

Final report for Mini-project MS0503:

Microalgae culture training for

Samoa Fisheries staff



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Background

Marine microalgae are known to be the basic source of important nutrients essential for larval development for almost all marine invertebrates, allowing growth and transformation through to juvenile and adult stages to proceed. Diatoms *Chaetocerus gracilis* and *Navicula ramoissima* are currently cultured for feed for aquaculture commodities in Samoa, namely for sea urchin *Tripneustes gratilla*. Both species are produced in a small algal laboratory located in the Fisheries Division main office in Apia (Fig. 1a), in 3000 ml glass conical flasks, and 500 ml and 1000 ml glass cylinders (Fig. 1b).



2), freshwater hatchery in Apia (Fig. 3) and the algal laboratory. Upgrading the facilities and purchase of backup equipment were also made possible.

Aquaculture in Samoa is at its infancy stage, focussing all efforts on initiative, operational and developing activities. Aquaculture at the subsistence or village level is popular however, as one of the objectives for MAF's work sequence for the next five years as stated in the Samoa Development Strategic Plan (SDS), which marks the progress of aquaculture development in Samoa. Other objectives included in the Division's SDS are: to formulate an aquaculture sector plan to provide a directive measure for all aquaculture activities: develop



Figure 1. Samoa Fisheries Division, Apia (a) microalgae laboratory, and (b) diatom culture in flasks.

Aquaculture activities in Samoa over the years have been haphazard primarily due to insufficient resources to work with, and of course the limited technical knowledge of staff. Financial support from the government has been limited, called for the collaboration of the Division with foreign aid agencies through which, several small funded projects were developed to assist mainly research trial activities. Major results were the establishment of the marine hatchery facility at Toloa (Fig.



Figure 2. Samoa Fisheries Division, Toloa marine hatchery.

a technical manual for sea urchin aquaculture; develop a manual for microalgal culture, and to formulate a hygiene protocol for the hatchery and algal laboratory.

There are four main aquatic species involved with aquaculture in Samoa. These include marine species such as: giant clam *Tridacna* sp; sea urchin *T. gratilla*; and trochus *Trochus nilotica*; and freshwater tilapia *Oreochromis niloticus*. Since the objective is to establish a commercial aquaculture venture, the essential aspect of the process would be to increase hatchery production of larvae through effective management and technical measures to enhance survival rate. One of these measures is to uphold production and supply of microalgae for feed. Feed quality and quantity are important aspects for larval rearing, as they would always have to approximately match the morphological and nutritional characteristics of the larvae for better results. Contamination of the algal cultures by any means is undesirable, therefore it is important to maintain good hygiene in the hatchery and algal laboratory at all times.



Figure 3. Samoa Fisheries Division, Apia freshwater raceways for tilapia culture.

Training

The knowledge and skills of Fisheries Aquaculture staff on the technical and managerial aspects of microalgal culture are limited. This, in addition to the initiative of SFD to formulate a manual for microalgae culture, called for further technical training of aquaculture officer, Aleluia Taise. Ms Taise undertook a three-week attachment in Australia with the Live Prey Unit at the Northern Fisheries Centre (NFC) in Cairns, Queensland, from April 20 to May 10 2005. The training aimed to enhance staff capacity at operating and managing all aspects of the laboratory, particularly with regard to maintaining good hygiene and sustaining production.

At NFC (Fig. 4 a,b), marine microalgae are culture mainly for larval feed for echinoderms such as sea cucumber (sandfish) and for enrichment for zooplankton such as rotifers and copepods, which are then fed to larvae of fish and crustaceans. The seawater system involves an intensive series of filtration techniques (including UV light) to minimize contamination from other unwanted microalgae species as well as protozoans and bacteria. The seawater for microalgal culture is further sterilised by addition of sodium hypochlorite (chlorine). However, it was suspected by DPI&F staff that the crash of some of the microalgal cultures could have been due to the poor quality of the chlorine. Chlorine may not be very effective after two weeks and could deteriorate the cultures.

Over the three weeks that was allocated for the



Figure 4. Northern Fisheries Centre Live Prey Unit microalgae facilities (a) stock cultures, and (b) scaled up algae production in carboys and plastic bags.



training, each day a lesson was learnt. Although the same activities were performed daily, each step was important. Outcomes of the training included the following:

- Acquired practical experience in inoculation and maintenance of stock cultures;

- Acquired knowledge for serial dilution procedure necessary when algal cultures are contaminated to bring the culture density down to ~ 1 cell/mL;
- Enhanced knowledge of counting cells under microscope;
- Enhanced knowledge on the appropriate optimal range of physical parameters for culture of microalgae such as water temperature, salinity and light intensity;
- Acquired an insight into different types of microalgae utilized for aquaculture in Cairns;
- Acquired knowledge of possible alternatives to encounter some problems and fill the gaps in the process in Samoa;
- Built initiative; and
- Enhanced knowledge of keeping a good hygiene level in the hatchery and laboratory.

The training at DPI&F in Cairns was both beneficial and challenging. Of course, resource availability was not an issue at NFC in comparison to aquaculture in Samoa. One subject that was surprising was that even local farmers possess their own hatchery and small, but effective, algal laboratory or so-called *work bench*. A field trip to fish farms south of Cairns during the attachment revealed that farmers are utilising different methods to keep their facility operating, taking into account the limited resources available to them.

Application for aquaculture in Samoa

Samoa has relatively good seawater quality, which eases the demand for establishment of costly UV treatment and huge water storage tanks. The water temperature and salinity are quite stable, although sometimes variations occur due to heavy rainfall or exposure to the sun. It is anticipated to establish polycarbonate clear roofing or alternatively at the marine hatchery to compensate for that problem. There had been failure to produce giant clam juveniles for species *T. maxima* for the last three spawning runs, and was suspected to be caused by either dramatic drop in water salinity due to freshwater influx from heavy rains or toxicity from using too much chlorine powder when cleaning the cement tanks prior to spawning. At the hatchery, all equipment used is soaked in a chlorine bath of unknown concentration overnight.

Flasks and laboratory material at the algal laboratory are thoroughly rinsed with 70 or 90% alcohol after cleaning with detergent. At NFC, chlorine is in liquid form (*sanichlor*) of standard ratio and utilized at different concentrations for sterilization according to the type of equipment or material to be cleaned or sterilized. The standard alcohol concentration used at NFC is 70% which lyses or ruptures the cell membrane and actually kills bacteria and other micro-organisms. Use of 90% alcohol results in dessication of the cell and would cause it to remain inactive, but the cell would become active again once water or moisture come in contact. Any concentration less than 70% is not effective.

Conclusions

In brief, the training at NFC was advantageous and helped to enhance the capacity of the Samoa Fisheries trainee at performing different operations for microalgae culture development. Enhanced knowledge and ideas obtained from the training are proposed to assist formulation of the microalgae manual for Samoa Fisheries Division Aquaculture group and be able to address the gaps in the hatchery and algal laboratory processes in Samoa.

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