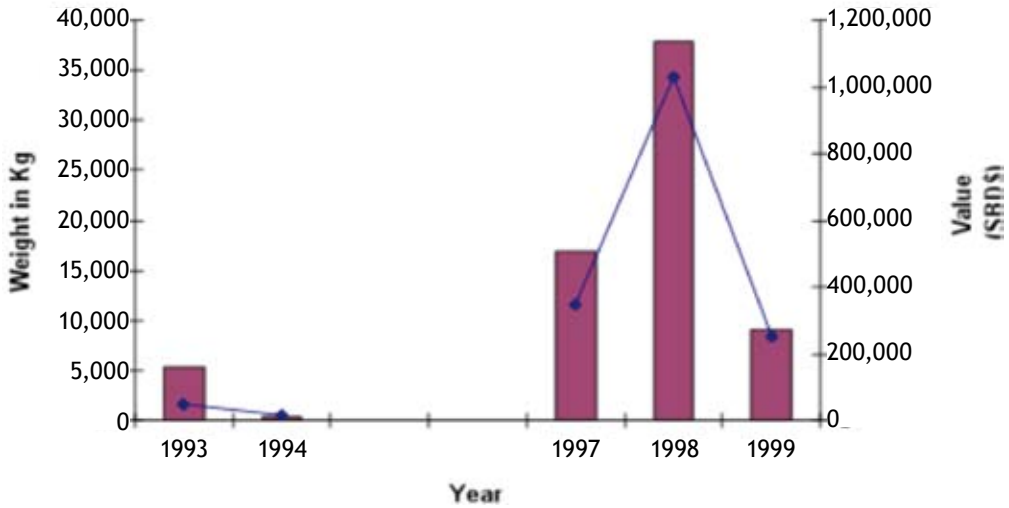
7.4 Penaeid shrimp and Macrobrachium *prawn*

7.4.1 Background information

The prawn industry started in the mid-1980s and resulted in the establishment of two private prawn farms located west of Honiara. This activity stopped during the ethnic tension.

Highest export production reached 38 mt worth SBD 1.2 million in 1998 (Fig. 9). Two species were used, *Penaeus monodon* an euryhaline marine shrimp species, and *Macrobrachium rosenbergii*, a freshwater prawn species. Owing to lack of local capacity for breeding and rearing larval stages in hatcheries, post-larvae for pond stocking were imported from Australia.

Figure 9: Export of prawns from 1993 to 1999 (production stopped in 1999 due to the ethnic tension).



7.4.2 Current status

Given the current competition within the prawn industry worldwide (particularly from Asia), it seems that rejuvenating prawn farming in Solomon Islands is a risky venture. However, the Aquaculture Division will support future local investors/ farmers who are interested in developing the industry and have land available for prawn culture.

Any future development of the prawn industry will rely heavily on land availability.

The land previously used for prawn farming has been reclaimed. This has blocked the restart of prawn farming and the industry, and investors have moved to other Pacific Island countries.

Since the 1990s, the shrimp situation overseas has also changed. Many shrimp hatcheries are now experiencing problems with shrimp viral diseases such as white-spot syndrome virus (WSSV). To resume shrimp post-larvae imports from these same sources would place a Solomon Islands industry at risk. Future imports of live shrimp should be restricted to reputable specific pathogen free (SPF) sources. Ideally, Solomon Islands should acquire its own capacity to breed and rear shrimp and prawns locally.

Lower technology farming of local freshwater prawns (*Macrobrachium* spp., e.g. *M. lar*), or integrated culture with taro, may be realistic development strategies. Production could benefit small local food markets (hotels/market places) and generate cash incomes in rural areas. There is renewed demand for prawns by hotels and restaurants in Honiara.

7.4.3 Proposed actions by MFMR

Macrobrachium *prawn*

- Assess feasibility of collecting sufficient juvenile *M. lar* post-larvae for economically viable capture-based grow-out enterprises
- Consider responsible introduction of *M. rosenbergii* for hatchery-based grow-out enterprises
- Assess other local prawn species for aquaculture or restocking potential
- Carry out grow-out trials together with villages in the Guadalcanal area
- Carry out a market analysis
- If the development of this commodity is found to be economically viable, train provincial officers and MFMR staff in collection, grow out and conditioning of freshwater prawns.
- Train communities to collect, grow and sell prawns
- Assist in the development of local markets (i.e. hotels in Honiara)

Penaeid shrimp

- Assist overseas partners in a survey of shrimp within Solomon Island waters for assessment of their viral disease status
- Carry out an updated feasibility study on the current market for prawns and its potential profitability.
- Assist prospective investors
- Investigate sources of post-larvae and conduct a proper risk analysis of disease-free sources from overseas

- Provide ongoing support to farmers once established
- Collate and disseminate information about shrimp in Solomon Islands to potential investors
- Investigate possible revitalisation of Ruaniu ponds or other suitable grow-out sites

7.5 Emerging commodities

MFMR believes that the commodities outlined above should be the focus of aquaculture development. However, aquaculture is a dynamic area and there are emerging commodities that could prove to be feasible. In due course, small-scale pilot trials could be carried out to test the technical and economic feasibility of the following emerging commodities, provided this does not detract from development of the priority commodities.

Rabbitfish from cage culture trial

Table 8: Summary of other potential commodities for Solomon Islands aquaculture. Impact and feasibility are ranked from low to high

Species	*Name*	*Culture method*	*Target areas*	*Target market*	*Feasibility*	*Impact*
Eel	*Anguilla* spp.	Elvers captured during recruitment and basic pond set up for grow out	Big islands with large river systems	Export of live adults	Low	Medium
Ornamental fish	*Amphiprion* spp.	Hatchery production of high value/high demand fish. Village based cage grow out.	Nusa Tupe for hatchery and Western province area for grow out	Export for the ornamental trade	Low	Medium/ high
Live rocks	Scleractinian rocks	Produce an artificial base and allow to colonise on the reef. Maintenance and owner-ship by village based farmers	Islands where the ornamental trade is active (Nggela, Marau and Western Province)	Export for the ornamental trade	Medium	Medium
Milkfish	*Chanos chanos*	Capturing fingerlings during recruitment in coastal areas. Grow out to plate size in basic pond set-up	Large islands with high protein needs (Malaita, Guadalcanal)	Local market for human consump-tion	Medium	Medium
Crocodile	*Crocodilus* spp.	Based on PNG example	–	Export for leather Local for meat	Low	High
Mud crab	*Scylla* spp.	Hatchery reared or capture of wild crablets for fattening	–	Exort/local (food)	Low	Medium
Sea urchin	Various spe-cies	Culture based fishery	Areas with large sheltered lagoons	Local or international market for human consumption	Medium	Medium
Rabbit fish	Siganidae	Capture-based cage culture	Large islands with high populations and sheltered lagoons	Local market for human consumption	High	Medium
Indigenous freshwater fish	Various species	Hatchery-based pond or cage culture	Large islands with abundant fresh-water resources	Local market for human consumption	Medium	Medium
Clams for shell money	*Beguina* spp.	Culture-based fishery	Locations with over-exploited clam fisheries	Local shell-money artisans	Low	Medium

8. FACILITIES, REGULATIONS, HUMAN RESOURCES AND CROSS-SECTORAL FACTORS

8.1 Aquaculture facilities

The WorldFish Center in the Western Province provides the only research based hatchery-operation in the Solomon Islands. WorldFish has the ability and technical skills to produce marine aquaculture commodities such as giant clams and, with additions to its infrastructure, could also support production of spat for pearl oyster or other marine invertebrates or fish.

Given the current state of development of aquaculture in Solomon Islands, construction of an additional marine hatchery to support development of the priority commodities is not presently envisaged.

Marine hatcheries are expensive to run, are labor intensive and require skilled staff. Elsewhere in the Pacific, government-operated facilities have struggled to provide a return on investment. MFMR would support private-sector development of small-scale hatcheries. For example, small-scale giant clam hatcheries have had some success around the Pacific region.

MFMR considers tilapia a priority commodity for Solomon Islands given the state of development of tilapia farming techniques and the success of Fiji, PNG and other countries in the region. There is a need to develop a pilot freshwater hatchery for GIFT tilapia (including a quarantine facility) that could supply quality fingerlings to farmers. MFMR proposes to investigate sites for a freshwater aquaculture facility (e.g. revitalization of the former ICLARM site), possibly in conjunction with institutional or private-sector stakeholders. If successful, MFMR will encourage private-sector entrepreneurs to join the venture and provide funds for extension.

8.2 Human resources

Aquaculture is not a common tradition in Solomon Islands. MFMR has, however, assembled a team of experienced and qualified local staff that exceeds the minimum HR requirements for training and skills in aquaculture. The Aquaculture Division was established in 2000 to administer aquaculture activities in conjunction with other members of the Coastal Fisheries Division and provincial fisheries officers.

Institutional strengthening and further building of knowledge are needed in the AD. In particular, training is required in specialised areas relating to some of the priority aquaculture commodities. The current staffing requirements and level of qualifications required for the division, according to the MFMR Corporate Plan, are shown in Table 9 below.

Table 9: Aquaculture Division staffing status

Position	*Level*	*Current Status*	*Required qualification*	*Current qualification*
Deputy Director-Inshore	12/13	Filled	Masters (Science)	Masters (Science)
Chief Fisheries Officer (Division Head)	10/11	Filled	Bachelor (Science)	Diploma (Tropical Fisheries)
Principal Fisheries Officer (Marine)	8/9	Filled	Bachelor (Science)	Bachelor (Science)
Principal Fisheries Officer (Freshwater and Brackish)	8/9	Filled	Bachelor (Science)	Bachelor (Science)
Senior Fisheries Officer (Marine)	7/8	Filled	Bachelor (Science)	Diploma (Tropical Fisheries)
Senior Fisheries Officer (Freshwater & Brackish)	7/8	Vacant	Bachelor (Science)	
Fisheries Officer (Marine)	7/8	Filled	Diploma (Tropical Fisheries)	Diploma (Tropical Fisheries)
Fisheries Officer (Freshwater & Brackish)	6/7	Vacant	Diploma (Tropical Fisheries)	

Policies and legislation

There is a lack of legislation and policies for aquaculture in Solomon Islands. In 2002, the first Aquaculture Regulations were drafted and circulated for comment. They cover the following items (the regulations are available on request from the MFMR AD):

1. ***Licensing***
2. ***Importation of exotic organisms***
3. ***Establishment of aquaculture facilities***
4. ***Health and disease issues***
5. ***Processing, sale, labelling, and export***
6. ***Lease for aquaculture purposes***
7. ***Aquaculture operations***

The draft regulations were completed through the combined efforts of the Fisheries Legal Adviser and Deputy Director (Aquaculture). They also provide guidelines for the division and the department as a whole. However, the draft is yet to be revised by the Attorney-General's Chambers to enable it to be forwarded for

gazetting. When it is gazetted, the AD will be in a stronger position to guide the development of aquaculture in the country. The review of the Fisheries Act now taking place should also address these matters.

Both EU projects, CoSPSI and 'Stimulating investment in pearl farming', are also developing policy and licensing recommendations, which should eventually be integrated into the regulations for aquaculture.

8.3 Cross-sectoral factors relating to aquaculture

Research and development

The MFMR Aquaculture Division will make best use of regional expertise. There have been many success stories in the Pacific region (as well as failures). Solomon Islands is still in the early stage of aquaculture development and can learn from these experiences and avoid mistakes.

Regional and international organisations (SPC, FAO, WorldFish), regional universities (USP) and NGOs can undertake or commission research on behalf of MFMR, or source technical information to assist Solomon Islands to develop a sound strategy for aquaculture.

Training

The MFMR AD will be launching training activities for its staff. The division will ensure that national training needs are wisely addressed and will make best use of training opportunities available in country. For example, MFMR provincial officers have been trained in giant clam spawning and larval rearing at the WorldFish Center station. Training on other commodities can also be arranged for MFMR staff and other stakeholders.

Training should be in accordance with national policies and priorities set for aquaculture. AD should consult with its institutional and financial partners to identify the training required to produce tangible outcomes. Regional organisations such as SPC or USP, for example, have experience in organising training workshops and individual attachments and these are avenues that will be pursued by MFMR.

Information

Relevant information on aquaculture is readily available in Solomon Islands and in the region and MFMR will ensure that good use is made of this information. Since the peak of aquaculture activities in the Solomon Islands prior to the ten-

sion, there has been a rapid evolution of aquaculture both regionally and globally. MFMR is well placed to take advantage of these developments and is seeking to acquire up-to-date knowledge that will benefit Solomon Islands.

MFMR will develop mechanisms to improve the flow of information from international/regional partners and industry operators to MFMR headquarters and on to MFMR provincial officers, who will disseminate it to rural farmers.

Information and communication infrastructure, including basic equipment such as telephones, computers, and radios, are an important part of information dissemination and will be a priority, especially for remote provincial stations.

Biosecurity

Due to its remoteness, the Pacific has a relatively pristine environment and some natural security against invasion by exotic species. However, the region is not free of the risks of introduction of some aquatic species (e.g. Mozambique tilapia has had negative results).

MFMR, in partnership with key agencies such as quarantine and environment services, intends to build up the national capacity to assess the impact of introduced species and protect against adverse impacts. This process will take place within the framework of the National Biosecurity Strategy and Action Plan (NBSAP).

Under the draft aquaculture regulations, there are measures to control the introduction of exotic animals. MFMR will also seek the expertise of regional organisations and specialists to assist in developing these strategies.

WorldFish Centre at Nusa Tupe Island

9. TRADE INVESTORS AND NGOs

9.1 Policy on trade investors

It is in the interest of Solomon Islands to attract private sector investment both locally and from overseas. Aquaculture success stories in the Pacific have often been generated by early private sector involvement. To attract investment, MFMR AD, and its partners, will provide information to prospective investors on the following issues:

Land and sea tenure

Solomon Islands has customary rules on sea and land access rights and ownership. There are many cases of conflict in Solomon Islands and elsewhere in the Pacific over land/sea ownership. This might be a limiting factor for private investment in Solomon Islands and MFMR will have to formulate clear rules and guidelines in this regard to make Solomon Islands more attractive for investors. The current study on tenure issues for pearl aquaculture could be extended to other aquaculture priority commodities.

Licensing

There is as yet no specific licensing for aquaculture in Solomon Islands. MFMR AD ought to make aquaculture attractive for private investors, noting that high prices for licenses could discourage investors.

MFMR should encourage competition but should also limit the number of licenses distributed for aquaculture in Solomon Islands. This issue is addressed in the draft aquaculture regulations.

Infrastructure

Inadequate infrastructure is a major limiting factor for aquaculture development in Solomon Islands. MFMR is well aware of this situation and will liaise with appropriate authorities to consolidate aquaculture in areas where infrastructure is adequate and extend it to new areas with promising potential.

Freight

MFMR should help develop freight pricing agreements for aquaculture commodities with shipping companies, whether internal or for export, e.g. sea freight for seaweed and air freight for ornamentals. MFMR wishes to assist developers in negotiating fair prices for shipping their commodities, within or out of Solomon Islands.

9.2 Policy on NGOs

There has been a great deal of collaboration between MFMR and NGOs in the past in implementing government objectives for fisheries and aquaculture. As the lead agency responsible for fisheries and aquaculture matters, MFMR seeks a relationship with NGOs in which:

- NGOs align their work programmes with those of MFMR to help implement national priorities
- NGOs and MFMR provide each other with information about intended work plans and target communities, sites and actions
- MFMR seeks to set up forums for dialogue with NGOs for information exchange
- All NGOs work towards establishing memorandums of understanding or mutually acceptable agreements with MFMR
- NGOs ensure project progress is reported back to all responsible bodies (MFMR, donors, provinces, communities)

Holding pens

ANNEX

Table 10: Development plans for each commodity

SEAWEED		
Immediate action	Within 2 years	Within 5 years
▸▸ Continue growth trials ▸▸ Maintain seaweed farming/ farmers ▸▸ Establish quality standards ▸▸ Expand to new sites ▸▸ Review domestic and international freight constraints ▸▸ Meet target of 500 mt per yr ▸▸ Explore follow-on arrangements after expiration of COSPSI in 2008	▸▸ Review farm gate price ▸▸ Increase export market opportunities ▸▸ Assess opportunities for mutually beneficial regional collaboration ▸▸ Meet target of 750 mt per year	▸▸ Investigate value adding opportunities (fertiliser etc.) ▸▸ Increase competition, e.g. explore direct marketing arrangements for communities ▸▸ Establish several sites of commercial significance ▸▸ MFMR to take a stronger regulatory role in development ▸▸ Private sector to take more responsibility for extension and training ▸▸ Meet target of 2000 mt per yr
SEA CUCUMBER		
Immediate action	Within 2 years	Within 5 years
▸▸ Maintain a watching brief on advances in sea cucumber production and marketing ▸▸ Build the capacity of Solomon Islanders in hatchery and grow-out techniques through attachments, training and research opportunities ▸▸ Integrate sea cucumber ranching and restocking into the bêche-de-mer management plan ▸▸ Prohibit the importation of live sea cucumber ▸▸ To avoid possible changes in population genetics, ensure that broodstock used to reseed areas are collected from the same locality or have a similar genetic make-up	▸▸ Engage with private sector to establish a demonstration hatchery ▸▸ Investigate potential sites for sea cucumber aquaculture taking into account factors such as fishery status and suitable habitat ▸▸ Investigate community based fisheries management models for sea cucumber aquaculture	▸▸ Investigate opportunities for post harvest value adding and maintenance of quality ▸▸ Develop responsible practices for translocation of live sea cucumbers within the country ▸▸ Explore options for a land based pond grow-out system

TILAPIA		
Immediate action	Within 2 years	Within 5 years
▸▸ Assess the feasibility of farming Mozambique tilapia as a food source ▸▸ Carry out IRA for introducing Nile tilapia ▸▸ Establish a hatchery immediate facility for training purposes	▸▸ Establish a national quarantine facility and national brood-stock maintenance facility ▸▸ Provide fish farm training ▸▸ Facilitate sale of farmed products ▸▸ If risks are within acceptable limits, and subject to existing regulations, introduce Nile tilapia	▸▸ Develop domestic market for tilapia sales ▸▸ Establish tilapia farming opportunities for subsistence purposes and/or semi-commercial purposes ▸▸ Establish a network of hatcheries to provide quality fingerlings
PEARL OYSTER		
Immediate action	Within 2 years	Within 5 years
▸▸ Carry out an assessment of feasibility of white-lip pearl oyster farming ▸▸ Develop investment guides for white-lip and black-lip pearl ▸▸ Develop economic planning models for pearl farming	▸▸ Assess options for wild-caught spat versus hatchery-reared spat ▸▸ Carry out farm trials for white-lip pearl ▸▸ Clarify tenure issues to establish secure farm sites and reduce risks identified by potential investors	▸▸ Attract private sector investment into the country for commercial farming ▸▸ Establish financing arrangements for rural based satellite farms ▸▸ Establish quality standards for commercial pearl exports ▸▸ Initiate rural based satellite farms, e.g. contract growers, or mabe pearl producers ▸▸ Source value-adding opportunities for rural communities (carvings, handicrafts)
GIANT CLAM FOR THE ORNAMENTAL MARKET		
Immediate action	Within 2 years	Within 5 years
▸▸ Continue production of juvenile clams ▸▸ Refine nursery grow-out ▸▸ Select sites for farming ▸▸ Provide training to fisheries provincial officers ▸▸ Maintain the ban on export of wild clams	▸▸ Expand activities into the private sector ▸▸ Assist giant clam producers with marketing strategies ▸▸ Gather market intelligence for giant clam products ▸▸ Establish trade accreditation (e.g. CITIES), and regulations for trade ▸▸ Develop competition	▸▸ Giant clam farming industry is established in rural communities ▸▸ Monitoring systems for trade and statistics in place ▸▸ Additional market opportunities sourced

CORALS FOR THE ORNAMENTAL MARKET		
Immediate action	Within 2 years	Within 5 years
▸▸ Carry out fragmentation grow-out trials (WorldFish) ▸▸ Identify most promising species for farming ▸▸ Select sites for community farms ▸▸ Train fisheries officers in extension techniques ▸▸ Expand size of the market	▸▸ Achieve better compliance with regulations on the trade of wild corals ▸▸ Promote farming of corals as an alternative, especially close to efficient transport routes	▸▸ MFMR to establish a regime for proper licensing and trade ▸▸ Coral farming is widely accepted in Solomon Islands as an alternative to wild harvest
FRESHWATER PRAWN		
Immediate action	Within 2 years	Within 5 years
▸▸ Assess the wild stock and recruitment patterns of indigenous freshwater prawn ▸▸ Based on the above analysis, assess the feasibility of capturing indigenous freshwater prawn post-larvae from the wild ▸▸ Assess the feasibility of cottage freshwater prawn industry	▸▸ Trial grow out of local freshwater prawn in co-culture and in monoculture ▸▸ Assess the domestic market demand for prawns ▸▸ Develop best-practice post-harvest processing techniques	▸▸ Expand freshwater prawn farming activity to other regions of Solomon Islands ▸▸ Refine husbandry methods for culture of prawns (local diets, stocking density and grow-out systems) ▸▸ Ensure wild stocks of prawn are not being affected by aquaculture ▸▸ Assess the viability of importing *Macrobrachium rosenbergii*
SPONGE		
Immediate action	Within 2 years	Within 5 years
▸▸ Expand sponge trials to interested communities/ groups ▸▸ Thoroughly study market capacity ▸▸ Produce a cost-benefit analysis for this commodity, adapted to Solomon Islands context	▸▸ Assist and attract private sector investment ▸▸ Assist in coordinating shipping of the commodity overseas ▸▸ Train provincial officers in propagation techniques	▸▸ MFMR to establish a licensing regime for this commodity ▸▸ Establishment of wild broodstock management ▸▸ Establishment of quality control practices
EEL		
Immediate action	Within 2 years	Within 5 years
n/a	▸▸ Carry out study of feasibility of trapping elvers for aquaculture ▸▸ Identify species ▸▸ Assess the feasibility of an eel industry	▸▸ Depending on the results of the study, carry out pilot trials for eel farming ▸▸ Source markets for export ▸▸ Establish village based opportunities for elver collection and grow-out

Table 11: Cross-sectional plan for strengthening the aquaculture industry

HUMAN RESOURCES		
Immediate action	Within 2 years	Within 5 years
▸ Training needs assessment carried out ▸ Short-term training instigated ▸ Staff identified for longer term training plan (i.e. degree level) ▸ In-country training workshops instigated	▸ Training of extension officers ▸ Partnerships with training organisations established (USP, SPC, WorldFish Center)	▸ Key personnel identified for long-term training are currently enrolled in their programme ▸ Training outsourced where applicable ▸ National accreditation of training schemes being investigated
AQUACULTURE POLICIES, REGULATIONS AND LICENSING		
Immediate action	Within 2 years	Within 5 years
▸ Aquaculture Development Plan is accepted ▸ Key policy issues identified ▸ Current draft regulations reviewed by AG's Chambers ▸ Requirements for aquaculture licensing regime reviewed	▸ Regulations gazetted ▸ Aquaculture management plans for commodities developed ▸ Specific licensing conditions identified ▸ Ongoing consultation with private sector to review licensing arrangements	▸ Regulations reviewed where necessary ▸ Policy and regulations regularly incorporated in national development plans
RESEARCH & DEVELOPMENT		
Immediate action	Within 2 years	Within 5 years
▸ Carry out a nation-wide assessment of all research and development projects in Solomon Islands ▸ Identify key research bottlenecks ▸ Identify key donor agencies and funding sources available to Solomon Islands ▸ Formulate channels for preparation of research proposals and funding	▸ Carry out research and development trials ▸ Encourage collaboration between government, NGOs and private sector ▸ Organise a national seminar to report on research results	▸ Publication of research results ▸ Uptake of technology transfer by the private sector ▸ Impact and outcomes of research results monitored and evaluated

INFORMATION		
Immediate action	Within 2 years	Within 5 years
▸ Determine information needs, best forms of media and language requirements to facilitate aquaculture development ▸ Collate Solomon Islands aquaculture information and statistics ▸ Investigate options for digitising or making data available online ▸ Explore options for communication to rural farmers and provincial officers	▸ Repository of aquaculture information is in place ▸ Publication on status of aquaculture in Solomon Islands produced ▸ Projects to raise information and awareness of aquaculture being undertaken ▸ Aquaculture data reporting systems in place	▸ Regular reporting of aquaculture information and statistics ▸ Regular flow of information from provincial to central offices

BIOSECURITY		
Immediate action	Within 2 years	Within 5 years
▸ Assess commodities being targeted for introduction or export ▸ Establish inter-agency linkages (fisheries, quarantine, environment, veterinarian) within country ▸ Develop biosecurity framework (EIA, IRA, quarantine, etc.) for aquatic organisms ▸ Assess capacity of national agencies to carry out aquatic biosecurity	▸ Review biosecurity policies for aquatic organisms and update Establish national biosecurity working group ▸ Establish model EIA and IRA templates for Solomon Islands ▸ Carry out up-skilling and training of Solomon Island officials involved in biosecurity	▸ National disease surveillance and management plan in place ▸ Legislation updated to accommodate aquatic biosecurity ▸ Importation and export of aquaculture commodities subject to routine biosecurity checks