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Aquaculture activities in Fiji

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Abstract — *Fiji has no aquaculture tradition, but the Government is engaged in aquaculture production since 1969, with the help of other countries and international organization like F.A.O. Some species have been tested :*

- *Fishes : Grass carp (*Ctenopharyngodon idellus*) and Tilapia;*
- *Molluscs : Oyster (*Crassostrea echinata*) and Mussel (*Mytilus viridis*);*
- *Crustacean : freshwater prawn (*Macrobrachium rosenbergii*) and shrimps (*Penaeus monodon*, *P. indicus*, *P. stylirostris*).*

Fiji's expertise in aquaculture is very limited and because there is no history in aquaculture the idea of private enterprise is not easily developed in a community based on social structure, which means that a lot of ground work has to be laid first.

FINFISH

In 1974, the Freshwater Fish Farm at Naduruloulou was established in order to propagate the chinese carp species called Grass carp (*Ctenopharyngodon idellus*) which is used for the control of aquatic weeds that infest rivers, lakes and canals. In the early 1960's it was observed that the largest river in Fiji (Rewa River) was heavily infested with the noxious submerged weed *Hydrilla verticillata* and *Potamogeton crispus* which then formed extensive beds especially in the lower reaches. The biomass of these weeds increased the siltation problem, prevented the free flow of water and blocked the water ways of the local people. The growth of these weeds has increased rapidly due to the stoppage of the major dredging works and the major river traffic in the 1960's. Grass carp (*Ctenopharyngodon idellus*) has been popular throughout the world in its ability to utilize and effectively control water weeds.

It is a voracious feeder, feeding on the soft and tender leaves of plants or grass thus converting into fish flesh. The fisheries Division made several attempts to import fry of grass carp from Malacca in 1969, Taiwan in 1970-1973, India in 1974, New Zealand in 1979 and Japan in 1984. The fry were raised to about 50 to 100 g size and then released into the rivers.

By 1974, the Fiji Government realized the need to establish a hatchery so that fry could be produced locally.

Hormone injection experiments were carried out but successful spawning was achieved in 1985 utilising silver carp pituitary gland.

Here at Naduruloulou the males are observed to mature in the second year and females in the 3rd year.

Selected ripe brooders are injected with hormone (1st injection at midday) dose 0.5-0.8 mg/Kg body weight of female fish. The second injection 8 hours later- dosage 1.01-1.6 mg/Kg body weight of female fish and 0.5-0.8 mg/Kg body weight of male fish. The eggs are released into the spawning tank during early hours of the morning in an egg collection case which would then be transferred to the hatching tanks.

Eggs would hatch out after 20 hours at a water temperature range of 26-28°C.

Feeding would start after all eggs hatch, hence at NRS after 3 or 4 days, hard boiled egg yolk would be blended and fed - (18-20 g) per day/10,000 Fry. Feeding done 4 times daily for 8-10 days.

The hatching would then be transferred to knockdown tanks and reared for at least a month before being transferred into nursery ponds.

In the nursery ponds, the fry are fed artificial food a mixture of Fish meal + Rice pollard in a 50 : 50 % ratio. The fry remain in the nursery ponds until they reach size of 50-100 g.

Silver carp (*Hypophthalmichthys molitrix*) and big head carp (*Aristichthys nobilis*) have been maintained for stocking into freshwater impoundments and for pituitary donors. Polyculture trials of the 3 species are also being carried out.

FRESHWATER PRAWN (*Macrobrachium rosenbergii*)

Successful rearing of *Macrobrachium rosenbergii* larvae to post-larvae under local condition has been accomplished at Naduruloulou Fisheries Station. The clear water technique has been adopted. Live *Artemia salina* nauplii, fish flesh, freshwater bivalve Kai (*Batissa violacea*), Kalkoso or ark shell (*Anadara cornea*), egg custard and ox-liver have been used as larvae feed. The present hatchery technique has produced an average of 60 post-larvae per litre. Production cost was calculated at \$ 7.00 per 1,000 post-larvae which is lower than that obtained from any other *Macrobrachium* hatchery.

Pond culture trials have been carried out to establish a suitable culture method in Fiji. Fiji has no aquaculture tradition. Initially high stocking densities of 15 to 20 prawns per sq. meter were utilized. Results showed that 70 to 80 % of prawns were under market size after 6 to 8 months rearing. This was due to lack of proper management skills and the inavailability of a suitable feed. Some later trials were disturbed by the occasional flooding at the farm. At present lower stocking densities and mixed culture with grass carp (*Ctenopharyngodon idella*) and tilapia (*Oreochromis niloticus*) are being examined.

Stocking prawns at 1/sq. meter with grass carp has shown that prawns can grow above 40 grams within 4 months.

OREOCHROMIS (*Tilapia niloticus*)

In 1982, saw the initiation of the Rural Aquaculture programme (RAP) which is being assisted by the US Peace Corp Volunteer Scheme. The main objective is to supply seeds of *Tilapia nilotica* to farmers in rural areas where protein supply was not easily available and at the same time generate income for the farmers. Seedling production of the species is going on very well at the station and as recorded last year, a total of over 50,000 fry were supplied to farmers from the hatchery. To date there are more than 50 farmers and about 70 to 80 ponds with an average pond area of 300 m².

The average culture period is around 150-180 days after which the fish would be about 140-180 g in body weight. Feed applied is 25 % fish or meat meal, 40 % copra meal + 35 % mill mix and fed at 3 % of the total body weight.

Last year the highest production obtained in six months was above 4,000 Kg/ha/year.

The programme is slowly extending to other parts of the main islands and at present have 6 Peace Corp Volunteers, 5 of whom are based in outer stations, at the hatchery who is assisting in the seedling production and also liaising with the Fisheries Division and the other PCV.

OYSTERS AND MUSSEL

The culture of oysters and mussels was initiated in 1969. A consultant on mollusc was in Fiji under the UNDP/FAO regional project to do a shellfish survey.

The project continued till 1976 under another FAO expert. Extensive grow-out trials and spat collection were carried out.

Till 1979, the project continued but on a small scale due to limited success in cultivation, the occasional disturbance by natural disasters and unsuitable sites.

During 1981, grow-out experiments on oysters were carried out in two new sites : Seeds of *Crassostrea echinata* were obtained from CNEXO, Tahiti with the objective of determining the growth and survival of the species under local conditions.

Factors like salinity, oyster density, depth and turbidity were examined for their effects on growth and survival.

Results showed that the growth rates were very poor, growth increment of many individuals was about 6 mm in 7 months. The growth surfaces were heavily infested with brown algae and a layer of silt, which resulted in high mortality.

The project was later suspended at the end of the year.

A small private company was assisted in starting a pilot mussel and oyster culture farm with seeds donated again by CNEXO, Tahiti. The initial growth rate of green mussel, *Mytilus viridis* and the rock oyster *Crassostrea echinata* was reported promising small shipments of CNEXO bred green mussel were received to replace the old stock.

The culture of oysters and mussels was again continued during the arrival of a Japanese expert in 1982 under the JAPAN-FIJI agreement. Results were not very promising and so the project has been somewhat suspended.

SHRIMP

The Government of Fiji and France Aquaculture joint shrimp Culture Project at Raviravi was established in 1981.

The main objective was :

- (i) to investigate the economic feasibility of *Penaeus monodon* culture in Fiji and to establish a commercial joint venture between FIJI GOVT., and French Aquaculture.
- (ii) to design and implement further development of the prawn farm to full commercial production.
- (iii) to investigate local and overseas prawn markets and to establish and adopt optimum marketing procedures for the shrimp.

The 1st Phase of Development — (1981-1983)

During the 26 months period, the main activity was on grow-out of shrimps.

Target was set on 1 tonne/ha/year. A hatchery was to be built up to allow the Project to produce its own post larvae. It was also necessary to investigate the possibility of manufacturing local feed pellets.

At this stage, the Fiji Government was to provide the sites and ponds, labour and technical staff plus other operational costs.

France Aquaculture was to provide for post larvae supply, a biologist, feed supply and a hatchery set-up.

Results

Some problems were identified during the grow-out of post larvae obtained from Tahiti and New Caledonia.

1. Water was too acidic in some ponds.
2. Pond sides were leaking.
3. Predation by birds and milkfish; even some were lost by poaching.
4. Growth of toxic mould on feed pellets during humid conditions.
5. Some post larvae were lost during transportation.

Anyhow, a total production of 1.7 tonnes/ha/year was obtained and that was higher than the target.

The 2nd phase from July 1984 — July 1986

Because of the results obtained during the 1st phase, the aim at this stage was to try and solve the domestic demands for prawns. The farm was then planned to be expanded from 7 ha to 20 hectares.

During November 1985, the Raviravi Prawn Farm had changed its name to Prawns Fiji Ltd.

This came about due to the transfer of the project from Fiji Government to the Fiji Development Bank nominees. The technical expertise was provided by France Aquaculture, this time the contract was to try and develop the farm into a commercial level. The species cultured are *Penaeus monodon*, *P. indicus* and *P. stylostris*.

The shrimp farm at Raviravi is constructed on mangrove reclaimed land and does not allow a good and clean water supply to the hatchery: secondly the pond soil has a high ph value of 3-4.

During the year 1986, the project aimed at producing 7.2 million of post larvae but managed to get only 1.8 million. The post larvae were not of good quality because of bacterial infection. At this stage it was necessary to look into the possibility of modifying the various stage of the hatchery operation plus the sanitary problems to be carefully considered.

After some modification and various treatments the larvae production was perfected.

In pond culture a lot of problems is still being experienced due to the high acidity of the pond soils, predation and pond leaked etc. An average production of 2.7 tonnes/ha/year was achieved.

In the following year, it was aimed that the production was to reach 3.2 tonnes/ha/year.

The problems mentioned earlier need to be solved to perfect productions.

OTHER SPECIES

Studies have also begun on Giant clams in 1986, especially on *Tridacna gigas* species. A common species in Fiji is *T. derasa* but mostly found in clean oceanic waters.

Experiments are on going on production of seeds and is being funded by Australian Aid.

Seaweed *Euclima alverzii* tambalang is on-going as from 1986, with funding from the Commonwealth Fund for Technical Co-operation (CFTC). Grow-out trials of the species was started by the New Zealand Company Coastal Biological. The farming of this seaweed is increasing slowly and proves profitable.

In 1986, 171.3 tonnes of dried *Euclima* was exported to New Zealand.

To conclude, Fiji has a lot of potential on Aquaculture but the main draw-back be the little knowledge we have on aquaculture. The concept

of aquaculture has to be introduced to a large number of people and hopefully to instill some tradition into the field.

	1975	1980	1985	1990
Fishes				
Grass carp (<i>Ctenopharyngodon idellus</i>)	Introduction	Experimental	Development	
Big head carp (<i>Aristichthys nobilis</i>)			Introduction	Experimental
Silver carp (<i>Hypophthalmichthys molitrix</i>)			Introduction	Experimental
Tilapia (<i>Oreochromis niloticus</i>)		Introduction	Development	
Molluscs				
Oysters (<i>Crassostrea echinata</i>)		Introduction] No Development	
Mussel (<i>Perna viridis</i>)		Introduction		
Crustacean				
Fresh water prawn (<i>Macrobrachium rosenbergii</i>)		Introduction	Experimental	Development
Shrimps				
<i>Peneus monodon</i>				
<i>Peneus stylirostris</i>		Introduction	Development	