

A SOCIO-ECONOMIC STUDY OF THE ARTISINAL FISHERIES  
IN THE DELTA OF GULF PROVINCE  
PAPUA NEW GUINEA.

BY

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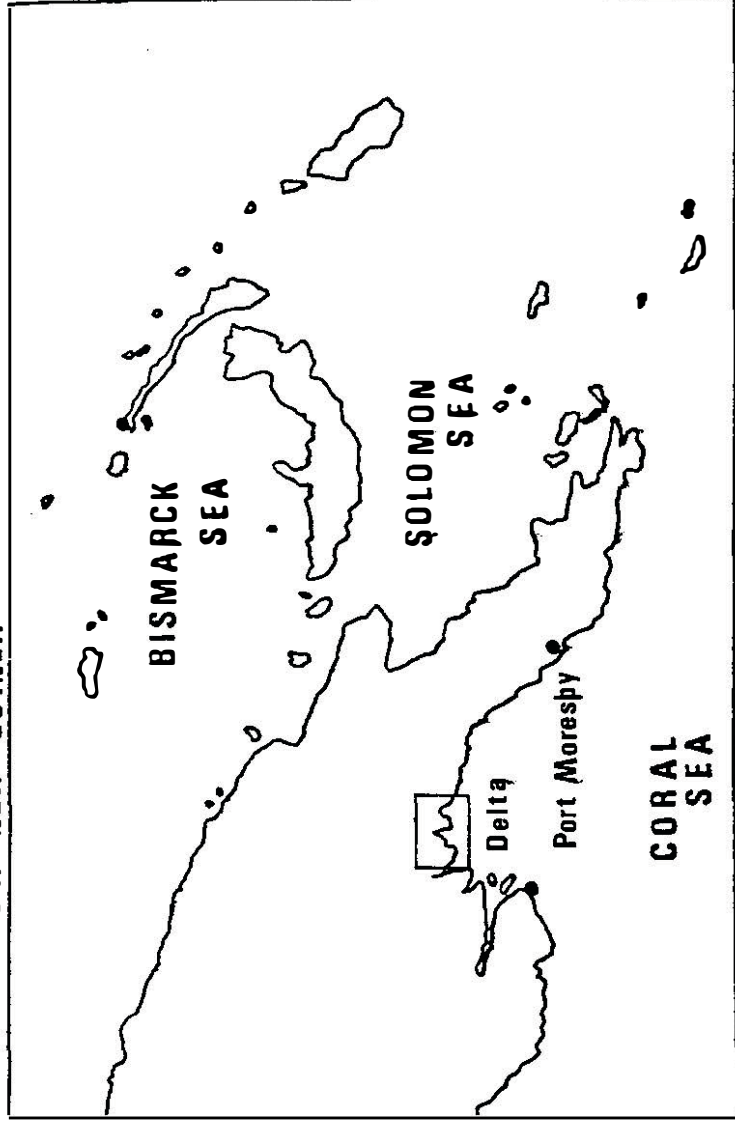
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This paper expresses the views of the author and not necessarily the views of either the Division of Fisheries or those of the many people who have corrected and assisted in the preparation of this study.

Port Moresby, May 1983

PAPUA NEW GUINEA



500 km

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### UNITS:

1 Kina = 100 toea = 1.18 US Dollar (mid-April 1983)

1 metric tonne (t) = 1,000kg

SDR = Special Drawing Rights of the International Monetary Fund.

## PART I: BACKGROUND

### CHAPTER 1. INTRODUCTION

The Delta of Gulf Province is a large estuarine area with a population of about 10,000. The area is one of the poorest in P.N.G., and there are few income opportunities. Food gathering and fishing are among the most important activities.

In order to provide the people of the Delta with income and employment opportunities, the Government requested assistance from the International Fund for Agricultural Development (IFAD) for the development of a village based commercial fishery. Assistance has been proposed in the form of a concessional loan of SDR 9.6m, which is to be used to finance the development of fisheries in Milne Bay and Gulf Province. The loan agreement is expected to be signed during 1983.

The proposed project required the collection of base-line information from the Delta area, so the project could be effectively planned and monitored. This was done during a four month survey from September to December 1983. Nearly 50 villages were visited and the villagers interviewed about their village economy and their fishing activities. The present study has emerged from this survey, supplemented by an on-going data collection programme, literature studies and interviews with officers of different Government Departments.

The selection of methods used during the survey were influenced by the time available and had certain disadvantages. For example a one day visit to a village is likely to produce only superficial information, and people will have a strong tendency to give the answer which they think the interviewer wishes to hear. These dangers were realized, and most of the information given was checked at least twice with other sources, such as outside people familiar with the area and other villages. However, this could not be done for some information such as the number of outboards and nets in a village.

The study is presented in three parts:

Part I gives background information on the Delta and includes a description of the physical setting, the inhabitants and the villages. The economy of the Delta is analyzed by identifying all cash earning productive activities and identifying sources of cash incomes and spending opportunities. Where possible, estimates for quantification of these are given along with a figure for the per capita cash income in the Delta. This figure could be the basis for a future evaluation of the project. Part I concludes with a chapter describing the fishery of the Delta, the catch methods employed and the infrastructure available.

Part II analyzes the economics of the fishery of the Delta. This includes catch data, calculations of catch per unit of effort, earnings from fishing and estimates of returns to labour. Included in this part are detailed tables showing total catches and earnings per village for each month between July 1981 and December 1982, catches by species group for each village and month, and percentage catch composition by village and month.

Part III analyzes the important short comings in our knowledge of the fishery of the Delta by discussing certain aspects of the proposed Artisinal Fisheries Project. Topics discussed include the planning approach, motivation, the technology gap and territorial use rights. Although this study is not the place to write a full critique of the Project, it is clear that these topics have not been adequately studied. The discussion of these topics indicates directions for possible and necessary future research.

## CHAPTER 2. DESCRIPTION OF THE DELTA

### 2.1 INTRODUCTION

The Delta of Gulf Province covers the area that is bounded by the Purari river on the east, by the Kikori river on the west and by the east-west line through Era-Mapua (see Annex 1) to the north.

The Delta is a swamp area of about 110km in length and 60km width. The main rivers flowing through the area are the Kikori, the Ivi, the Wapo, the Pie and the Purari. The largest of these is the Purari river. All the rivers drain from the Highlands lying to the north of the Delta. The waters from the Highlands are rich in sediments from which the Delta is formed. The Delta contains large areas of swampy plains, and many constantly shifting islands and mud banks. The main rivers are interconnected by a complex system of waterways.

The Delta can be broadly divided into several zones of vegetation, reflecting the degree of penetration of salt water from the sea (Haines 1979):

A) The freshwater zone. The waterways consist of main channels, side branches and oxbow lakes with varying degrees of isolation. This zone is present only in the Purari delta, i.e. east of the Pie river. The vegetation is freshwater-swamp-forest, with Phragmites and Saccharum growing along deposit banks.

B) The upper estuarine zone. Here the water is almost fresh, but there is a marked tidal influence. Vegetation is generally swamp forest with Pandanus and clumps of Sonneratia. Between the lower and upper estuarine zones, between the Kikori and Era rivers, there is a vast Nypa palm zone, reflecting more brackish water and a regular marked tidal influence.

C) The lower estuarine zone. Here, the type of water can vary from almost sea water to almost fresh water, depending on the amount of outflow from the rivers and the extent of penetration of the tides. The area consists of low lying islands vegetated by mangrove forest and interspersed with tidal creeks. Where centres of larger island are above the high-tide level, the mangrove vegetation changes into freshwater-swamp-forest.

D) The coastal zone. This consists of shorelines, beaches, inlets, lagoons and tidal pools. Here, and to a lesser degree in the estuarine zones, there is continual change. Land is built up or disappears almost overnight. The main navigational hazard is caused by the continuously shifting sand-banks.

Due to variations in the tidal penetration of the rivers, these zones are not geographical zones. They are rather a way of distinguishing between different types of habitats in the Delta. However, there is one common feature: all the water, except in the upper freshwater zone, is very turbid. Only at certain places, mostly in the dry season, does clear water penetrate inland at high tides.

There are two distinct seasons. The dry season, during which the south-east wind blows, from May until December, and the wet season, with mainly north-west winds. Annual rainfall ranges from 3000mm in Baimuru to more than 7000mm in Kikori, compared with a national average of 2000 to 3000mm.

## 2.2 THE PEOPLE

According to the Census (1980), 11,644 people live in the Delta. The average absentee rate is 23%, but for some villages it may be as high as 46% (Provincial Data System 1978/79). Most of these absentees are living in Port Moresby. A list of villages with population figures is given in Annex 2

Three ethnic and linguistic groups live in the Delta (Franklin 1973). West of Era River are descendants of the Kiwai migration and linguistically called the Transfly stock. They speak the North Eastern Kiwai language.

People living between the Pie and Era rivers belong to the Ipiko culture, linguistically the Inland Gulf stock. Finally, people living east of the Pie river are the Puraris, linguistically called Isolates.

The lingua franca in the Delta is Motu. Melanesian Pidgin is not generally understood, although probably more so than English. A list of the typical possessions of a household in the Delta is presented in Annex 3.

## 2.3 THE VILLAGE

The villages, with an average population of 140, are mostly built alongside the smaller rivers on very muddy and swampy land. The "raised platform" houses are made of bush material and elevated on stakes or poles. The frames of the houses are made from mangrove wood, the walls from nipa palm leaves and the floor from black palm. Houses are typically divided into several sections, usually one or two sleeping sections, a cooking corner (where a fire is always kept burning) and a room for storing possessions.

Another type of village house to be found is the "long-house" or "mens-house". These houses played a central role in the village before the influence of Christianity. The long-house was the place where the men lived, where all spiritual rituals were performed and where politics were discussed. In the past there could have been more than one long-house in each village, now there is only one or even none. The ones that still exist are smaller than in former days.

The villages close to the shore are built mostly on sandy ground. Pigs walk freely through the village. The main paths in the village are made of coconut husks. Inland, where the ground is muddy, pathways are made from logs. In some villages, log pathways are elevated. Most of the inland villages have a separate pig camp. The villages built on higher ground have firm grass under foot.



In general, there is no set plan for villages. When on firmer ground, houses are scattered around in a seemingly random way, but often standing rather close together. When built on mud, with one or more (elevated) pathways, houses are built alongside these pathways. In some villages, each house has its own plot with a low fence around it.

There are two urban (administrative) centres in the Delta: the government stations at Kikori (population 763) and at Baimuru (population 645). A list of services available in the Delta is given in Annex 4.

## 2.4 DIVISION OF LABOUR

There is in general a strict division of labour between men and women. The division however has changed from the traditional one through the influence of Westernisation.

Traditionally, the tasks of the men were primarily directed towards protection of the village and the land from both enemy tribes and bad spirits. Thus the major part of the time was spent in fighting, religious affairs and head hunting. In the sphere of providing food, hunting was and still is an important task of the men. Other important activities of men were house building (usually only the frame) cutting down sago palms and making canoes. All political organization was centered around the men.

With the influence of the missions and government patrols, the roles of fighter and protector against bad spirits disappeared. Hunting, logging, cutting sago palms and building canoes are still tasks of men. Commercial activities in general are done by men, but the marketing of goods by women. The politics of village life is still dominated by men, but women seem to have a certain influence in the process. In around 50% of the villages where interviews were held, the women were also responding. In certain villages, women are also allowed to enter the long-house.

The tasks of the women are all centered around providing food and minding the children. Women make the bags for sago processing, weave walls and roofs for houses, make bush string for fishing gear and make their own ornaments. If food is sold in markets, this is generally done by women. Thus the women have the heaviest task load in terms of hours per day and also probably in terms of energy expenditure.

In the house, men and women sleep in separate corners. Children, when very young sleep with the women and later in the corner with others of their own sex. A man can have one or more wives. Boys and men who are not married find a place in a mens' house, sometimes there is also a boys' house. Girls stay with their family until they are married.

## CHAPTER 3. PRODUCTION AND CASH INCOMES

### 3.1 INTRODUCTION

The most important feature of life in the Delta is the fact that it is a combination of subsistence and cash economies. To quantify the importance of subsistence production, a detailed study of time spent on production is needed. This has been done by Morauta (1981, 1982a) for a village in Eastern Gulf Province. There was neither time nor opportunity to do such a study in the Delta and where necessary, reference will be made to Morauta's studies.

In the first part of this chapter, the productive activities incorporated in the daily village life will be discussed in more detail. Productive activities include those activities that make use of one or more of the scarce labour, capital and natural resources. These productive activities are both for subsistence and for cash income. No figures are included in this discussion.

The second part of this chapter tries to arrive at an estimate of the amount of the per capita cash income in the Delta. The results are then compared with the results of Morauta's 1983 study, and with some provincial and national statistics.

### 3.2 PRODUCTIVE ACTIVITIES

#### HOUSE BUILDING.

Providing shelter for the family is an important activity, and one that needs to be done regularly because villages are shifted from time to time and the houses have a short life. After clearing a piece of land, a frame is built by the men. Hardwood or mangrove timber is used for the house posts. The floor is laid, consisting of strips of the bark from black palm. The matting for the walls, which sometimes have a simple design, is made by women. Roofs are also made from nipa palm leaves. The two latter activities are sometimes also done by old or disabled men. Depending on how urgently the new house is needed and on how many people work on it, the building of a house can take two or three months.

When the roof of a house starts to leak and the walls do not give protection any more, then either a new house is built in another place, or the house is demolished completely except for the elevated floor. In this case the walls and roof of the new house are built on the floor of the old house. No regular maintenance is done on the houses.

#### CANOE BUILDING.

Canoes play an important role in the life of the Delta people, and are their only means of transport. All canoes in the area are dug-outs, without an outrigger. Some are built with a transom to carry an outboard motor.

Canoes are made from timber found in the freshwater swamp forest. A selected tree is cut down and brought to the village. The dug-out is made with axe and adze. This work is hard and slow, even with the metal tools now available. A man working three or four hours a day will work a month to complete a small canoe.

Canoe lengths range from 1m for children to more than 15m for ceremonial use. A "normal" canoe can hold up to eight people. Canoes for ceremonial use are often made by a large group of villagers, all working together.

The coastal villages often have no access to proper timber with which to build a canoe. They therefore tend to buy whole canoes, rather than buying a suitable log. Prices vary from K15 for a small one to K110 for a big canoe. However, other sorts of payments are often made using shell money or tobacco. Canoes are also used to pay off social obligations, in particular bride prices.

#### SAGO PRODUCTION.

Sago is the staple food throughout the area and both men and women are involved in making sago. Sago camps are made where there is good supply of trees (Metroxylon sagu) and may be a considerable distance from the village. When a stand of sago palms is finished, the camp is moved. The depletion of sago in the neighbourhood may be a reason for moving an entire village. Sago palms are now cultivated by many villages.

To produce an adequate amount of sago, the tree needs to be at least 20 years old (Toft 1980). The felling of a sago tree is done by men and the men transport the log to the camp and strip the leaves and bark from the upper side of the trunk. Women then begin to hack out the sago pulp, with special beaters, from the interior of the trunk. These beaters are made of wood, sometimes with a stone point. This part of the sago production is very tiring and hard work. When enough pulp has been collected, it is put into special baskets inside a gutter. At the end of the gutter is a catchment basket made from banana leaves. The pith is put into a basket made from sago leaves, and water is poured through. The bag is squeezed with the hands and the starch that comes out is caught in the catchment basket. After some time the water drains out of it, and the sediment settles. After completion of the process, the sago is wrapped in leaves, thus producing a bundle of between 10 and 20kg. This weight includes 30% water.

A tree of 20 years old will be about 10m high and will produce about five bundles of sago. According to Toft (1980) it takes two women about six weeks to produce ten bundles. Productivity per hour of pounding and washing is around 2-3.5kg/hour (Thownsend, 1982; Ulijaszek & Poraituk, 1981). A bundle of sago will sell for K2-3 on the Baimuru or Kikori markets. In Port Moresby the same bundles will fetch between K12-18. It is not known how much sago goes to Port Moresby, nor how much of the money actually comes back to the villages. The sago for Port Moresby is shipped on the

coastal vessels that come to Baimuru from time to time.

#### FISHING.

Fishing for subsistence is a very important food producing activity. Fishing for cash income has been gaining importance in recent years and is discussed in detail in Chapter 4.

#### GROWING GARDEN FOODS.

Garden foods are in general grown in inland areas where the ground is higher and firmer. Even here however, growing activities are not very intensive. Most garden foods are kept by the villagers themselves, and only occasionally does produce find its way to the Baimuru or Kikori markets. Marketed garden foods include sweet potato, taro, vegetables, pineapple, oranges, lemons and tomatoes. Also included are mangos, breadfruit, sugarcane and bananas.

Because there are so few garden plots in the Delta itself, a clear impression could not be formed of whether the tending of the plots is done by men, women or both. In Baimuru some of the workers of the fish plant and the sawmill have their own plots, these are tended by men.

#### CASH CROPPING.

Introduced by the Department of Primary Industry, cash cropping is only at an experimental stage. Crops that have been introduced include coffee, chilli, rubber and rice. Products are bought by the Department.

#### BETEL-NUT TRADING.

Like elsewhere in P.N.G., betel-nut is of great importance in the economy. Betel-nut is particularly suitable for paying small but frequently occurring social obligations. Betel-nut is sold on the markets in abundance, mainly to the regular wage-earners.

#### HUNTING.

Hunting is an activity that is particularly enjoyed by men and is done with spear, bow and arrow or occasionally with a shotgun. Liem & Haines (1977) list the following wildlife species that are caught by villagers: bush-pig, cuscus, Torres Strait pigeon, crocodile, wildfowl, hornbill, spoonbill, blackduck, pelican, monitor lizard, bandicoot and water rat. It is thought that the first three are the most frequently caught. The bush-pig seems to be still abundant in most areas. None of these species are sold on the market, except for the occasional piece of bush-pig.

## COCONUT AND COPRA.

Coconut trees occur naturally near the sea-shores. More inland, in every village there are numerous planted trees. There is little trading in coconuts, except in the markets of Baimuru and Kikori.

Copra production is one of the few exclusively commercial economic activities. However at the time of this study (late 1981) the price of copra was very low and nearly every village had stopped producing copra. In early 1983 the world market price for copra was still very low.

## CROCODILE FARMING.

This commercial activity has proved successful in some villages. Crocodiles are either bought live by the Government Wildlife Office in Kikori, or the skins are bought by the Wildlife Section in Konedobu. Of the villages visited by the author, ten had an active farm.

## LOGGING.

Suitable trees for logging are generally not found around Biamuru, but more upstream, where the freshwater rain forest starts. Trees are cut down, stripped of their branches, and bound together to form a raft, which is then floated down a river.

Trips from the logging site to the sawmill in Baimuru can take many days, as the raft is completely dependent on tidal movements. The current is in the desired direction for only four to five hours after which the craft is moored while waiting for the tide to turn again.

There is one sawmill in operation in Baimuru. A second one is situated in Era Mapua, but was temporarily closed at the time of this study.

## 3.3 CASH INCOMES

The method used to estimate per capita cash incomes is an indirect one. It was judged that asking people directly what their cash income was, would give useless answers because of the irregularity of the cash incomes. Instead of this, people were asked their sources of income and where they sell their products. In this way a picture of cash income sources emerged. Cash income opportunities were identified by interviews and observations. These cash flows are charted in Annex 5.

Each of these sources and expenditure opportunities was quantified, if there was a basis on which to do so. An estimate of the per capita income was derived by combining the information on inflow and outflow.

It is assumed that all cash entering the Delta is consumed immediately, as there are very few investment opportunities.

The following cash income sources have been identified:

- a. logging
- b. fishing
- c. garden production
- d. sago production
- e. copra production
- f. artifacts
- g. public servant wages
- h. church and mission wages
- i. private business wages
- j. remittances from outside the Delta
- k. services

The following cash spending opportunities have been identified:

- a. trade store goods
- b. markets
- c. outboard fuel
- d. transport
- e. education
- f. council tax

The selling of logs to the sawmill in Baimuru is a speciality of a few villages. Around 96% of the revenue is earned by six villages, giving those villages a total annual income of K36,120 (Sept 1980- Sept 1981). The average per capita income for these six villages from logging is K27.76.

Income from selling fish to the fish plant amounted to around K15,000 in 1981 and to K30,274 in 1982; a per capita income of K4.21 for the 34 villages involved. Of the total revenue, 64% was earned by six villages. Further discussions on this follow in Part II.

In December 1981, a survey was done on the market in Baimuru and the products sold and their value were recorded. It is difficult to determine whether or not the figures are representative of the whole year but it is assumed here that they are. On this basis, the estimated turnover on the market in Baimuru is K25,000 per annum. The market in Kikori is smaller, with a narrow range of goods. The estimated turnover is K15,000 per annum.

Sago is marketed to Port Moresby via the coastal vessels that go between Baimuru/Kikori and Port Moresby. Some villages specialize in this from time to time and send 200 bundles or more in one shipment. Village people resident in Port Moresby organise the marketing.

Price differences between the Delta and Port Moresby are around K10-12 per bundle. Transport costs are K1-1.50 per bundle, while the fee for selling sago on one of the public markets in Port Moresby is 60 toea per person per day.

Copra purchased by the Department of Primary Industry between November 1978 and October 1979 was worth K9,982 to the villagers. After that time, the Department stopped buying and the trade was taken over by a private copra buyer who was soon discouraged by the low copra price. Currently, he is buying some copra and there are occasional shipments to Port Moresby. No figures are available.

Sales from experimental cash cropping amounted to K1,761 between November 1978 and October 1979. Since that period sales have stayed at about the same level.

At present there are no figures available on the sales of live crocodiles and crocodile skins or on artifacts bought by dealers who occasionally visit the Delta, or by the Office of Business Development.

There are two distinct groups of public servants: those living and working in a government station (i.e. Baimuru and Kikori) and those living in the villages. The first group includes people from Provincial Affairs, the Public Service Commission, the Police, DPI, Elcom, T&C.A., Minerals and Energy, Health and the labourers attached to these various departments. The people living in the villages are the teachers in the community schools and the aid-post orderlies. The wages paid to the public servants in the Delta amount to K260,000 per annum.

There are two missions permanently in the area. The United Church mission in Kapuna and the Seventh Day Adventist mission in Kikori. Together they pay about K100,000 per annum in wages. Wages paid by private businesses (mainly the sawmill and the stores) amount to K100,000 per annum.

Remittances from town are an old and well established source of income in the Delta. For decades people from the Gulf Province have migrated between Port Moresby and their village. Those that work in Port Moresby often send money or goods to their family in the village, usually to their parents. Morauta (1981) recorded this in Kukipi village in Eastern Gulf Province. Because of the similarities between the people in this village and the people of the Delta, it is thought that Morauta's findings can be applied to the Delta to arrive at an estimate for remittances to the the Delta villages.

Morauta found that the 379 residents in Kukipi received gifts in cash and kind, worth K33.28 per head per annum. In this village, 560 people were absent. The gifts amount to K22.25 per absentee per annum. This figure has been applied to the absentee figures for each Census Division in the Delta, resulting in an average gift received of K6.68 per capita per annum, of which K3.07 is in cash (See Annex 6).

Providing transport is an inter- and sometimes an intra-village service. People without outboard engines paddle to Baimuru and Kikori to sell things at the market and to buy store products. This sometimes takes two or three days of travelling. However, some villagers own a large canoe with an outboard which is operated as a "public motor vehicle". People who want to travel

have to pay for this service. There are no figures available.

### 3.4 SPENDING OPPORTUNITIES

Store products are very popular and fall into two categories. The first consists of products that seem to be important for the development of the area. These are, for example, outboard motor spare parts, kerosene for lamps, fishing lines, nets, clothes, knives, radios, batteries and all sorts of tools. The second category contains luxury and prestige foodstuffs such as tinned fish, 'lolly-water' (a local name for soft drinks), other tinned foods, biscuits, sweets for the children and sugar. Although sago is still, and probably always will be the staple, rice and tinned fish have become very popular. Sugar is increasingly popular. (When in December 1981 sugar was out of stock in the Kikori and Baimuru trade stores, villagers were prepared to pay high prices for sugar to those who had some in stock).

There are two categories of retail outlets or trade stores. The first contains the stores in the urban centres. In Kikori, Delta Stores is run by a non-citizen and two smaller stores are owned by citizens. There is also a small store in the S.D.A. mission, where radios and clothes are the best selling items. In Baimuru there is one trade store owned and supplied by Steamships Trading Co., a second store is owned and operated by a citizen. The turnover of all these stores together, including the sales of outboard fuel, is estimated to be more than K1,000,000 per annum.

The second category of villages stores are either owned by private persons, or the community, or by a business group. These stores are often short lived and 90% were found to be "out of stock". In the other 10% the stock consisted of one or two bags of rice, a carton of tinned fish and some tabacco. Nearly all these goods had been bought in Kikori or Baimuru.

At times a village group buys some store goods which on arrival in the village are placed in the house of the most important man of the group. But instead of selling the products, it often seems necessary to build a new store first, and as this can take months, the goods stay unsold for a long time. In some ways the ritual of building a store and the fact of having a store seems to be more important than the goods that are in it. Store owners nearly always seem to be under heavy pressure to give away goods or to sell goods at a very low price to relations.

The buying of products in the markets is probably done mostly by wage earners, however no research has been done on this. By definition the expenditure is the same as in 3.3.

Outboard motor fuel is very important for transport in the Delta, although there are only about 200 outboards working (Nov 1981). Sales figures are included in the turnover figures for the stores. The maximum retail price for gasoline in Baimuru is 49.0 toea per litre as opposed to 36.2 toea in Port Moresby.



Buying transport services includes trips made by air. Talair and Douglas Airways both have a daily flight to Baimuru from Port Moresby (except on Sundays) whilst Douglas Airways also flies to Kikori. A single trip from Port Moresby to Baimuru costs K96. Trips are also made on the occasional coastal vessel to Port Moresby, this costs K25. No figures are available.

Both primary education in the community schools and higher education is considered by parents as extremely important. This is somewhat in conflict with the feelings of most of the older generation in the villages. They believe that education has no relevance in village life and that schools prepare children better for city life than for village life. However people will work to earn money to educate their children. The cost of education includes school fees, clothes, transport to and from the school and boarding in the case of higher education. Transport is nearly always by air. Village primary education is much cheaper, and the school fee is only K1.50 per year.

Payment of council tax is an obligation rather than an opportunity and collection of this tax appears to be very difficult. In the Kikori Council area the actual amount collected is 50-60% of what it should be, and the collection operation is very expensive because it is done by boat with outboard motor. For this area in 1981 the flat rate was K8 for men and K2 for women. Baimuru Council has had even more difficulty with collection because the rate was set too high in 1981.

### 3.5 ANALYSIS

With respect to the cash incomes, estimates are available for most of the categories, except for some which could be very important: the sales of sago, crocodiles, copra and artifacts. The total of the available estimates is K690,000.

On the spending side, estimates of several important items are lacking, including transport by air, school fees and related expenses and inter village transport. The total of the estimates is K1,100,000.

The real figures should be higher, because estimates for some important categories are not available. However those figures which are available give an indication of the level of cash incomes that can be expected in the Delta, with the following reservations:

Remittances from town contribute to an unequal income distribution in the village, as remittances in general go only to close relations (i.e. parents).

Public servants constitute about 2% of the population in the Delta, but earn a substantial share of the total cash income. Most of their income is probably spent in stores rather than in the village. Therefore, public servants (and other wage earners) account for a substantial part of the turnover of the stores.

Most of the total income from logging is earned by six villages. Similar specialization applies to the sago trade with Port Moresby. Six villages earn 64% of the total income from fishing.

### 3.6 CONCLUSIONS

In the Delta, the cash income per capita per annum is at least K94.84 for the period 1981-1982.

The income distribution between places is very unequal. Assuming that nearly all wage earners live in Baimuru and Kikori, and that most people living in these centres are wage earners, then the non-wage cash income in the villages is K62.52 per capita per year.

The per capita income in six villages from logging is K27.76 (1981); the per capita income from fishing in six other villages is K17.26 (1982).

### 3.7 DISCUSSION

The definition of income used in this study does not relate to any of the accepted definitions of income. By estimating gross flows into and from the area, the availability of the amount of cash per capita is estimated and this is used as an indication of per capita income.

Using the same method for data available for Kukipi village (Morauta 1983), the per capita cash income in the village is K33.15, substantially lower than indicated for the rural incomes in the Delta. However, income differences between villages in the Delta are very large, and depend on the number of absentees from the village, closeness to either Baimuru or Kikori and access to good timber and sago grounds.

Morauta (1981) found large differences in incomes inside the village, with the richest household earning 75 times as much as the poorest. Transfers within the village hardly compensated for this, indicating that remittances from town are the largest contributor to income differences between households. It can be expected that the same unequal income distribution will be present in the Delta.

Per capita income in Gulf Province (market component) was K92 in 1971/72 (Jackson 1981, p.188). This indicates that the Delta has a lower cash income than the average of the Gulf Province. However, for reasons already mentioned in this section, care must be taken when comparing the results of the present study with official statistics. Gulf Province ranked very low in P.N.G., which had an average per capita income (market component) of K172 in 1971/72.

## CHAPTER 4. FISHERIES OF THE DELTA

### 4.1 THE RESOURCE

The Delta consists of a vast estuarine area, which is fed by the rivers coming from the highlands. The water is turbid and probably rich in nutrients. The present estimate is that the harvestable potential in the Delta exceeds 2,000t per annum. (Frielink, 1983).

The following main species groups are found in the Delta (see Liem & Haines, 1977 and Haines, 1979):

Arridae (catfishes)  
Lates calcarifer (barramundi)  
Mugilidae (mulletts)  
Polynemidae (threadfin salmons)  
Carangidae (trevally)  
Chandidae (perchlets)  
Sciaenidae (jewfish)  
Pristidae (sawshark)  
Carcharhinidae (sharks)  
Scylla serrata (mangrove crab)  
Macrobrachium and Penaeus species (prawns)

Liem & Haines (1977) recorded a total of 141 species occurring in the Delta.

Haines (1979) has made some preliminary resource appraisals by trial fishing and listed the occurrence of the different species in the different biological zones. "The fish fauna of the Purari and related systems is richer in species along the coast and in the deltaic areas than in the rivers proper. Only a few species are confined to the freshwater rivers, most species present being also found in the coastal and estuarine zones. In part, it probably also reflects the marine origins of the fish fauna." Haines (1979, p.15).

From a commercial point of view, the following species are important: barramundi, threadfin salmon, shark, jewfish and catfish. Prawns and mudcrabs have a certain potential.

A list of vernacular names of fishes, together with names of fishing methods is given in Annex 7.

### 4.3 FISHING METHODS IN THE DELTA

GATHERING. In general, the gathering of fish is done by women. A tidal creek is selected which typically is 1.5 to 2m deep at high tide and empty, or nearly empty at low tide. The overall width might be 2-3m. When the tide has been running out for some time and the water level is already low, two weirs built with mud and nipa palm leaves are made about 10 to 20m apart and, as the water level falls, prawns and small fish can be collected by hand. This activity is most effective at night, when kerosene lamps are used to attract the fish.

HAND TRAPS. These traps are made from bush material and are cone shaped. They are used by women and small boys who hold them by the pointed end, and stab the trap down into the mud while walking slowly through knee-deep water. Trapped fish and prawns are observed by the disturbance they make and are then removed from the trap. This method, when done by an experienced person is reasonably productive, particularly when the women use one in each hand in a rhythmic manner so that one of the two traps is always in the water. While occasionally a man may participate in gathering activities, using hand traps is exclusively a woman's activity which the men seemingly find degrading.

SCOOP NETS. Twine which is made from bush material by the women is woven into a shallow bag and attached to an oval frame made from cane. Scoop nets are used exclusively by women, who catch small fish and prawns with these nets as they stand waist to breast deep in the muddy water.

SPEARS. The spearing of fish is done by men. This method is for catching bigger fish and crocodiles. It requires great skill, because in most places the water is very muddy, and the fish's location must be guessed from movements on the water surface. During the night, with the use of a kerosene lamp, fishermen can see the eyes of the fish that have been attracted. Spears are made from bamboo, with a bamboo or wooden point. Modern versions use an iron point which is multi-pronged.

BOW AND ARROW. These are used more often than spears, because they are easier to handle in a canoe and are more effective than spears. The same skills are required as for spearing. Sizes of bows range from 50cm for those used by small boys to more than 2m for bows used for hunting pigs. Bows used for fishing are about 1m in length and are used when standing in a canoe. Bows are made from bush material and arrows are made from bamboo, either with a wooden or bamboo point, or an iron multi-pronged tip.

NET SEINING. This technique is used only by coastal villages, mainly by the people originating from Goaribari Island. Nylon gill-nets of 2" or 3" mesh are used. The nets are handled by two or three people who drag the net through the water towards and onto the shore.

SEINE FENCES. These are made by binding slats (usually 10-15mm wide, 2mm thick and 2m in height) of either split bamboo or split sago frond midrib. The slats are woven to form a fence of various lengths, using bush rope. They are used to seal off a creek, which usually dries out at low tide. The fence is held in place by strong sticks, placed in the mud 30-60cm apart and can be 6 to 10m long. After the tide has gone down, the fishermen slap the water with derris root. The latex of the roots affects the oxygen transport mechanism across the gill membrane of fish and they become unconscious and rise to the surface. (Frusher & Subam, 1982).

FISHING LINES. Traditionally these were made from woven fibres from different trees but nylon lines are used now. Fishing lines are either used as handlines, or tied to a stick set in the

water. Traditionally hooks were made from shell, but now all hooks are made from metal. Prawns, molluscs and small fish are used for bait.

SEINE BAGS. According to Frusher & Subam these are only used around Urama Island. Made from bush fibre, these bags are placed either at the sides of larger creeks or in the middle of a narrow and shallow creek. As the tide ebbs, fish are caught in the bag.

#### GILL-NETS

There are around 350-400 gill-nets in the Delta (1981), most of them in poor condition. Nets of 1"-4" mesh monofilament nylon (25 yards long) and 6"&7" mesh multifilament nylon (25 yards or sometimes 50 yards long) are most common. Small meshed gill-nets are often used for seining, as described, and 4" gill-nets are used to catch the smaller catfish (popular for smoking) and threadfin salmon. For the commercial barramundi fishery, 6" and 7" nets are used.

For barramundi fishing there are three ways of setting the nets. The first is to tie two or three nets together across a creek at low tide. In this way both float line and bottom line can be fastened to mangrove trees. Barramundi swimming against the current, as the tide ebbs, are caught behind the gills.

The second method, drift netting, is to float a net from the side of a river. One end is tied to a mangrove or a nipa palm, the other end is held down by a weight. The net moves with the current and fish swimming against the current are caught in the net. The third method is to select a spot in a bigger river, where the water is swirling, i.e. the inner side of a bend. The net will then stay in about the same position all the time, and fish swimming against the current will be caught in the net.

Gill-nets need much attention and maintenance and are often damaged by sharks and crabs. After three or four nights of fishing, nets usually need repair otherwise catch rates will decline.

#### 4.4 FISHING PRACTISES AND BELIEFS

Fish exploitation in the Delta is at a low level compared with the potential yield. This is so for two reasons:

- (i) the whole area has a very low population density;
- (ii) fishing is one of many subsistence activities and commercial fishing either does not exist or is only at a very low level.

Every village has its traditional fishing grounds (see Annex 8). The villagers have the right to fish on their traditional grounds and people from other villages are refused access. Since the level of exploitation is low, there are few disputes over fishing grounds. Problems concerning fishing rights can be expected when

fishing effort becomes more intense.

The daily need of the villagers for fish and crabs is met by the women, who often do not go to the traditional fishing grounds but fish close to the village. As can be seen from Annex 7, traditional fishing grounds are sometimes far away from the village because villages shift from time to time, whilst keeping their original fishing grounds.

Traditional fishing grounds are visited for subsistence fishing by men and also for fishing for the market or the fish plant. A group of men go to their grounds and stay for two to six nights. The camps may be fairly large, with six to eight shelters. Except when fishing for the plant, fishing trips tend to last more than one or two nights. Fish caught is smoked immediately.

It is not known what exactly makes people decide to go fishing. When fishing for the plant, motivation is clearly connected with the need for cash. Fishing for sale in one of the markets or for the family and relations is done very irregularly, from once or twice a month to twice a year. This level of fishing activity makes it unnecessary to visit the traditional grounds, as there is always enough fish near the village.

The best fishing is at low tide at half moon, at this time the water is very calm. Around full moon, when the tide differences are larger and the current stronger, the water tends to be full of branches, nipa palm leaves and flowers. This can make fishing, especially with nets, very difficult.

There seems to be no difference between the wet and the dry season for fishing. When it rains very hard for one or two weeks, people do not go out fishing.

#### 4.5 THE INFRASTRUCTURE

In 1979 the P.N.G. Government published the Coastal Fisheries Development Plan. The plan proposed the establishment of a series of fisheries stations, about 120 miles apart, and the provision of a refrigerated collection system to bring product from outlying coastal villages. In their initial development, these stations would be government subsidized, but it was hoped that they would eventually become profitable operations.

One such station was established in Baimuru in 1979 at the site of a closed-down hotel. Before that time, there had already been trials with shipments of live crabs and the purchasing of barramundi fillets, using old domestic freezers. In late 1979, the hotel property was bought by the Gulf Provincial Government and a full size holding freezer was installed. Since then the plant has been expanding at a slow but steady pace.

The facilities were bought and the property was established with repairs and equipment for a total cost of K73,000. The plant has been further improved with assistance from the National Government, who provided the services of a manager and operating

capital totalling K80,000 during 1981/82. The plant will be further expanded with financial assistance from the IFAD.

Currently, the most important facilities present and in operation in Baimuru are:

- a building with an area of 244 m<sup>2</sup>, housing equipment and the processing area;
- 90 KVA. - a 65 KVA generator -
- 40 m<sup>3</sup> coldstore;
- 800kg/24hrs block ice machines; 3x800 4x400
- 25 KVA standby generator;
- shrink wrapping machine;
- bandsaw;
- 5x2000 gallons water storage;  
1200 kg/24HR, BLAST.

There is a separate building housing the office, the workshop and the generators.

Fish is delivered to the station by 20 nearby villages. To encourage production and to improve the quality of the catch, the manager introduced ice-boxes suitable for canoes. Since July 1982, the station has operated a small collection dory, which services the more distant villages, transporting the fish on ice.

The plant buys fish gutted with gills in. About 10% of the catch is rejected due to bad quality. The barramundi, shark and catfish are mainly filleted, and the threadfin salmon is frozen whole. Fillet products are shrink wrapped on trays and packed in 10kg cartons. These are shipped out on the coastal vessels. Some shipments are flown to the Ok Tedi mine development in the Highlands.

## PART II: THE ECONOMICS OF THE FISHERY

### CHAPTER 5. THE DATA BASE

#### 5.1 FISH BUYING RECORDS

Since the reopening of the plant in July 1981, fish buying records have been kept by the management of the plant. These records have been made available for analysis. They contain the following information:

- i) date;
- ii) name of the fisherman;
- iii) name of his village;
- iv) kg of fish bought from the fisherman, divided into five commercial groups:
  - a) Barramundi;
  - b) Catfish;
  - c) Shark;
  - d) Mixed fish;
  - e) Other (i.e. crabs or prawns);
- v) the price per kg for each of these species;
- vi) the amount of money paid to the fisherman.

These records are normally kept by the foreman of the fish receiving and processing area. The information recorded may not always be accurate because:

- i) questions about a persons name and his village are asked in Motu or in one of the local languages and then written down in either English or Motu spelling;
- ii) people use different names on different occassions. Everybody has one or more nicknames, which are used as often as the original name. Combinations are also used.
- iii) many villages have their traditional name, a second "traditional" name and their official name, as it appears in the records of the Census Office and the National Statistical Office;
- iv) sometimes, people give the name of the village of their parents, instead of the village they inhabit while on other occasions they give the name of the village they visited the night before they went fishing;
- v) the weighing of the fish and the recording of information are done by different people and each person has his own way of reading the scale and rounding the figures.



- vi) fishing is mostly done in groups, either family groups, business groups or others. In some cases, people have their total catch recorded under one or two names only; in most cases the catch is divided between all members of the group, and the share is recorded for each individual separately.

For these reasons, the information in the records is not always accurate and analysis per fisherman has proven to give too many problems. Analysis per village is not always accurate, because in some cases the name is an (unknown) local one, or is illegible.

## 5.2 CATCH PER EFFORT SURVEY

Since late January 1982, the Research and Surveys Branch together with the Planning, Economics and Marketing Branch, has been conducting a catch per effort survey on catches landed at Baimuru. Information recorded includes size of fishing group, number of nets used, number of nights fished, site fished, weight of catch in 20 species groups, and number of fish caught in each group.

To date, this survey has not been completely satisfactory, as the percentage of the catch recorded during 1982 amounts to only 30% of the total catch landed. Communication difficulties have hindered a full understanding of the problems involved. One obvious problem is the fact that there is only one technician recording the catches. He works eight hours a day, while the plant is open 24 hours.

## 5.3 BASE-LINE SURVEY

During the second half of 1981, a four month village survey was carried out in the Delta. Amongst other information, numbers of engines, nets and canoes, traditional fishing grounds, methods used and the major problems in the villages were recorded. This base-line survey was the basis for Part I of this study.

The survey was carried out by visiting villages by boat. Typically, the interviewer stayed one morning or one afternoon in a village, talking with the villagers through an interpreter. Occasionally, nights were spent in a village. This method, which has its drawbacks, was the most viable considering the time constraints, communication problems and problems of relations between the villages and the fish plant. Thus, answers given might not have been correct due to misunderstandings and to mistrust. Also, engines and nets of poor quality were often kept hidden and their proportion had to be estimated. The relevant information from this survey is summarized in Table 5.1.

TABLE 5.1 SUMMARY OF VILLAGE CENSUS, AUGUST THROUGH DECEMBER 1981

CD	CU	NAME	POPULATION			WATER TANKS number	OUTBOARD ENGINES horsepower			GILLNETS stretched mesh					FREEZERS usable u/s		ACTIVITIES economic activities
			P.D.S. res.	%	CENSUS res.		6	15	25	2	3	4	6	7	(16)	(17)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8, 9, 10)			(11 through 15)					(16)	(17)	(18)
5	3	Kopi	139	46.1	218	2	2	-	-	1	-	2	-	-	-	-	sago, gardens, crocs.
	4	Horeru	66	15.3	65	-	-	-	-	-	-	-	-	-	-	-	sago, canoebuilding
	5	Ogomobu	60	33.3	79	-	1	-	2	1	2	1	1	-	-	-	sago, gardens, crocs.
6	1	Ai'id'io	30	19.0	30	-	-	-	-	-	-	-	-	-	-	-	sago, gardens, crocs.
	2	Aviova/Apeoa	161	33.5	144	1	1	-	-	-	-	1	1	14	1	-	fish, sago, gardens, crocs
	3	Babaguina	150	38.0	209	1	5	-	-	-	1	1	1	-	1	-	fish, garden, sago, crabs
	4	Biat	185	28.0	151	-	-	-	-	-	-	-	-	-	-	-	fish, garden, sago, crabs
	5	Doibo	59	44.3	105	-	-	-	-	-	-	-	-	-	-	-	fish, sago, gardens, crocs
	6	Dopima	74	51.3	41	-	1	-	-	-	1	1	-	-	2	-	sago, fish, crabs, pigs
	7	Ero	500	23.1	446	4	4	3	2	-	-	4	-	80	4	-	sago, fish, gardens
	8	Goari	76	17.4	53	-	-	-	-	-	1	-	-	-	7	-	sago, fish, crabs
	9	Kampu'u	84	24.3	69	-	-	-	-	-	3	-	-	-	7	-	sago, fish, crabs, gardens
	10	Kemei	69	11.5	70	-	-	-	-	-	-	-	-	-	-	-	sago, fish, crabs, gardens
	11	Samoa	150	43.2	97	1	-	1	-	-	-	-	2	6	1	-	sago, crabs
	12	Tipeowa	135	15.1	113	-	-	-	-	-	-	-	-	-	-	-	sago, crabs
7	1	Epegau	69	0.0	61	-	-	-	-	-	-	-	-	-	-	-	sago, gardens, logging
	2	Gibi-Meagoma	518	13.8	469	2	1	1	5	-	-	9	1	3	-	-	sago, crocs, fish, pigs
	3	Homobavi	194	10.6	155	1	2	-	1	-	-	4	-	2	-	-	sago, fish, crabs
	4	Buri	193	5.4	100	-	-	-	-	-	-	-	-	-	-	-	sago, fish, crabs
	5	Tetehui	171	0.0	76	-	-	-	-	-	-	-	-	-	-	-	logging, gardenfoods
	6	Tovei	87	6.5	133	-	-	-	-	-	-	-	-	-	-	-	logging, gardenfoods
	7	Minogolravi	197	10.0	191	2	-	-	-	-	-	-	-	-	-	-	sago, gardenfoods, poultry
	8	Waitari	114	8.8	116	1	1	-	1	1	-	-	-	-	-	-	sago, logging, gardens
	9	Wowobo	156	1.9	168	-	-	-	-	-	-	-	-	-	-	-	sago, logging, gardens
	10	Ubou	0	0.0	208	2	3	3	1	-	5	-	-	2	1	-	sago, brabs, fish
8	1	Aibigahe	146	18.0	100	2	1	2	-	-	2	-	-	3	-	-	sago, fish, poultry
	2	Daiwaibari	5	78.3	25	-	-	-	-	-	-	-	-	-	-	-	sago, fish, poultry
	3	Gauri	12	25.0	67	-	-	-	-	-	-	-	-	-	-	-	sago, fish, poultry
	4	Kalaki	56	21.1	0	-	-	-	-	-	-	-	-	-	-	-	sago, fish, poultry
	5	Kinomere	164	14.1	152	1	1	-	-	-	-	-	-	-	-	-	sago, fish, poultry
	6	Kivaumai 1	110	23.1	120	3	1	-	1	1	2	-	1	5	1	-	fish, sago, logging
	7	Kivaumai 2	135	9.4	175	-	-	-	-	-	1	-	2	3	-	-	sago, fish, crabs
	8	Larimia	99	9.2	135	3	-	-	-	-	-	-	-	8	-	-	fish, sago, logging
	9	Mairipepea	100	9.1	79	1	-	-	-	-	-	-	-	-	-	-	sago, crabs, fish
	11	Morovamu	103	17.6	78	-	-	-	-	-	-	2	-	18	-	-	fish, crabs, artifacts
	12	Umaumere	72	1.4	57	-	-	-	-	-	1	11	-	-	-	-	fish, crabs
	13	Veraibari	143	21.4	124	1	-	-	1	-	-	1	-	6	-	-	sago, crabs, pigs

TABLE 5.1 CONTINUED

CD	CU	NAME	POPULATION			WATER TANKS number	OUTBOARD ENGINES horsepower			GILLNETS stretched mesh					FREEZERS usable u/s		ACTIVITIES economic activities
			P.D.S. res.	%	CENSUS res.		6	15	25	2	3	4	6	7	(16)	(17)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8, 9, 10)			(11 through 15)					(16)	(17)	(18)
9	1	Aimei	98	3.9	92	1	-	-	-	-	-	-	-	-	-	-	gardenfoods
	2	Aurei	88	11.1	79	1	-	5	5	-	-	-	-	-	-	-	fish, crabs, logs, crocs
	3	Era-Maipua	161	13.4	181	1	-	-	-	2	-	-	2	9	-	-	sago, fish
	4	Gigori	82	0.0	76	2	-	-	-	-	-	2	-	-	-	-	sago, fish
	5	Golravi	27	27.0	6	-	-	-	-	-	-	-	-	-	-	-	sago, fish
	6	Imeia	51	3.8	53	-	-	-	-	-	-	-	-	-	-	-	logs, fish, sago, crocs
	7	Naharonere	106	7.0	85	1	2	-	-	-	-	-	-	2	-	-	logs, fish, sago, crocs
	8	Veiamu	21	4.5	16	-	-	-	-	-	-	-	-	-	-	-	logs, fish, sago
11	1	Anepoke	199	1.0	131	-	-	-	-	-	-	1	-	1	-	-	logs, fish
	2	Bekoro	123	25.5	135	-	-	1	2	-	-	11	-	4	-	-	fish, logs, crocs, gardens
	3	Karurua	457	37.6	363	-	-	-	-	-	-	-	-	-	-	-	logs, fish, sago
	4	Kavipaka	83	9.8	100	-	-	-	-	-	-	-	-	-	-	-	logs, fish, sago
12	1	Akjaravi	160	27.3	183	-	-	-	-	-	-	-	-	-	-	-	logs, fish, sago
	2	Korovaki	182	12.5	234	1	7	2	3	-	-	-	-	1	-	-	logs, fish, sago
	3	Oravi	165	26.3	87	-	-	-	-	-	-	-	-	-	-	-	logs, fish, sago
13	1	Akoma	272	12.8	305	-	-	-	-	-	-	-	-	-	-	-	fish, crabs, sago, logs
	2	Ara'ava	146	19.3	353	-	3	-	5	-	-	40	-	4	-	-	fish, crabs, sago
	3	Ikinu	100	35.5	100	-	1	-	1	-	-	-	-	-	-	-	copra, sago, logs, crocs
	4	Kinibo	0	0.0	343	5	1	2	-	-	-	-	-	1	-	-	logs, sago, pigs, fish
	5	Kairaravi	52	16.1	51	1	-	-	-	-	2	1	-	1	-	-	crabs, fish
	6	Kairimai	199	45.8	167	1	3	2	1	-	-	2	-	1	-	-	crabs, fish
14	1	Mariki	332	9.3	428	3	1	2	1	5	4	-	1	-	-	-	crabs, fish
	2	Mirimailau	110	30.8	108	1	-	-	-	-	2	-	-	-	-	-	crabs
	3	Varia	221	27.1	259	1	-	1	-	-	-	-	-	-	-	-	crabs, fish, sago

(1) C.D. = Census Division

(2) C.U. = Census Unit

(3) Village name as used in official statistics

(4) P.D.S. = Provincial Data System, which records the resident and total populations of rural villages.

(4) The data are for 1978/79. A person is recorded as absent (= belonging to the population but not resident) when away from the village for 6 months or more. \*res.\* = resident population.

(5) % = percentage absent (see 4).

(6) res. = resident population according to the 1980 Census. This census counted all people present in the village at time of counting. This included also one night visitors.

(7) Watertanks = are special tanks to catch rainwater from roofs made of corrugated iron.

(8), (9) and (10) Outboard engines present in the village, and working. Generally, non-working outboards were kept hidden.

(11 through 15) Gillnets present in the village. Most of these nets were in a bad state of repair.

(16) and (17) Domestic holding freezers. Usable = not broken down. All freezers counted were in good state of repair because they were never used. Absence of a generator, or lack of money to buy fuel were the reasons.

(18) Economic activities for money and for barter. Crocs = crocodile skins. Gardens = garden crops. Every village trades betelnut. Many villages used to make copra, but claimed to have stopped due to the very low price at the time of this census.

NOTE: - = 0  
- = not available

## CHAPTER 6. MONTHLY CATCHES

### 6.1 THE FISHERY IN 1981/82

After the reopening of the plant in July 1981, the monthly landings showed large fluctuations. There was a gradual increase in catches during the first three months, stimulated by the growing confidence of village people and by the introduction of the use of ice to fishermen. The next three months were dominated by freezer break-downs and other set-backs. By late January 1982, the station was in full operation again and showed an increase in catches until June. There were general elections during this month, which resulted in a drop in effort.

After July, the volume of fish delivered leveled off to around with a large decline in October when, due to a severe water shortage, it was not possible to make ice. On several occasions during 1982 there were problems of shipping the product out and consequently not all fish offered by the fishermen could be bought. Between August 1981 and December 1982, 41 villages delivered fish to the plant at one time or another.

### 6.2 CATCH RECORDS

Table 6.1 gives a summary of the catch records by village and Table 6.2 a summary by month. The species composition for the various villages shows large differences, reflecting the locations of the traditional fishing grounds and the skills of the individual fishermen.

The species composition by month shows less fluctuation, with standard deviations of 7.6 for barramundi, 3.6 for catfish, 4.1 for shark and 8.4 for other species. The series is too short to draw conclusions on seasonality, although it is generally believed that October through February is the best period for the barramundi fishery.

Tables 6.3 to 6.8 give detailed information from the catch records, while Tables 6.9 to 6.12 give the percentage of each commercial species in the total catch. Figures 6.1 to 6.5 show this again graphically.

TABLE 6.1 BAIMURU CATCH RECORDS, AUGUST 1981 - DECEMBER 1982

Summary by village, catches in kilograms of gutted fish, % is percentage by weight in total catch

	BARRAMUNDI kg	%	CATFISH kg	%	SHARK kg	%	MIXED FISH kg	%	TOTAL CATCH, kg	AMOUNT PAID Kina
AIBIGAHE	351	25	112	8	68	5	854	62	1385	583.43
AIMEI	93	63	45	30	0	0	11	7	149	105.28
AKOMA	751	49	196	13	28	2	566	37	1541	871.36
ARAAVA	517	24	551	25	381	17	750	0	2199	946.47
AVEEOA	23	31	0	0	36	48	16	21	75	32.35
BABAGUINA	831	85	0	0	51	5	97	0	979	750.48
BAIMURU	4396	43	882	9	2204	21	2833	27	10315	5126.56
BAVI	20	40	13	26	0	0	17	34	50	23.91
BEKORO	640	20	202	6	181	6	2183	68	3205	1406.24
ERA-MAPUA	1219	55	536	24	115	5	330	15	2200	1229.67
GAURI	16	100	0	0	0	0	0	0	16	13.17
GIBI-MEAGOMA	1014	47	164	8	205	10	757	35	2140	1183.16
GIGORI	1	25	0	0	0	0	3	75	4	1.85
IKINU	1640	51	424	13	231	7	950	29	3245	1806.11
IMEIA	1934	74	63	2	120	5	490	19	2607	1856.55
IPIKO	342	61	151	27	2	0	66	12	561	323.16
KAIRIMAI	111	89	3	2	0	0	11	9	125	104.95
KAPAI	0	0	0	0	9	100	0	0	9	1.70
KARURUA	1426	18	1351	17	1648	20	3615	45	8040	2991.62
KEMEI	26	23	45	39	18	15	27	23	116	40.12
KIKORI	47	100	0	0	0	0	0	0	47	39.95
KINIPO	8	57	0	0	0	0	6	43	14	8.72
KINOMERE	2647	20	1372	11	4920	38	4013	31	12952	4762.90
KITI	603	47	90	7	260	20	334	26	1286	677.48
KIVAUMAI	231	8	249	9	698	24	1692	59	2870	929.23
KOROVAKE	304	29	117	11	220	21	391	38	1032	440.19
KUPORO	0	0	4	14	0	0	25	86	29	9.17
LARIMIA	1897	15	720	6	2334	18	7701	61	12652	4955.81
MAIRIPEPEA	3944	29	871	6	5420	40	3436	25	13670	5569.15
MAPAIO	50	31	32	20	30	18	49	31	160	71.44
MARIKI	200	24	28	3	58	7	548	66	834	394.04
MIRI-POINT	241	20	95	8	247	21	599	51	1182	433.47
MOROVAMU	389	24	68	4	320	20	839	52	1616	709.22
NAHARO	501	70	87	12	102	14	22	3	712	454.93
OMATI	7	100	0	0	0	0	0	0	7	5.60
PIVARA	0	0	0	0	0	0	20	100	20	6.82
RAVIPAKA	4	22	0	0	0	0	14	78	18	8.12
URAMA	0	0	0	0	0	0	555	100	555	221.80
VARIA	17	9	0	0	0	0	178	91	195	85.55
VERAIBARI	93	18	39	8	125	24	263	51	520	201.84
WAIAMU	0	0	20	100	0	0	0	0	20	3.00
TOTAL	26534	(30)	8526	10	20026	22	34261	38	89347	39386.57

TABLE 6.2 BAIMURU CATCH RECORDS, AUGUST 81 - DECEMBER 82  
 Summary by month, catches in kilograms of gutted fish, % is percentage by weight in total catch

		BARRAMUNDI	%	CATFISH	%	SHARK	%	MIXED FISH	%	TOTAL	AMOUNT PAID	Toea
		kg		kg		kg		kg		CATCH, kg	Kina	per kg
1981	August	1214	31	331	8	816	21	1552	40	3913	1643.91	42
	September	1387	29	448	9	759	16	2194	46	4788	2148.49	45
	October	1914	37	572	11	596	12	2032	40	5114	2607.88	51
	November	1714	46	579	15	632	17	819	22	3744	1896.12	51
	December	706	40	238	14	354	20	464	26	1762	816.17	46
1982	January	134	22	117	19	86	14	267	44	604	241.63	40
	February	1231	43	322	11	720	25	599	21	2872	1391.01	48
	March	2943	35	906	11	2118	25	2521	30	8488	3938.81	46
	April	1724	23	663	9	2397	31	2834	37	7618	3023.16	40
	May	2427	28	1030	12	2104	24	3211	37	8772	3730.91	43
	June	1618	25	690	11	1222	19	2816	44	6346	2710.61	43
	July	1599	17	815	9	2357	25	4488	48	9259	3514.07	38
	August	1475	27	445	8	1299	23	2311	42	5530	2273.84	41
	September	1577	27	305	5	1126	19	2827	48	5835	2662.06	46
	October	1006	30	313	9	798	24	1228	37	3345	1439.41	43
	November	1699	31	456	8	1216	22	2053	38	5424	2455.17	45
	December	2165	36	300	5	1427	24	2044	34	5936	2893.32	49
AVERAGE		26533	30	8530	10	20027	22	34260	38	89350	39386.57	44

TABLE 6.3 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
 TOTAL CATCHES in kilograms of gutted fish

VILLAGE NAME	1981					1982												TOTAL
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
AIBIGAHE	165	168	204	51	20		14	37	13	29	294	4		169	126	57	35	1385
AIMEI			11	88							12	38						148
AKOMA								439	207	481	165	88			163			1541
ARAAVA	8	19	110				125	500	685		8	7	159	82	128	94	277	2201
AVEEOA														75				75
BABAGUINA								671									309	979
BAIMURU	394	954	376	373	336	41	365	1106	1161	1189	299	394	375	333	96	574	1953	10316
BAVI				33	17													50
BEKORO	532	606	474	25		6	6	27			42	935	75	171	198	95	10	3199
ERA-MAPUA				522	29		148	295	7	215	167	10	213	235	139	152	69	2199
GAURI																16		16
HIBI-MEAGOMA	330	3	139				279		52	154	196	226	479	126	11		10	2005
GIGORI				4														4
IKINU							570	437	420	715			286		106	114	599	3244
IMEIA			21							202	257	515	238	1092	137	106	81	2647
IPIKO	17	7	17	85	145	25	46		94		61	29	26	10				560
KAIRIMAI		11							143									154
KAPAI							9											9
KARURUA	960	863	410	391	446	405	166	307	250	355	580	904	479	551	100	581	294	8040
KEMEI														45	44	17		105
KIKORI									47									47
KINIPO										14								14
KINOMERE	51	365	428	119	6			453	712	1978	1648	2490	1170	599	1319	945	573	12852
KITI										548	331	202	89	81	37			1286
KIVAUMAI	45	56	259	200			14	216	168	61	150	925	124	285	43	112	214	2869
KOROVAKE		8	47				25	256	208	26	91	155	66	36	8		109	1031
KUPORO												29						29
LARIMIA	444	816	803	626	49		18	1245	1529	1473	1061	1151	395	392	267	1326	1062	12652
MAIRIPEPEA	685	571	1305	952	580	27	825	2318	1313	1072	905	903	926	440	133	412	306	13671
MAPAIO				9						54	44	53						159
MARIKI			167									48	139	300		181		834
MIRI-POINT									580	72		98	73	26	163	171		1181
MOROVAMU	244	308	270	112		7	93	105	53	137	7	91	56	59	14	58	4	1616
NAHARO	32	34	74	156	136	93	116	10	11		15		20				15	711
OMATI	7																	7
PIVARA																	20	20
RAVIPAKA											18							18
URAMA														555				555
VARIA			3											176	17			195
VERAIBARI							56	69							102	294		520
WAIAMU												20						20
	3913	4789	5118	3743	1762	604	2871	8487	7647	8772	6346	9312	5384	5834	3345	5300	5935	89160

6.4 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
 FS PAID TO FISHERMEN IN KINA

SE NAME	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	TOTAL
IBIGAHE	80.11	57.00	88.70	16.47	3.53		7.70	19.89	5.37	13.44	136.28	3.40		72.69	50.09	15.44	13.32	583.43
AIMEI			23.57	50.79							10.20	20.72						105.28
AKOMA								276.21	100.77	245.69	112.99	29.34			106.36			871.36
ARAAVA	1.20	12.61	116.83				72.11	165.42	250.29		2.17	5.95	77.14	40.20	84.04	42.39	76.12	946.47
AVEEOA														32.35				32.35
SAGUINA								511.03									239.45	750.48
BAIMURU	177.88	498.50	196.84	205.85	172.78	23.39	128.87	535.21	371.65	372.92	142.09	194.93	172.88	91.77	49.18	435.60	1356.22	5126.56
BAVI				14.58	9.33													23.91
BEKORO	193.96	266.46	255.13	14.47		2.10	4.67	9.27			30.27	333.00	45.87	79.41	84.57	80.32	6.74	1406.24
A-MAPUA				340.78	13.70		84.40	147.27	5.95	138.32	81.56	6.22	132.05	128.80	46.54	67.50	36.58	1229.67
GAURI																13.17		13.17
MEAGOMA	242.70	2.72	168.74	50.70			141.36		36.94	105.28	94.85	73.63	197.17	52.15	8.85		8.07	1183.16
GIGORI				1.85														1.85
IKINU							402.88	257.40	220.28	447.48			150.93		30.70	64.14	232.30	1806.11
IMEIA			16.80							125.26	185.47	351.61	201.87	805.09	68.60	56.77	45.08	1856.55
IPIKO	9.85	5.20	3.92	29.52	103.59	4.75	34.82		50.42		35.27	18.65	18.67	8.50				323.16
AIRIMAI									104.95									104.95
KAPAI							1.70											1.70
KARURUA	336.95	347.59	189.38	158.41	131.74	135.07	58.41	97.56	107.54	127.06	229.98	314.15	162.43	218.25	34.59	222.95	119.56	2991.62
KEMEI														18.20	16.55	5.37		40.12
KIKORI									39.95									39.95
KINIPO										8.72								8.72
INOMERE	18.75	186.72	121.34	43.34	4.80			193.43	258.64	672.91	547.00	895.73	429.17	252.18	556.87	410.51	171.51	4762.90
KITI										270.90	185.00	106.97	46.64	52.87	15.10			677.48
IVAUMAI	8.95	7.07	77.70	113.20			3.32	61.11	50.94	25.16	55.79	272.20	37.79	98.76	16.54	49.36	51.34	929.23
OROVAKE			37.60				18.07	70.91	96.53	13.97	41.19	51.52	35.00	27.17	6.37		41.86	440.19
KUPORO												9.17						9.17
LARIMIA	198.32	401.60	320.72	194.79	33.18		15.30	474.03	594.35	692.56	378.72	416.40	148.53	132.21	109.39	475.95	369.76	4955.81
RIPEPEA	259.78	208.55	731.72	485.81	270.14	21.77	273.64	1052.14	414.83	366.76	390.19	308.78	316.65	116.85	61.41	181.51	108.62	5569.15
MAPAIO				1.35						17.84	28.70	23.55						71.44
MARIKI			66.76									17.70	56.31	106.52		146.75		394.04
I-POINT									276.76	46.19		27.40	19.67	5.32	23.93	34.20		433.47
OROVAMU	109.86	137.57	119.45	65.69		5.95	37.19	45.73	28.08	40.45	2.45	30.05	13.77	30.77	9.22	29.59	3.40	709.22
NAHARO		16.90	71.78	108.52	73.38	48.60	88.14	8.50	8.92		12.32		11.30				6.57	454.93
OMATI	5.60																	5.60
PIVARA																		6.82
AVIPIKA											8.12							6.82
URAMA														221.80				221.80
VARIA			.90											70.20				85.55
RAIBARI							18.43	13.70							14.45			201.84
WAIAMU												3.00			46.06	123.65		3.00
	1643.91	2148.49	2607.88	1896.12	816.17	241.63	1391.01	3938.81	3023.16	3730.91	2710.61	3514.07	2273.84	2662.06	1439.41	2455.17	2893.32	39386.57

TABLE 6.5 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
 ARRAMUNDI: catches in kilograms of gutted fish

VILLAGE NAME	1981					1982												TOTAL
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
AIBIGAHE	68	20	55	43			8	19	4	8	75	4		35	12		3	351
AIMEI			7	54							12	21						93
AKOMA								253	58	226	111	6		99				751
ARAAVA			32				74	72	116			7	51	23	79	29	35	517
AVEEOA														23				23
BABAGUINA								564									267	831
BAIMURU	151	466	269	231	157	21	158	425	131	120	105	147	105	19	43	486	1367	4396
BAVI				13	8													20
BEKORO	44	102	155	17			6				34	46	38	57	43	95	7	640
ERA-MAPUA				399	15		83	116	7	147	79	7	125	128	35	53	28	1219
GAURI																16		16
IBI-MEAGOMA	283	3	81				118		38	103	74	43	218	36	10		10	1014
GIGORI				1														1
IKINU							430	248	178	504			112			51	119	1640
IMEIA			21							127	203	369	238	851	46	43	37	1934
IPIKO	10	7	10	23	122		39		52		34	17	20	10				342
KAIRIMAI									111									111
KAPAI																		0
KARURUA	188	195	136	67	37	34	31	42	62	36	100	120	54	103	17	128	78	1426
KEMEI														12	14			26
KIKORI									47									47
KINIPO										8								8
KINOMERE	6	128	89	26	6			154	153	324	255	431	201	136	396	270	77	2647
KITI										266	139	94	42	52	12			603
KIVAUMAI	3			104				23	18	8	15	9	3	8	7	30	5	231
KOROVAXE			47				19	15	71	11	31	25	25	30	8		24	304
KUPORO																		0
LARIMIA	146	206	159	78	36		18	128	248	363	89	120	65	13	50	130	50	1897
MAIRIPEPEA	221	198	718	465	245	25	135	859	234	127	216	115	142	21	52	121	53	3944
MAPAIO										7	30	13						50
MARIKI												5	27			168		200
MIRI-POINT									168	42					31			241
MOROVAMU	68	35	93	68		7	15	18	20	5		3	2	25	9	20	4	389
NAHARO	21	29	44	129	82	47	100	10	11		15		10				6	501
OMATI	7																	7
PIVARA																		0
RAVIPAKA											4							4
URAMA																		0
VARIA															17			17
VERAIBARI															30	63		93
WAIAMU																		0
TOTAL	1214	1387	1914	1714	706	134	1231	2943	1724	2427	1618	1599	1475	1577	1006	1699	2165	26532



BLE 6.6 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
 FISH: catches in kilograms of gutted fish

VILLAGE NAME	1981				1982												TOTAL	
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI		XII
AIBIGAE	50	20	1982	7	12		6	3	5	3	18	4		19	12	30	3	2172
AIMEI			7	30							12	15						63
AKOMA								18	3	176	111	28			99			434
ARAVA	8	9	39				35	225	132		3	7	5	23	79	25	91	679
AVEEOA														36				36
BABAGUINA								38									14	51
BAIMURU	3	102	45	20	60	6	64	155	247	91	34	16	8	5	3	23	3	882
BAVI				13	8													21
BEKORO	56	9	51	9			6				5	58	18	15	43	95	7	368
ERA-MAPIA				61	14		25	61	7	44	81	4	25	61	98	60	7	546
GAURI																16		16
BI-MEAGOMA	283	3	22				22		38	103	27	49	41	3	10		10	609
GIGORI				1														1
IKINU							56	65	65	99			25		32	4	79	424
IMEIA			21							13	10	21	238	16	5	15	11	348
IPIKO	3	7	8	52	10	20	3		42		14	17	20	10				204
KAIRIMAI								3										3
KAPAI							9											9
KARURUA	144	141	92	132	106	80	51	102	4	27	73	102	68	119	17	88	7	1351
KEMEI														8	25	12		45
KIKORI									47									47
KINIPO										8								8
KINOMERE	41	14	10	13	6			42	49	311	311	238	105	24	87	154	17	1419
KITI										35	29	26	35	7	25			156
KIVAUMAI	3			21			11	18	9	8	16	75	30	18	7	31	60	305
KOROVAKE		8	47				19	40	28	3	12	27	3	30	8		54	277
KUPORO												4						4
LARIMIA	45	74	76	129	36		18	59	15	73	23	109	28	18	59	37	38	833
MAIRIPEPEA	15	74	185	85	11	25	43	120	50	140	32	16	62	16	6	19	164	1059
MAPAIO				9						22	8	2						40
MARIKI											8	17	43			3		71
MIRI-POINT								14	42		31	29	24	21	171			332
MOROVAMU	15	22	18	6		7	8	18	3	66	7	22	45	13	9	3	4	264
NAHARO	11	6	27	10	27	11	7	10	11		15		4				10	146
OMATI	7																	7
PIVARA																		0
RAVIPAKA											4							4
URAMA																		0
VARIA															17			17
VERAIBARI							3	69							20	16		108
WAIAMU												20						20
TOTAL	681	487	2628	595	288	149	383	1040	768	1262	841	896	802	506	678	801	573	13375

TABLE 6.7 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
SHARK: catches in kilograms of gutted fish

VILLAGE NAME	1981					1982												TOTAL
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
AIBIGAHE	9	20	55	7	5		8	13	4	3	2	4		35	12	30	3	207
AIMEI			7	54								12	21					93
AKOMA								253	58	226	111	28			99			774
ARAAVA	8	9	10				6	52	141		3	7	21	23	79	29	133	519
AVEEOA														36				36
BABAGUINA								38									14	51
BAIMURU	96	190	7	94	17	21	77	217	398	566	52	86	61	220	34	25	67	2224
BAVI				13	8													20
BEKORO	26	60	1	17			6				34	37	18	40	43	95	7	380
ERA-MAPUA				35	15		24	10	7	8	79	4	125	35	35	53	28	456
GAURI																16		16
GIBI-MEAGOMA	283	3	81				71		38	103	35	14	25	61	10		10	732
GIGORI				1														1
IKINU							3	41	16	32			112			51	140	393
IMEIA			21							40	25	6	238	16	13	10	11	378
IPIKO	10	7	10	23	122		39		52		2	17	20	10				309
KAIRIMAI									111									111
KAPAI							9											9
KARURUA	168	104	66	42	100	51	33	70	67	65	55	279	125	120	37	176	94	1648
KEMEI														13	5			18
KIKORI									47									47
KINIPO										8								8
KINOMERE	41	50	80	36	6			224	381	791	537	955	395	150	560	295	427	4926
KITI										93	76	25	35	7	25			260
KIVAUMAI	28			104			11	148	98	8	8	273	8	3	7	31	93	817
KOROVAKE			47				19	57	42	3	23	41	25	30	8		54	348
KUPORO																		0
LARIMIA	121	84	184	134	36		18	134	411	139	218	165	110	52	59	301	224	2388
MAIRIPEPEA	225	255	203	249	205	25	473	1049	795	292	177	411	440	295	64	126	164	5445
MAPAIO				9						6	6	9						30
MARIKI												5	15	43		168		231
MIRI-POINT									48	42		5		24	31	171		320
MOROVAMU	85	9	45	19		7	6	18	3	66	7	22	45	13	9	3	4	358
NAHARO	11	29	44	10	28	35	6	10	11		15		4				10	210
OMATI	7																	7
PIVARA																		0
RAVIPAKA											4							4
URAMA																		0
VARIA															17			17
VERAIBARI							4	69						3	49			125
WAIAMU																		0
<b>TOTAL</b>	<b>1116</b>	<b>818</b>	<b>859</b>	<b>842</b>	<b>540</b>	<b>139</b>	<b>810</b>	<b>2398</b>	<b>2724</b>	<b>2490</b>	<b>1476</b>	<b>2411</b>	<b>1818</b>	<b>1223</b>	<b>1145</b>	<b>1627</b>	<b>1477</b>	<b>23910</b>

TABLE 6.8 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
MIXED FISH: catches in kilograms of gutted fish

VILLAGE NAME	1981					1982												TOTAL
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
AIBIGAHE	39	148	149	2	3		6	2	4	19	200	4		116	114	27	32	864
AIMEI			5	4							12	2						23
AKOMA								169	146	79	55	55			64			566
ARAAVA	8	10	27				11	152	297		5	7	82	59	50	40	19	765
AVEEOA														16				16
BABAGUINA								69									28	97
BAIMURU	145	196	55	28	102	15	67	310	385	413	108	146	202	90	16	41	517	2833
BAVI				8	10													17
BEKORO	408	435	263	9		6	6	27			3	794	30	60	155	95	4	2292
ERA-MAPUA				28	14		17	109	7	16	7	4	63	11	6	39	35	354
GAURI																16		16
GIBI-MEAGOMA	47	3	37				68		15	52	62	121	330	26	1		10	770
GIGORI				3														3
IKINU							81	84	162	81			149		74	59	262	950
IMEIA			21							22	19	66	238	226	74	52	33	749
IPIKO	5	7	8	10	14	5	4		42		12	12	6	10				131
KAIRIMAI		11							3									14
KAPAI							9											9
KARURUA	461	424	117	150	204	240	52	93	117	227	352	404	233	209	30	190	115	3615
KEMEI														12	25	15		52
KIKORI									47									47
KINIPO										6								6
KINOMERE	4	173	249	45	6			35	129	553	546	866	469	290	277	326	54	4019
KITI										154	88	57	13	22	25			358
KIVAUMAI	11	56	259	75			4	28	44	53	112	568	84	257	37	51	56	1692
KOROVAKE		8	47				6	144	67	12	26	62	38	6	8		32	453
KUPORO												25						25
LARIMIA	132	453	384	286	13		18	924	856	898	732	758	192	310	158	858	750	7719
MAIRIPEPEA	225	45	200	154	119	2	175	292	235	512	480	362	282	109	12	146	90	3436
MAPAIO				9						20	8	29						65
MARIKI			167									35	80	257		10		548
MIRI-POINT									350	30		63	44	2	111	171		770
MOROVAMU	78	243	114	20		7	65	87	30	66	7	66	10	21	5	36	4	857
NAHARO	11	6	4	8	27	11	4	10	11		15		6				10	121
OMATI	7																	7
PIVARA																	20	20
RAVIPAKA											14							14
URAMA														555				555
VARIA			3											176	17			195
VERAIBARI							49	69							49	166		332
WAIAMU												20						20
TOTAL	1578	2217	2107	836	511	285	637	2600	2943	3211	2857	4522	2548	2837	1302	2334	2067	35390

TABLE 6.9 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
percentage by weight of BARRAMUNDI in the total catch (blank is no catch, 0 is no BARRAMUNDI in catch)

VILLAGE NAME	1981					1982												AVERAGE
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	XI	XII		
AIBIGAHE	41	12	27	84	0		57	51	31	28	26	100		21	10	0	9	25
AIMEI			64	61	0						100	56						63
AKOMA								58	28	47	67	7			61			49
ARAAVA	0	0	29				38	14	17		0	100	32	28	61	31	13	23
AVEEOA														31				31
BABAGUINA								84										85
BAIMURU	38	49	72	1	47	51	43	38	11	10	35	37	28	6	45	85	70	43
BAVI				39	47													40
BEKORO	8	17	33	68	0	100	0	0			81	5	50	33	22	100	70	20
ERA-MAPUA				76	52		56	39	100	68	47	70	59	54	25	35	41	55
GAURI																100		100
GIBI-MEAGOMA	86	100	58				42		73	67	38	19	46	29	91		100	51
GIGORI				25														25
IKINU							75	57	42	97			39		0	44	20	51
IMEIA			100							63	79	72	100	78	34	41	46	73
IPIKO	59	100	59	27	84	0	85			55	56	59	76	100				61
KAIRIMAI		0								78								72
KAPAI							0											0
KARURUA	20	23	33	17	8	8	19	14	25	10	17	13	11	19	17	22	27	18
KEMEI														27	32	0		25
KIKORI									100									100
KINIPO										57								57
KINOMERE	12	36	21	22	100			34	21	16	15	17	17	23	30	29	13	21
KITI										49	42	47	47	64	33			47
KIVAUMAI	7	0	0	52			0	11	11	13	10	1	2	3	15	27	2	8
KOROVAKE		0	100				76	6	34	42	34	16	38	83	100		22	29
KUPORO											0							0
LARIMIA	33	25	20	12	73		100	10	16	25	8	10	16	3	19	10	5	15
MAIRIPEPEA	32	35	55	49	42	93	16	37	18	12	24	13	15	5	39	29	17	29
MAPAIO				0						13	69	24						31
MARIKI			0									10	19	0		93		24
MIRI-POINT									29	58		0	0	0	19	0		20
MOROVAMU	28	11	34	61		100	16	17	38	4	0	3	3	42	67	34	100	24
NAHARO	66	85	59	83	60	51	86	100	100		100		51				40	70
OMATI	100																	100
PIVARA																	0	0
RAVIPAKA											23							23
URAMA														0				0
VARIA			0											0	100			9
VERAIBARI							0	0						30	21			18
WAIAMU												0						0
AVERAGE	31	29	37	46	40	22	43	35	23	28	25	17	27	27	30	32	36	30

TABLE 6.10 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
percentage by weight of CATFISH in the total catch (blank is no catch, 0 is no CATFISH in the catch)

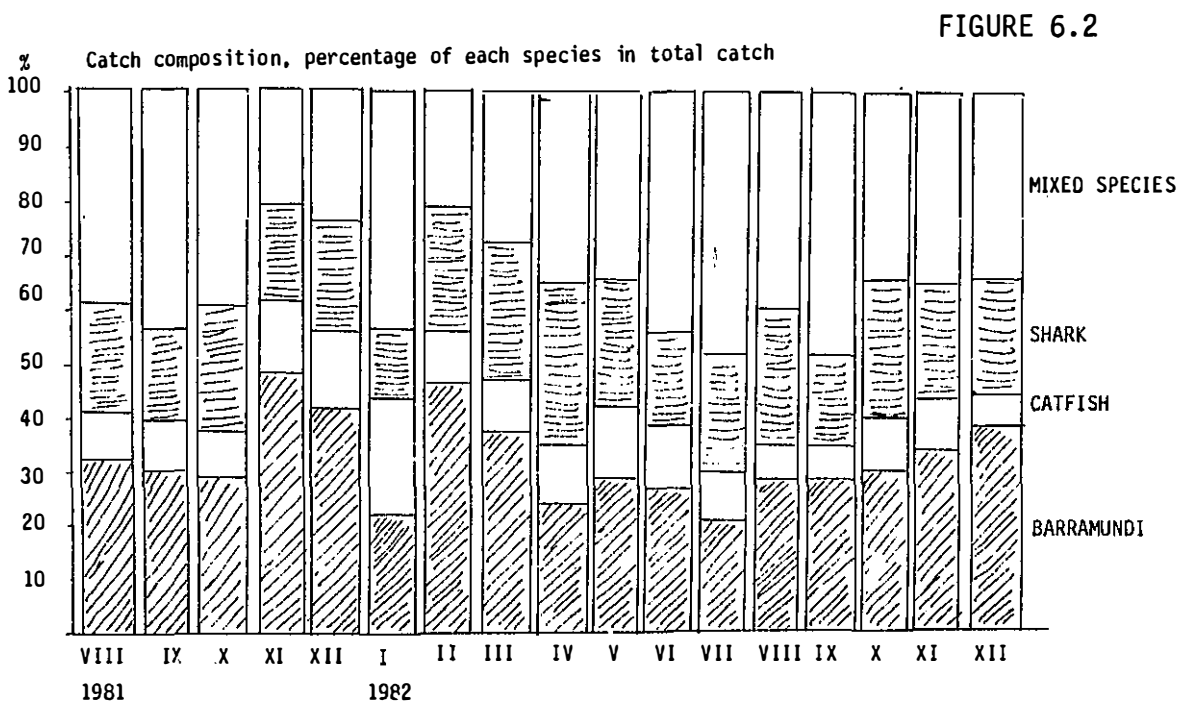
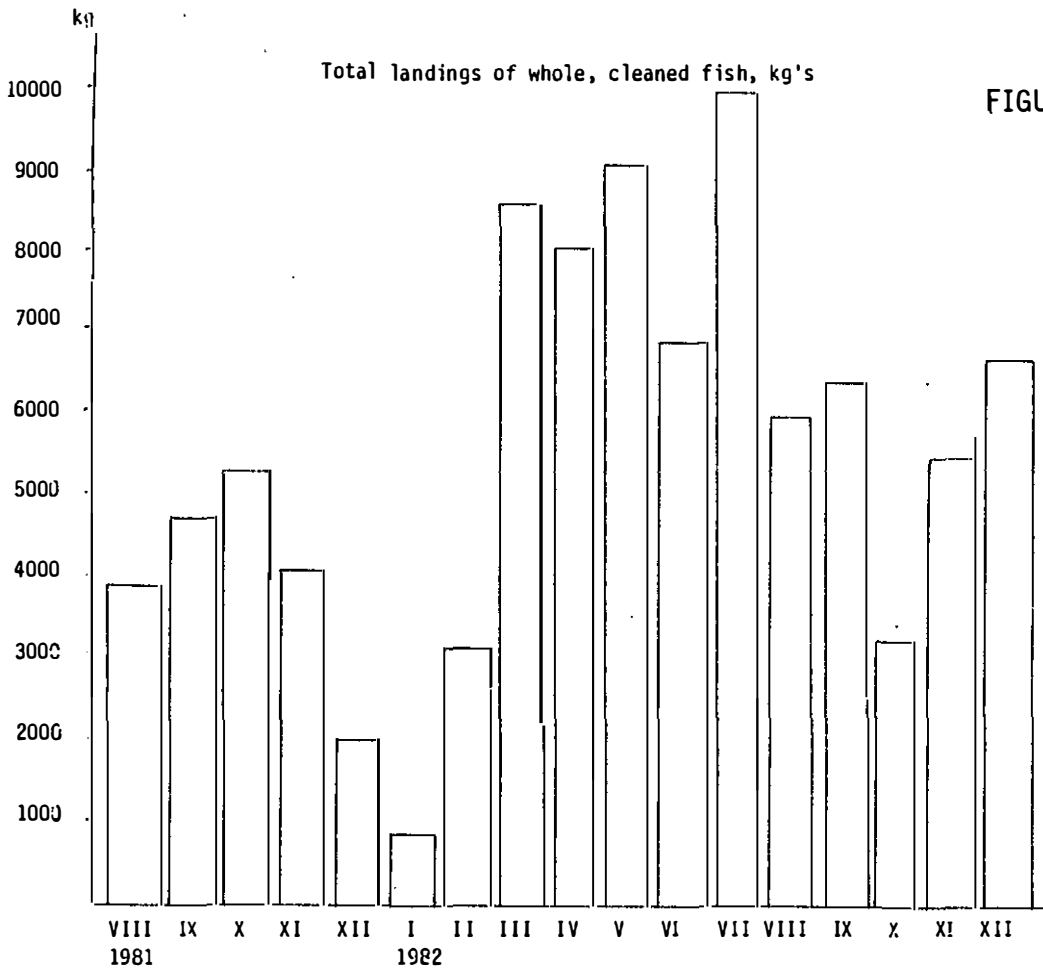
VILLAGE NAME	1981					1982												AVERAGE
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
AIBIGAHE	30	0	0	0	59		0	5	28	64	68	0		69	90	47	93	8
AIMEI			0	34							0	5						30
AKOMA								38	71	16	33	62			39			13
ARAAVA	0	0	35				8	30	43		60	0	52	72	39	43	7	25
AVEEOA														21				0
BABAGUINA								10									9	0
BAIMURU	1	11	12	5	18	35	18	28	33	35	36	37	54	27	15	7	26	9
BAVI				39	0													26
BEKORO	10	1	11	34		100	0	100	0		7	85	40	35	78	0	35	6
ERA-MAPUA				12	49		11	37	28	7	4	0	30	5	4	25	51	24
GAURI																0		0
GIBI-MEAGOMA	0	0	16						24		34	31	54	69	20	9	0	8
GIGORI				0														0
IKINU							14	19	38	11			52		70	52	44	13
IMEIA			0							11	7	13	0	21	54	49	41	2
IPIKO	18	0	44	62	7	20	8		0		19	41	24	0				27
KAIRIMAI		0							0									2
KAPAI							0											0
KARURUA	15	16	22	34	24	59	31	30	47	64	61	45	49	38	30	33	39	17
KEMEI														27	0	88		43
KIKORI									0									0
KINIPO										41								0
KINOMERE	0	4	2	11	0			8	18	28	33	35	40	41	21	35	9	11
KITI										28	26	28	14	27	0			7
KIVAUMAI	7	0	0	10			25	13	26	87	75	61	67	87	85	45	26	9
KOROVAKE		100	0				22	56	32	45	28	40	58	17	0		29	11
KUPORO												86						14
LARIMIA	10	9	9	21	0		0	74	56	61	69	66	49	79	59	65	71	6
MAIRIPEPEA	2	13	14	9	2	6	20	13	18	48	53	40	30	25	9	35	29	6
MAPAIO				0						36	0	53						20
MARIKI			0									73	57	33		6		3
MIRI-POINT									60	42		64	61	6	68	0		8
MOROVAMU	6	7	7	5		0	70	83	57	48	0	73	18	36	33	61	0	4
NAHARO	0	160	36	6	20	0	3	0	0		0	0	31				0	12
OMATI	0																	0
PIVARA																	100	0
RAVIPAKA											77							0
URAMA														0				0
VARIA			0											0	0			0
VERAIBARI							87	0							48	56		8
WAIAMU												0						100
AVERAGE	8	9	11	15	14	19	11	11	9	12	11	88	8	5	9	9	5	10

TABLE 6.11 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
percentage by weight of SHARK in the total catch (blank is no catch, 0 is no SHARK in the catch)

VILLAGE NAME	1981					1982												AVERAGE
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
AIBIGAHE	5	0	0	13	26		0	35	0	10	1	0	12	0	0	53	0	5
AIMEI			0	0							0	0						0
AKOMA								0	0	0	0	32			0			2
ARAAVA	100	47	9				4	10	21		40	0		0	0	0	48	17
AVEEOA														48				48
BABAGUINA								6									4	5
BAIMURU	24	20	2	25	5	0	21	20	34	48	17	22	16	66	36	4	3	21
BAVI				0	0													0
BEKORO	5	10	0	0	0	0	0	0			0	4	23	23	0	0	0	6
ERA-MAPUA				7	0		16	3	0	4	0	35	0	15	0	0	0	5
GAURI																0		0
GIBI-MEAGOMA	0	0	0				25		0	0	18	6	5	49	0		0	10
GIGORI				0														0
IKINU								1	9	4	4		0		0	0	23	7
IMEIA			0					0			20	10	12	0	1	9	9	0
IPIKO	0	0	0	0	0	0			0		2	0	0	0				0
KAIRIMAI		0																0
KAPAI							100											100
KARURUA	18	12	16	11	22	13	20	23	27	18	9	31	26	22	37	30	32	20
KEMEI													29	29	0	0		17
KIKORI									0	0						31		0
KINIPO										0								0
KINOMERE	80	14	19	30	0			49	54	40	33	38	34	42	42		74	38
KITI										17	23	12	39	9	67			20
KIVAUMAI	62	0	0	0			75	68	58	0	5	29	6	1	0	28	43	24
KOROVAKE		0	0				0	22	20	12	25	27	0	0	0		49	21
KUPORO							0					0						0
LARIMIA	27	10	23	21	0			11	27	9	21	14	28	13	22	23	21	18
MAIRIPEPEA	33	45	16	26	35	0	57	45	61	27	40	45	48	67	48	31	54	40
MAPAIO				100						11	14	17		48		0		19
MARIKI			0									0	11	14				7
MIRI-POINT									8	0		5	0	94	0	100		21
MOROVAMU	35	3	17	17		0	6	0	6	48	100	24	79	22	0	5	0	20
NAHARO	34	0	0	6	20	38	5	0	0		0					17	63	14
OMATI	0																	0
PIVARA																	0	0
RAVIPAKA											0							0
URAMA														0				0
VARIA			0											0	0			0
VERAIBARI							7	100							3			24
WAIAMU												0						0
AVERAGE	21	16	12	17	20	14	25	25	31	24	19	25	24	19	24	23	24	22

TABLE 6.12 BAIMURU CATCH RECORDS AUGUST 81 - DECEMBER 82  
percentage by weight of MIXED FISH in the total catch (blank is no catch, 0 is no MIXED FISH in the catch)

VILLAGE NAME	1981					1982												AVERAGE
	VIII	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
AIBIGAHE	23	9	8	4	15		0	5	28	64	68	0		69	90	47	93	62
AIMEI			41	5							0	5						7
AKOMA								38	71	16	33	62			39			37
ARAAVA	0	53	24				8	30	43		60	0	52	72	39	43	7	34
AVEEOA														21				21
BABAGUINA									10								9	10
BAIMURU	37	21	15	7	30	35	18	28	33	35	36	37	54	27	15	7	26	27
BAVI				23	56													34
BEKORO	77	71	53	0		100	0	100	0		7	85	40	35	78	0	35	68
ERA-MAPUA				5	0		11	37	28	7	4	0	30	5	4	25	51	0
GAURI																0		0
GIBI-MEAGOMA	14	0	26						24		34	31	54	69	20	9	0	38
GIGORI				75														75
IKINU							14	19	38	11			52		70	52	44	29
IMEIA			0							11	7	13	0	21	54	49	41	19
IPIKO	26	0	0	11	9	20	8		0		19	41	24	0				12
KAIRIMAI		100							0									7
KAPAI							0											0
KARURUA	48	49	28	38	46	59	31	30	47	64	61	45	49	38	30	33	39	45
KEMEI														27	0	88		26
KIKORI									0									0
KINIPO										41								43
KINOMERE	8	2	0	38	0			8	18	28	33	35	40	41	21	35	9	31
KITI										28	26	28	14	27	0			26
KIVAUMAI	24	75	0	38			25	13	26	87	75	61	67	87	85	45	26	59
KOROVAKE		0	0				22	56	32	45	28	40	58	17	0		29	38
KUPORO												86						86
LARIMIA	30	48	44	46	26		0	74	56	61	69	66	49	79	59	65	71	61
MAIRIPEPEA	33	7	6	16	21	6	20	13	18	48	53	40	30	25	9	35	29	25
MAPAIO				0						36	0	53						31
MARIKI			0									73	57	33		6		66
MIRI-POINT									60	42		64	61	6	68	0		51
MOROVAMU	32	29	22	17		0	70	83	57	48	0	73	18	36	33	61	0	52
NAHARO	0	0	5	5	0	0	3	0	0		0	0	31				0	3
OMATI	0																	0
PIVARA																	100	100
RAVIPAKA											77							78
URAMA														0				100
VARIA			0											0	0			91
VERAIBARI							87	0							48	56		51
WAIAMU												0						0
AVERAGE	40	46	40	22	26	44	21	30	37	37	44	48	43	48	37	39	34	38





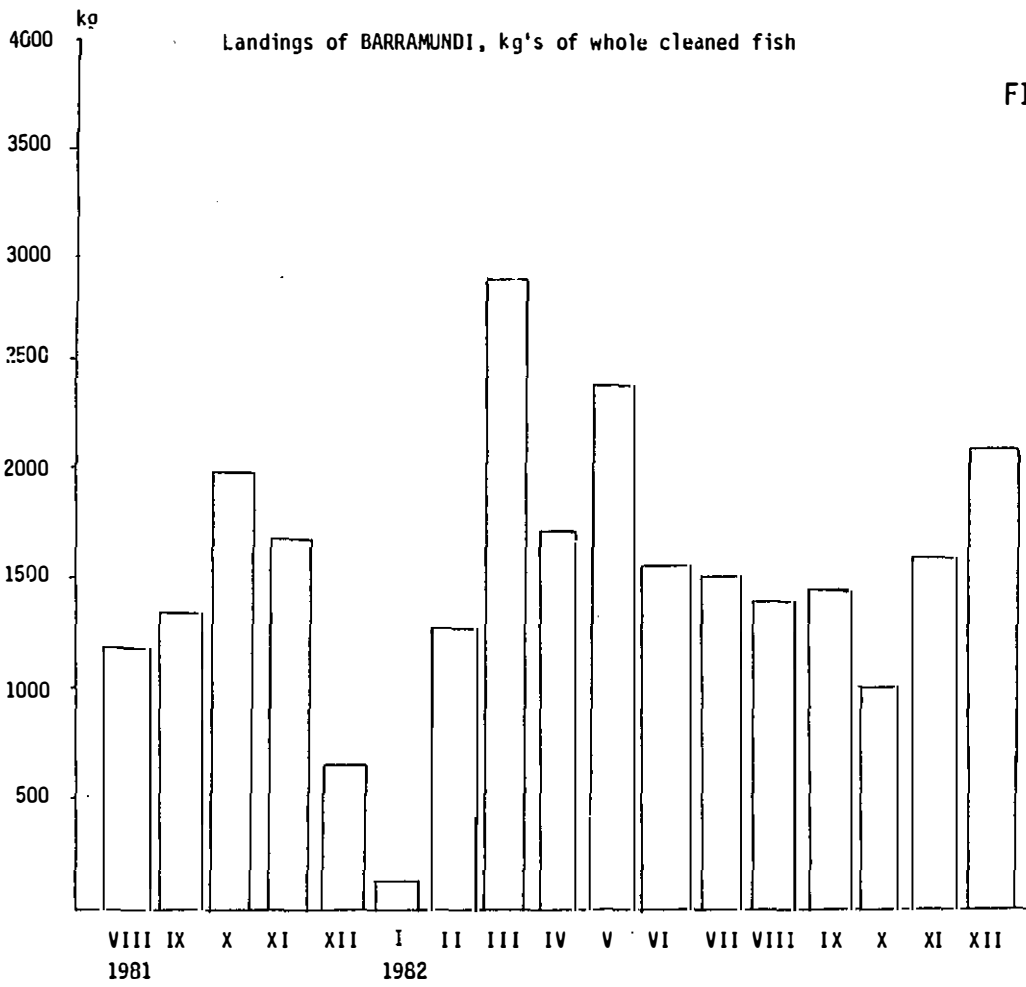


FIGURE 6.3

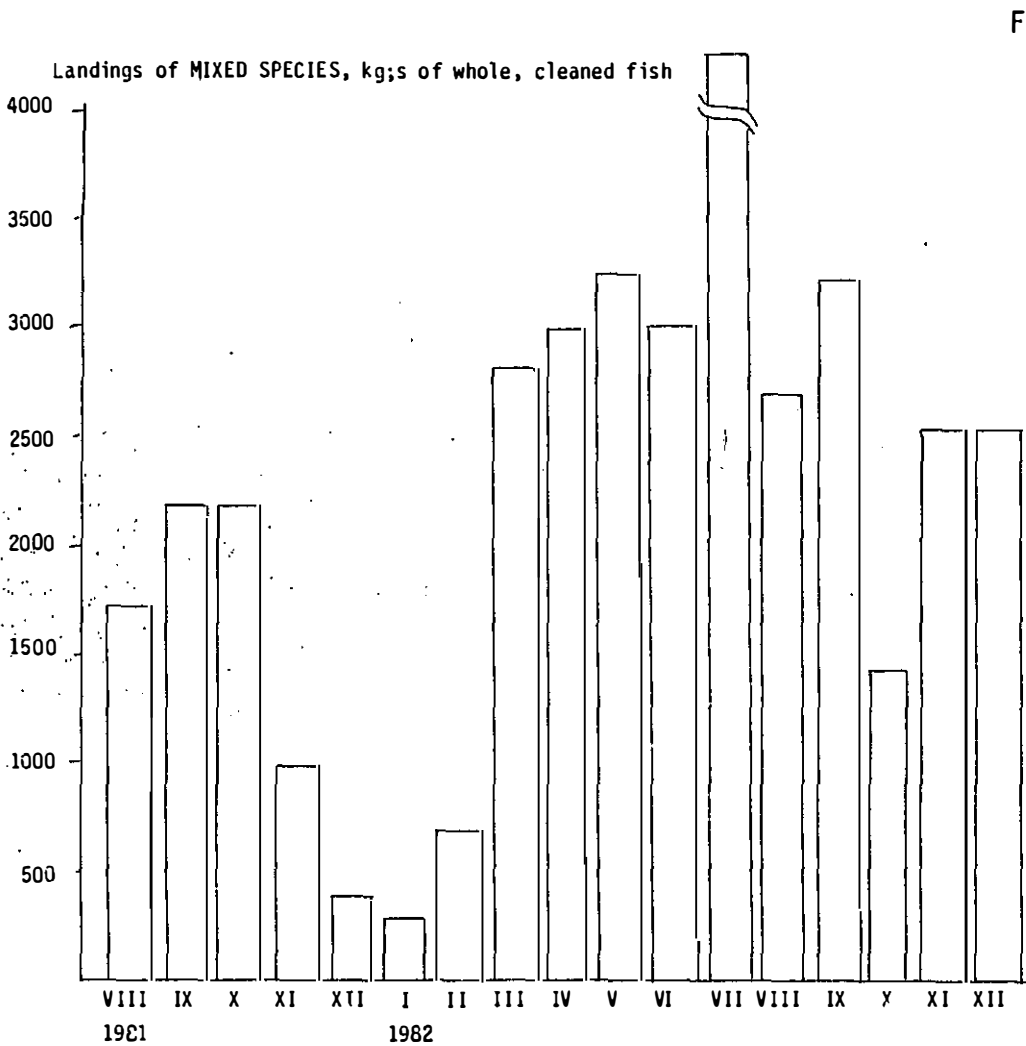


FIGURE 6.4

FIGURE 6.5

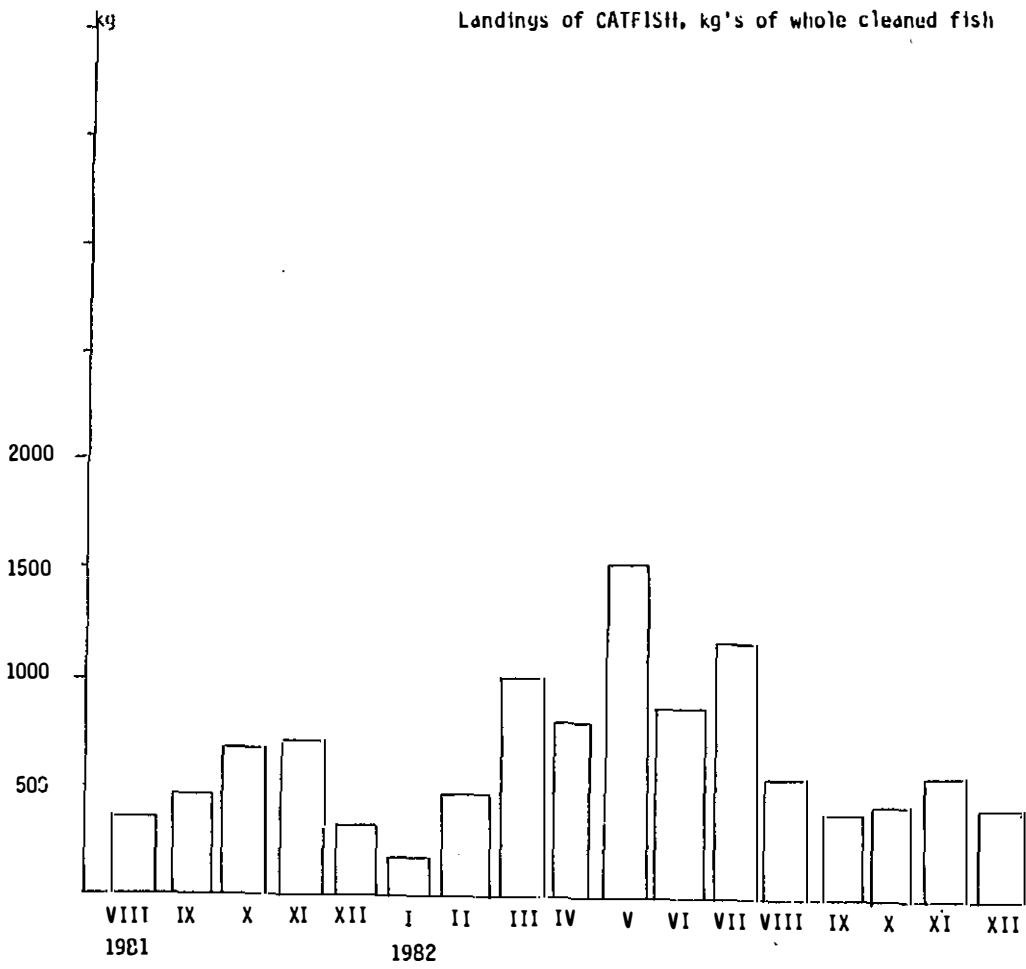
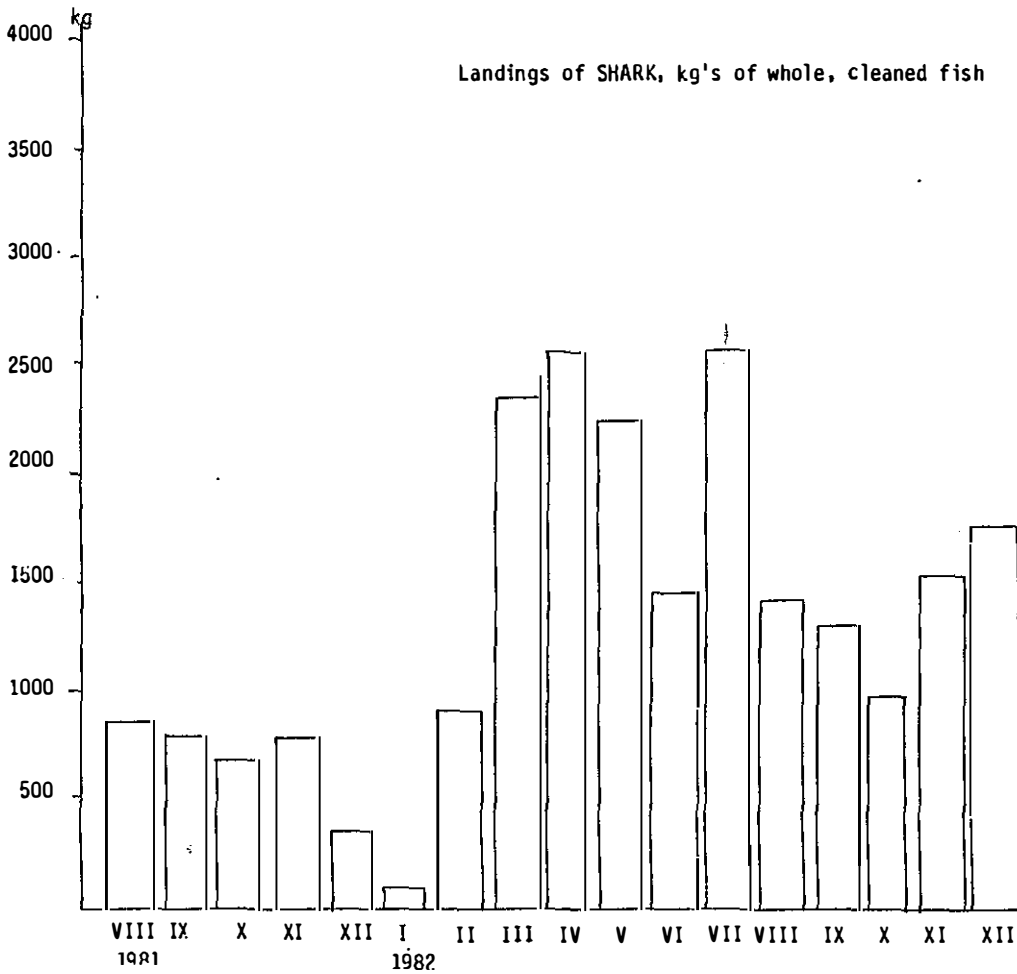


FIGURE 6.6



CHAPTER 7. PRODUCTION AND INCOME

## 7.1 DISTRIBUTION OF LANDINGS

Analysis of Table 6.1 shows that while 41 different villages delivered fish to the station in the period August 81 - December 82, only eight villages made a significant contribution, (accounting for 75% of the total landings). The other 33 villages accounted for 25%. The four villages that produced more than 10t during this period, accounted for more than 55% of the landings.

TABLE 7.1 Distribution of landings August 81 - December 82.  
Weight in kg of gutted fish.

Village	Landings	Totals	% of the Total Landings
Mairipepea	13,670		
Kinomere	12,952		
Larimia	12,652		
Baimuru	10,315		
	-----	49,589	55.5
Karurua	8,040		
Ikinu	3,245		
Bekoro	3,204		
Kivaumai	2,870		
	-----	17,359	19.4
		66,948	74.9
33 other villages		22,399	25.1
		-----	
Total landings		89,347	

## 7.2 CATCHES PER FISHING MONTH

Out of the total of 697 months the 41 villages had during this period (17 months for each village), 291 were used for fishing. This does not mean that these months were only spent fishing, but that during these months there was at least one entry in the buying records. Only three villages fished during every month, while the average for all villages was 7 months out of the 17. The figures are summarized in Table 7.2.

TABLE 7.2 Average catches per fishing month.  
Weight in kg of gutted fish.

Village	Number of Fishing Months	Total	Average	Average Catch per Fishing Month
Mairipepea	17			804
Kinomere	15			863
Larimia	16			791
Baimuru	17			606
	--			---
		65	16	787
Karurua	17			473
Ikinu	8			406
Bekoro	14			229
Kivaumai	15			191
	--			---
		54	14	321
		---		
8 villages		119	15	572
33 other villages		172	5	129
		---		
All villages		291	7	307

### 7.3 EARNINGS FROM FISHING

Due to the different species compositions of the landings of different villages, the average price that villages received for their catch varied from 15 to 85 toea/kg. The average was 44 toea over the whole period. Therefore, the list of the eight villages that earned most of the income (Table 7.3) differs somewhat from the list of landings in Table 6.2.

The average income per fishing month is given in Table 7.4. Again, the differences are large, reflecting both the differences in catch composition and in effort.

Table 7.5 gives the earnings per capita for the top 10 producing villages excluding Baimuru. In the case of Baimuru it is impossible to distinguish between catches of fishermen and catches of extension and research personnel.

The earnings per capita are calculated averages, using the population figures from the 1980 Census. It must be pointed out however, that the income differences inside a village will be very large. In general, only certain people in a village specialize in fishing, although most people will participate in at least one trip in the course of a year. Thus the per capita earnings for "fishing families" will be higher. This is in accordance with the findings of Morauta (see Chapter 3).

With an average non-wage cash income of K 62.52 per capita per annum for villages (Chapter 3, conclusions), the contribution of fishing activities to the income is significant. However, as has been pointed out before, the differences between villages are

large so that the importance of fishing is different for each village. The data required for an analysis of this are not available.

TABLE 7.3 Earnings from fishing.

Village	Earnings ( Kina)	Totals	% of Total Earnings
Mairipepea	5,569.15		
Baimuru	5,126.56		
Larimia	4,955.81		
Kinomere	4,762.90		
	-----	20,414.42	51.8
Karurua	2,991.62		
Imeia	1,839.75		
Ikinu	1,806.11		
Bekoro	1,406.24		
	-----	8,043.72	20.4
8 villages		28,458.14	72.2
33 other villages		10,928.43	27.8
All villages		39,386.57	

TABLE 7.4 Average earnings per fishing month.

Village	Number of Fishing Months	Total	Average	Average Earnings per Fishing Month (Kina)
Mairipepea	17			327.60
Baimuru	17			301.56
Larimia	16			309.74
Kinomere	15			317.52
	--	65	16	-----
Karurua	17			175.98
Imeia	9			204.41
Ikinu	8			225.76
Bekoro	14			100.45
	--	48	12	-----
8 villages		113	14	251.84
33 other villages		178	5	61.40
All villages		291	7	135.35

TABLE 7.5 Earnings per capita.  
(Amounts in Kina).

Village	Total Earnings	Total Earnings per Capita	Average Earnings per Capita per Month		Earnings per Cap. 1982
			Fishing	Month	
Mairepepea	5,569.15	70.50	4.15	4.15	45.74
Larimia	4,955.81	36.71	2.16	2.29	28.20
Kinomere	4,762.90	31.33	1.84	2.45	28.87
Karurua	2,991.62	8.24	0.48	0.48	5.03
Imeia	1,839.75	34.71	2.04	3.86	34.40
Ikinu	1,806.11	18.06	1.06	2.26	18.06
Bekoro	1,406.24	10.42	0.61	0.74	5.01
Era Mapua	1,229.67	6.79	0.40	0.52	4.84
Gibi Meagoma	1,183.16	2.52	0.15	0.21	1.53
Araava	946.48	2.68	0.16	0.21	2.31

## CHAPTER 8. CATCHES, EARNINGS AND EFFORT

### 8.1 CATCH AND EFFORT

During 1982, 29% of the catch landed in Baimuru was recorded by the Research and Surveys Branch for the C.P.U.E. survey (Table 8.1). Due to problems with data entry and programming, these data cannot be analysed in detail at present. Analysis by village, by fishing area and by different net size has not been done yet.

TABLE 8.1 Records for C.P.U.E. Survey.

1982	Total Catch (kg)	Catch recorded for CPUE Survey	% Recorded
January	604	0	0
February	2,871	548	19.1
March	8,487	3,101	36.5
April	7,647	1,580	20.7
May	8,772	2,469	28.2
June	6,346	1,534	24.2
July	9,311	3,318	35.7
August	5,384	823	15.3
September	5,834	0	0
October	3,344	1,485	44.4
November	5,300	1,374	25.9
December	5,935	3,924	66.1
Totals	69,835	20,156	
Average			29.0

It is not possible to determine how representative this 29% is for the total landed catch. Possibly, bigger catches are more frequently recorded than the smaller catches. It is assumed here that the figures give a good indication of the efficiency of the fishery in the area, with the nets and methods presently in use.

On average, two men operate each net (mainly 4" and 7" mesh gill-nets, 50m long). The average number of men in a fishing unit for each night the unit is fishing is 2.6. The results are presented in Table 8.2.

TABLE 8.2 Nets and Men.

1982	Number of Men per Fishing Group per Night	Number of Men per Net
January**		
February	3.4	2.0
March	2.9	4.8
April	3.1	2.1
May	1.9	1.9
June	2.4	2.2
July	1.9	1.5
August	1.6	1.2
September**		
October	3.6	1.6
November	2.8	1.3
December	2.6	1.1
Average	2.6	2.0

\*\* No recordings for this month.

The variation in catches per net-night and man-night are rather large, ranging from 6.4kg/net-night to 20kg/net-night. These figures are presented in Table 8.3.

## 8.2 EARNINGS AND EFFORT

Returns on capital input and on labour input indicate the efficiency of the fishery and the attractiveness for people to go fishing. It is not possible to correctly calculate these returns as the exact costs involved are not known. As a first step the gross earnings per effort was calculated (Table 8.4). These figures will be used in Chapter 9 to arrive at some tentative calculations regarding returns to fishermen.

During 1982, 695 different names of fishermen were recorded. They earned a combined total of K30,274. It is assumed here that on average the number of men recorded under one particular name equals the number of different names recorded for the same person. Thus the total catch in 1982 was landed by 695 fishermen (77% of all men between 17 and 45 years old, living in the villages recorded) and earned them K43.56 per capita. The income

distribution was very unequal as many fishermen made only one or two trips during the year.

TABLE 8.3 Catch and Effort.

1982	Catches per Net-night (kg)	Catches per Man-night (kg)
January**		
February	6.4	4.7
March	12.1	2.9
April	13.1	11.2
May	9.7	5.4
June	7.6	3.9
July	15.4	10.7
August	7.4	8.3
September**		
October	15.2	10.7
November	15.4	17.4
December	20.0	18.1
Average	12.2	9.3

\*\* no recordings for this month.

TABLE 8.4 Gross Earnings and Effort.

1982	Earnings per Net-night Kina	Earnings per Man-night Kina
January**		
February	3.09	4.21
March	1.33	5.54
April	4.41	5.14
May	2.11	3.82
June	1.90	3.68
July	5.58	8.02
August	3.11	3.76
September**		
October	3.07	5.45
November	2.97	3.99
December	4.91	4.36
Average	3.25	4.78

\*\* no recordings for this month.



## CHAPTER 9. RETURNS TO THE FISHERMEN

9.1 It is not yet possible to calculate exact returns to fishermen, as the actual costs involved in fishing are not known. However, this is possibly the most important matter from the fisherman's point of view and the net income that people will earn from fishing will decide the success of any fisheries development project. Therefore, this chapter will investigate the returns to the fishermen that might be expected on the basis of the information that is currently available and estimates of costs involved.

9.2 One of the most important developments that has taken place since August 1981, is the introduction of the insulated holding container ("ice-box"), of a size to fit a 4-6m single hull canoe. These ice-boxes can contain between 350 and 500kg of iced fish and are lent to the fishing groups. The plant also provides ice and after two nights of fishing the group returns to the plant with the catch. The use of an ice-box while fishing has several technical and organisational advantages:

- it enables fishermen to clear their nets several times before selling their catch;
- this in turn means that catches per night will be higher and that the quality of the fish will be higher;
- it forces fishermen to overcome several problems before actually going on a trip, like forming a group, deciding on compensation for the owners of the outboard engine and the nets, and deciding on the fishing spot.

It is not possible on the basis of the data available to measure the precise effect of the introduction of the ice-boxes on catch rates. It was observed however, that it boosted production both in quantity and quality.

9.3 The ice-box is a device which is apparently suitable for local use. The technology involved is not too advanced and is readily accepted by the fishermen. Moreover, it does not require much maintenance and it can be used in a flexible way. Fishermen or fishing groups can decide how many people and how many nets there will be for each ice-box on a particular trip. This flexibility makes the box very suitable for use in a Melanesian subsistence environment.

For the same reasons, it is more logical to regard the ice-box as the central or productive unit, rather than "the fishermen" or "the fishing group". This leaves people free to decide on their own needs. Moreover, from an analytical point of view, it seems important to have this approach, so as to avoid planning mistakes based on wrong expectations regarding effort. Thus first the net returns on ice-boxes will be discussed and then possible net returns to fishermen under different assumptions.

#### 9.4 The following assumptions will be made:

1. That the ice-boxes are owned by the plant and lent to the groups. This means that boxes can rotate and be productive during more nights than individual groups will be. Calculations are made for three, four and five nights of fishing per week per box for 48 weeks per year.
2. That each ice-box is associated with six nets, owned by the fishermen. The nets are standard 6" or 7" mesh, multifilament nylon, 25 yards long and 50 mesh deep. The investment costs per net are K150, and the life expectancy is two years. Maintenance and repairs depend on the use of the nets. Assumed is a cost per net of K17 per year for three nights of fishing per week, K33 for four nights and K50 for five nights.
3. A suitable sized canoe (although often made by the owner himself) will cost K300 with a life expectancy of four years. An outboard engine (25hp) costs K900, with a life expectancy of three years. Maintenance costs are fixed and assumed to be 10% of the value of the engine. Operating costs are calculated as follows: 4 hours per night x ~~7~~ 7 1/2 hour x K0.66 (fuel per lt) x K0.06 (lubrication oil per lt). This gives a total cost of K20.33 per night of fishing.
4. The catch rates are assumed to be somewhat higher than the average recorded in 1982, as nets can be cleared several times each night. Therefore the catch rate is assumed to be 15kg/net-night, or 90kg/ice-box-night.

9.5 Table 9.1 summarizes these assumptions and shows the net revenues per operating week and per operating night. It is clear that these returns are very low. There are six nets per ice-box in operation, and in 1982 there were on average two men per net, so the net returns have to be divided between 12 men, leaving each with slightly more than K1 per night of fishing. The no risk minimum rural wage is K3 per day. Even if the number of men involved is halved, the net revenue is still only about k2/person.

9.6 The main problem in the operation are the costs of outboard motors. A reduction of 20% in these costs (say less hours per night and going at 75% of full speed) would increase net revenue 33%. Even then fishing is not an attractive proposition except that often there are no alternative cash earning opportunities.

Increases in returns to labour should be sought by improved gill-netting and alternative fishing methods. Recently, the fish plant has started a collection service for some areas, whereby people have an ice-box stationed in the village and fish is transported to the plant by a collection vessel. Although the fishermen receive a lower price for their fish, this method should increase the net revenues, as fuel costs will be minimized.

TABLE 9.1 RETURNS TO LABOUR PER OPERATING NIGHT

All amounts are in Kina.  
For assumptions see text.

	3 nights per week	4 nights per week	5 nights per week
<u>REVENUE</u>			
48 weeks, 90kg/night 44 toea/kg	5,702.40 <sup>100</sup>	7,603.20 <sup>100</sup>	9,504.00 <sup>100 76</sup>
<u>COSTS</u>			
<u>Fixed</u>			
depreciation canoe	75.00 1.3	75.00 1.0	75.00 225
depreciation o/b	300.00 5.3	300.00 3.9	300.00 270
maintenance o/b	90.00 1.6	90.00 1.2	90.00 95
	-----	-----	-----
	465.00 8.2	465.00 6.1	465.00 95
<u>Variable</u>			
nets	550.00 9.6	650.00 8.5	750.00 1950
operating costs	2,927.52 51.3	3,903.36 51.3	4,879.20 211710
	-----	-----	-----
	3,477.52 61.0	4,553.36 60	5,629.20
<u>Total costs</u>	3,942.52 69.2	5,018.36 66.1	6,194.20 64.1
Returns to labour per year	1,759.88 30.9	2,584.84 34.0	3,409.80 9
Returns to labour per operating week	36.66	53.85	71.04
Returns to labour per operating night	12.22 =====	13.46 =====	14.21 =====

## CHAPTER 10. DISCUSSION AND CONCLUSIONS

10.1 Although unique in P.N.G., the data-base available for the socio-economic analysis of the fishery in Baimuru is still very narrow. While the quality of the material is not always high enough to warrant detailed analysis (as discussed in Chapter 5), there is enough information to draw some conclusions about the present fishery.

10.2 The most important aspect of the commercialized part of the fishery in the area is the fact that 55% of the catch comes from four villages and that 75% comes from eight villages out of the 41 that delivered to the plant at some stage. Moreover, three out of the eight are located close to the plant and have important alternative income sources in logging and public servant wages (Baimuru, Karurua and Bekoro). Thus, only a few villages presently benefit from the presence of the fish-plant, which enlarges the already enormous income gap between villages (see Part I).

10.3 As the total number of trips per fishing unit has not been recorded, fishing months were chosen to give an indication of effort. Again differences between villages are large, with only three villages fishing every month during the period. The average catch per fishing month reflects the number of trips made during the month, the efficiency of fishing and the location of the fishing grounds. Until such time as the catch per effort analysis can be done by village, no conclusions can be drawn.

10.4 Differences in species composition between villages are mainly caused by:

- the location of (traditional) fishing grounds;
- the availability of nets of different mesh sizes;
- the skills of the fishermen;
- The state of repair of nets.

Thus the average price that a village receives for its fish shows large differences and consequently the average earnings per fishing month not only reflect effort and catch per effort, but also the mesh size and quality of the nets used.

10.5 The average non-wage rural cash income was calculated to be K65.52, which indicates that fishing made a substantial contribution to the cash incomes in some villages, while in most villages the contribution was insignificant. However, as pointed out before, the income differences are large, so that the contribution of fishing to the village income has to be calculated separately for each village. The data to do this are not yet available. It must be noted that the top five per capita income earning villages (Table 7.5) have no important alternative income sources, apart from remittances from town.

10.6 Only 29% of the total catch landed in 1982 was recorded for the C.P.U.E. survey. In the future it will be possible to analyse these data on a computer and calculate the c.p.u.e. for different villages, different fishing areas and different sizes of net. At present it is only possible to calculate catches per net-night and man-night, as well as earnings per effort.

Table 8.2 shows two men are involved in each setting of a net, this makes the fishing very labour intensive and indicates an inefficient use of the nets. Ben Yami (pers. comm.) indicated that artisinal fishermen may use 200-300m of net per man, except were catches are very heavy or fishing grounds are very difficult. It is not known whether or not the fishing grounds in the Delta are abnormally difficult.

10.7 The average gross earning per man-night of K4.78 is very low because the method used is so labour intensive. When taking into account all associated costs, net returns to labour are also very low; about K1 per man-night of fishing. This compares with a minimum wage of K3.00 per day.

The conclusion is that the commercialized fishery in the Delta is confined only to a few villages and that overall the efficiency of the fishery is very low, as are the gross earnings per effort.

## PART III: THE DEVELOPMENT OF THE FISHERY

### CHAPTER 11. INTRODUCTION

11.1 Part I of this study provided background information on the Delta region of the Gulf Province, arrived at an estimate for cash incomes in the area and gave a description of the fishery. Part II presented the available data and an analysis of the fishery of the Delta. The picture that emerges from these two parts is as follows.

11.2 The Delta is a large, thinly populated estuarine area with abundant, if unassessed fish resources. The 10,000 inhabitants of the area form a society that is mainly engaged in subsistence activities and is only now starting to enter the cash economy. The region is extremely poor in terms of imported material wealth, productive capacity, trained labour resources and the availability of cash. In terms of natural resources like timber, wild life and fish, the region is rich. Transport in the area is by water only.

11.3 Until recently, fishing activities were mainly for subsistence or barter trade, using traditional knowledge and methods. This has been changing slowly over the last ten years, with the introduction of nylon gill-nets and the provision of marketing facilities by the government. However, few villages are actually engaged in commercial fishing, while the returns to labour are low.

11.4 In view of the fact that there are few income opportunities in the Delta, and that the fish resources appear to be abundant, Part III will examine the possibilities of developing a commercial fishery in the Delta, to provide the population with income opportunities and employment. This will be done in the context of the project designed and funded by the International Fund for Agricultural Development (IFAD). The project, officially known as P.N.G. Artisinal Fisheries Project, will be referred to as the Project.

11.5 After a short history of the Project, the different components of the Project and the aims and methods will be presented in Chapter 12. Chapter 13 will discuss the main constraints towards implementing the Project successfully and identify research needs in connection with these constraints.

## CHAPTER 12. IFAD ARTISINAL FISHERIES PROJECT

### 12.1 SHORT HISTORY

In April 1980, a Special Programming Mission of the IFAD visited P.N.G. "to develop long term guidelines, in agreement with the Government, for continuing assistance from IFAD; and to propose several key areas in which specific IFAD projects should, in the view of the Mission, be formulated" (IFAD, 1980, p iii): It was concluded that "... the development strategy should focus strongly on the traditional subsistence food production systems, from land and sea... Special importance is attached to the increase of fish and food production for sale to the domestic market... Sweet potato and fish (coastal and inland) would constitute the main commodity focus in this strategy ..." (IFAD 1980, pp 118-119).

Thus, in 1980 an Identification Mission visited the country, to identify possible fishery projects, and in April/May 1981 a Project Preparation Mission came to P.N.G. The mission visited the Baimuru Fishery Station, observed fishing operations and held discussion with government officials, fishermen and members of the fishing industry. As a result, two areas in P.N.G. were judged suitable for IFAD assistance in the development of fisheries (IFAD, 1981).

Finally, after some delays, a Project Appraisal Mission visited the proposed project sites and drafted the final project document. This document was the basis for loan negotiations between IFAD and the P.N.G. Government, and for presentation to the Board of Directors of IFAD for approval, both in December 1982. The loan agreement, regarding a "soft" loan of SDR 9.6 million, is expected to be signed in the course of 1983.

### 12.2 PROJECT DESCRIPTION

The Project is based on the 1979 Coastal Fisheries Development Plan, which calls for the establishment of a network of 20 coastal fisheries stations. "Seven of these planned stations have already been established and the present project aims to assist the Government to improve the operation of two stations, the Baimuru station and its Kikori sub-station in the Gulf Province and the Samarai station in the Milne Bay Province." (IFAD 1982, p.10). Hereafter, reference will only be made to the part of the Project that deals directly or indirectly with Gulf Province.

"The main target group of the project in Baimuru .... would be the disadvantaged, isolated coastal communities which are traditionally involved in fishing as part of their subsistence activities" (p.10). "The project's design takes into consideration the existing social-cultural conditions ..... For the Gulf Province, the project aims to capitalize on the existing fishing methods and techniques" (p. 11).

"The objectives are to:

- (a) increase cash earning opportunities for the fishing population living in remote coastal communities;
- (b) make available additional animal protein from presently under-utilized, renewable fish resources;
- (c) help improve skills, techniques and methods through extension activities leading to better returns through rational harvesting of fisheries resources; and
- (d) increase foreign exchange earnings." (p. 11).

In order to achieve this, the Project consists of the following components (Baimuru only, amounts in US\$):

i)	Civil works	1,078,600	26%
ii)	Plants, machinery, equipment	628,320	15%
iii)	Collection operation	77,000	2%
iv)	Revolving fund (fishing gear)	366,600	9%
v)	Technical assistance	492,000	12%
vi)	Training	165,700	4%
vii)	Experimental fishing	44,200	1%
viii)	Operating costs (5 years)	1,302,000	31%
-----			
	TOTAL	4,155,120	100%

- sub i) Civil works include renovation of existing buildings and wharfs and construction of houses.
- sub ii) Plants, machinery and equipment include ice plants and storage, chilled and frozen storage, blast-freezers, generators and fuel tanks.
- sub iii) Collection operation includes two collection vessels and insulated boxes for canoes and for the villages.
- sub iv) Revolving fund for fishing gear, engines and supplies, to be sold on a credit basis to the fishermen.
- sub v) Technical assistance includes a master fisherman, a marine mechanic, a plant operation specialist and civil engineers.
- sub vi) Training includes overseas and on the job training.
- sub vii) Experimental fishing will concentrate on the introduction of "long-tail" diesel engines and improvement of existing fishing methods.
- sub viii) Operating costs also include all extension costs.



The project target is to reach a production volume of 1,215t by Year 7, 5% of which will be retained in the village and 12% will be lost through gutting. The plant through-put by Year 7 therefore will be 1,016t. It is hoped that this target will be reached through:

- i) Improvement of fishing techniques. It is assumed that the introduction of 7" mesh monofilament gill-nets will double catch rates from 15kg/night to 30kg/night.
- ii) An extension programme. By Year 7, there will be four extension assistants, each of them responsible for 12 villages.
- iii) Establishment of a workshop for mending nets and maintenance and repair of outboard engines.
- iv) Establishment of a collection service, for villages that are too far away to deliver fish themselves.
- v) The provision of ice-boxes to villages that deliver fish themselves.

Eventually, it is hoped that 50 villages will provide fish to the plant, and will fish on an increasing scale upto 135 nights per year with a total of 300 nets.

The financial analysis of the Project shows an internal rate of return of 16.3% and the economic internal rate of return is 32%.

## CHAPTER 13. DISCUSSION OF THE PROJECT

### 13.1 INTRODUCTION

It is not the aim of this chapter to provide an extensive discussion and critique of the Project. This is not the place to do this, nor is the information given in the previous chapter sufficient to warrant this. Instead the purpose of this Chapter is to discuss several approaches and concepts used in the project and use those to explore possibilities of and constraints to fisheries development in the Delta. The following topics will be discussed:

- The planning approach;
- Motivation;
- The technology gap;
- Returns to the fishermen;
- Traditional user rights.

## 13.2 THE PLANNING APPROACH

For the formulation of this Project, the different missions visiting the country had both the advantages and disadvantages of having to formulate a project "on top" of an ongoing project. Clear advantages are that experience on technical matters and on possibilities and constraints has already been gained. Disadvantages include the fact that during the period between project identification and project implementation (after signing of the loan agreement) the existing project changed in size and scope, thus making certain aspects in the final document outdated and others invalid.

The mission that formulated the project in detail (Preparation and Appraisal) spent a significant part of its time in the field. There it met with representatives of the Provincial Government, with fisheries officers, the station manager and a representative of the local government council. Different villages were visited and villagers were interviewed. However, language problems and unfamiliarity of the village people in dealing with "white people from outside" (the reverse is also true), made this difficult and unproductive.

Overall, the project is characterised by "top down planning", with the project coming down from the National Government with some input from the Provincial Government and from the station management. The people who are to do the fishing and are to benefit from the project have not participated in planning.

P.N.G. has a history of this type of planning, although most of the necessary political and administrative structures required for an alternative approach exist. At the village level there are village councils and organizations like business groups, youth groups, womens groups and others. At a higher level there are the council areas, with their own political and administrative systems, often representing 40 villages or more, and the Provincial Government. However, many people have become discouraged by the local "talk shops", where village people can (literally) talk for years about a proposed project without any result.

In short, there appears to be an enormous gap between "educated" provincial (and even local) government leaders on the one hand and the "uneducated" village people on the other hand. Therefore, the present project has less chance of successful implementation than might be expected. However the Project has the advantage that the basic infrastructure already exists and that the people are used to it. But it is questionable if the proposed expansion, without more involvement of the local people, will be achieved.

### 13.3 MOTIVATION

The motivation of the people in the Delta will amongst other things, be closely related to their involvement in the Project. Many other factors are (potentially) involved and these factors are hardly discussed in the Project Appraisal report. The justification for increased effort by fishermen is given in Annex F, page 1 (Fishermen's Incentives): "The existence of the processing plant offering a market outlet at a guaranteed price means that fishermen desirous of increasing their earnings are assured that increased effort and production will result in increased earnings. This has been demonstrated in practise in other countries e.g., St. Helena and Kiribati, to be sufficient incentive to fishermen to increase their level of activity and production." People in the Delta are historically unfamiliar with 'market forces' and 'fluctuating prices'. Since the recent introduction of cash, prices have been relatively stable for most products (copra being the exception). Thus, a stable price will not change the earning perspective of the fisherman.

It is also stated that "Promotional efforts and simple practical instruction in the use, repair and operation of fishing gear and engines is likely to have a greater effect on fish production than the availability of a marketing outlet" (Annex B, page 7). However since the plant came in to operation, the production figures have fluctuated considerably, more than can be explained by operational difficulties experienced by the plant or by fluctuations in effort by extension personnel.

Unlike many other countries, P.N.G. does not have a (landless) class of fishermen who fish full time and who have developed a marketing system. In contrast, the coastal villages in P.N.G. have the character of the Melanesian subsistence society. In this type of society, every person does something of everything, within the boundaries of the sexual division of labour, and fishing is only one of many activities. Full time occupation in one direction does not occur and a larger market place for any product has not yet developed spontaneously.

Thus, motivation is closely related to cash needs, social obligations, productivity of food crops grown in gardens, availability of land etc. Table 13.1 gives an indication of possible positive and negative aspects of motivation and some related crucial factors that determine them. Although the list is far from complete, it might form the basis for further research. Development policies should be directed at influencing positive factors and at compensating negative factors.

TABLE 13.1 MOTIVATING FACTORS

POSITIVE ASPECTS	CRUCIAL POINTS	NEGATIVE ASPECTS
(a) Earning a cash income.	Spending opportunities; price expectations; related status.	High cash expectations; low prices.
(b) Easy work.	Perception of "work"; relation to other activities.	Hard work.
(c) Friendly environment.	Relation to other activities. protective clothing.	Unfriendly environment.
(d) Status ownership of gear.	Relation to other status symbols.	Status ownership of gear.
(e) Independency.	Perception of wage job.	Night work.
(f) Satisfaction of big catch.	Training; quality of gear; knowledge of grounds.	Risk of small catch.
(g) Modern technology.	Extension work; credit schemes.	Technology gap; high costs involved.

- (a) Cash income. The positive aspects of earning a cash income are closely related to spending opportunities like education, consumer goods or taxes. As practically all cash earned is consumed, the benefit in status or power, related to the ownership of consumer goods, is also important.

This positive aspect is counter-balanced by the very high expectations of the people in the Delta. There seems to be a minimum price and income expectation, below which no effort to earn money is made, except when money is urgently needed for taxes or school fees. Also related is the question of how much money can be earned from other activities, and how much money can be obtained from relatives in town.

- (b) Work. "Hard work" and "easy work" are relative concepts. They are perceived differently by each individual, and are relative to the amount of work needed to do other subsistence and cash earning activities.

- (c) Environment. For the people of the Delta, the bush and the swamps are the natural "friendly" environment in which they have grown up. Work in this environment probably counts as positive. However, working in rain and wind, even with protective clothing, can turn this environment into an "unfriendly" one. Modern type clothing has been introduced, and many people wear t-shirts and shorts. But even when available, rain coats and other protection against weather are not used.
- (d) Status. The status aspect of consumer goods and of fishing gear are important. Throughout the world, fishermen have always had a very low social status, because boats and gear are considered to be worth much less than land and farms. In the Delta, as everywhere else in P.N.G., nearly everybody is entitled to a piece of land. A landless fishing class does not exist as yet. The ownership of gear comes in addition to entitlement to land and is not a substitute. The question of whether there is individual ownership of gear and collective entitlement to catch, or collective ownership of gear and individual entitlement to use, is a very important one in this respect.
- (e) Independence. As opposed to being a wage earner, being a fisherman means freedom in setting ones own working time, within a certain social structure, and in determining ones own working method. This aspect is more or less the same for many traditional subsistence activities. A negative aspect might be that the freedom is restricted by the fact that fishing has to be done mainly at night.
- (f) Satisfaction. Catching a large amount of fish and presenting it to the plant can give satisfaction to a fisherman. This is countered by the risk of having a very small catch and perhaps loosing face.
- (g) Technology. Working with modern technology can give a certain status or satisfaction. This is offset by the difficulties involved in working with modern gear, and the high costs involved.

#### 13.4 THE TECHNOLOGY GAP

The width of the technology gap (both in terms of use and of costs) and the success in overcoming this gap, will be one of the determinants of the fisherman's motivation. Therefore it is important to investigate in more detail, which modern technologies are involved, how expensive they are for the user and what training is needed.

The Appraisal Report more or less assumes that the basic technology involved in producing the increased catch is already accepted by the people, except when it comes to repair and maintenance of nets and outboard engines. (This might not be true at all, as 75% of the production comes from only eight villages).

It is possible to identify the following steps from traditional to modern technology, that a fisherman needs to make in order to be able to deliver fish to the plant that is acceptable (from the view point of the Project) in quantity and quality. The list is indicative only, and should be expanded when research in this area is undertaken.

TABLE 13.2 TECHNOLOGICAL INPUT

	TRADITIONAL KNOWLEDGE	MODERN TECHNOLOGY
(a) Knowledge of grounds	Experience traditional	Experience paired with research effort
(b) Gear	Traditional nets spears bow/arrow hand traps scoop nets traps line/hook	Nylon gill-nets  input gear- specialist
(c) Transport	Paddled canoe	Canoe with outboard engine.
(d) Preservation	Drying smoking cooking	Ice-box, ice

(a) There is a danger of tension developing between traditional user rights and possible outcomes of research effort. For example, when certain areas are proven to be rich in barramundi, disputes between villages can evolve. Also, the outcome of research can be in conflict with the conservation ideas of village leaders.

(b) The step from traditional to modern gear is a large one and has four different aspects. Firstly, a nylon gill-net involves a fishing technique which is altogether different from the traditional methods. Secondly, a nylon gill-net requires greater effort to justify the cost of the net. It also induces the contradictory expectation that the introduction of gill-nets will make catches bigger and that less effort is needed. Thirdly, for the first time it becomes necessary to maintain gear, and this concept is not customary in a subsistence society which makes all traditional hardware from bush material. Lastly, the gill-net involves a high cash outlay, as opposed to traditional gear, which only needs labour and time to produce.

- (c) The step from paddle to outboard engine might also cause problems; not because outboard engines are difficult to use, but because they require maintenance, repair and careful usage. A general aspect and common problem of every step forward in technology, is that the step produces an extra requirement for maintenance, and this requirement is usually larger than the step itself. Again, high costs are involved.
- (d) Traditionally fish is not really preserved in the Delta. Smoking is a technique that is used, but in such a primitive way that products will only last a few days (in fact the fish is cooked rather than smoked). The step to the use of ice does not seem to be very big, although ice was unknown until recently and people have only a faint idea of what happens when they use it.

### 13.5 RETURNS TO THE FISHERMEN

Closely related to the introduction of modern technology are the high costs involved in the use of it. In Part II, the returns to the fishermen were calculated on the basis of certain assumptions. These results can now be compared to similar calculations made in the Appraisal Report, and needs for further research can be identified.

The report estimates the incremental income per village as a result of the project as follows (Year 7):

Number of villages		50
Projected catch (t)		1,016
Average catch (t/village)		20.3
Average Gross Income (Kina)	11,165	
Cost of gear	990	
Cost of transport	990	
Net earnings per village	9,185	
Present income	1,350	
Incremental income	7,385	=====

It is assumed that there are 135 fishing nights per year, so returns to labour per village per fishing night for the whole project are K68.04. The report assumes an average of six nets per village, indicating an involvement of 12 people. Therefore, returns per man for each fishing night is K5,67. This compares with the results in Part II (Chapter 9) of a return of around K1.

The main differences between the two calculations are the catch rates and the catch composition. Catch rates in the latter case are double (30kg/net-night as opposed to 15kg) and the catch contains 50% of the high valued barramundi instead of 30%. Also, the Appraisal Report did not include depreciation and maintenance and repairs in the transport costs.

The main question is, are the net returns to labour (to the village) sufficient to induce people to go fishing? In the case of IFAD's calculation, a return of K68 per village for each fishing night might seem low. With 135 nights per annum, and an average of 200 persons per village, it gives an annual income of K45.93.

Both calculations contain too many assumptions. Research is needed to investigate

- actual operating costs of outboard engines for each village;
- actual number of hours involved in fishing;
- actual costs of nets (including repairs and maintenance);
- the income differences between villages;
- the distribution of effort within the village;
- the sharing systems within the village.

After these have been assessed, the returns to labour can be compared with returns on other activities, both subsistence and commercial. Only then can it be decided whether or not fishermen receive enough money for their effort for there to be a sufficient incentive to go fishing.

### 13.6 TERRITORIAL USE RIGHTS

Territorial use rights in fishing (or traditional fishing rights) in the Delta are a subject that is not discussed in IFAD (1982). However, territorial use rights in fishing (called TURFs hereafter) play a major role in the fisheries of P.N.G. and in the Delta. A detailed knowledge of TURFs is vital for the successful planning and management of any fisheries development project in P.N.G.

Little is known about TURFs in P.N.G., the form they take or the role they play. Malinowski (1922), Carrier (1979), Frusher&Subam (1982) and Wright (1983) have described traditional fishing methods in P.N.G., with some comments on rights. Examples for other countries are Hirasawa (1980) for Japan and Alexander (1982) for Sri Lanka. Christy (1982) investigated the possibility of using TURFs as a management alternative to common property systems.

TURFs can take different forms and can perform different functions. The rights can relate to an area, to certain types of gear, to certain seasons, to certain species of fish, to certain fishermen and/or villages and combinations of these. TURFs can serve the purpose of simply defending an area to secure food supplies for a village, or serve as a conservation method for certain species or groups of species.

The sheer complexity of TURFs makes research into their structure and functions very difficult. Moreover, research activities themselves can make people aware of outside interest into their rights, and induce them to extend their claims to new areas. Also, research activities can increase local awareness of old disputes, resulting in (sometimes violent) new disputes. Investigators are often viewed as representatives of the



government, which makes people think that their claim, after recording, has an official status.

TURFs can only be investigated by the traditional anthropological method of living in an area as observer/participant. Other methods (like the one employed by the author during the survey) are likely to give superficial and probably incorrect results. The mapping of traditional grounds as presented in Chapter 4 and in Annex 8 must therefore be regarded with caution.

The Project relies on the use of non-traditional fishing methods, and ignores traditional combinations of certain methods, territories, seasons and species. As fishing pressure increases the fished areas will expand and this will result in conflicts between villages or groups of villages, and in the over fishing of certain areas.

### 13.7 CONCLUSION

In this chapter, some important aspects of fishing in the Delta, in relation to the IFAD Project have been discussed. Although the discussion is far from complete it is clear that our knowledge of the fishery in the Delta is limited.

The different topics that were discussed will all determine in the end the motivation of the people of the Delta to participate in the Project and therefore will decide the extent of success the Project. Failure to recognize gaps in knowledge and the need to fill the gaps will result in a basic misunderstanding of the reaction of the people involved in the Project.

The present study is only an introduction to the Delta, its people and its socio-economic situation. It is hoped that during the implementation of the Project, more money and more manpower will be devoted to research into the different aspects of the fishery in the Delta, so that the Project money will be effectively used to increase the well-being of the 10,000 inhabitants of the Delta.

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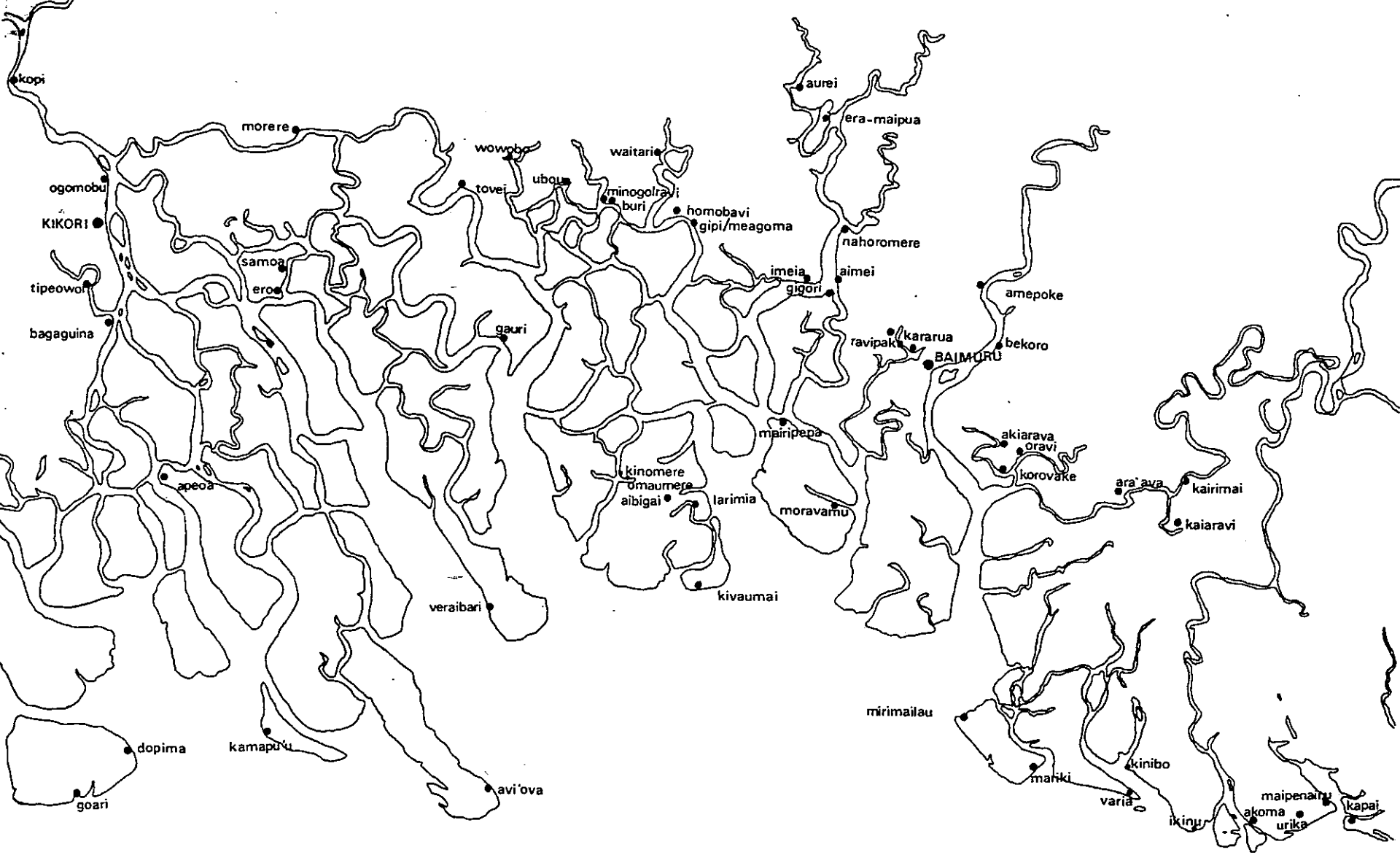
Finally, my thanks go to J. Paro and I. Eevavi who have tried very hard to teach me to fish and to all the people in the villages who have supplied me with information and many stories.

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ANNEX 1. MAP OF THE DELTA, GULF PROVINCE



DELTA REGION, GULF PROVINCE.



## ANNEX 2.

## THE POPULATION OF THE DELTA, GULF PROVINCE

C.D.	C.U.	NAME	P.D.S. RESIDENT (3)	P.D.S. TOTAL (4)	ABSENTEE RATE (5)	CENSUS 1980 POPULATION (6)
5	3	KOPI	139	258	46.1	218
	4	MORERE	66	78	15.3	65
	5	OGOMOBU	60	90	33.3	79
			265	426	37.8	362
6	1	AI'ID'IO	30	37	19.0	30
	2	AVIOVA/APEOA	161	241	33.5	144
	3	BABAGUINA	150	242	38.0	209
	4	BISI	185	257	28.0	151
	5	DOIBO	59	106	44.3	105
	6	DOPIMA	74	152	51.3	41
	7	ERO	500	650	23.1	446
	8	GOARI	76	92	17.4	53
	9	KAMAPU'U	84	111	24.3	69
	10	KEMEI	69	78	11.5	70
	11	SAMOA	150	264	43.2	97
	12	TIPEOWA	135	159	15.1	113
		1,673	2,389	30.0	1,528	
7	1	EPEGAU	69	69	0.0	61
	2	GIPI MEAGOMA	518	601	13.8	469
	3	HOMOBAVI	194	217	10.6	155
	4	BURI	193	204	5.4	100
	5	TETEHUI	171	171	0.0	76
	6	TOVEI	87	93	6.5	133
	7	MINOGOIRAVI	197	219	10.0	191
	8	WAITARI	114	125	8.8	116
	9	WOWOBO	156	159	1.9	168
	10	UBOU	0	0	0.0	208
		1,699	1,858	8.6	1,677	

## ANNEX 2. CONTINUED

C.D.	C.U.	NAME	P.D.S. RESIDENT	P.D.S. TOTAL	ABSENTEE RATE	CENSUS 1980 POPULATION
(1)	(2)		(3)	(4)	(5)	(6)
8	1	AIBIGAHE	146	178	18.0	100
	2	DAIMAIBARI	5	23	78.3	25
	3	GAURI	12	20	25.0	67
	4	KIAKI	56	71	21.1	0
	5	KINOMERE	164	191	14.1	152
	6	KIVAUMAI 1	110	143	23.1	120
	7	KIVAUMAI 2	135	149	9.4	175
	8	LARIMIA	99	109	9.2	135
	9	MAIRIPEPEA	100	110	9.1	79
	11	MOROVAMU	103	125	17.6	78
	12	UMAUMERE	72	73	1.4	57
	13	VERAIBARI	143	182	21.4	124
				1,145	1,374	16.7
9	1	AIMEI	98	102	3.9	92
	2	AUREI	88	99	11.1	79
	3	ERA MAIPUA	161	186	13.4	181
	4	GIGORI	82	82	0.0	76
	5	GOIRAVI	27	37	27.0	6
	6	IMEIA	51	53	3.8	53
	7	NAHAROMERE	106	114	7.0	85
	8	VEIAMU	21	22	4.5	16
			634	695	8.8	588
11	1	AMEPOKE	199	201	1.0	131
	2	BEKORO	123	165	25.5	135
	3	KARARUA	457	732	37.6	363
	4	RAVIPAKA	83	92	9.8	100
			862	1,190	27.6	729
12	1	AKIARAVI	160	120		183
	2	KOROVAKE	182	208		234
	3	ORAVI	165	224		87
			507	552	8.2	504
13	1	AKOMA	272	312	12.8	305
	2	ARA 'AVA	146	181	19.3	353
	3	IKINU	100	155	35.5	100
	4	KINIBO	0	0	0.0	343
	5	KAIARAVI	52	62	16.1	51
	6	KAIRIMAI	199	367	45.8	167
			769	1,077	28.6	1,319

## ANNEX 2. CONTINUED

C.D.	C.U.	NAME	P.D.S. RESIDENT	P.D.S. TOTAL	ABSENTEE RATE	CENSUS 1980 POPULATION
(1)	(2)		(3)	(4)	(5)	(6)
14	1	MARIKI	332	366	9.3	428
	2	MIRIMAILAU	110	159	30.8	108
	3	VARIA	221	303	27.1	259
			663	828	19.9	795
15	1	AIKAVARAVI	358	507	29.4	248
	2	ERAVA	61	81	24.7	61
	3	MAIPENAIRU	218	338	35.5	225
	4	OKAIKENAIRU	125	218	42.7	102
	5	RAVIKAUPARA 2	246	413	40.4	329
	6	RAVIKIVAU 1	158	234	32.5	132
		1,166	1,791	34.9	1,097	
16	1	APIOPE	82	89	7.9	72
	2	AIVEI	89	111	19.8	75
	3	AUMU	157	193	18.7	176
	4	KAPAI 1	78	84	7.1	50
	5	KAPAI 2	171	254	32.7	152
		577	731	21.1	525	
TOTALS			9,960	12,911	22.8	10,236
		BAIMURU URBAN:				645
		KIKORI URBAN:				763
		TOTAL CENSUS 1980:				11,598

## NOTES:

(1) C.D. = Census Division

(2) C.U. = Census Unit

(3) P.D.S = Provincial Data System, which records the resident and total population of rural villages. The data are for 1978/79. A person is recorded as absent (belonging to the total population but not resident) when away from the village for six months or more.

(4) and (5): see (3)

(6) The Census held in 1980 counted all people in the village at the time of counting. This included one night visitors.

General: Large differences between P.D.S. and Census figures occur because of the continuous movement of people between villages which belong to the same clan. People in C.D. 12 for example should be regarded as one village. They belong to the same clan and most of the time live in the same village, Korovake.



### ANNEX 3. HOUSEHOLD POSSESSIONS

The following items are typically found in a household in the Delta:

#### TRADITIONAL:

axe with stone blade	sago beater	clay pots
adze with stone blade	sago bags	pipe
spear with bamboo point	sago filters	floor mats
bow and arrow	string bags	clothing
fishing gear		

#### IMPORTED AND NOW FOUND IN MOST HOUSEHOLDS:

axe with metal blade	clothes	sheets
bushknives	pans	pillows
handknife	bowl	posters
spear with iron point	mugs/cups	kerosene lamp

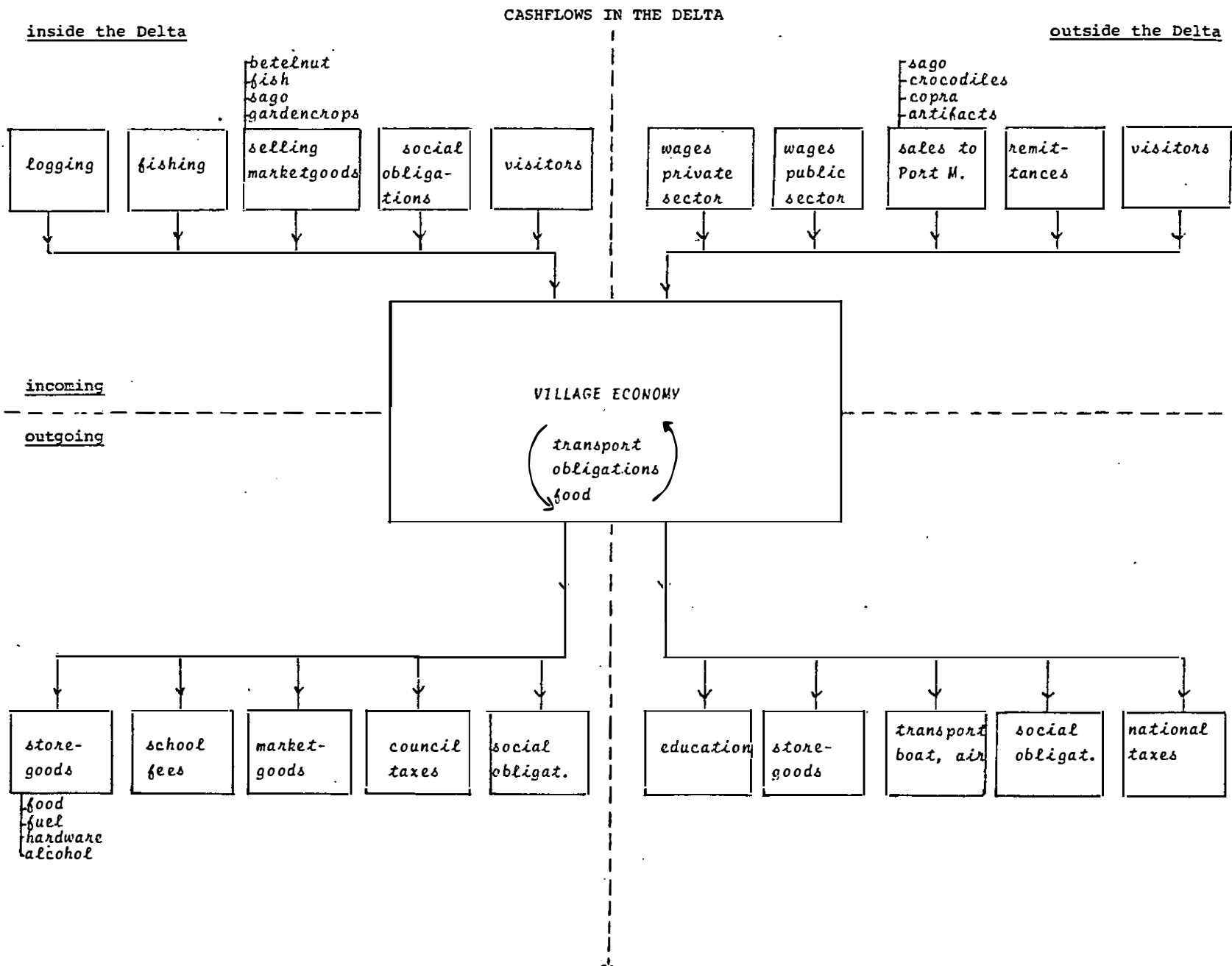
#### IMPORTED AND ONLY FOUND IN A FEW HOUSEHOLDS:

outboard motor	nylon nets	shotgun
radio	Coleman lamp	table
chair	patrol box	watch
torch		

**ANNEX 4. SERVICES**

The following services are available in the Delta:

1. airstrips: Kikori (all weather) and Baimuru.
2. community schools: Kikori, Veiru, Ero, Ubou, Era, Kivaumai, Baimuru, Korovaki, Ara'ava, Mariki, Varia Kiņipo, Mapaio and Kapai.
3. aid posts: Babaguina, Kikori, Ero, Waitari, Era, Gibi, Kiņomere, Kivaumai, Gigori, Baimuru, Korovake, Mapaio, Mariki, Ikinu, Maipenaru and Kapai.
4. hospitals: Kikori and Kapuna.
5. markets: Kikori and Baimuru.
6. trade stores: Kikori and Baimuru and occasionally in a village.
7. churches: The two most influential churches are the United Church (Kapuna) and the Seventh Day Adventist Church (Kikori).



## ANNEX 6.

## CALCULATION OF THE REMITTANCES FROM TOWN RECEIVED IN THE DELTA

CENSUS DIVISION	PROVINCIAL RES.	DATA SYSTEM TOT.	% ABS.	# ABS.	KINA SENT TO C.D.	KINA RECEIVED TOTAL	CASH
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
5	265	426	37.8	161	3,630.55	13.70	6.30
6	1673	2389	30.0	716	16,145.80	9.65	4.44
7	1699	1858	8.6	159	3,585.45	2.11	0.97
8	1145	1374	13.7	229	5,163.95	4.51	2.07
9	634	695	8.8	61	1,375.55	2.17	1.00
10	862	1190	27.6	328	7,396.40	8.58	3.95
12	507	552	8.2	45	1,014.75	2.00	0.92
13	769	1077	28.6	308	6,945.40	9.03	4.15
14	663	828	19.9	165	3,720.75	5.61	2.58
15	1166	1791	34.9	625	14,093.75	12.09	5.56
16	577	731	21.1	154	3,472.70	6.02	2.77
TOTAL	9960	12911		2951	66,545.05		
AVERAGE			22.8			6.68	3.07

## NOTES:

- (1) Census Division Number as used by the P.D.S. and 1980 Census.
- (2) Resident population according to the Provincial Data System, 1978/79.
- (3) Total population according to the P.D.S.
- (4) (3)-(2) as percentage of (3).
- (5) (3)-(2).
- (6) (5) multiplied by a gift per absentee of K22.55 (Morauta 1983)
- (7) Kina received per capita per annum. (6) divided by (2).
- (8) 46% of (7) (Morauta 1983) is received in cash, 54% in kind.

## ANNEX 7. VERNACULAR NAMES IN THE DELTA

ENGLISH	MOTU (1)	URAMA (2)	KORIKI (3)
shark	kwahala	ome	ai'i
catfish	neku	atu	nava & koria
mullet	lobu	mai'a	pirika
barramundi	hanava	gidobu	emeke
thr.f.salmon	--	mure & ga'ha	kaiparu
jewfish	--	pudema	vaikeke
small fish	garume marakidi	uho keke	ina ma'uma'u
prawns	pai	gaiti	kekene
mud crabs	bava	eme	au'ei
sawshark	--	gabora	pinane
eel	minema	bebe	bara (saltw.) urei (frehw.)
codfish	--	ipou	apia
mudskipper	--	tava	iko'e (big) anava (small)
smoked fish	kakoro	uho-wato	ina'kani
crocodile	huala	hiba	komara
turtle	motapuse	va'ema	ne'uu
water	ranu	obo	ere
wind	lai	kawaia	kawaia
mud	gedah	tiro	keka
high tide	aroubada	aru'obo	ere'aru
low tide	kororo	kahiro	vai'kia
canoe	vanagi	pee	vi'i
paddle	bara	aibi	lei'i
net	reke	foho	keve
handtrap	--	gaho	orea
scoopnet	--	abbah	everi
spear, wood	io	peho	akore
iron point	karauti	ke'oo	keveaa
bow/arrow	diba bona peva	ga'ii wahumo	anai anane
light f/fish.	kalaudi	--	--
poison	emoro	emoro	emoro
hand line	kimai	kimai	kimai
pole&line	kimai au	kimai papa	kimai ope

## Notes:

(1) Motu is the lingua franca.

(2) Spoken in Urama, Gope and Era Census Divisions.

(3) Spoken in Baimuru, Baroi, Karimai, Iari and Maipua Census Divisions.

**ANNEX 8. MAP OF TRADITIONAL FISHING GROUNDS**

The map on the following page shows the traditional fishing grounds of the villages that were visited during the survey in the period Sept to Dec 1981.

Indicated are the areas where the traditional grounds are, with arrows from the respective villages to these grounds. It should be noted that these grounds are not static and they might have expanded under increasing fishing effort, or even have shifted.

Generally, where grounds are indicated as being located along the banks of larger rivers, people will fish in the smaller rivers and streams which join the main river.

DELTA REGION, GULF PROVINCE.

0 20 40 60  
Kilometers

