

MARINE RESOURCES

The coastal waters in Fiji have rich ecosystems characterized by extensive coral reefs and dense mangrove forests. Blessed with warm tropical climate and high rainfall, these waters are further enriched with nutrients from land which enable them to support a wide diversity of marine life. Because economic benefits could be derived from them, the coastal zones teem with human settlements.

The FIJI FISHING INDUSTRY at large is generally divided into four primary sectors, although the distinction between these is becoming less clear cut as they develop and diversify. They are:-

- (1) **THE INDUSTRIAL FISHERY** - which operates on a large scale and is primarily export orientated. This involves mainly the PACIFIC FISHING COMPANY (PAFCO) tuna cannery at Levuka, and tuna capture and supply by both local and overseas vessels. The deep water fishery is now starting to fit into this category.
- (2) **THE ARTISANAL FISHERY** - This sector includes most small- scale commercial production for domestic sale. It is a significant source of domestic fish supply and employment.
- (3) **THE SUBSISTENCE FISHERY** - involving catches for self consumption with the occasional sale of surplus catch.
- (4) **AQUACULTURE** - which is receiving increased attention in the fisheries development, but remains largely experimental. Aquaculture has an advantage of not being based on limited natural fish resources but requires a comparatively large investment and sound management in most cases

The main objectives of the Development Plan 9 are:-

- (a) Generate further employment opportunities in the exploitation and processing of marine resources;
- (b) Increase production to satisfy local demand for fish and other marine products;
- (c) Increase value added in fish production for exports; and
- (d) Regulate and control the exploitation of fin and non fin fishery products.

Some of the important marine resources currently under exploitation are:-

(1) TUNA

Six species of tuna occur in Fiji waters.

SKIPJACK tuna - growing up to 15kg. Usually caught by pole and line vessels.

YELLOWFIN tuna - growing up to 150kg or more. Usually caught by long lines or drop lines. BIGEYE tuna - growing up to 200 kg

ALBACORE tuna - growing upto 40kg. usually caught by long line and drop lines.

MACKERAL and FRIGATE tuna. The reef associated DOGTOOTH tuna is actually a BONITO.

With the exception of mackeral tuna, all the above can be regarded as highly migratory, moving freely through the Fiji and adjacent 200 mile zones.

FIJI has a tuna cannery at Levuka (PAFCO) which can handle about 15,000 tonnes of tuna per year. There are three main sources of tuna for the cannery :-

(a) Pole and line boats ; 3 from IKA corporatin, 3 privately owned, 2 Japanese chartered and 2-3 Kiribati chartered. All fishing in Fiji waters for skipjack tuna. They landed about 4,200 tonnes in 1988.

(b) Long line boats ; At present 15-20 chartered Taiwanese boats fish for Albacore tuna around Fiji. They landed about 4,800 tonnes in 1988.

(c) Direct import ; Foreign sources of tuna from Kiribati, Solomon Islands and Papua New Guinea. PAFCO imported about 6,600 tonnes of tuna in 1988.

It can be seen that one of the main constraints of the development of tuna resource is the lack of local tuna fishing boats. Tuna boats are expensive and expansion has to be gradual.

IKA corporation has commissioned 2 new boats from the government shipyard.

There are more efficient ways of catching skipjack tuna other than pole and line, such as purse seining, but Fiji tuna stocks are not rich enough to support the operation of the large, cost-effective purse seiners that operate nearer the equator. We are trialling a smaller purse seiner under a cooperation agreement with a Phillipines Fishing Company.

PROCESSING - PAFCO has a 3 line plant with 15,000 tonnes capacity. Over 90% of the product are exported, Canada (white meat), United Kingdom (light meat), Japan (petfood). Some lower grade, fish meal and by-catch sold locally. Fish cans are locally made.

The cannery employs over 500 people, mostly women on Ovalau, and tuna is one of Fiji's biggest exports, worth over \$45m in 1988. It is by far the most valuable fishery in Fiji and is extremely efficiently run, producing an exceptionally high quality product for European and Canadian markets.

(2) BECHE DE MER

Beche de mer or sea cucumbers occur in all tropical and temperate seas of the world. In Fiji numerous species are found. BDM are basically detritus feeders, passing large volumes of sand and sediment through their system. They are utilized in a variety of forms. Locally they are consumed in fresh form, usually

after boiling. Virtually the entire international trade is however in smoked dried product. After manual collection, it is boiled, gutted, boiled second time then smoked and sun-dried. The finished product is graded by species, size and quality and bagged for export.

BDM exports hovered around 50 tonnes per year for most of 1970's and 1980's. But trade took off dramatically in 1986 and by 1987, 640 tonnes were exported. In 1988 this was over 700 tonnes and fishermen are complaining that BDM, especially driloli, are becoming hard to find.

The main constraint on developing this industry is the limited resource. The Fisheries division estimates that the maximum sustainable yield of BDM from Fiji waters is in the order of 100-200 tonnes per year. Clearly 700 tonnes is way over the top and we can expect the resource to show a dramatic decline of catches in future. Our main aim is to try to reduce the volume of exports, but this is difficult when the incentives for export (eg tax-free zones) are so high.

BDM is attractive because just about anybody can collect it and dry it. The market is extremely good because trade links to mainland China, through Hongkong, have opened up and China has an enormous demand for BDM. Even for low quality BDM that Hongkong people will not look at. This is a good example of disasters that can happen when Fisheries regulations are not strict enough, and a lot of people will find their source of income drying up very soon. A similar BDM resource crash occurred last century (1820- 1840) when American traders stripped Fiji's reefs. It took 30 years to recover.

(3) SEAWEED

Many kinds of marine algae, generally known as seaweed, are used throughout the world, either in whole form or as a source of chemicals for the food-processing industry. In Fiji 5 genera of local seaweeds are widely eaten. These are simply collected from natural stocks rather than intensively farmed

Fiji's native seaweeds do not occur in large enough quantities to support a seaweed exporting industry. For that reason, we introduced a strain of seaweed which originated from the Philippines (it was sent to Kiribati, then Tonga, then Fiji) called *Eucheuma cottonii*. *Eucheuma* is a very fast growing weed and easy to cultivate. It is vegetatively propagated and cannot attach itself to reefs (it has to be tied to lines manually) so there is no danger of it "escaping" and overgrowing Fiji's

The whole production is exported for processing into carageenan, which is a food-additive used for stabilizing

a variety of food products such as ice-cream, sauces, canned foods, beer etc as well as such non-food products as toothpaste, cosmetics and air-fresheners. It is not eaten in whole-weed form.

The harvested raw weed is sun-dried on simple racks, pressed and baled, then shipped to chemical plants for final processing.

The main constraints on developing this industry are the world price (which fluctuates in the same way as sugar and copra prices) and the commitment of farmers.

Seaweed growing started in 1984 and rapidly expanded to over 200 farmers by 1986. But a combination of factors led to the buying and promoting company pulling out of Fiji in 1988 :

- (1) The coups, which led to trade bans by New Zealand, where all the weed was being exported at the time ;
- (2) The rise of the beche de mer industry. Many of the seaweed "farmers" were really fishermen and many preferred catching fish to make their money rather than working 3-4 days a week on seaweed farms ;
- (3) A drop in the world price, caused by rapid expansion of seaweed growing in Indonesia. However, the world price started to rise again as new uses were found for carageenan as a food additive and we were convinced that the industry remained viable.

There was also the need to support the small scale farmers, so, National Marketing Authority took over the buying and exporting of the crop as an interim measure.

At the present time the future of seaweed looks a lot brighter. The world price is high and NMA was recently able to raise the local price from 35 to 45 cents per kg. A new seaweed company is due to start operations very soon and take over NMA's buying role. The new company will be based on Vanua Levu, at Fawn harbour and hopes to turn seaweed growing into a large - scale export industry, providing both employment and supporting small- scale farmers.

(4) TROCHUS SHELLS

The turban top snail or trochus is a reef-associated marine snail. They are found on the reef flat and feed on calcareous algae. Trochus is collected for the production of quality buttons and for ornamental purposes. Collection is by hand. The shell is usually boiled to extract the meat which is eaten as a subsistence item.

In the manufacture of buttons, blanks are cut from the shell following the whorls around and later buffed and polished. The residual shell still has value and can be further processed to produce mother of pearl chips.

Trochus exploitation is increasing as more button factories are setup in Fiji under the new export incentives. Currently 2 factories operate in Fiji using around 300 tonnes per year. A number of companies exported 398 tonnes, valued at \$2.01m mainly to Japan, Korea, Hongkong and China-Taiwan.

(5) CORALS

Ornamental coral feed by capturing plank tonic organisms and generally grow as colonies in attractive shapes and colors and are used for ornamental or curio purposes. Those occurring in Fiji include branching corals, stinging corals, organ pipe corals, brain corals, and mushroom corals. The blue coral occurs in Rotuma. The live coral pieces or colonies are carefully separated from the substrate, sun-dried on shore and subsequently cleaned and bleached for sale. Value is determined by size, shape and rarity of the species involved.

A variety of corals are used for lime production, road surfacing and building. The exploitation is low level. There is only one company licensed to export and is sending 1-2 container per month to United States of America for aquaria. The Fisheries Division has to perform baseline and follow up surveys at every collection site. Coral is a renewable resource.

The Black coral is used to make high quality jewellery for the tourist trade. The retail value of black coral jewellery sold annually in Fiji could be around \$250,000.

(6) AQUARIUM FISH

On Fiji's coral reefs, damsel fish, angel fish, butterfly fish, tangs and a wide range of other colorful species are available. The juvenile fish are caught using either fine monofilament hand nets or fence nets. SCUBA gear is used in all but very shallow water, as the exercise requires a great deal of patience, as well as skill and knowledge of fish behaviour. Fish are ensured to be healthy and disease-free before they are air freighted to their destination in water bags enriched with pure oxygen. About 72,000 live fish worth \$329,000 was exported mainly to US in 1988.

(7) MOTHER OF PEARL SHELLS

The mother of pearl is a bivalve feeding by filtering algae and diatoms over the gills and passing them by hair-like cilia to the mouth. There is a pearl farm at Namarai, operated by a Japanese creating natural pearls for local and overseas markets.

About 57 tonnes of mother of pearl shells worth \$465 000 was exported mainly to Japan in 1988.

(8) DEEPWATER SNAPPER

Rapid development of deep water snapper fishery is creating a semi-industrial fishery. Fishes of the family Lutjanidae inhabiting the outer slopes at depths of 60-250 fathoms are known under the general term "Deep water Snappers" Others include groupers, emperors and amber jacks. All of the above species are top-level carnivores feeding on fish, squid and deep water shrimp.

About 172 tonnes valued at \$841,000 was exported in 1988 mainly to Australia and US.

(9) SPINY LOBSTER

In Fiji 4 species of tropical spiny lobsters occur in reef areas. They feed on algae and small reef animals. The product is typically sold as frozen tails, although there is a preference in some markets (eg. Japan) for live, whole lobsters shipped on ice. Quality standards for these export markets are very demanding. Local sales are mostly through hotels and restaurants. About 39 tonnes were sold locally through various outlets in 1988.

(10) GIANT CLAMS

Three species occur in Fiji, *Vasua dina*, *Cega* and *Katavatu*. The largest giant clam of all *T.gigas* is recently extinct in Fiji. Giant clams can live entirely on sunlight via the photosynthetic products of the microscopic algae which they "farm" inside the cells of the mantle.

In Fiji giant clams are harvested predominantly for their meat. The shell is a much under-utilized resource. The meat comprises 7-10% of the total weight and is composed of two commercially useful parts:

- (a) Mantle - the tougher coloured meat lining the mouth of the shell
- (b) Muscle - the tender white meat holding the valves of the shell together.

(11) COLLECTOR'S SHELLS

Collector's shells are marine invertebrates from the classes Gastropoda (sea shells), Pelecypoda (bivalves), Scaphopoda (tusk shells) and Cephalopoda (nautilus). People are attracted by the beauty of these shells and collect them for their ornamental and decorative appeal. People also collect shells as hobby or for their scientific value. Fiji is not rich in its shell population, but it has a total of over 800 species of shells that are of interest to the collector.

Shells can be found in every type of marine habitat, from coral reefs to volcanic sand and silt or mud. Shells can be easily collected and forms a good source of income for the village. Most of the shells are sold through the numerous stalls and shops that cater to the tourist industry. Some of the very rare cowries cost as much as \$9,000.

(12) FRESHWATER MUSSEL

Freshwater mussel or Kai is found on the sandy or muddy bottoms of rivers. It is restricted to the lower freshwater reaches of rivers, between the upper limit of tidal influence (i.e. where the river flow stops due to the influence of incoming tides) and the upper limit of saltwater penetration. Kai is common in the Rewa, Navua, Sigatoka, Nadi, Ba, Labasa, Wainikoro, Dreketi and various Tailevu rivers.

Kai are collected almost entirely by village women feeling with hands and feet in shallow water. The meat recovery is about 20% , is a relatively cheap and nutritious source of protein. The kai fishery is one of the most valuable village-level fisheries in the country. About 1300 tonnes is marketed annually and this does not include a considerable amount of subsistence production. Most kai is sold at Suva and Nausori markets and roadsides.

(13) CRAB

A wide variety of crabs and similar crustaceans are utilized at the subsistence level but several are of commercial importance. These include mangrove crab or qari, land crab or lairo, and small mangrove crabs or kuka. The much sought after coconut crab is now restricted to a few islands only and the mud lobster or mana caught by traditional traps in mangrove areas is important both for subsistence and commercial sale. The mangrove crab is the most important of these species by volume and value. Qari are caught by hand, hooked from burrows and in baited hoop nets or pots. Also caught by gill net fishermen fishing near mangroves. Most fishing for qari is done by women and as with most crabs they are bound and marketed live.

Qari is exported in small quantity. The sales in 1988 was :-

Qari	126 tonnes	average price/kg	\$6.00
Kuka	30 tonnes	average price/kg	\$2.00
Mana	13 tonnes	average price/kg	\$3.00
Lairo	12 tonnes	average price/kg	\$3.00

(14) SPANISH MACKERAL

The spanish mackeral, walu, swift fearless predators are restricted to coastal lagoon and reef waters. Walu are primarily captured in Fiji by trolling, using a variety of artificial lures and live-bait fishing around lights.

Most walu is sold in fresh or frozen form, either as whole fish or steaks. Local markets readily absorb all available catch. Walu is particularly suited to smoking and smoked fillets have considerable potential both as an export item and as a high priced local product. Local sales in 1988 was about 171 tonnes with an average price/kg of \$4.00.

(15) MARINE PRAWNS

With their unique texture and delicate flavour, penaeid prawns command high prices on both local and export markets. In Fiji, the larger marine prawns are captured at night along estuary shorelines using lanterns in conjunction with fine spears and scoops. Smaller penaeids and moci are captured with small mesh push nets in estuaries.

Most prawns are sold through the wholesale and retail outlets with average price/kg of \$12.00

(16) FRESHWATER PRAWNS

No intensive fishery for freshwater prawns exists in Fiji. Push nets, hands, fine spears and traps are all used to catch.

Women are typically involved. A disturbing trend has been the increasing use of chemicals such as bleach and weedicides to kill freshwater prawns. Most prawns are sold through roadsides and retail outlets with average price/kg of \$7.00

(17) FRESHWATER EELS

Adults are utilized for subsistence purposes and are in demand for smoking. Local preference for freshwater eels is not strong and there is no organised fishery for them. They are caught with baited lines, spears, a variety of traditional woven traps, hollow poles and cane knives. Most consumption is for subsistence purposes.

(18) SHARKS

The fins of some species are used to produce a highly regarded soup base in south east asian countries. There is an international trade in dried and frozen fins. The skin of many species has been used to produce quality leather, the liver was used as a source of vitamin A until synthetic substitutes were developed. More recently, interest has grown in the liver of the deepwater sharks as a source of squalene, a fine oil used for cosmetic bases. The teeth of tiger and mako sharks are used for jewellery and the jaws cured and dried as curios. Some sharks are the target of gamefishermen and preserved specimens are used in large quantities as teaching aids.

Sharks are caught by gill and sunk nets, set lines, ocean long lines and other techniques. Fiji has been a significant exporter of dried shark fins.

(19) REEF FISH

They are captured for subsistence and commercial purposes. They include herbivorous (algae or coral eating) families such as parrot fish, rabbit fish and surgeon fish; carnivores, such as groupers, snappers and moray eels; and omnivores such as emperors. There are other fishes which occur in less close association with reefs such as trevally, barracuda and other midwater predators.

Most fish are caught by handlining, spear and gillnet.

(20) INDIAN MACKERAL

Gill nets are used to surround schools of salala sighted at the surface. Are also caught in set gill nets. In the western division, sizeable quantities are taken by the illegal use of dynamite. Salala is generally consumed fresh with small quantities hot smoked. 1988 production was about 221 tonnes.

(21) TURTLE

Two marine turtle species are commonly sighted and captured, the green and the hawksbill turtle. Turtle meat is prized. The shells are used for ornamental purposes. In Fiji turtles are marketed live or butchered. The meat, bodyfat and intestine and other organs are all eaten.

Quantities of vonu are consumed at traditional feasts and

for subsistence purposes and is regarded as a chiefly food and is offered first to the chief.

(22) MANGROVE RESOURCES

Mangrove swamps are no wastelands - it is one of the most productive and rich environments. While it is difficult to give dollar value to the resource, mangroves are important food sources for the marine as well as coastal fishes. Apart from being the primary source of energy, mangroves, because of their location on land-water interface and with their characteristic root structure also act as shoreline stabilizer and prevents siltation of estuarine channels and shore erosion.

(23) BAIT FISH

The usage of baitfish range from subsistence to commercial fishery. The pole and line skipjack fishery is completely dependent on the availability of live baitfish. Some of the common baitfish species in our waters are :- anchovies, sprats, sardines, herrings, silversides and cardinals.

(24) TILAPIA FARMING

Rural fish farming is gradually being established in Fiji, and over 60 ponds are now being operated by some 30 farmers around the country. The culture of tilapia or maleya now form an important source of protein for some rural communities. Tilapia farming is now gaining popularity. The whole aim of the program is to enhance production in protein deficient inland areas of the two main islands. During 1988 about 40,000 fry were distributed to the 27 farms in operation. About 4 tonnes of tilapia was produced.

(25) AQUACULTURE

The following aquaculture activities are currently undertaken :-

Marine prawns - pond production trials were initiated at Raviravi, Ba in 1981, as a joint venture between Fiji government and France aquaculture. It has now moved into commercial production with Fiji development bank and France aquaculture.

Seaweed culture (Eucheuma)

Mother of pearl farm at Namarai.

Giant clam hatchery at Mokogai.

Experimental work on green mussels.

Red tilapia, grass carp and fresh water prawns at our research station in Nausori.

Fish has been introduced into rivers and dams. Grass carp has

been introduced into rivers for controlling weeds and also for subsistence. Tilapia is introduced in the Monosavu dam and Black bass is introduced into Vaturu dam. It is noted that the population is increasing and people living nearby are utilizing the fish for subsistence.

CONCLUSION

It is essential to consider marine resources as valuable assets that should be utilized on a sustainable basis. Unregulated fishing efforts and the use of destructive fishing methods, such as mechanized push-nets and dynamiting have caused serious destruction of fish habitats and reduction of fish stocks. Indiscriminate cutting of mangroves for aquaculture, fuel wood, timber and the like have brought temporary gains in fish production, fuelwood and timber supply but losses in nursery areas of commercially important fish and shrimp and coastal erosion.