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Subsistence Fisheries in Lower Order Streams:
Notes on Species Preference, Fishing Methods, Catch
Composition, Yield and Dietary Importance of
Fish

A report prepared for project PNG/85/001
Sepik River Fish Stock Enhancement Project

by

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This paper was prepared during the course of the project identified in the title page. The conclusions and recommendations given in the report are those considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project.

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PREAMBLE

This report is based for a considerable part on the survey and study done by my friend and colleague Benoît Mys. He was killed in an accident while he was collecting the data upon which this work is founded. His name is kept as first author of this work in recognition of his memory, the considerable work he has done during the short period he was attached to the project and the enthusiasm and ability he showed during this time.

INTRODUCTION

One of the aims of the Sepik River Fish Stock Enhancement Project is to find out the potential of fish stocking into the Sepik-Ramu river system. To achieve this aim research is done that is primarily biological and ecological in nature. However, the aim of stocking is to improve the fishery resources available to the people living in the region. Coates (1985) has pointed out that the yield from the floodplain area is low compared to other floodplain areas in the world. He attributed these low yields to the impoverished fish fauna of the Sepik basin. Although fishing is not a major activity of the people living in the hills and mountains of the Sepik-Ramu catchment, it is nevertheless generally assumed that fish forms a considerable part of their protein diet, as other protein sources are (equally) scarce. One of the aims of the fisheries survey in this region above the main channel and its system of floodplains, lakes and backswamps done by Benoit Mys was to find out how important fish is in the diet of these people, and what effort they put into fishing. With this knowledge the effects of improving fish stocks can be assessed. Due to the tragic circumstances outlined in the preamble to this report only a small part of the necessary data were collected. Furthermore an analysis of the data in conjunction with other existing data bases on population distribution, nutrition and land use is not yet possible. This report gives a limited analysis of the fisheries survey done to give an impression of the existing subsistence fisheries activities and an estimate of the yield in the areas under consideration. It is hoped that in later stages the project will be able to provide for the missing information.

2. METHODS

2.1 Village surveys

After a preliminary survey in several villages in the Torricelli mountains three questionnaires were devised to obtain information on the fishing practices of people in the whole Sepik-Ramu area in relation to other food gathering activities as well as religion, money generating activities etc.:

1. A general village survey ("village survey") (Appendix 1). With regard to the survey the following are noted: a list of vernacular names of the fish species was made by showing pictures of all the fish species known to us and asking the interviewees to give a name if they recognized the fish. On immediate arrival in a village the questionnaire was completed with a number of people from the village prior to any other interviews.

Often individuals visiting from neighboring villages were present: these people were interviewed separately about their village. In this way general information on 27 villages was obtained. The data on the villages were completed with information about area and population particulars from 1:100,000 scale maps and the 1980 census (Table 8).

2. A comprehensive fishing survey ("individual survey") (Appendix 2)

3. A shortened version of 2 ("fishing survey") in which the sections 7, 8 and 9 of the "individual survey" about dietary habits with regard to animal protein, money earnings and fish introductions were left out. In this survey people were merely asked about their fishing practices.

Before interviewing individuals a map of the village was made and the number of people living in each house noted. Care was taken to interview at least one person per house(hold). In this way complete information on fishing practices and related matters was obtained from 7 villages (Table 9).

2.2 Yield estimates and catch composition

The information of both the fishing surveys on catch and effort formed the basis for the catch composition, the yield estimates per village and a crude estimate for the yield of the whole area under consideration. A data base was constructed from the information per interviewee on days spent fishing during the past half year, species and numbers of fish caught and estimated lengths for each species caught. Lengths were converted to weights with calculated length-weight relationships for each species obtained from data of species sampled in the study area (van Zwieten 1989 and unpublished data) and from earlier work done in the region (Coates 1983, Coates 1984, Coates in prep). For each of the seven villages surveyed, a yield estimate was obtained by extrapolation of the average catch per fishday and average number of fishdays per interviewee with 1980 census data on the population of the village. A maximum figure was obtained by using the total number of people in the village, a minimum figure by subtracting the number of people from the age classes 0 - 5 years old and older than 45 years from the total population. In the case of Yengis, the central highlands village studied in this survey, the number of women in the village was also subtracted from the total population figure, as women do not fish in that area.

The yield estimates per village thus obtained were subsequently used to obtain an rough estimate of the total yield in the area studied. For this purpose the estimates of population distribution per altitudinal range in Coates and Mys (1989) were used. It is obvious that this total yield

estimate is based on too small a sample to have any statistical significance; it is only presented here to give an approximate idea about the contribution of the lower order hillstreams and mountainous streams to the total yield of the whole Sepik-Ramu basin.

3. RESULTS

Results are presented in Table 1 and 2 (in text) and Tables 3 to 7.

3.1 Preference and taboos

The survey and our observations while sampling rivers (Van Zwieten 1989) made clear that all the species found in the lower order streams are regularly caught and eaten where they occur. Even the smallest species, the gobies (max. weight 6 g) and Mogurnda nesolepis (max. weight 6 g), are caught, roasted and eaten, and small specimens of all other species are fished as well.

There is, on the other hand, a clear preference for certain species in the study area. By dividing the percentage preference and percentage occurrence in 27 village fishing areas a point system was devised (Table 3). From this can be inferred that in virtually all the villages the most preferred fish are Anguilla spp., followed by Neosilurus spp., Arius velutinus, Oreochromis mossambicus and Ophieleotris aporos. These are the all relatively large species, and, except for Oreochromis mossambicus, have large amounts of fat reserves, which is highly regarded by the people of the Sepik and Ramu.

An immense diversity in food related taboos ("tambu") exist all over the area. Taboos related to fishes need to be considered when assessing the suitability of a species for introduction. In general none of the villages surveyed have traditional taboos holding for everybody on any of the species: all species are eaten. There are however many partial taboos in all cultures, especially for certain stages in life. To mention some: most common are the taboos related to pregnancy, and breast feeding. A great diversity of species that are taboo during that period is mentioned: these include Glossamia gjellerupi, Ariidae, Oxyeleotris heterodon, Pristis microdon. Often mentioned as forbidden food both for young children and pregnant and breast-feeding women are Anguilla spp.; in some villages men are not allowed to eat any fish during their initiation, or when building menshouses ("haus tambaran"). In one village plotosids, ariids and eels were considered to be men's food, because women once gave birth to these fishes and they were not allowed to eat their own sisters. In another village the group of people allowed

to eat these species was restricted to only the "bigmen" or the leaders of the village..

There is however a fairly widespread taboo introduced by a "modern" christian religion: Seventh Day Adventists keep strictly to the food regulations mentioned in Leviticus. One of the classes of forbidden food mentioned here is scaleless fish, which means in the Sepik-Ramu context that Neosilurus spp., Arius spp. and Anguilla spp. may not be consumed by followers of this religion.

3.2 Catch composition

The catch composition by percentage number and percentage weight in the five surveyed villages are presented in Tables 4 and 5. In Aurump (360 m) the whole village goes out fishing with Derris poison, beaten out of the roots of this vine, once or twice a year. During this party hundreds of fish are caught and divided between the villagers. Hardly any fishing activity takes place during the rest of the year. There is also some confusion with the people interviewed about the identification of some of the species caught. The data from this village are therefore excluded from the following discussion. In Table 1 the % total number and weight for each species caught for the six remaining villages are compared with the %total average density and biomass of fish in lower order streams (Van Zwieten 1990).

Table 1: Catch in % number and % weight by species or species group in six villages in the Sepik catchment. Occurrence in % density and % biomass computed from samples taken in lower order streams in the Sepik and Ramu catchment.

	CATCH		OCCURRENCE	
	%NUMBERS	%WEIGHT	%DENSITY	%BIOMASS
Melanotaeniidae	18.2	1.4	58.5	31.7
Neosilurus spp.	17.8	17.1	0.8	3.1
O. mossambicus	13.7	26.8	2.1	9.3
H. transmontanus	11.3	2.2	2.3	4.5
A. velutinus	11.0	22.9	0.3	3.1
G. gjellerupi	7.0	3.7	8.7	22.5
Anguilla spp.	4.7	22.5	0.3	13.0
Other species (10)	16.3	3.4	18.3	10.0
Species not mentioned (8)	-	-	8.7	2.8

The preference for the species mentioned earlier is clearly reflected in the catch composition: Neosilurus spp., Oreochromis mossambicus, Arius velutinus and Anguilla bicolor are in terms of weight and in most cases in terms of numbers the most important fish species in the subsistence fisheries

of the villages surveyed. Melanotaeniidae and, to lesser extent, Glossamia gjellerupi and Hephaestus transmontanus form a large part in the fisheries in terms of numbers mainly because they are abundant. On the other hand, the four most important species for the fisheries all appear in low densities in the rivers, and, in the case of Neosilurus spp. also with a very low relative biomass. The low % biomass of Arius velutinus must be viewed with some caution: it is probably an underestimate because the species appears mainly in rivers where we could not sample (Van Zwieten 1989). Even so it seems that the species is heavily fished in all the rivers it ascends. In contrast with A. velutinus, the four Neosilurus spp. live in pools of smaller rivers and creeks where they can grow up to sizes of 300 - 400 mm. Specimens of these sizes were never caught by us in the heavily populated areas of the Torricelli range. Although it cannot be concluded directly from these figures that the plotosids are overfished in these areas, this is very plausible. Villagers regularly told us that they did not catch any large specimens as they used to do, and in some villages and areas a total ban on the fishing of these species had been imposed by the owners of the rivers.

3.3 Fishing methods

3.3.1 General

A wide variety of gears and methods are used to catch fish. Table 4 gives a summary. In general fishing is done by men, women and children, although this may differ from place to place. For instance, at higher altitudes in the central highlands only men fish using traps. Most methods are used by both men and women although some methods are almost exclusively used by men: these are spearfishing, fishing with bow and arrow and diving with spearguns. Again who uses what method differs from place to place. The most common used method is fishing with hook and line: this is used by men, women and children during low water and flood periods. Children mostly fish with hook and line and with their bare hands, and are sometimes brought in communal fishing activities (i.e. blocking off rivers, fishing with Derris poison).

No analysis could be made as yet on the relative importance of various gears and methods in the subsistence fisheries.

3.3.2 Description of methods

1. Spears ("supsup"), Bow and arrow, Speargunfishing ("Glas na gummi"): several types of spears are in use, depending on the size of the fish that is fished. The general

construction is the same: around one end of a bamboo pole a series of five to ten arrows are fixed in such a way that they are tapering towards the bamboo pole. Arrows are made of a range of materials (steel, bamboo, wood) and may have barbs. The bamboo pole sometimes has a piece of string to hold onto while throwing the spear in the water. Arrows used with bows have a similar construction. Fishing with bow and arrow is not very common. Speargunfishing on the other hand is becoming increasingly popular. It is usually done in larger rivers with deep pools. The guns are made of wood and the iron spear is triggered off with a piece of strong rubber.

2. Hand nets/scoop nets: a wide range of forms exist. The general form is a net, made out of twine extracted from bush materials, that is rigged up in a circular or oval bamboo frame. The nets are used to scoop up fish from under the banks of a river. Other types of hand nets have the form of an elongated sack hanging from a circular bamboo rod that forms a rigid opening (Quinn et al. 1984). Handles are attached to the rod for pulling the net along the banks of a river ("handtrawling").

3. Baskets/traps: again a large variety of forms exist, from simple large baskets with a small opening on one side, via cone shaped fyke like traps to very elaborate constructions with doors that close triggered by the movements of the trapped fish. At lower altitudes the traps are usually made from materials taken from the sago palm, the eel traps used in the central highlands are made of twigs.

4. Fish poison: two types are known; the most common is the poison extracted from the roots of the vine Derris sp., ("rop diwai") less well known is the bark of the tree Clerdendron sp.. The vine is cultivated in gardens, the bark of the tree is collected from the forest. The roots or the bark are beaten with sticks to squeeze the poisonous sap out, which is then collected. This takes several hours. Subsequently mud is thrown into the river or stirred up from the bottom after which the poisonous liquid is poured into the water. The drifting fish are collected, usually by a large number of people. The method is used in small rivers during low water. Often the river is blocked off downstream.

3. Blocking off small rivers: this again is usually a communal activity. A small river is temporary blocked off with logs, stones and mud. Subsequently the area downstream is drained and the fish collected.

4. Hooks and lines: this method is fairly recently introduced in most of the areas. Hooks and nylon thread are purchased. Lines are handled by hand, no poles are used.

3.4 Yield

In the seven villages the average number of fishing days per person per year is 2.1 (min. 1.6, max 3.2). Excluding the oldest (>45 year) and the youngest (<5 yr) inhabitants, the corrected average number of fishing days is 2.2 (min.1.4, max. 3.2). The average catch per fishingday per person is 1.28 kg (min 0.74 kg, max 2.11 kg) (Table 7). The high catch per day in the highlands village Yengis (1000 m) must be qualified: men go out hunting in this area for a number of consecutive weeks. One of their activities during that period is fishing for eels using traps. Once or twice a week these traps are lifted. In the survey the total catch of such a hunting period is called one fishing day, which gives an exaggerated catch per fishing day. As fishing is done only during these hunting periods, the computation of the total catch/year or yield is not affected by this assumption.

A similar hunting practice is found in Kemeilmin (750 m), where one of the hunting and fishing areas of the village is a days walk away from the main village. In this case direct methods, like spearfishing and fishing with hook and line are used, and an estimate of the total fishing activity during such a period could be made. Villagers also go out fishing for a few hours in the rivers near the village.

In the village Aurump (360 m) all fishing activity is confined to a few days a year when the whole village goes out fishing with Derris poison. During the interviews with villagers an estimate of the amount of fish collected per person during such a fishing session was obtained.

The catch data give a corrected average yield for the seven villages of 290 kg/year (min. 162 kg/yr, max. 451 kg/yr). The highest yield (451 kg/yr) is found in Rabiawa, a village at the edge of the grasslands and foothills in the Western Torricellis, where the rivers are slow flowing and already have some characteristics of marginal floodplain rivers. Oreochromis mossambicus grows to a normal size in these rivers and does not seem to be stunted, as it is at higher altitudes. 74 % of the catch in Rabiawa is O. mossambicus. Avia, in the eastern Torricellis near Green River, is a village at a similar altitude to Rabiawa near the Green River, on the edge of the hills and the floodplain. No O. mossambicus is found in the rivers these villagers fished, although they know the fish from other areas. The catch per fishing day in Avia is about half that of Rabiawa.

The relatively high yields, in both the highlands villages, Kemeilmin (750 m) and Yenkis (1000 m) is

noteworthy, considering the low fish biomass found in rivers at those altitudes. In Kemeilmin Arius velutinus and Neosilurus gjellerupi gjellerupi make up nearly 90% of the yield. The latter species is in terms of numbers the most important fish as well. The surroundings of Kemeilmin are characterized by steep mountains and narrow valleys. Fishing, as part of other hunting and gathering activities, is probably more important here than in the other areas surveyed, where agriculture and gardening account for a larger part of the daily food supply. In Yenkis subsistence fisheries is based entirely on the two Anguilla spp., which are the only species found in the area.

Extrapolation of the yields found in the seven villages to the total study area gives a total yield of 1000 - 2100 tonnes/year. For each altitudinal range a yield estimate is obtained by using the data from the villages with corresponding altitudes. The total yield is then calculated by adding the figures of each altitudinal range thus obtained. For the higher figure it is assumed that the whole population fishes; in the lower figure children below 5 years, adults older than 45 years and, in the central highlands, women are excluded from the fishing population, using the figures of the villages surveyed.

The total yield of the Sepik-Ramu floodplain is estimated 6000 tonnes/year (Coates 1989). Applying the lower estimate of our study area of 1000 tonnes/year, the yield in the lower order streams is about 17% of the estimated yield from the total Sepik-Ramu floodplain.

4. DISCUSSION AND CONCLUSION

An analysis of the fishing effort, catch and yield is made difficult because the data are based entirely on the memory of the people interviewed. This problem is expressed especially in the case of fishing with rotenone, which is practised nearly in all the lower altitude villages surveyed. This communal activity is hard to quantify because the answers given are usually that "many" people caught "many" fish. In addition, other fishing methods and practices are difficult to quantify when dependant on memory, because fishing is usually part of other hunting and gathering activities during a day and hardly ever done alone or as a special activity. Furthermore, fishing as an activity is qualified by the villagers themselves: children catching small fish by hand is not regarded as fishing and as such is hard to quantify. On the other hand, because fishing is not a very regular activity, the interviewees generally seemed to remember well when they went out fishing and how much they and their companions caught. An close analysis of all these practices is required but could not be done at this moment.

The figures presented here thus give a simplified account of what happens in reality.

Although in all the villages surveyed the number of fishing days per person per year is low, this figure actually means that once every two to four weeks fish from the rivers is part of a meal in a household of about seven people. To assess the importance of fish in the protein diet compared to other types of animal protein, a brief analysis of the answers to section seven, "Animal protein food", of the individual survey is presented here. The answers of 111 interviews learn that, on average, animal protein is consumed on 2.8 days a week. On average the other 4.2 days in a week no animal protein is eaten at all!

Table 2: Percentage breakdown of the answers to the question 'which animal protein was consumed during the last 24 hours ("today") and last 48 hours ("yesterday") if any'. The column "last time" gives the percentage breakdown of the answers to the question of what animal protein was eaten the last time if no animal protein was consumed "today" and "yesterday".

	today	yesterday	last time
Tinned meat	2.1	10.3	2.9
Tinned fish (mackerel)	42.6	44.8	24.6
Fresh fish (caught)	10.6	10.3	13.0
Fresh/smoked fish (bought)	2.1	-	-
Pig (wild + raised)	12.8	13.8	36.2
Chicken	4.3	6.9	8.7
Sagogrubs	8.5	3.4	2.9
Eggs	2.1	-	1.4
Bandicoot	6.4	3.4	5.8
Lizard	2.1	3.4	1.4
Flying fox	-	-	1.4
Wild cat	-	-	1.4
Snake	2.1	-	-
Cuscus	4.3	3.4	-

Table 2 gives a breakdown of the protein food consumed. Most striking in this table is the overwhelming importance of tinned fish. This is the case in all the villages surveyed. Combined with river fish, fish is eaten once in every two to three animal protein meals. Fish from the river, either fresh or smoked, is eaten in 10% to 13% of the cases, which means there is one (fresh) fish meal in every eight to nine meals with animal protein, or about once in every three weeks. This supports our estimate calculated from the catch and yield figures.

Although, once again, no statistical significance can be given to the presented figures, the general trend, however,

is believed to give a good impression of the actual situation. Fish is thus an important part of the protein diet in the hills and mountainous areas, and subsistence fisheries plays an important role in providing people living in these areas with animal protein. It is also clear that, although there is no shortage of food in any of the areas surveyed, the diet is very much imbalanced: there is a shortage of animal protein; the diet mainly consists of bulk food in various forms of starch (Sago, Taro, Yam, Bananas etc.) grown in gardens or collected in the wild. This shortage in protein also gives reason to the fact that virtually all animal protein that people can lay their hands on is used: with fish this means that however small, it is fished and consumed.

It must be stressed that most of these considerations apply even at higher altitudes where no fish is found except migrating eels. Subsistence fisheries plays an important role in providing villagers with animal protein in these regions as well. Most households have at least one eeltrap, all the interviewed knew how to use them.

It is clear from the survey and other observations that in most foothill and mountain areas in the Sepik-Ramu catchment people know how to fish. The fact that fishing is traditionally regulated by imposing bans on certain species if overfishing is suspected, or during certain periods of the year, indicates a good awareness of river stocks. When asked about the present problems regarding fish and fisheries in the area, villagers usually answered that there was not enough fish and that fish were too small. Overfishing was mentioned in some areas of the Torricelli mountains (Arius velutinus, Neosilurus gjellerupi coatesi). An indication of the possible effects of an improved stock is given by one of the villages surveyed, where Oreochromis mossambicus accounts for the majority of the catch and where catch per person per fishing day is higher than anywhere else. If stocks in lower order rivers are improved through introductions, it will be hard to argue that they will not be utilized.

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APPENDIX 1

Village Survey Sheet

SEPIK RIVER FISH STOCK ENHANCEMENT PROJECT
(PNG 85/001)

FISHERIES SURVEY SHEET

village survey

Village survey no. :
Name of the recorder :
Survey date(s)/hour :
Informants:

Are you originally from this village: yes no.
if no:

from where did you come?
how long have you been here?
the answers on the questions describe the
situation:

here other:

1. Area/population particulars

a.name of the area :

b.name of the village :

c.national district number:

census division number:

census unit number:

zone:

d.name of tok ples :

e.wantok area :

f.number of people in
the village :
(cf. census data; indicate distribution of households)

g.altitude: longitude: latitude:
(cf. map)

h.religion in village
majority :
other :

if all groups fish:

do lapun men fish:	often	-	occasionally	-	never
lapun meri	often	-	occasionally	-	never
bigmen	often	-	occasionally	-	never
meri bilong bigm.	often	-	occasionally	-	never
yangpela men	often	-	occasionally	-	never
yangpela meri	often	-	occasionally	-	never
mangies	often	-	occasionally	-	never
pikinini man	often	-	occasionally	-	never
pikinini meri	often	-	occasionally	-	never
liklik pikinini	often	-	occasionally	-	never

b. is fishing regularly done by only a few individuals?

yes no

if yes: who are they?

how many of them?

c. who is really a fisherman/woman in this village?

d. do people fish:

- regularly throughout the year.
- only during the dry season.
- only during the rainy season.
- more frequently during the dry season.
- more frequently during the rainy season.
- occasionally
- never

IF NOT REGULARLY: during which period(s) do they fish (more)

1. period from _____ to _____

2. period from _____ to _____

e.do people fish: *during dry season or throughout year*

- daily
- once a week
- between daily and once a week
(specify: _____)
- between less than weekly and
once a month (specify: _____)
- once a month
- less than once a month.
(specify: _____)
- never

during rainy season

- daily
- once a week
- between daily and once a week
(specify: _____)
- between less than weekly and
once a month (specify: _____)
- once a month
- less than once a month.
(specify: _____)
- never

3. Fishing sites

a.are the fishing sites : near the village
 away from the village

indication of distance _____
or
time spent travelling _____
to reach the site _____

remarks:

b. are the usual fishing sites in during low water during flood

- | | | |
|--------------------------|--|--|
| 1. roundwaters/
lakes | | |
| 2. streams: slow | | |
| 3. streams: fast | | |
| 4. main river
channel | | |
| 5. swamps | | |
| 6. floodplain | | |
| 7. other _____ | | |

c. are the fishing sites : communal property
 owned by family/individuals

4. Fish

a. Fish species list

use drawings or cardboard models at natural scale.

	<i>vernacular name</i>	<i>pigin name</i>	<i>scientific name</i>
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

11	_____	_____	_____
12	_____	_____	_____
13	_____	_____	_____
14	_____	_____	_____
15	_____	_____	_____
16	_____	_____	_____
17	_____	_____	_____
18	_____	_____	_____
19	_____	_____	_____
20	_____	_____	_____

c.what species are most common?

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____

d.what species are preferred as food?

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____

e.what do fishermen do with the fish caught?

	<i>if plenty</i>	<i>if few</i>
1.eat them :	0	0
2.distribute them:	0	0
3.smoke and keep them:	0	0
4.sell/trade them:	0	0
5.barter them:	0	0
6.throw then away:	0	0

d.marketed/consumed state of fish :

if few:

- 1.fresh : all- most- half- some- none
- 2.smoked : all- most- half- some- none
- 3.other _____: all- most- half- some- none

if plenty:

- 1.fresh : all- most- half- some- none
- 2.smoked : all- most- half- some- none
- 3.other _____: all- most- half- some- none

e.what preservation methods are used:

- O smoke *how long kept edible*
 - O lightly _____
 - O heavily _____
 - O keep in smoke _____
- O salt _____
- O dry (& salt) _____
- O keep cooked in bambu _____
- O other: _____

5.Fishing methods

a.what kind of gear do the villagers use for fishing?

	<i>who</i>	<i>where</i>	<i>period used</i>
1 O gillnets	_____	_____	_____
2 O cast nets	_____	_____	_____
3 O hand nets	_____	_____	_____
4 O baskets/ traps	_____	_____	_____
5 O spears	_____	_____	_____

6 O bow/arrow _____

7 O hook and line _____

8 O fish poison _____

9 O blocking off of small rivers/creeks (barats)

100 catch with hands _____

110 emptying floodplain pools during receding flood _____

120 spearfishing (*glas na gummi*) _____

130 at night with lights (specify): _____

140 using canoes: _____

how many canoes in village:

how many outboard motors:

what gear used from canoes:

b.what species are caught with:

	1spears	2hook/line	3_____	4_____	5_____
1	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____

6. Gillnets (if used: yes no)

a. how many nets in the village?

b. how many years have villagers been using nets?

c. are the nets used : multifilament nets |
| purchased
 monofilament nets |
 handwoven nets (self made)
 both, but mainly _____

d. if nets are purchased: where:
cost:

e. size of nets : number of nets examined: _____

mesh sizes _____ inch or cm

length of nets _____ meter

depth of nets _____ meter

REMARK: if possible give range and averages of sizes found.
See appendix for measuring mesh size and depth of nets.

f. at what time of day are the nets set ? early morning
 late afternoon
 other, _____

g. how often are the nets checked while set? _____ times a day
when?

h. how long are the nets left set in the same place? _____ days.

i. what species are caught in nets 1 _____
2 _____
3 _____
4 _____
5 _____
6 _____

7. Consumption.

what is your main staple food?

1. sago
2. banana
3. kaukau
4. taro
5. yams
6. rice
7. mami

FISH

a. how many fish do you generally eat at one meal?
(indicate size of fish cf. tape measure).

adults:

large fish:
middle-sized fish:
small fish:

children:

large fish:
middle-sized fish:
small fish:

b. is tinned fish often eaten? yes no

c. easy tinpis access?

- store in village:
 number:
 continuous supply? yes no
 store in one day walking distance:
 only in town (distance:)

d. is tinpis preferred above locally caught fish? yes no

reason:

OTHER SOURCES OF ANIMAL PROTEIN

a. what kind of animal protein food (*abus*) is mostly eaten here?

b. do you have difficulties getting it now?

c. what kind of protein food (*abus*) is preferred here?

d. do you have difficulties getting preferred *abus*?

e. do people hunt:

- regularly throughout the year.
- only during the dry season.
- only during the rainy season.
- more frequently during the dry season.
- more frequently during the rainy season.
- occasionally
- never

IF NOT REGULARLY: during which period(s) do they fish (more)

1. period from _____ to _____

2. period from _____ to _____

f. do people hunt: *during dry season or throughout year*

- daily
- once a week
- between daily and once a week (specify: _____)
- between less than weekly and once a month (specify: _____)
- once a month
- less than once a month. (specify: _____)
- never

during rainy season

- daily
- once a week
- between daily and once a week (specify: _____)
- between less than weekly and once a month (specify: _____)
- once a month
- less than once a month. (specify: _____)
- never

g. do people go to the store:

- daily
- once a week
- between daily and once a week (specify: _____)
- between less than weekly and once a month (specify: _____)
- once a month
- less than once a month. (specify: _____)
- never

h. how many trade stores in village:

i. other sources of commercial goods:

8. Dietary taboos

a. is there a taboo on certain fish-species? yes no
which species?

b. if yes, why?

c. are there any dietary taboos for:

small children?
which?

from: till: age?

young women?
which?

from: till: age?

young men?
which?

from: till: age?

pregnant women?
which?

lactating women?
which?

elderly people?
which?

mourning people?
which?

c. do you have nutrition taboos after accidents or illness
due to certain foods? yes no.

if yes: does it affect eating fishes now? yes no
species?

why?

for how long?

d. do you have periods of inactivity during mourning?
 yes no

if yes how long?

e. are these taboos and customs generally strictly followed
now yes no

or is it something of former times? yes no

do young people mostly follow them? yes no

 9. Money earning

a. what are the sources of money in this village?

if no:

is there any source of money for the future?

if yes:

which is the most important?

does money come from:

wage earners (how many in village:)

remittances from relatives working for
government or businesses.

running PMV's (how many in village:)

cash crops:

coffee

tea

rubber

cocoa

copra

cardamom

other: _____

forestry or mining royalties

shop keeping (number of shops in vicinity: ;
owned by:)

pig husbandry

cattle husbandry

marketing (where?)

vegetables

staple food (which)

meat

eggs (kakaruk, muruk, wailfawl)

artifacts/bilas

fish

betelnut

other: _____

gold digging

other: _____

b.do you have bride price customs here? yes no

what is the amount of the bride price?

other customary payments?

10.Fish introductions

a.what are the present problems regarding to fish and fisheries in the area?

- no problems
- no fish
- not enough fishing gear
- not enough fish
- overfishing
- fishes too small
- seasonal difficulties
- access to fishing sites (distance)
- access to fishing sites (landownership)
- other: _____

b.if there are NO FISHES,

- do they eat fish?
 - what kind ?
 - where from?
- would they eat fish?
- would they know how to catch fish?
 - method:

c.are there any carp in the area?
 tilapia
 trout

d.when did the villagers catch *Tilapia* (tok pisin: *makau*) for the first time?

where?

e.when did the villagers catch carp for the first time?

where?

f. did carp come from:

- upstream (from the mountains)
- downstream (from the Sepik/Ramu river)
- did someone introduce carp in the area?
who:

g. do villagers prefer carp
 tilapia as food?
 native species

h. have there been any introductions of carp, tilapia or trout in the area?

- tilapia
- carp
- trout

i. did they succeed? tilapia: yes no
carp: yes no
trout: yes no

j. who introduced them? DPI, didiman
 mission
 other _____
 don't know

k. did they arrive from an other place along the river?
 tilapia
 carp
 trout

l. did they notice any deleterious effects from these new fishes?

tilapia:

carp:

trout:

11. General remarks

Give the general situation of the village, indicating the distribution and size of the households.

APPENDIX 2

Individual survey sheet

SEPIK RIVER FISH STOCK ENHANCEMENT PROJECT
(PNG 85/001)

FISHERIES SURVEY SHEET

individual survey

survey no.:

see village survey no:

Name of the recorder:

Survey date:

Time:

1. Area/population particulars

a.name of the area :

b.name of the village :

c.religion :

d.religion related nutrition taboos:

e.what season is it here at the moment:

rainy season

dry season

transition: rainy to dry

dry to rainy

no clear seasonality

is this situation: usual

unusual.

2. Individual data.

name :

kristen name.

tokples name:

name bilong papa:

m/f

age (approx.) :

don't know: adult child

if adult : married: 0 yes 0 no?

how many children: alive
died

occupation: 0 stap long ples tasol

0 wage-earner:

0 business:

0 other:_____

how many people in the household (= people eating
from one "source")?

who did go out fishing in your household during
the past year?

who goes out fishing most often in your household?

how often does that person go out fishing?

for unmarried people:

do you live:

0 with your parents

0 with brothers or sisters

0 in a haus bilong meri

0 in a haus boi

0 other:_____

with how many people are you staying there?

relation to other people interviewed:

3. Fishing effort and - sites.

a. do you fish:

- only during the dry season.
- only during the rainy season.
- more frequently during the dry season.
- more frequently during the rainy season.
- regularly throughout the year.
- occasionally
- never

IF NOT REGULARLY:

during which period(s) do they fish (more)

1. period from _____ to _____

2. period from _____ to _____

b. do you fish: *during the dry season*

- daily
- once a week
- between daily and once a week (=)
- between weekly and once a month (=)
- once a month
- less than once a month (=)
- never

during the rainy season

- daily
- once a week
- between daily and once a week (=)
- between weekly and once a month (=)
- once a month
- less than once a month (=)
- never

what gear did you use: (1):
 (2):
 (3):
 (4):

did you fish alone: (1): yes no
 (2): yes no
 (3): yes no
 (4): yes no

if no, other: 1.family;
 2.other people of
 same age- and sexgroup;
 3.mixed group of villagers;
 4.other: _____

(1): how many:
 (2): how many:
 (3): how many:
 (4): how many:

d.do you remember when was the second last time (4) you
 tried to catch fish?

yes no

if yes: when?

4.Fishing methods.

a.what is the fishing method you use most frequently?
(use the numbercode given in villsur for fishing methods)

during the dry season:

during the rainy season:

throughout the year:

b.do you usually fish: alone
 with other people:
 how many:

c. what gear do you own and use to catch fish?

indicate *exact type and price* of purchased equipment and whether or not the person interviewed has the *ability to make some of the equipment himself*.

indicate, if the gear is bought, whether or not it was produced *locally (L)* or *elsewhere in PNG (P)* or *outside PNG (I)*.

		<i>number of gear type owned per fisherman</i>	<i>bought/ price</i>	<i>make</i>
O gillnets	:	_____		
O castnets	:	_____		
O handnets	:	_____		
O baskets	:	_____		
O traps	:	_____		
O spears	:	_____		
O bow/arrow	:	_____		
O hook and line:		_____		
O glas/gummi/ wire	:	_____		
O torch (bombom):		_____		
O coleman lamp:		_____		
O canoe:		_____		
O outboard motor:		_____		

d. do you have baskets? O yes O no

what do they catch?

baited?

what are they made from?

are they O recuperated
O left to rot?

7. Animal protein food.

a. did you eat animal protein food:

(1) during the last 24 hours: yes no
 (2) during the 24 h. before: yes no

* if no: when did you last eat animal protein food:

what was it:

* if yes: what was it: (1):

(2):

if fish, what species: (1):

(2):

where did it come from: (1):

(2):

if fish, how many did you eat: (1):

(2):

b. did you go out hunting

(1) during the last 24 hours: yes no

(2) during the 24 h before : yes no

if no hunting in that period of time:

when was (3) the last time you went hunting:

c. do you normally go out hunting:

only during the dry season.

only during the rainy season.

more frequently during the dry season.

more frequently during the rainy season.

regularly throughout the year.

occasionally

never

IF NOT REGULARLY: during which period(s) do you hunt (more)

1. period from _____ to _____

2. period from _____ to _____

c. do you hunt: *during dry season or throughout year*

- daily
- once a week
- between daily and once a week (=)
- between weekly and once a month (=)
- once a month
- less than once a month (=)
- never

during rainy season

- daily
- once a week
- between daily and once a week (=)
- between weekly and once a month (=)
- once a month
- less than once a month (=)
- never

8. Money earnings.

a. do you have access to any source of money? yes no

if NO: what is the most likely source of income you can see for the future?

if YES: (indicate approximate amount generated by each income source for this year and last year.)

shopkeeper; where did the original investment money come from? K____ ; K____

running a PMV K____ ; K____

transporting and selling other people's goods at the market. K____; K____

pig raising and selling. K____; K____

customary payments received. K____ ; K____

(also paid? yes no ; amount:)

remittance from relatives working for government or private businesses. K____; K____

forestry and/or mining royalties. K____; K____

digging for gold. K____; K____

cash crops

coffee K____; K____

cocoa K____; K____

copra K____; K____

rubber K____; K____

cardamom K____; K____

other: _____ K____; K____

marketing

where do you go to?

how often do you market goods?

daily

once a week

between daily and once a week (=)

between weekly and once a month (=)

once a month

less than once a month (=)

what do you sell at the market

(indicate revenue for average market day:
K_____)

vegetables

staple food (which)

meat

eggs (kakaruk, muruk, wailfawl)

artifacts/ bilas

fish

betelnut

other _____

other: _____

f. did they arrive from somewhere else along the river?

- carp
- tilapia
- trout

g. did you ever eat:

carp; tilapia; trout; other: _____

if yes, did you like it:

carp; tilapia; trout; other: _____

is it better than the native fishes:

carp; tilapia; trout; other: _____

h. do you think the introduced fishes in your area did harm the native fishes or other fauna?

yes no

which species?

reason:

10. General remarks on this survey.

TABLE 3: Presence in lower order streams and preference as food of fish species as mentioned in village surveys in 27 villages in the Sepik-Ramu catchment. The figures are in percentages of occurrence and mentioned preference. The points were obtained by dividing % preference with % occurrence.

SPECIES	% OCCURRENCE	% PREFERENCE	POINT
<i>Anguilla bicolor</i>	100	88.5	0.9
<i>Anguilla marmorata</i>	96.2	80.8	0.8
<i>Ophieleotris aporos</i>	34.6	19.2	0.6
<i>Arius velutinus</i>	53.8	34.6	0.6
<i>Neosilurus</i> spp.	73.1	42.3	0.6
<i>Oreochromis mossambicus</i>	42.3	26.9	0.6
<i>Oxyeleotris heterodon</i>	23.1	11.5	0.5
<i>Mogurnda bloodi</i>	57.7	15.4	0.3
<i>Glossamia gjellerupi</i>	57.7	15.4	0.3
<i>Cyprinus carpio</i>	15.4	3.4	0.3
Melanotaeniidae	84.6	19.2	0.2
<i>Oxyeleotris fimbriata</i>	42.3	7.7	0.2
<i>Glossogobius</i> spp.	65.4	15.4	0.2
<i>Mogurnda nesolepis</i>	26.9	3.8	0.1
<i>Hephaestus transmontanus</i>	61.5	3.8	0.1
<i>Parambassis confinis</i>	42.3	3.8	0.1

TABLE 4: Fishing methods used in 24 villages (3 floodplain villages excluded). Numbers are number of time mentioned in the general village survey section 5 (Fishing methods). Clear = clear water; flood = flooded, murky water; spear = throwing spears from land; blocking off = blocking of small rivers and barats; hands = catch with bare hands; floodplain pools = emptying floodplain pools during receding floods; spearfishing = diving with goggles and speargun; torch at night = nightfishing with torches.

METHOD	WOMEN	MEN	CHILDREN	CLEAR	FLOOD
Gillnets	-	-	-	-	-
Cast nets	-	-	-	-	-
Hand nets	7	4	4	6	3
Baskets/traps	3	11	-	7	7
Spears	2	13	2	14	3
Bow/arrow	-	16	1	14	2
Hook & line	18	23	14	20	17
Fish poison	13	17	9	17	3
Blocking off	9	11	4	11	-
Hands	12	12	8	13	4
Floodplain pools	-	-	-	-	-
Spearfishing	1	20	-	18	-
Torch at night	6	11	3	13	6

TABLE 5: Percentage catch in numbers in seven villages situated at different altitudes in the Sepik foothills and mountains. Altitude in meter above sea level.

SPECIES	ALTITUDE							TOTAL
	60	80	160	360	500	750	1000	
Anguilla spp.	4.7	1.1	0.9			0.1	100.0	2.9
A. velutinus	1.6	38.6				3.8		6.7
C. carpio		0.6		0.3*				0.2
Glossogobius spp.				21.3		12.9		10.5
G. gjellerupi	7.9	5.8	20.7			2.6		4.3
H. transmontanus	17.4		32.6		0.3	10.9		6.9
Melanotaeniidae	35.8	4.1	20.0	41.8	11.1	28.2		27.3
M. bloodi	4.1				7.8	8.3		2.3
M. nesolepis					57.1			4.5
O. mossambicus		47.7				5.9		8.4
O. aporos	3.5			36.6*				14.4
O. fimbriata	0.3	1.0						0.2
O. heterodon		0.4						0.1
P. confinis						2.6		0.4
Neosilurus spp.	24.7	0.7	25.7		23.7	24.8		10.9

* Doubted whether this species occurs here

TABLE 6.: Percentage catch in weight in seven villages situated at different altitudes in the Sepik foothills and mountains. Altitude in meter above sea level.

SPECIES	ALTITUDE							TOTAL
	60	80	160	360	500	750	1000	
Anguilla spp.	38.0	2.0	5.1			>0.0	100.0	21.9
A. velutinus	17.7	20.9				54.7		22.3
C. carpio		0.3		4.4 *				0.2
Glossogobius spp.				5.9		0.3		0.2
G. gjellerupi	4.6	1.4	28.2			0.4		3.6
H. transmontanus	1.8		15.5		0.4	2.1		2.2
Melanotaeniidae	3.5	0.3	4.4	31.4	4.1	2.1		2.2
M. bloodi	6.9				23.8	6.3		2.7
M. nesolepis					2.5			0.1
O. mossambicus		74.2				0.7		26.1
O. aporos	2.5			58.4 *				1.6
O. fimbriata	0.3	0.3						0.1
O. heterodon		0.1						>0.0
P. confinis						0.1		>0.0
Neosilurus spp.	24.7	0.5	46.8		69.2	33.2		16.7

* Doubted whether species occurs here

TABLE 9: Villages covered by the general village survey during the field work end 1988 beginning 1989. Altitude is in meter above sea level according to 1 : 100000 scale maps with 40 m contour lines. Number of inhabitants according to the 1980 census.

NAME	ALTITUDE	LATITUDE	LONGITUDE	INHABITANTS
Avia	70	3 51'	141 05'	125
Aurump	360	3 36'	141 13'	140
Swatch Ketjil	500	3 16'	141 04'	86
Yamainda	400	3 41'	141 02'	106
Kulunge	320	3 35'	141 01'	296
Rabiawa	80	3 49'	143 35'	265
Kemeilmin	750	4 54'	144 36'	218
Atemkiakmin	1000	5 06'	141 35'	113
Wapia	600	3 50'	141 50'	106
Unamo	360	4 47'	141 50'	77
Papi	60	4 35'	141 58'	80
Kambot	20	4 17'	144 09'	593
Arai	40	4 21'	141 39'	135
Pinkil	320	3 32'	140 06'	101
Tofongu	600	3 26'	142 01'	66
Hotmin	60	4 35'	141 35'	160
Lariaso	80	4 36'	142 12'	49
Meska	30	4 36'	143 05'	203
Numburuan	180	3 40'	143 15'	199
Simbomie	130	3 43'	143 16'	155
Pelnandu	140	3 35'	142 50'	210
Eram	120	4 55'	143 56'	200
Kopailu	700	5 01'	144 53'	181
Yenkis	1000	5 07'	144 54'	526
Ulimola	280	5 02'	143 50'	153
Monokam	2160	5 24'	143 39'	1419
Pasalagus	1100	5 08'	143 29'	660
Nere	500	4 59'	143 20'	200

TABLE 10 : Villages in which a complete fishing survey was conducted during the field work December 1988 to April 1989. See legend table 9.

NAME	ALTITUDE	LATITUDE	LONGITUDE	INHABITANTS
Avia	60	3 51'	141 05'	125
Rabiawa	80	3 49'	143 35'	265
Pelnandu	160	3 35'	142 50'	210
Aurump	360	3 30'	141 12'	140
Swatch Ketjil	500	3 10'	141 04'	86
Kemeilmin	750	4 54'	141 36'	218
Yenkis	1000	5 07'	144 54'	526

NAME	MEN	WOMEN	% 0-5 YEAR	% >45 YEAR
Avia	63	62	15.0	10.7
Rabiawa	130	135	17.4	16.9
Pelnandu	102	108	15.6	16.8
Aurump	77	63	19.7	8.2
Swatch Ketjil	46	40	15.0	10.9
Kemeilmin	111	107	19.0	7.7
Yenkis	286	240	23.0	10.0

NAME	RELIGION	LANGUAGE
Avia	Christ.Broth.Church=CMML	Gargar
Rabiawa	Catholic/Pentecostal	Boiken
Pelnandu	SSEC/New Apostolic	Urati
Aurump	CMML/Revival	Awai mengana
Swatch Ketjil	Catholic	Waris
Kemeilmin	Baptist	Mianmin
Yenkis	Baptist/SDA	Enga

NAME	NO.OF INTERVIEWS	MEN	WOMEN
Avia	19	18	1
Rabiawa	44	34	10
Pelnandu	31	28	3
Aurump	11	11	0
Swatch Ketjil	6	6	0
Kemeilmin	23	21	2
Yenkis	19	19	0

