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P. N. G. Inland Fisheries

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Abstract

Two extensive tributary systems drain nearly one third of the mainland PNG of an area of approximately 0.45 million km^2. At commercial and particularly subsistence levels, the tilapia fishery *(Oreochromis mossambica)* is important in the Sepik River system and the giant perch fishery *(Lates calcarifer)* in the Fly River system. Two species of fish, *Cyprinus carpio* and *Salmo gairdneri*, are used for aquaculture in the Highlands. Various constraints against development of these fisheries are discussed.

Introduction

Among all tropical Pacific island states, Papua New Guinea (total land area approx. 450,000km^2) is the only one with a considerable inland area. A massive central cordillera divides the mainland of New Guinea into two distinct fluviatile regions, the northern or Gaimardian and the southern or Riedian (MUNRO, 1972). More than one third of the P. N. G. inland area is drained by two major rivers and their tributaries. The Fly flows southeastly into Gulf of Papua while the Sepik northerastly into Bismarck Sea. Both are some 1,200 km long and characterized by a cool upper reach in the highlands and a reticular lower reach with extensive deltas near the mouth. The area is also drained by numerous lesser systems including Ramu and Markham in the north and Kikori and Purari in the south (Fig. 1). However, significant inland fisheries presently are connected to the two major river system only.

As an island state, P. N. G. is unique in its demography. The majority of its population (approx. 3 million) lives sparsely in inland areas without access to the country's rich living marine resources. The country annually imports about 25,000t of cheap canned fish at a cost of more than K10 million. It appears that this commodity has become a major animal protein source for the common inland inhabitants. Per capital consumption of this import in P. N. G. is about 8 kg a year. Nutritionally, protein energy malnutrition is by far the most serious national problem (LAMBERT, 1980). To develop

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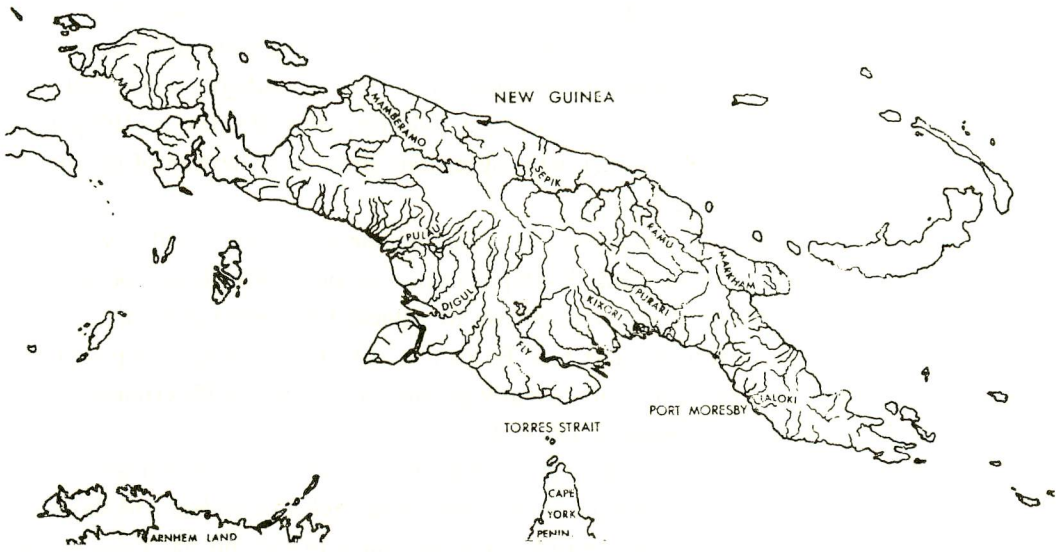

Fig. 1. Location of the major rivers of New Guinea. Note that Papua New Guinea is on the east half of the island.

coastal and inland fisheries has been given a high priority in the overall national development plan (DENSLEY, et. al., 1978?; ANON; 1979).

The objective of this paper is to overview the present status of inland fisheries, including freshwater fish culture, in P. N. G.. Certain constraints associated with the development of inland fisheries are also discussed.

The Sepik River System Fisheries

Tilapia

This algae feeding cichlid *(Oreochromis mossambicus)* was first introduced to P. N. G. in 1954 (GLUCKSMAN, et. al., 1976). The fish has since become widespread throughout the lowland via many internal introductions. In the Sepik, tilapia rapidly filled an empty niche created or left by New Guinea's unique zoogeographic history. The fish is not stunt here and has proliferated in the river and its tributaries and flood plain water bodies.

Tilapia provides the mainstream of a subsistence fishery for river villagers. Annual harvestable biomass of the fish was estimated at 20,000–30,000 t with some 8,000t wet weight as contributable to animal protein needs of the Sepik region. For off–region consumption inside P. N. G., the fish are treated through the Department of Primary Industry's "Solpis" ("Salt–fish") program initiated in the mid–1970's. The fish are filleted,

salted, air–dried and packed in plastic bags for various sizes for marketing especially in the highlands. At present this operation is carried out at Angoram and Pagwi. The whole mechanism relies on simple, standardized low cost technology (canoe, gill net, salt, bucket, wooden platform, simple solar heat collector, etc.). BARDACH (1977) commented the "Solpis" in detail together with suggestions given on utilization of its offal as crocodile and domestic animal feeds.

The "Solpis" program has been part of a multimillion Kina (K1 = Y210) Asian Development Bank financed East Sepik development project since 1976. It was projected a production of about 3,000t of salted–dried fish be achieved by 1980 (DENSLEY, et. al., 1978?). In spite of an excellent start (see BARDACH, 1977), the program has suffered greatly during the past few years, with a yearly production of only 24–35t estimated as of 1982 (see KAN, 1983; WANKOWSHI & GWYTHER, 1980).

Decline of the Sepik tilapia fishery in general has been attributed to biological problems caused by the recent infestation of the water–fern, *Salvinia molesta*, in this river system. The fern was "accidently" introduced in the early 1970's and has been rapidly spreading ever since. About 25% of the waters adjacent to the main river channel were constantly covered by it up to 1979 (THOMAS, 1979; MITCHELL, et. al., 1980). The presence of salvinia was estimated to have depressed the fishery's yield by 30% (see COATES, 1982). However, as indicated by COATES (1982), this depression may not be due directly to biological consequences and be due rather to the fisherman's inability or hesitation to fish in sites densely covered with the fern (RICHARDS, 1980). Stock enhancement programs via introduction of other tilapia species or other suitable species that are able to cope biologically with the dence salvinia are planned (COATES, 1982; see D. P. I, 1984). Nevertheless, according to Dr. D. S. Mitchell, the world authority on *Salvinia*, this salvinia infestation represents the worst social and economic problems caused by plants anywhere in the world.

Other Species

Apart from tilapia, the Sepik fisheries resources are based on an assortment of fish such as cyprinids, catfishes (Ariidae), tarpons (Megalopidae), mullets (Mugillidae), gudgeons (Electridae) and eels (Anguillidae), and the giant freshwater prawn *(Macrobranchium rosenbergii)* and other prawns. All play roles only in the subsistence fishery for river villagers. The Sepik elvers were academically suggested for exploitation to become a source for Taiwan or Japan eel culture to generate foreign exchange (BARDACH, 1977). A small commercial operation based on the wild *M. rosenbergii* appears existing seasonally for hotels in Wewak and Angoram (see DENSLEY, et. al., 1978?).

Problems in Resources Development

No doubt the salvinia infestation inflicts heavily upon the Sepik fisheries in general and the tilapia fishery in particular. Meanwhile a lack of biological information nearly on all resource organisms is a major problem in the formulation of development programs (COATES, 1982).

As recently independent developing country, P. N. G. is seriously short of experienced inland fisheries managers. In spite of the prevailing favorable climatological, hydrological and biological conditions, the eel and prawn cultures for the Sepik region seems unattainable mainly due to technological and economic constraints.

The Fly River System Fisheries

The aquatic food resources of the Fly River and adjacent river systems on the Gulf of Papua were excellently summarized (ANON, 1976; BRANFORD, 1983; etc.). The region is divided into four fisheries districts: the Middle Fly and Lake Murray, Balium, Fly Delta, and Kikori–Purari Delta. The division, not reflecting major difference in resource organisms, is necessary due to the need of the regional development strategies that as a rule involve the survey of fishable stock and the setups at a center of freezer facilities. Villagers can therefore fish directly into a land based freezer/processing plant, or if more isolated, into a freezer boat (5–20t capacity) which eventually operates into the plant. Plants of various sizes are presently located at Boset and Miwa (the Middle Fly and Lake Murray), Samari and Sui (Fly Delta), Kikori and Baimuru (Kikori–Purari Delta) and Daru, the major town in Western Province.

Barramundi (Giant Perch)

This catadromons species, *Lates calcarifer*, occurs widely in rivers on the Gulf of Papua. The fish spawn mainly in the intertidal zone between Sigabaduru and Jarai on the coast about 100 km west of Daru. During their second or third year, juveniles commence upstream migration to rivers and lakes and mature fish return to the spawning ground when three or four years old. Other aspects of P. N. G. barramundi biology concerning sex inversion, spawning and larval life, growth, migration, and population dynamics based on works carried out 1970–6 were reported in detail recently (MOORE, 1979 & 1982; MOORE & REYNOLDS, 1982; REYNOLDS, 1978; REYNOLDS & MOORE, 1982). Research programs geared to additional management/conservation oriented biological information regarding recruitment, catch per unit of effort, commercial production, population structure and tagging have been continuing (see BRANFORD, 1982 & 1983; D. P. I. 1984; WANKOWSHI, 1979; WANKOWSHI & GWYTHER, 1980).

Barramundi are gill–net fished in the Middle Fly and Lake Murray district and along the coast near Daru as they migrate downstream towards the spawning ground. The spawning run starts in September/October and ends probably in December (Table 1). During a 11–year periods, an average annual catch of 263t is recorded with one–third of it taken from the inland (Table 2). Annual fluctuation in catch may be caused by the size of spawning runs in that high inland water levels result in a reduced run and that low inland water levels cause an increased run (BRANFORD, 1983).

The barramundi fishery ranks fourth in P. N. G. fisheries in terms of the value of

foreign exchange earning (some K650,000 estimated for 1974). Its size may be doubled to 500t under proper management measures (DENSLEY, et. al., 1978?). Major market of the filleted barramundi is Queensland, Australia.

Other Fish

For mainly subsistence consumption, the following fish are important in one or more of the four districts:

Catfishes – Tachysuridae

Mullets – Mugilidae

Basses – Lutjanidae

Drums – Sciaenidae

Sharks – Pristidae, Calcharhinidae

Table 1 Annual catches*of the Daru based barramundi fisheries-in tons, whole weight (from BRANFORD,1983).

	Fisheries		
Season	Inland	Coastal	Total
1971–72	146	248	394
1972–73	56	185	241
1973–74	96	187	284
1974–75	31	321	352
1975–76	28	151	179
1976–77	26	184	210
1977–78	55	115	170
1978–79	34	173	207
1979–80	70	151	221
1980–81	117	191	308
1981–82	121	207	328
Average	71	192	263

*Season: September 1 to August 31.

Shellfish

The yabbies, *Cherax* spp., are common in the Middle Fly and Lake Murray and the Balimo districts. The giant freshwater prawn, *M. rosenbergii*, and the mangrove crab, *Scylla serrata*, are widespread in nearly all four districts. Apparently all three are important locally and seasonally. BARDACH (1977) considered the yabbies to have a very large resource potential.

Problems in Resources Development

Difficulties in the operation of freezer units, especially smaller ones, have been experienced in such aspects as the high running costs, high modernization costs, unstable fish supply, and maintenance of acceptable quality control levels (ANON., 1979). Basic

Table 2 Monthly catches of the Daru based barramundi fisheries during 1982—in tons, whole weight (from BRANFORD, 1983).

Month	Fisheries		
	Inland	Coastal	Total
January	1.00	13.63	14.63
February	1.44	8.25	9.69
March	11.09	2.83	13.92
April	12.67	0.16	12.83
May	13.93	0.23	14.16
June	10.60	0.59	11.19
July	9.44	0.34	9.78
August	10.00	0.24	10.24
September	23.62	17.20	40.82
October	13.64	33.39	47.03
November	7.06	28.80	35.86
December	0.00	8.09	8.09

biological information are still to be obtained for providing sound management measures for the barramundi fishery (see BRANFORD, 1983). Meanwhile the large–scale mining at the upper Ok Tedi River may have an enormous impact on the fisheries ecology of the river and those further down including the Middle Fly. Finally any confusions over legal aspects of the traditional fishing right regarding resources exploitation among local villages and co–operatives especially in the Kikori–Purari Delta district should be removed though governmental efforts.

Inland Fish Culture

Dr. K. R. UWATE of East–West Center, Honolulu is reviewing the history and status of aquaculture of all South Pacific island countries. KAN (1983) reported the state of P. N. G. inland fish culture. Table 3 summarizes information of the only two significant activities in fish culture currently engaged in this country.

The potential for aquaculture in P. N. G. is high in terms of environmental, biological and even socio–ethnic conditions. Constraints against the development of aquaculture include a lack of technological know–how and, likely, of suitable foreign market for intensive culture products (KAN, 1983).

Table 3 A summary of information on two inland fish farms in Papua New Guinea.

	Trout Farm	Carp Farm
Type	Intensive	Extensive
Establishment	1973	1960's
Location	Kotuni, East Highlands Province	Aiyura, East Highlands Province
Purpose	Commercial	Production and distribution of fingerlings
Pond Type	Concrete, semi—concrete, and elevated metal	Earthen
Pond Size	About 10 of various size	Four grow—out ponds (total 14,000m²)
Hatchery	Yes but simple	No
Species	*Salmo gairdneri*	*Cyprinus carpio*
Seed	Eggs imported from Australia	Natural spawning on site
Feed	Artificial	Usully no
Diseases	Occasional egg saprolegnia infections	Occasional eye helminth infestations
Annual Production	20—25t	About 6,000 fingerlings distributed

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