FISHERIES RESEARCH ANNUAL REPORT FOR 1984

TECHNICAL REPORT 85/5

April 1984

DEPARTMENT OF PRIMARY INDUSTRY
HERIES DIVISION
RT MORESBY

PAPUA NEW GUINEA

DEPARTMENT OF PRIMARY INDUSTRY

FISHERIES DIVISION

FISHERIES RESEARCH
ANNUAL REPORT FOR
1984

PORT MORESBY

APRIL 1984

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Edited by David Coates and John Lock

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1.0 FOREWORD

This report summarises the activities undertaken by the Fisheries Research and Surveys Branch during 1984. Since the Branch plays a part in many aspects of Papua New Guinea's fisheries development the report will also give the reader an appreciation of the current status of Fisheries in this country.

One of the major objectives of the Fisheries Division is to encourage employment within the Fisheries Sector and much of the Research Branch's activities during 1984 have been aimed at the development requirements of the coastal fishing industry. The Gear and Vessel Appraisal Unit was established specifically to assist with this development and is now in its second year. Results achieved are encouraging. At Wewak, a pilot fishing programme has proved that deep-line fishing is viable and several local fishermen have adopted this fishing method with good results. Two new vessel designs are presently being tested, an 8-metre catamaran and a plywood canoe. Both vessels have proved extremely economical to run and have a role to play in the country's small-scale fishery development.

Monitoring of the fishing industry continues to be an important part of Research's work. On the commercial front, tuna and prawn both appear to have potential for development as figures for catch, effort and total landings are encouraging. Research has now introduced a catch data collection programme at three coastal centres with the aim of monitoring the expansion of the coastal fisheries. The lobster trawl fishery has shown a sharp decline in recent years and in 1984 came under a joint P.N.G.-Australia management plan with an effective total ban on commercial trawling. Initial results from a Research trawl survey indicate that the lobster migration was much reduced in 1984, and the ban on trawling probably saved the industry many thousands of Kina by preventing the target trawling for lobster.

An important addition to Research's capability was the acceptance in 1984 of the two European Economic Community (E.E.C.) funded vessels 'Kulasi', of 25 m and 'Melisa' of 18 m. Both vessels are fitted out to undertake surveys in P.N.G.'s near and distant

waters and it is hoped they will help to identify new fishery resources. They will also act as bases from which new gear and vessels can be tested, particularly in remote areas. International Agencies further assisted Research with technical assistance (Food and Agriculture Organisation of the United Nations; South Pacific Commission), fishing gear (E.E.C.) and travel and study funds (S.P.C.; E.E.C. and the East-West Centre). In its turn the Research Branch has assisted C.S.I.R.O. in setting up tide gauges around the country and a number of visiting scientists were assisted by Research staff in carrying out their work.

In the Highlands the aquaculture facility at Aiyura has now been completed and is expected to commence carp fingerling production in 1985. Considerable interest has been shown by local farmers in this project and it is hoped that carp farming will play its part in producing cheap fish locally in the future.

At times of budget cut-backs it is sometimes questioned whether Research is a luxury which should be dispensed with. Provided Research is of direct relevance and has practical application there is no doubt that it can provide a valuable contribution to this country's development.

B BAI
Secretary
Department of Primary Industry

2.0 INTRODUCTION

This annual report for the Research and Surveys Branch outlines the major research projects undertaken during 1984. The aims of the Branch were laid down in 1968, and have remained essentially unchanged since then. However, in recognition of the importance of coastal fisheries development, Research also has an active role in gear and vessel appraisal work. The aims of the Branch are:

1. To appraise the marine and freshwater fish resources by identifying and defining their size, composition and distribution.

2. To appraise the suitability of new and improved fishing gear and vessels for introduction into coastal waters.

3. To ensure the fish resources are properly managed through the collection and analysis of catch data and the monitoring of the commercial and artisanal fisheries.

4. To undertake biological studies relevant to the appraisal and management of the fish resources.

5. To provide advice and information on matters relating to the exploitation and development of fish resources.

6. To conduct research into the potential for aquaculture in Papua New Guinea.

2.1 ORGANISATION

The Fisheries Research and Surveys Branch has four main sections: Appraisal, Management, Freshwater Fisheries and Aquaculture, and Technical Support. The principal functions of each section are given in Table 2.1.

Table 2.1. Organisation and principal functions of the Fisheries Research and Surveys Branch.

Appraisal Section

- appraisal and demonstration of new and improved fishing gear and vessels
- undertake pilot fishing projects
- provide advice and recommendations to fishing industry on gear and vessel improvements
- survey and identification of marine and estuarine resources
- preliminary estimation of fish resources
- collection and collation of basic biological and ecological paramters

Management Section

- monitoring established commercial fisheries
- monitoring the expanding coastal artisanal fisheries
- collection and analysis of catch and effort data
- detailed biological studies
- detailed assessment of resource size
- definition of management strategies

Freshwater Fisheries and Aquaculture Section

- study freshwater fish resources
- development of freshwater fisheries
- development of aquaculture, both marine and freshwater

Technical Support Section

- purchase and despatch of equipment
- maintenance of vessels and equipment
- construction of fishing gear
- technical staff matters

2.2 RESEARCH STATIONS

The location of the Branch's five research stations are shown in Fig. 2.1. The new facilities at Aiyura were established in 1984 together with modifications and improvements to the Kavieng facilities.

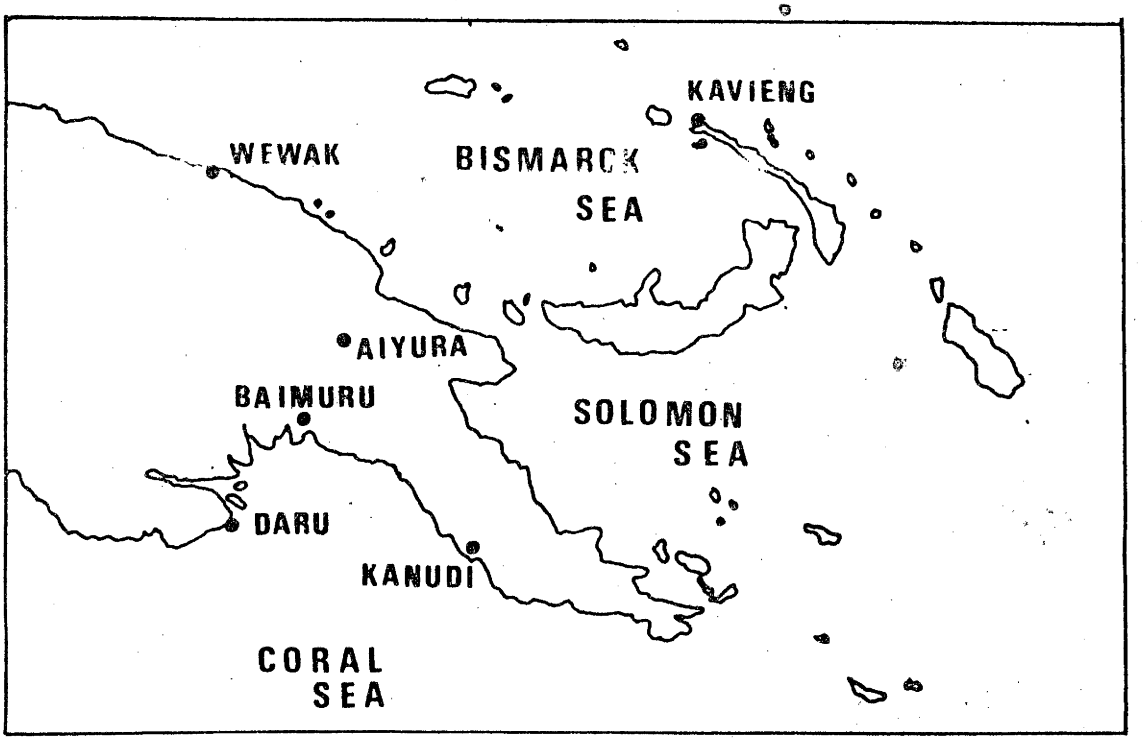


Fig. 2.1: Map of Papua New Guinea showing the locations of Fisheries Research Stations

Addresses

Fisheries Research and Surveys Branch, Kanudi, Department of Primary Industry, P. O. Box 417, KONEDOBU. ('phone 214522) Andy Richards Jim Prescott. Joel Opnai

Fisheries Research Laboratory, P. O. Box ~~101~~ 337, KAVIENG, New Ireland Province. ('phone 942037) Molean Chapau

Fisheries Research Laboratory, P. O. Box 65, DARU, Western Province. ('phone 659097) Ursula Kolkolo

Fisheries Research Laboratory, P. O. Box Baimuru, BAIMURU, Gulf Province. (Contact: Joel Opnai at Kanudi).

Fisheries Research, Highlands Agricultural Experimental Station, Aiyura, P. O. Box ~~384~~ 102, KAINANTU, Eastern Highlands Province. ('phone ~~771216~~ 773513) Petrus Sagom

Fisheries Research Laboratory, P. O. Box 434, WEWAK, East Sepik Province. ('phone 862598) Walain Ulaiwi

2.3 STAFFING

The staff list for 1984 was as follows:

Chief Fisheries Biologist

John Lock

Senior Fisheries Biologists

Molean Chapau (O.I.C. Wewak)
David Coates
David Cook
Stewart Frusher
Pochon Lili (M.A. course in Zoology, U.S.A.)
Joel Opnai (O.I.C. Baimuru)
Andrew Richards (O.I.C. Kavieng)
Charles Tenakanai (O.I.C. Daru)
Reginald Watson (resigned April)
Jim Prescott

Fisheries Biologists

Philip Crane
Paul Dalzell
Ursula Kolkolo
Petrus Sagom (O.I.C. Aiyura)
Daniel Thiesen (resigned December)
Andrew Wright
Augustine Mobiha

Analyst Programmer

David Waites

Sea-Going Staff

David Miller, Captain FRV 'Melisa' (recruited February)
Lars Jenssen, Captain FRV 'Kulasi' (recruited May)
Peter Diggie, Coxwain FRV 'Melisa'
Michael Kenoli, Captain FRV 'Marigili'
David Hart (recruited August - Chief Engineer EEC Vessels)
Philip Agis (Engineer FRV 'Marigili')

Kanudi Station Manager

Kapa La'a

Chief Technical Officer

Melvyn Lockhart

Librarian

Josepha Gima

Fisheries Technicians

Mishak Tatamasi
Philip Buiena
Gideon Eremu
Paul Murri
Francis Elly
Alea Saiga
Tapas Potuku
John Kaoboe
Peter Mom (resigned)
Yarang Kurtama
John Makis (resigned January)
George Baidam
Toneba Papata
Samuel Ako
Helen Kuk
Lamila Pawut (resigned)
Paul Anayabere
John Aini

Artisans

Mundi Yube	Laui Loroi

Technical Assistants

Mabi Dukawa	Mathew Kapi
Robert Pam	Kanawi Pakop
Simon Taedagi	Toka Vare
Komisa Mapa	Ipiroro Ioka
James Gamalewa	Ovei Maivage
James Aiwai	Aini Hauba
Paul Kumalau	Komesa Mapa

Support Staff

Eri Serei	Ume Sepoe
Nancy Mafu	Rose Eli
Bonnie Ranga (transfered)	Gibson Pihone
Natatuma Alabati	Kiu Seng (appointed February)

3.0 EEC RESEARCH VESSELS

During 1984 the Fisheries Division took delivery of two new research and survey vessels. The 18 m 'Melisa' (Fig. 3.1) arrived in Port Moresby in March and the 25 m 'Kulasi' (Fig. 3.2) arrived in September. Both vessels were built under funding provided by the European Economic Community (E.E.C.) and the total cost was approved in December, 1980, with further funding being approved in May, 1982. The vessels were built by Cygnus Marine of Falmouth, England. The funding included the supply of fishing gear.

The decision to request the E.E.C. for funds followed protracted discussions within the Fisheries Division during 1979 and 1980 as to what sort of vessels were required. Consideration was given to requesting a single large vessel to undertake tuna research but it was eventually decided that a small vessel was required to operate in coastal waters and a larger stern trawler was needed for prawn surveys and to carry out oceanographic work. Once E.E.C. approval was given, tenders were issued in May 1981. A consultant naval architect assisted the P.N.G. Government in the selection of the shipbuilders and represented the Government throughout the construction period.

It is intended that 'Melisa' will operate in the coastal waters of P.N.G., assessing the fisheries resources and carrying out exploratory and experimental fishing. She will be used to investigate new fishing grounds. She will also test suitable gear for use in the country's small-scale coastal fishery.

'Melisa' can spend at least two weeks at sea and has accommodation for four scientists and six crew. A small freezer will be used to store some of the catch.

'Kulasi', being the larger of the two vessels, will undertake surveys further offshore in addition to coastal and inshore work as required.

It is also envisaged that both vessels will be used as floating bases from which research and gear and vessel appraisal work can

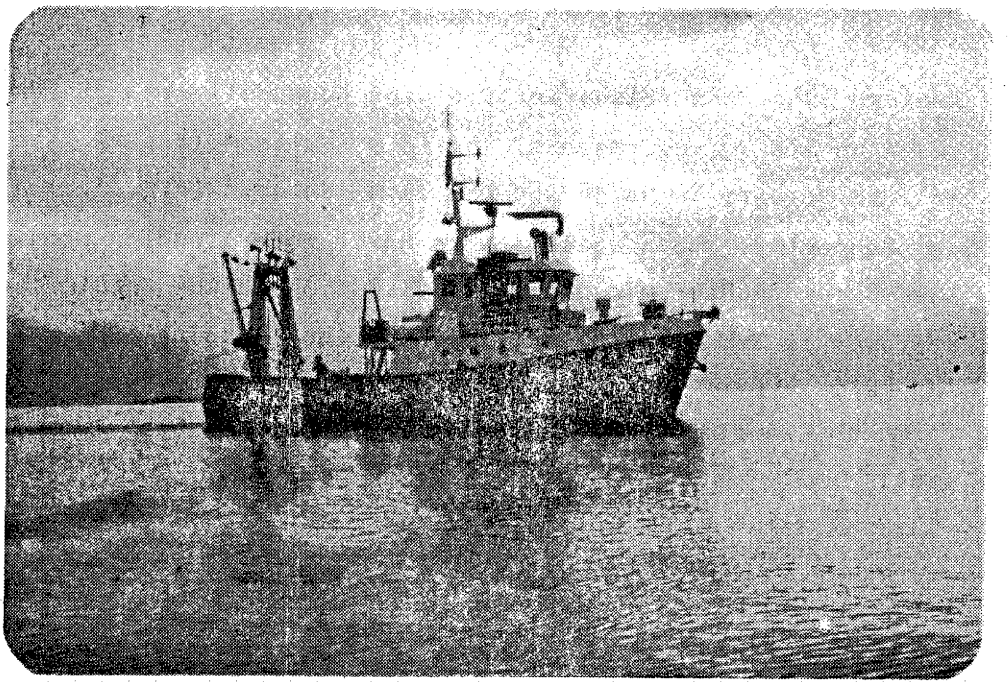


Fig. 3.1: F.R.V. 'Melisa'

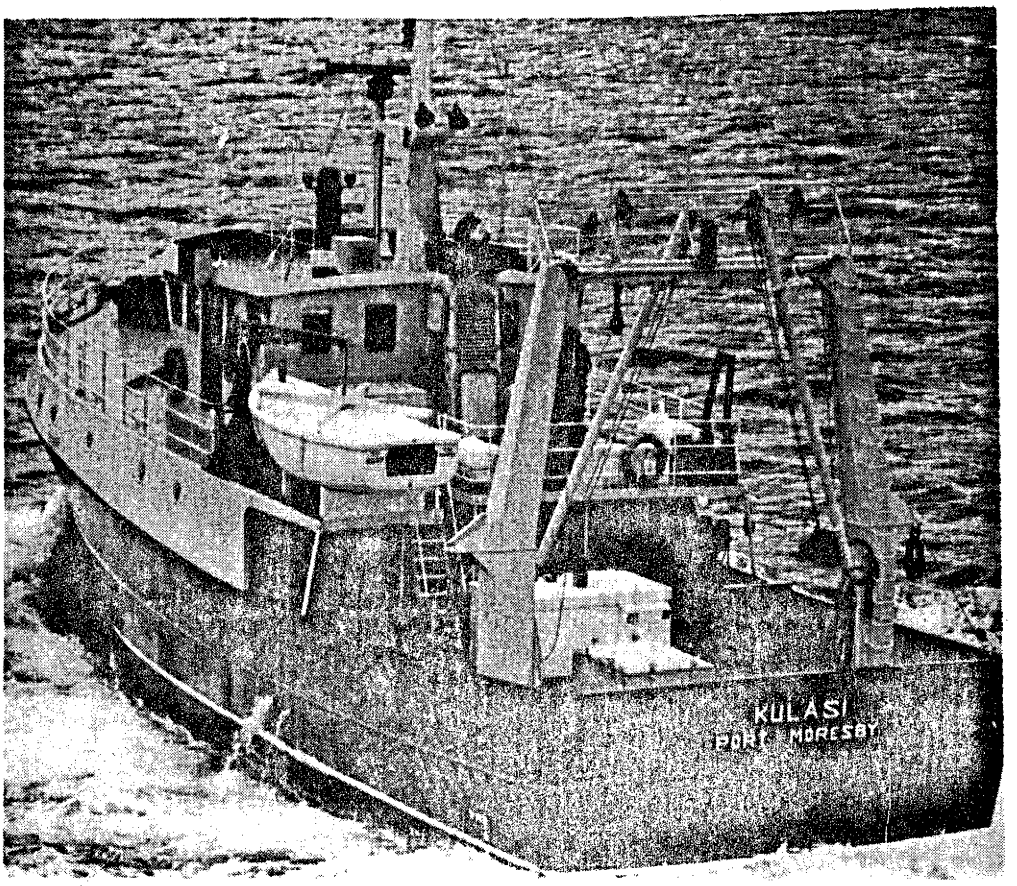


Fig. 3.2: F.R.V. 'Kulasi'

be undertaken, particularly in more isolated areas. Programmes so far undertaken are discussed elsewhere in this report.

EEC Research Vessels - Brief Specifications

Both vessels were built to Lloyds Class +100A1. Some specifications for the two vessels are provided in Table 3.1.

Table 3.1: Some approximate specifications for the two EEC Research Vessels.

	Kulasi	Melisa
Length overall (m)	25.0	17.7
Beam (m)	7.5	6.1
Draught (m)	3.3	3.0
Cruising speed (knots)	9.0	8.0
Tank capacities (tonnes)		
Fuel oil	40.0	15.0
Freshwater	10.0	4.0

'Kulasi'

Accommodation is provided for 12 persons and is divided into two single cabins for the captain and engineer, three double cabins for 4 scientists and 2 crew members and one 4 berth crew cabin. The galley/messroom provides seating and eating facilities for the total complement and is very well equipped. Two washrooms and shower compartments are situated forward of the accommodation area. Aft of the accommodation area are the wet and dry laboratories where biological work is carried out and records are kept. A small deep freezer is provided in the dry laboratory for scientific use. The vessel has a blast freezer room arranged for box storage or for trays, enabling a varying type of catch to be frozen down to - 30°C. Freezer capacity is approximately 5 tonnes and a one tonne per day ice-making machine is also fitted.

The aluminium wheelhouse is a spacious, self-contained control

centre, incorporating a large chart table and storage area, and equipped with an impressive array of electronic fishing and navigation equipment. These include:

Satellite navigator, type Navidyne ESZ 4000
Autopilot/TMC system, type Plath Navitrans-P/Navipilot EL
Electromagnetic log, type Plath Naviknot-NF
Binnacle compass, type Plath Navipol 1-F
VHF Radiotelephone, type Sailor RT 144C
SSB Radiotelephone, type Sailor T124/R110
Radar, type Atlas 4500 "X" band radar
Hydrographic echosounder, type Atlas 781 with digital readout
Fishfinding echosounder, type Atlas 471
Sonar, type Elac Honeywell, with paper recorder

'Kulasi' is powered by a caterpillar 3412 D1-T diesel engine, 4 stroke, V-12 cylinder, turbocharged, direct injection, developing 450 bhp at 1800 rpm continuous rating through marine transmission gearbox type Caterpillar 7231 with a reduction ratio of 5.88:1. Two diesel auxillaries type Lister HRW4 and HRWS6 are installed. The vessel has a broad range of hydraulic fishing equipment consisting of two split trawl winches, 3.5 t mid drum pull, one combination gillnet hauler with line wheel attachment, one hydrographic winch and an anchor windlass.

'Melisa'

Accommodation is provided for 9 persons and is divided into three double cabins and one 4 berth crew cabin. Forward of the accommodation area is a washroom consisting of two hand basins complete with mirrors, shaving light sockets, two toilet compartments and a large shower compartment. The galley area has seating for the whole crew and is fully equipped.

The main engine is a Caterpillar 3406T diesel engine developing 250 shp at 1800 rpm, equipped with a Twin Disc MG154 gearbox with 6:1 reduction ratio and reverse gear driving a 4-bladed bronze propellor. Auxillaries are type Lister HRW3 and HRW4 each driving a Newage alternator to give 20 kw and 28 kw respectively. The

wheelhouse is equipped with the same equipment as 'Kulasi'.

'Melisa' has the capabilities of a combination gillnetter/ - longline hauler and a broad range of fishing equipment has been installed including two 3.5 tonne split trawl winches mounted on the aft deck, a net line hauler, two 1.5 tonne cargo winches, a hydrographic winch, a one tonne boat twist and davit, and an anchor windlass. The vessel has a blast freezer of approximately one tonne capacity.

4.0 TUNA

During 1984, a catch of 50,400 tonnes of tuna was reportedly taken from P.N.G. waters. Of this, 94.3% was taken by foreign-based vessels (222 vessels licenced), 5.4% by the local pole-and-line vessels and 0.3% by a local purse-seiner operating out of Rabaul.

4.1 Domestic Pole and Line

In August, 1984, the local pole-and-line fishery was re-opened following a joint venture agreement between P.N.G. and Okinawan fishermen. This fishery, which depends upon live baitfish for catching tuna, had been closed since 1981. The new Kavieng based venture operated 8 catcher vessels of 59 GRT and one anchored mothership. Each catcher vessel is crewed by 22 to 26 men.

Landings of tuna were 2,744 tonnes between August 22nd and December 3rd, 1984. Of the total catch, 86.6% was Skipjack and 13.5% Yellowfin and 174 tonnes of baitfish were used. Monthly catch and effort data are shown in Table 4.1. Species composition is shown in Table 4.2.

Good catches were obtained from the New Hanover tuna grounds and nearby areas, especially in September. Vessels took 1,123 t of tuna with an average monthly catch of 140 t per vessel (5.2 t daily). Baitfish catches averaged 7 t per vessel (0.26 t daily). Each vessel fished about 3 schools of tuna per day.

During October, the number of schools fished daily dropped from 3 to 1 and catch rates of baitfish decreased due to the north west monsoon. Consequently, the fleet moved into the Cape Lambert grounds in late October. Similar conditions were experienced in the Cape Lambert area and within a week vessels moved to the south coast of New Britain. Operations ceased on December 3rd, after one month's fishing, due to a lack of both tuna and baitfish.

Fishing is expected to resume in March, 1985. It is not clear why there has been an overall lack of tuna and baitfish but this could be the result of changing weather conditions in the area.

Table 4.1: Catch and effort for local pole-and-line vessels 1984.

	AUG	SEPT	OCT	NOV	DEC	TOTAL & AVERAGES
Total tuna catch (t)	407	1,123	582	558	72	2,744
Total baitfish catch (t)	21.0	57.0	48.0	46.0	3.5	174.0
Number of vessels	8	8	8	8	8	8
Total period fishing (days)	76	216	192	180	19	683
Tuna per vessel (total t)	51.0	140.0	73.0	70.0	9.0	69.0
Tuna per vessel (t day^{-1})	5.4	5.2	3.0	3.1	3.8	4.0
Baitfish per vessel (total t)	2.5	7.1	6.0	5.7	0.4	4.3
Baitfish per vessel (t day^{-1})	0.3	0.3	0.2	0.2	0.2	0.3
Tuna to baitfish ratio (t per t)	20.31	19.8	12.1	12.2	20.3	15.8

Table 4.2: Percentage catch composition 1984.

	Skipjack	Yellowfin
August	88.32	11.68
September	91.16	8.84
October	81.04	18.96
November	82.64	17.36
December	76.54	23.46
5 month Average	86.47	13.53

4.2 Foreign Based Vessels

Foreign vessels took an estimated 47,542 tonnes of tuna up to the end of November, 1984. Of this, Purse-seiners took 40,916 tonnes, Longliners 6,543 tonnes and Pole-and-liners took only 82.8 tonnes.

A total of 2.6 million kina was collected as licence fees from the 552 licences given to 222 foreign vessels (vessels may have more than one licence). The fleet composition is given in Table 4.3. Of the 222 foreign vessels licenced during 1984, 37.3% either applied for a licence but didn't fish or fished but no catch reports were submitted.

Table 4.3: Foreign-based vessels licenced to fish in P.N.G. waters in 1984. The numbers in the brackets show the number of vessels that have actually sent in catch reports. Unbracketed numbers are the total number of licenced vessels in 1984. (Tuna licences extend for two months only. Vessels may have more than one licence per year).

(a)

Vessel Types	Number of Vessels operated by:				
	Japan	USA	Korea	Taiwan	Phillipines
Purse-seiners	42(33)	48(17)	7(4)	9(5)	6(3)
Longliners	78(69)	-	-	-	-
Pole-and-liners	32(8)	-	-	-	-
	152(110)	48(17)	7(4)	9(4)	6(3)

(b)

Vessel Type	Number Vessels	Total Number of Licences issued	Number of trips reported
Purse-seiners	112 (61)	333	151
Longliners	78 (69)	181	127
Pole-and-liners	32 (8)	38	8

5.0 FISHERIES RESEARCH STATISTICS CENTRE

The Fisheries Research Statistics Centre (F.R.S.C.) is responsible for the analysis of data from two main sources; catch returns from commercial fishing ventures, and research data collected by officers in the Fisheries Division. All of the commercial catch returns (except for the foreign-based tuna companies) and the larger data sets from research projects are entered onto the large computer at the National Computer Centre (N.C.C.) at Waigani, where they are also processed. The rest of the data is entered onto the microcomputers at Kanudi and processed there. Copies of all the foreign-based tuna catch reports are sent to the South Pacific Commission at Noumea for entry and processing.

A computer-based P.N.G. fisheries bibliography has been developed at Kanudi. The records of articles, which include author, title, date, journal reference and keywords, are stored on microcomputer diskettes. A copy of every article is placed in the fisheries library. References can be retrieved by typing either an appropriate keyword or the author into the microcomputer. Each article has been assigned an index number by which it can be located in the library.

Because of the large and ever-increasing amount of data that must be handled, new hardware is being ordered. A Winchester hard disk drive has been bought and is to be installed in the first quarter of 1985.

6.0 RESOURCE ASSESSMENT

6.1 Remote Sensing

Progress was slow during 1984 due to the UNITECH (Lae) computer being out of action for a number of months. It is hoped that the projected analysis of the reefs and associated substrates in the Kavieng area will commence in earnest in 1985.

During 1984 funding was approved by the Australian Development Assistance Bureau for a joint Australia-P.N.G. project to produce shallow water maps of the Milne Bay area. The project will use LANDSAT imagery and will produce a detailed analysis of substrate types. The project will be run under the auspices of the Surveying Department of the University of Queensland. The initial area of interest will be the Trobriand Islands and associated reefs.

6.2 Fish Trapping

From December 1983 onwards, 10 modified Cuban S-traps were set on Nusalik Reef which forms part of the western boundary of Kavieng harbour. This area was chosen because it is lightly fished, is a typical island fringing reef and is conveniently close to the laboratory. An arrangement was made with the Nusalik Islanders whereby the fish obtained from the traps were eventually returned to them for their consumption.

Traps were constructed from 1.6 mm gauge chicken wire of 54 mm mesh overlaid with 0.9 mm gauge 25 mm wire mesh. The double mesh system served the purpose of retaining all but the most juvenile specimens whilst affording extra strength and protection against shark attacks. Most traps were supported with a frame-work of mangrove sticks and were set in depths ranging from 5 to 25 m and betwen 50 and 100 m apart along reef slopes.

Between January and August, a series of different soak times was employed to investigate the relationship between catch and the duration of immersion. Fig. 6.1 suggests that the data obtained for Kavieng are similar to those obtained in previous studies, in

that an asymptotic catch curve is evident.

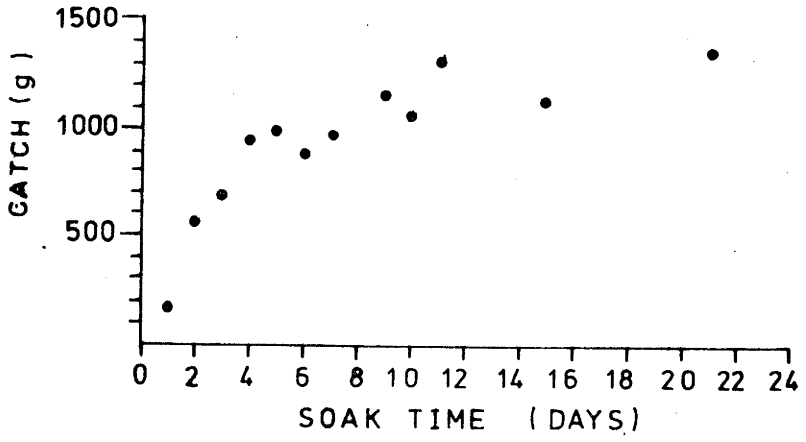


Fig. 6.1: The relationship between cumulative catch and soak time for S-traps on Nusalik Reef.

An index of stock density termed Availability (A) can be determined from the data and A is equal to the mean daily rate of ingress of fishes into the traps. The estimate of Availabilty for this area was 216.8 g day^{-1}.

Even if the choice of traps is changed for further comparative work, the principle at least has been demonstrated. The use of passive gear, like fish traps, provides a convenient method of sampling synchronously over a wide area on the reef. This could not be achieved via other methods without considerably more effort. The method provides one way of obtaining resource estimates of trapable species. In P.N.G., the relative lack of catch/effort data for the coastal and reef fisheries necessitates the consideration of these alternative methodologies. Given this methodology and comparable fishing gear, it should be possible to conduct similar exercises on other P.N.G. reefs to obtain estimates of A for comparative purposes.

The number of species caught in the S-traps increased between January and August, suggesting that they become more effective

with time. A total of 125 species belonging to 29 families were observed in the S-traps. Species composition of the catch is shown in Fig. 6.2. Surgeonfishes (Acanthuridae), and in particular Acanthurus gahhm, were the most dominant in catches and parrotfishes (Scaridae) were the second most commonly caught fish. The commonest predatory species were rock cod (Serranidae) and emperors (Lethrinidae).

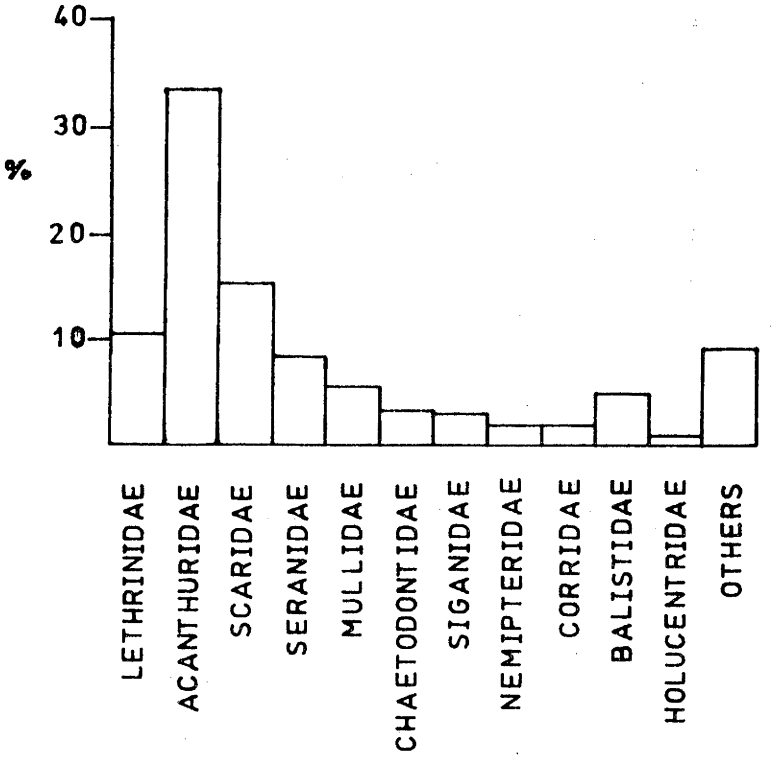


Fig. 6.2: The species composition, by number of individuals, of S-trap catches from Nusalik Reef.

Biological information has been collected on all fishes in the traps but low numbers of most species will preclude all but the most basic of analyses. A more detailed study of A. gahhm may be possible since this species represented approximately 15% of the weight of the catch.

From June onwards some trials were conducted with an arrow-head trap, as commonly used in Puerto Rico. Between 3 and 5 traps were set in front of the Kavieng laboratory in 15 to 25 m of water. More intensive trials will take place with these traps.

7.0 ARTISANAL DATA COLLECTION

The collection of fisheries statistics in P.N.G. has previously focused on industrial catches, i.e. tuna, bait-fish, prawns and lobster, or on artisanal catches of high priced product such as barramundi or lobster. Little attention has been paid to production from the coastal areas by artisanal fishermen who normally sell their catch to a Government Fish Purchasing Centre (GFPC) or in the market place. The development of P.N.G.'s coastal resources has proceeded without accurate base-line data on past and present levels of exploitation in any given area.

At the request of other Branches within the Fisheries Division, Research and Surveys Branch became responsible for the collection of catch and effort statistics for the coastal artisanal fisheries in P.N.G. Three requirements were identified.

7.1 Analysis of Historical Data

Data has been collected in a passive sense at the GFPCs through the issue of receipts to each artisanal fisherman who sells his catch. Whilst there are limits to the analysis of this data, it can provide a useful insight into some of the factors affecting the dynamics of coastal artisanal fishing.

The receipt books of the Kavieng GFPC extend from 1970 to the present. The period 1970 to 1982 was studied and the data obtained in the receipt books was summarised and collated during 1984. The mean annual production figure for this period was 23.2 tonnes. The total production for the Tigak Islands area is shown in Fig. 7.1. From 1976 onwards, fish production increased markedly although the same trend is not apparent in the number of landings. Therefore, the increase in production is probably due to an increase in fishing effort per fishing trip or to increased catches per unit of effort, rather than to an increase in the frequency of fishing.

More detailed analyses were made on data available for 10 villages/islands that regularly produced fish between 1970 and 1982. There was no correlation betwen the number of landings and

rainfall. Distance from Kavieng, however, significantly affected production since it declined with increased distance from Kavieng GFPC. Villages close to Kavieng GFPC had much higher landings than those from more distant regions. This is as expected because the effort and cost involved in selling the catch increases with distance from Kavieng. In two villages there is a significant negative correlation between the mean annual copra price and fish production. This highlights the point that most coastal fishermen fish part-time and have alternative occupations. The overall prevailing economy, therefore, affects the fishery.

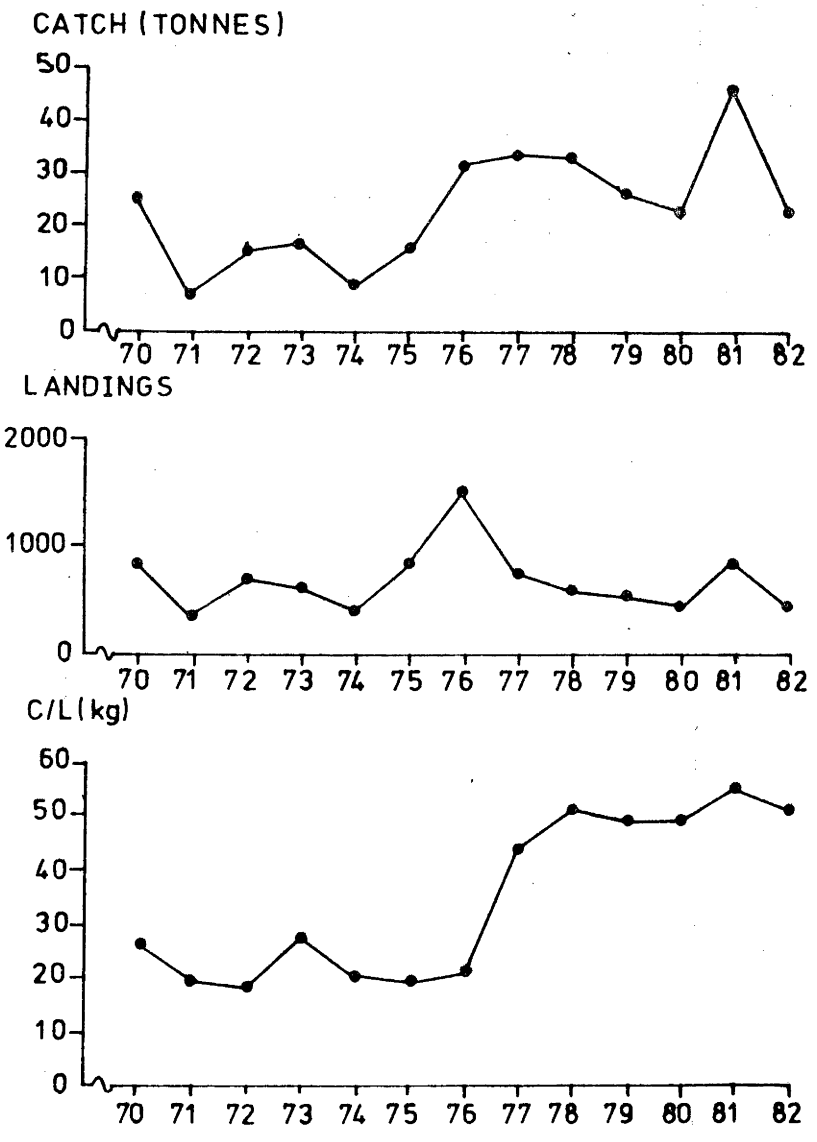


Fig. 7.1: Total landings and mean catch per landing (C/L) at Kavieng Fisheries Depot of fish from the Tigak Islands, 1970 to 1982.

7.2 New Data Recording System

The above findings illustrate the importance of data collection for the artisanal fisheries. During 1984, attempts at a unified approach to coastal fishery data collection began with the introduction of a Produce Purchase Docket. The docket, which is completed when fish are purchased from the fishermen, records some basic information on the fishing trip. This system fulfills the function of recording both catch and effort. Once the data recording system is established, annual summaries of data can be compiled that will give a breakdown of catch by location, method and catch/effort.

7.3 Fisheries Poster

In order to assist with data collection a poster is being designed. This will illustrate the major components of the coastal fisheries' catch and assist in the identification of the main groups of fish.

8.0 PORT MORESBY ARTISANAL SURVEY

The survey has as its objectives the collection and analysis of catch and effort data from the well developed reef fishery centred on Port Moresby, and the estimation of fish yields from these reef areas. Economic data are also being collected and the results of the study will help with planning fishery development elsewhere in the country's coastal waters.

Details of daily catches are recorded by a number of fishermen on a voluntary basis. Data forms are collected regularly from the fishermen by Research staff and independent checks are also made on landings. The survey commenced in February, 1983, on Daugo Island, and in 1984 this was expanded to include the villages to the west of Port Moresby, namely, Roku, Kouderika, Porebada and Boera.

Fishing from these villages is concentrated along the coast and offshore around Daugo Island, on the shallow reefs around Idihi and Bava Islets and on the Lepu-Lepu reef which is approximately 20 km offshore. The Daugo fishing community uses 5.8 m GRP dinghies powered by 25 hp outboard engines, while in the mainland villages outrigger and double canoes are more common. A variety of fishing methods are used including trolling, handlining, netting and spearing. Fishing is undertaken both during the daytime and at night, but fishermen generally stay at sea for less than twelve hours at any one time. Fish is sold mainly at Koki and Gerehu markets in Port Moresby. Since most customers visit the market between 1600 and 1800 h, the catches are generally landed in the villages in the early afternoon and transported to the various markets. Women are usually involved in the selling of fish.

8.1 Results

Data will continue to be collected through to early 1985 when a full analysis will be undertaken. The provisional results indicate that fishermen, particularly from Daugo Island, fish throughout the year with no significant decrease in fishing activity during the S.E. trade-wind season from April to October

(Fig. 8.1). However, many fishermen do change their fishing technique throughout the year, probably in response to the seasonal availability of fish. Fig. 8.2 gives details of the methods used by one Daugo fisherman during a twelve month period. It can be seen that troll fishing was replaced by hand spearing as the main fishing method in June. Hand spearing was mainly for long-toms (Belonidae) and was undertaken at night. The main fishing method used from the mainland fishing centres is netting. This entails setting several nets in a circle and the fishermen then enter the enclosed areas to spear individual fish. Fishermen from the mainland appear not to vary their fishing methods as much as those from Daugo Island, with the majority fishing only with nets and hand lines.

The total landings for one fishing boat operating from Daugo Island are given in Table 8.1. In the 12 month period this fishing unit caught nearly 11 tonnes of fish with an average daily catch of 48 kg. The daily catch of fishermen working in this boat was 31 kg. Catch rates appear to decline during the S.E. trade-wind period, although this may be the result of factors other than unfavourable wind conditions, such as the movement of large pelagics out of the area.

Details of the number of fishing boats and fishermen in each of the fishing centres have now been collected and the total annual production for the villages will be estimated. When related to the total reef area fished, this will give an indication of the present yield of fish per unit area of reef.

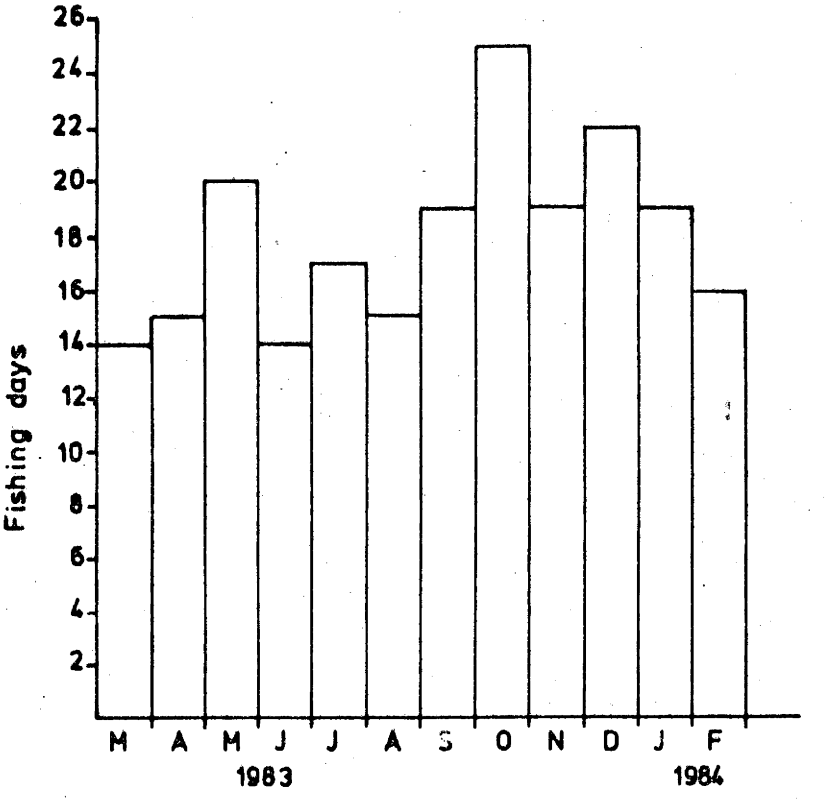


Fig. 8.1: The number of days spent fishing each month by a Daugo Island fisherman.

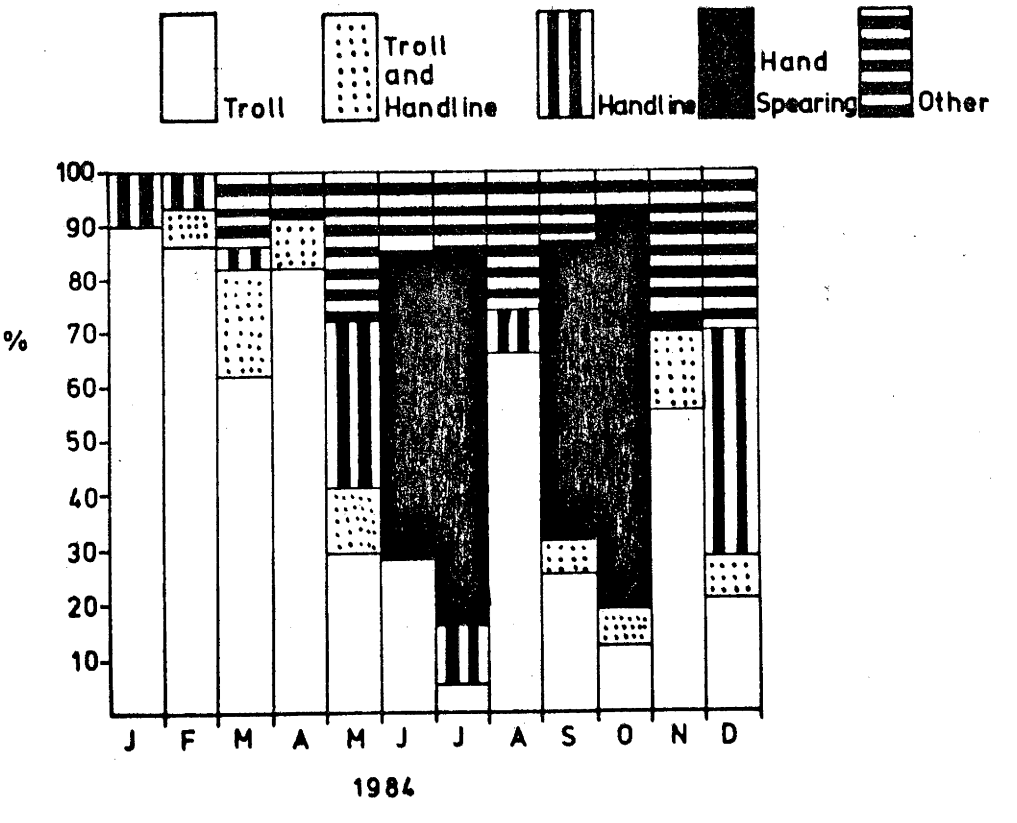


Fig. 8.2: The fishing methods used by one fisherman during a 12 month period.

Table 8.1: Catches made by one Daugo Island vessel during 1984.

	Totalcatch (kg)	Number of fishing days	Catch per trip (kg)	Catch per fisherman per day (kg)
January	1176	19	62	44
February	1050	16	66	55
March	1047	24	44	28
April	567	17	33	30
May	589	24	25	16
June	205	7	29	17
July	682	17	40	21
August	244	12	20	17
September	767	16	48	26
October	1950	26	75	41
November	1434	27	53	38
December	1182	20	59	30
TOTAL	10893	225	48	31

9.0 COASTAL PELAGIC FISHERIES

The troll fishing survey of large pelagic fish, which started in July, 1982, was completed in 1984. A South Pacific Commission masterfisherman visited Wewak from April to June and aided in the construction and deployment of two fish aggregating devices (FADs). Research in 1984 concentrated on monitoring of the FADs and analysing the troll survey data.

9.1 Troll Survey

The aims and methods of this survey were described in the 1982 and 1983 Annual Reports. The results indicate that a commercial fishery around Wewak for Spanish mackerel (Scomberomorous commerson), which forms 80% of the troll catch, would be uneconomical. However, vessels travelling from fishing grounds to Wewak could considerably increase the harvest of Spanish mackerel by a slight alteration of their sea routes, time of travel and the use of more commercially orientated fishing gear.

9.2 Fish Aggregating Devices

The use of FADs has been one of the biggest boons to the commercial skipjack (Katsuwonus pelamis) and yellowfin tuna (Thunnus albacares) fisheries in other regions over the last decade. Commercial FADs are generally deployed in deep water (1000 - 3000 m) several km from the coast.

In P.N.G., a project was established to evaluate the potential of FADs for artisanal fishermen using small scale techniques and vessels. To make the FADs accessible to coastal fishermen their use in shallow water (<500 m) and close to shore (<8 km) was evaluated.

Two FADs were deployed in April, 1984. FAD 1 in 160 m of water and FAD 2 in 390 m. The rafts were constructed of 200 litre drums packed with foam (Fig. 9.1). Crushed polystyrene or commercial two-part polyurythene foam were used as packing. Drums were enclosed in angle-iron frames. The FADs were of the "semi-taut" type.

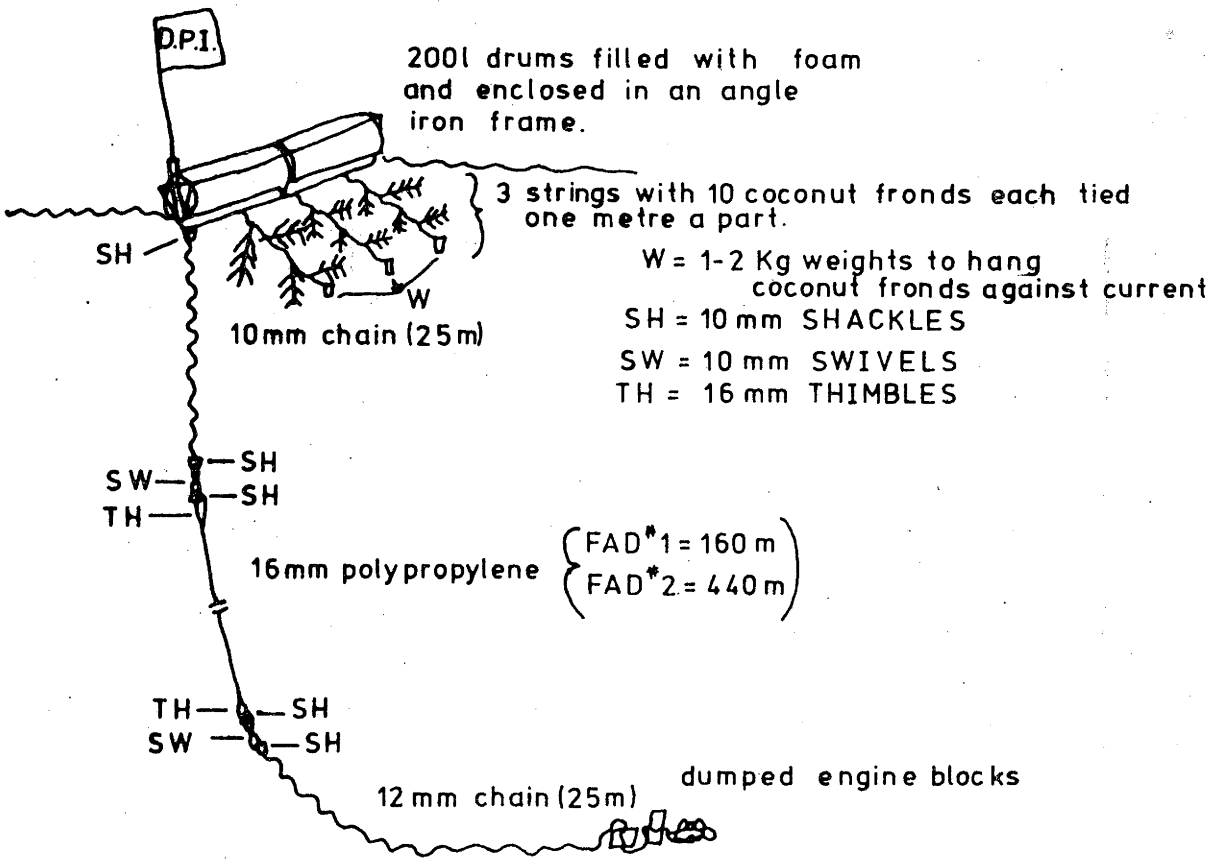


Fig. 9.1: Details of the construction of the FADs used in Wewak.

Juvenile trevally (Caranx tille), scads (Megalaspis cordyla and Decapterus russelli), rainbow runners (Elegatis bipinnulatus) and triggerfish (Alutera monoceros) aggregated around both rafts within a week, but no fish suitable for artisanal exploitation were caught until June. Since June, large numbers of juvenile tuna (Euthynnus affinis, Auxis thazard and Thunnus obesus) were caught around FAD 2 together with rainbow runners and dolphinfish (Coryphaena hippurus). Tuna ranged in size from 170 to 350 mm fork-length. Catch rates varied from 0 to 47 kg h^{-1} $vessel^{-1}$ with an average of between 10 to 15 kg h^{-1} $vessel^{-1}$ for vessels with three or four trolling lines each with one to three hooks.

FAD 1 produced sporadic catches of only mackerel and frigate tunas and this FAD is considered non-viable.

Vertical longlining trials were initiated at FAD 2 and these caught sharks (Carcharhinus falciformes). A market for treated shark-meat and fins has been located and fishermen are being encouraged to use small longlines (100 m long, 6 - 7 hooks, 3 m snoods).

9.3 Future work

Two more FADs are to be deployed in 1985 (Fig. 9.2). FAD 3 will be placed in the same depth of water as FAD 2 but at a different locality (Fig. 9.2). FAD 3 is designed to investigate the effects of the underwater ridge on the effectiveness of FAD 2 (see Fig. 9.2). FAD 4 will be placed near FAD 3 but in about 500 m depth of water.

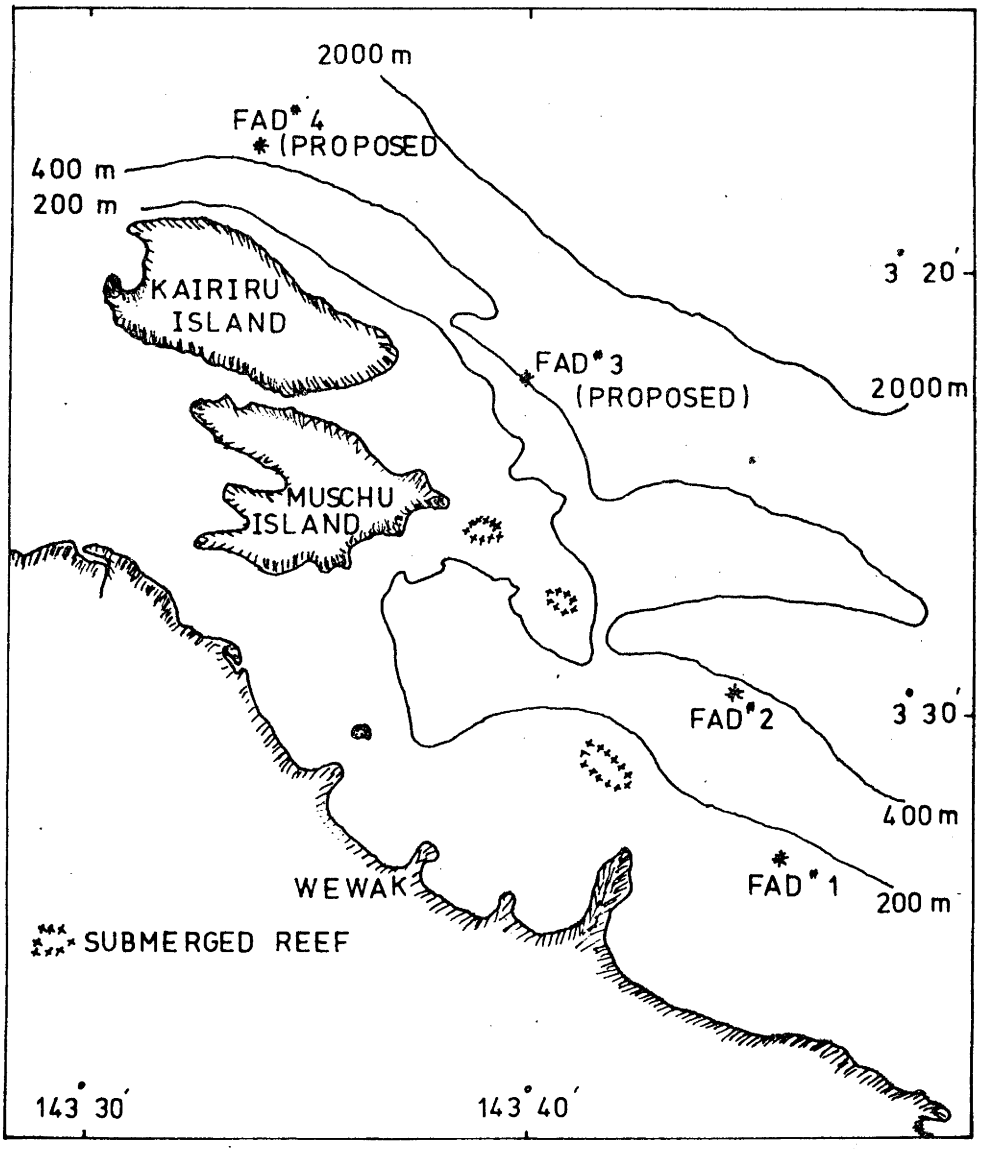


Fig. 9.2: The localities of deployed and proposed FADs. The 200, 400 and 2000 m depth contours are shown.

10.0 THE NORTHERN GULF OF PAPUA NEW GUINEA PRAWN FISHERY

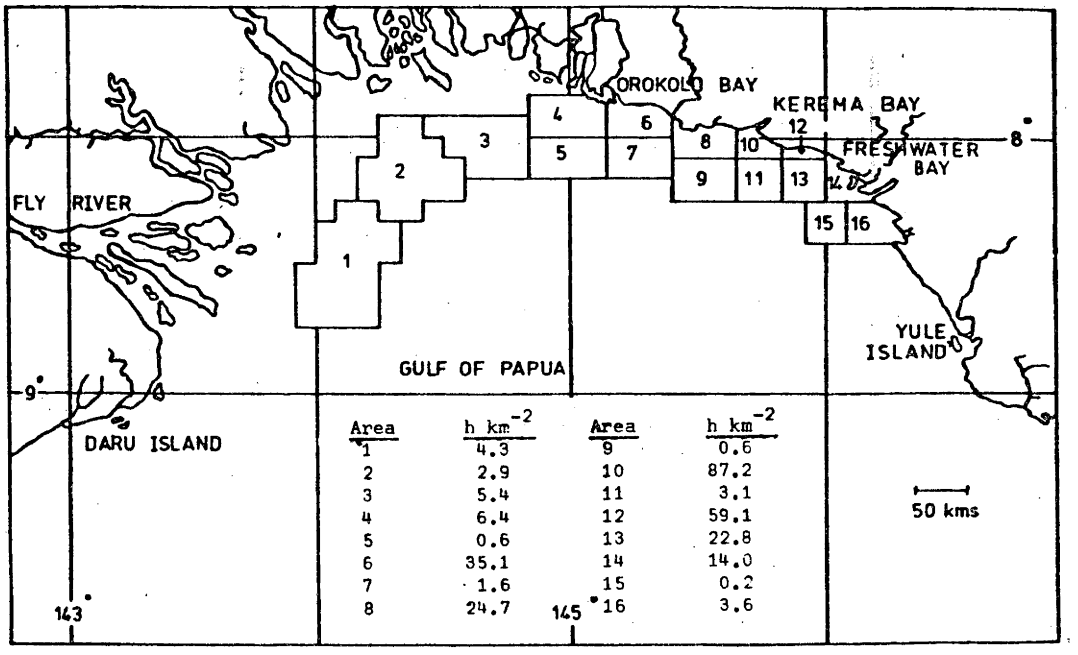
A new prawn trawler, the "Gulf Star 1", joined the existing fleet of 12 large-class vessels (>20 m length overall, L.O.A.) and a small-class vessel (14 m LOA) fishing the prawn grounds of the northern Gulf of Papua during 1984. The new vessel is owned by one of the existing prawn companies operating in the fishery.

Catch and catch per unit effort (C.P.U.E.) data are given in Table 10.1. The total prawn catch of 1,133.4 tonnes (tailweight) represented the landings of the larger vessels. No catch reports were submitted by the smaller vessels. Catch and C.P.U.E. have decreased by 22% and 41% respectively over 1983's figures. Fishing effort (hours), however, increased by 34% in 1984 compared with 1983. Some of this increase in effort fishing for prawns would have been due to the closure of the lobster trawl fishery in 1984.

Table 10.1: Prawn catch (tonnes of tails), C.P.U.E. (kg tails h^{-1}) and number of trawlers in the Gulf of Papua.

Year	Effort (hours)	*P. merguiensis* Total Catch	*P. merguiensis* C.P.U.E.	All Prawns Total	All Prawns C.P.U.E.	No. of Trawlers
1977	42,108	291.1	6.9	529.1	12.6	12
1978	67,272	531.2	7.9	996.5	14.8	13
1979	77,579	635.8	8.2	1178.2	15.2	13
1980	67,617	667.9	9.6	1177.6	16.9	13
1981	66,921	517.1	7.7	1026.3	15.3	19
1982	60,113	418.2	7.0	878.9	14.6	11
1983	55,584	631.7	11.2	1141.2	20.5	11
1984	74,412	489.9	6.6	1133.4	15.2	14

Fig. 10.1 shows the major fishing areas and the fishing intensity (hours fished km^{-2}) within each area. The distribution of catch and fishing effort by area is given in Table 10.2.



Area	h km^{-2}	Area	h km^{-2}
1	4.3	9	0.6
2	2.9	10	87.2
3	5.4	11	3.1
4	6.4	12	59.1
5	0.6	13	22.8
6	35.1	14	14.0
7	1.6	15	0.2
8	24.7	16	3.6

Fig. 10.1: Fishing areas and fishing intensity in the northern Gulf of Papua prawn fishery during 1984.

As in previous years fishing effort has concentrated in defined areas 6, 8, 10 and 13. These areas contributed 56% of the 1984 catch but only constitute 13.12% of the total defined area. Unlike previous years, fishing outside the boundaries of the areas in Fig.10.1 was minimal at only 1.0% of the annual effort.

Table 10.2: Distribution of catch and effort by fishing areas.

Area	% of Total Effort	Prawn Catch (t tails)
1	10.8	153.6
2	5.8	65.7
3	7.4	84.4
4	5.5	48.9
5	0.5	5.1
6	16.1	181.4
7	1.1	14.1
8	11.3	134.5
9	0.4	4.2
10	20.0	211.0
11	1.4	13.7
12	3.3	39.5
13	10.4	100.9
14	3.0	28.6
15	0.1	1.1
16	1.7	19.1
18(area undefined)	1.2	14.4

The Gulf of Papua fishery is a relatively stable year-round fishery. The main season is from February to August when catches were an average 96 tonnes per month (C.P.U.E. 15.2 kg tails h^{-1}) with well over 100 tonnes of prawns caught monthly from April to July. From September to January, catches averaged 89 tonnes of prawn per month (C.P.U.E. 14.4 kg tails h^{-1}) during 1984.

Although the overall C.P.U.E. for 1984 has dropped from the previous year, this is probably not due to overfishing. It is likely to be due to natural variations in prawn abundance. Indications from an analysis of the relationship between C.P.U.E. and total effort for the fishery show no decline in C.P.U.E. with increasing effort as yet.

11.0 ORANGERIE BAY PRAWN FISHERY

The prawn resource contained in Orangerie Bay (Milne Bay Province) is relatively small. Two companies operated a vessel of 14.4 m (LOA) and 19.3 m (LOA) respectively in the area during 1984.

The vessels fished intermittently between April and November and landed a total catch of 28.42 tonnes of prawns (tail weight) in 703 hours of trawling. Of this, the 19.3 m vessel caught 19.59 tonnes of prawns (tails) in 469 hours of trawling (C.P.U.E 41.76 kg tails h^{-1}) from April to July. The 14.4 m vessel caught 8.84 t of prawns (tails) in 234 hours of trawling (C.P.U.E. 37.75 kg tails h^{-1}) in April, July, October and November. The distribution of the catch by weight was approximately 83% Banana, 5% Black Tiger, 2% Tiger, 2% Endeavour and 8% mixed prawns.

Socio-political problems, including direct attacks on one of the vessels, forced the Orangerie Bay fishery to be closed in August. Non-regular fishing activities during 1984 and in previous years do not permit any seasonal pattern of the fishery to be determined from the catch records. Nevertheless, the resource exists and its exploitation should be encouraged.

12.0 AIYURA AQUACULTURE CENTRE

Much of the work undertaken in 1984 concerned the establishment of fish farming facilities. In addition, basic information on water flow to the four fish ponds and on fish growth rates was obtained.

Work started on two L40 (Nadzap type) houses and a modest office early in January. By May these three buildings were completed. Construction of the fish hatchery also began in January and by June much of the work was completed, except for minor plumbing and electrical work. A security house, close to the ponds, was completed early in 1984.

In April, during the dry season, the water flow to the Aiyura ponds was measured and found to be 280 l min^{-1}. This is adequate for approximately one hectare of pond and sufficient for the four ponds that presently exist.

Obtaining suitable broodstock (>1.0 kg) remains a major problem. There are presently about 20 broodstock available and induced breeding will be carried out on these.

12.1 Common Carp Fingerlings Distributed

The number of fingerlings produced was low due to a lack of suitable broodstock for the extensive fish culture method used. Naturally spawning common carp, Cyprinus carpio, can produce between 1 and 2 x 10^4 larvae per spawning per adult female of 200 to 250 mm length. However, a high mortality (60 to 80 %) of larvae is usually experienced under the natural system. In 1984, a total of 4,735 Golden and Cantonese variety carp were distributed (Table 12.1).

12.2 Common Carp Growth Rates

In December 1983, 115 fingerlings were distributed to farmers and institutions. Of these, 75 were given to Kainantu Corrective Institution Service. These were stocked into a 0.3 ha secondary

sewage pond which is stagnant for most of the year. From a size at stocking of 50 mm, it took 6 months for them to reach lengths greater than 250 mm (suitable table size) with an average weight of 0.6 kg. Some feeding was undertaken which consisted of waste food from the kitchen. A 100 % survival rate for these fish was obtained.

Table 12.1: Recipients of carp fingerlings in 1984.

Province	Farmers	D.P.I.	Corrective Institution	Others	Total
Eastern Highlands	470	52	100	70	692
Western Highlands		980			980
Southern Highlands		1200			1200
Simbu		123			123
Madang				600	600
Morobe	30			110	140
Central	1000				1000
				Total	4735

13.0 BAITFISH AND COASTAL FISHERIES INTERACTION

This project aims to investigate the effects of baitfishing on the artisanal coastal fishery, since baitfish may be a food resource utilised by fishes traditionally exploited by island residents.

In 1984, the analysis of the stomach contents of demersal and pelagic fish collected in the vicinity of P.N.G.'s main baiting ground, at Ysabel Pass, New Ireland Province, was completed. Adult, but small, reef-associated schooling pelagic fishes formed 90.5% of the non-target component of the Ysabel Pass baitfishery in 1981 (the pole and line fishery closed in that year and re-opened in mid-1984) as shown in Table 13.1. During 1981, 319 tonnes of baitfish were harvested from Ysabel Pass. This was considerably less than the previous three year average of 736 tonnes. This was due to the early cessation of fishing in October, 1981. The two anchovies, Stolephorous heterolobus and S. devesi, and the blue sprat, Spratelloides gracilis, are the target species for the baitfishery.

The stomachs of 1,200 fishes, belonging to 78 species of pelagic and demersal fish that are commonly caught in the coastal fishery, were analysed. Of the fish examined, 41 species, representing 14 families, had eaten fish species forming a component of the tuna bait hauls. For 27 of these species, major components of the baitfishery formed a significant component of their diet. Based on this investigation, the catches of artisanal and subsistence fishermen operating in the Tigak Islands have been divided into three broad trophic groups (Table 13.2). Further analysis may lead to a better understanding of the interaction between the baitfishery and the reef fishery.

Table 13.1: Non-target species contributing more than 1% (by weight) to the 1981 bait fishery in Ysabel Pass.

Species	%	Estimated catch (t)
Apogonidae		
Rhabdamia cypselurus	6.3	6.1
R. gracilis	9.7	9.4
Atherinidae		
Hypoatherina ovalaua	5.1	4.9
H. temminickii	1.3	1.2
Atherinormorous lacunosa	2.8	2.7
Caesidae		
Gymnocaesio gymnopterus	13.2	12.8
Clupeidae		
Herklotsichthys quadrimaculatus	20.2	19.6
Sardinella sirm	7.4	7.2
Thrissna baelema	12.2	11.8
Dussumeiridae		
Spratelloides delicatulus	4.3	4.2
Carangidae		
Selar crumenopthalmus	6.5	6.3
Scombridae		
Rastrelliger faughni	1.6	1.5

Table 13.2: The percentage contributions of fish of different trophic levels to the Tigak Island shallow-water reef fishery.

Piscivores	40.2%	- Serranidae, Sphyraenidae, Carangidae, Belonidae, Lutjanidae, Scombridae
Omnivores	23.9%	- Lethrinidae, Mullidae, Gerridae, Scombridae (*Rastrelliger kanagurta*) Acanthuridae (*Acanthurus xanthopterus*)
Herbivores	35.9%	- Mugillidae, Siganidae, Chanidae, Scaridae, Acanthuridae

14.0 SEPIK RIVER FISH STOCK ENHANCEMENT

In 1984 several reports on the biology of the fish species of importance to the fishery were completed including a general description of the fisheries and fish fauna of the Sepik River system. Fish yield estimates for the Sepik River floodplain fishery have also been made. Various options for the development of this fishery have been considered and it has been suggested that further fish species be introduced. This approach has been endorsed by a consultant from F.A.O. (Dr. T. Petr) who visited P.N.G. in May, 1984. Without the introduction of further fish species little artisanal or commercial fishery development can properly take place.

The intentional introduction of new species into such a large river system is not something to be considered lightly. Much would depend on which species are proposed. Further advice is being sought on these matters.

15.0 GEAR AND VESSEL APPRAISAL WORK

A considerable investment has been made in shore-based processing facilities, aimed at assisting the development of small-scale commercial and semi-commercial coastal fisheries in P.N.G. In many cases these facilities are dependent for their supply of fish on simple dugout canoes, imported dinghies and government-run diesel-powered work boats or "dories" of 7 to 8m in length. The Fisheries Division recognizes that the development of improved, cost-effective designs of small fishing craft is crucial to the success of many village-level, small-scale, commercial fishing operations in P.N.G. A vessel appraisal programme was started in 1983 by the Fisheries Research and Surveys Branch. This programme has two main aims. The first is to identify the constraints affecting the operational viability of the present small craft in use by fishermen. The second is to test possible improvements to such small craft and also to develop and test new designs of simple and appropriate fishing craft. Such craft should be capable of being locally constructed and be more cost-effective to operate than present craft.

15.1 Local Dugout Canoes

A variety of dugout canoe designs and sail plans are found throughout P.N.G. Each area has its own particular design or designs which relate to the ethnic background of the local people. An example of the degree of diversity between different types is evident when a comparison is made between the Trobriand Islands and the Western Province canoes (Fig. 15.1).

Catches from canoes drop off markedly in many areas during windy conditions. A relatively light wind of, for example, 17 knots, is sufficient in exposed waters to severely restrict the operations of most canoes which are not decked over. Under such conditions bailing is usually a continuous process, especially in the smaller canoes. Winds of over 17 knots are not uncommon in many areas, especially on the South coast in the season of south-east winds (approximately April to November). In some areas where canoes are decked over, the load carrying capacity can be

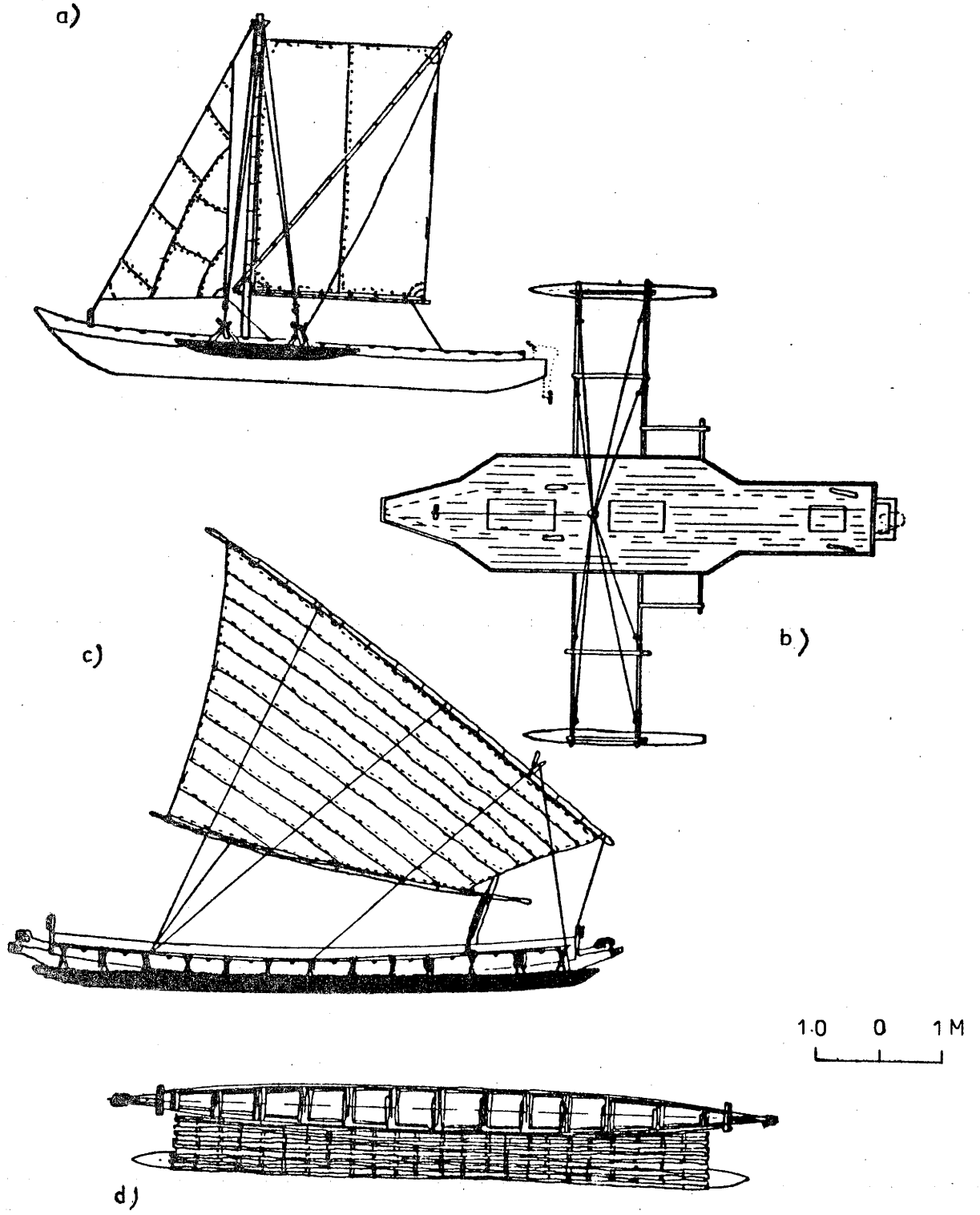


Fig. 15.1: A sketch of a Trobriand Islands canoe, upper figure, and a canoe from Western Province, lower figure.

increased by raising the freeboard and increasing the strength of the internal frames.

Where they are required to operate in exposed waters, most canoes in their present form do not make good full-time commercial fishing craft. Although there are exceptions, the main reasons are their limited carrying capacity and relatively low sea-worthiness. This may be one reason why fishing is still undertaken as a part-time activity. Clearly, the present design and construction of dug-out canoes act as a constraint to fisheries development. For this reason, new vessel designs are being appraised by the Research Branch.

15.2 11 m Transport Fishing Canoe, P.N.G. 1

The 1983 Annual Report gives an introduction to "P.N.G. 1" an 11 m, transport-fishing canoe designed by F.A.O. for the East Sepik Province of P.N.G. The vessel is currently owned and operated by the Fisheries Section of the East Sepik Provincial Government. Trials undertaken on this prototype are documented in Report No. 84-08.

At the 1984 prices of fuel at major centres, fuel costs were about K0.56 per nautical mile when a 25 hp outboard motor was used and K0.31 per nautical mile when a 15 hp outboard was used. The use of this smaller outboard gave a saving in fuel costs of about 44%. This saving in cost was at the expense of a loss in speed of only 20%.

The canoe designer (Oyvind Gulbrandsen) undertook sea trials on the prototype in Wewak in October, and proposed a number of minor design alterations and additions.

The building of a second canoe incorporating the design alterations was commissioned by the Branch in mid-1984. This craft will undergo more extensive trials on the Papuan Coast using a variety of sizes of outboards and a long-tail diesel engine. The performance of the vessel under the rougher south-easterly conditions of this area will also be tested. These trials will start in earnest in 1985. The construction was

undertaken by a small commercial yard at a cost of K5,100 excluding engine. Material costs amounted to K1,800. A complete assessment of the potential of the 11 m plywood/planked P.N.G. 1 will be available only after the results of the 1985 trials are known. Following these trials the vessel will be loaned to small-scale commercial fishermen to be assessed whilst undertaking full-time commercial fishing and transport operations. If the vessel is found to be suitable for transport and fishing purposes it could only be recommended for use in areas where there are good income-earning opportunities.

15.3 The Sandskipper Catamaran

The Sandskipper catamaran is a plywood, beach-landing, sail-assisted, fishing vessel powered by a small diesel engine. Originally sponsored by the British Overseas Development Administration, the 7.3 m L.O.A. double-hulled craft has a working payload of two tonnes. It has been tested as a small-scale fishing vessel in a number of tropical countries with varying degrees of success. Certain features of the Sandskipper design suggest that it may be suitable for use as a commercial fishing craft in the vicinity of the National Capital District (N.C.D.).

Most fishermen in the N.C.D. use either imported dinghies or dugout craft powered by outboard motors, but some fishermen from villages near the capital rely entirely on sail, poling and paddling. Fishermen from the N.C.D. may fish up to six days per week but usually do not stay out for more than 12 hours each day. The operators of 5.8 m GRP dinghies appear to be the most consistent fishermen and the more skillful of these catch between 40 and 60 kg of fish per day. Fuel costs vary greatly but appear to average about 20 toea per kg of fish caught. Ice is not normally carried by most fishermen.

Extensive fishing trials have been carried out with the Port Moresby-based Sandskipper, the FRV 'Matabudi'. The 'Matabudi' has been fitted with four FAO wooden hand-reels and used as a deep-water snapper fishing vessel. The results indicate that the vessel operating out of Port Moresby, under capable hands, should

regularly land over 500 kg of good quality fish per week under favourable weather conditions. The number of weeks per year when weather conditions would permit this is not yet known.

In comparison to the local craft currently operated, the Sandskipper has a considerably greater carrying capacity and much lower fuel costs. Using village fishermen as crew together with Fisheries Technicians from Kanudi, has been the most effective way to assess the 'Matabudi'. The best results have been obtained by going to the more distant and more productive fishing grounds carrying ice and ice-boxes and staying there for 24 to 48 hours. In this way fuel costs are only 10 % of those presently incurred by dinghy fishermen. One drawback to the present operation is the availability and cost of ice in Port Moresby. A second drawback is the handling and marketing infrastructure in N.C.D. which is unaccustomed to larger landings of fish. Further improvements in the marketing/handling field are needed.

The results of operating the Sandskipper as a trial commercial fishing vessel, based in the N.C.D. have been favourable. Calculations on costings with the vessel depreciated over three years, at 15% interest, indicate that the vessel could be used to earn a good living for three skilled fishermen, even at the existing cost of ice. This, however, would be dependent on the operators or the families of the operators taking an aggressive marketing policy, in order to ensure the rapid distribution and sale of their catch.

15.4 Longtail Diesel Engines

Yanmar diesel longtail engines, model TS 130, have been chosen as the unit to power the three Sandskipper catamarans built in P.N.G. in 1984. These 11 hp engines have been tested during 1984 and trials will continue during 1985. The engines are simple to operate, economic and parts are available within P.N.G. A few minor problems have been encountered with the longtails in use, but these have largely been due to the operator's lack of experience. Initial findings indicate that these engines may have considerable potential for the powering of certain small village-level craft. Different sizes of longtail units will also

be tested on double canoes and dugout-outrigger canoes in 1985.

15.5 Gear Appraisal at Kavieng

Methods of exploiting the demersal fish stocks on the outer reef slopes include bottom droplining, bottom-set longlining, bottom-set gill-netting, trapping and vertical longlining. Of these, bottom droplining has been the only method extensively tested in P.N.G. Some success has been achieved in the Pacific and Caribbean using botttom-set longlines, deep water traps are successful in the Caribbean and vertical longlining has shown promise on steep slopes in Papua New Guinea. It is assumed that bottom-set gill-netting would be impractical because of the presence of sharks.

Three types of bottom-set longline fishing gear were appraised near Kavieng, from 1981 to 1984. A P.V.C. pole bottom-set longline system incorporating a portable line-hauler proved to be the most effective of the three gears tested. The P.V.C. pole system shows promise as a complementary gear to the dropline handreel, especially in depths over 250m where the handreel loses some of its efficiency, and where the incidence of shark attacks on hooked fish is less than in shallower waters.

Vertical longlines were fished from March to July on reef slopes off Kavieng in waters 150-250m deep (Fig. 15.2). A maximum of 3 lines were fished at any one time, each with 10 hooks. Catch rates ranged from 0 to 0.5 kg hook^{-1} h^{-1} with an average of 0.2kg hook^{-1} h^{-1}. This gear will be re-tested during the north-west monsoon season on the steep slopes of the south coast of Baudessing Island.

Deep water fish traps of a box design with two conical entrance funnels were deployed in waters 140-170 m deep off Kavieng from September to October. Nine hauls were made for a total of 60kg of fish, mainly Pristipomoides multidens and Seriola purpurascens. The catch rate varied from 0.07 to 5.13 kg trap^{-1} lift^{-1}, with an average of 2.2. The mean time taken to haul, re-bait and re-set one trap was 20 minutes. The average time to complete one trip (3 traps) is 2 hours. Caribbean Z traps and other trap designs will be investigated during 1985.

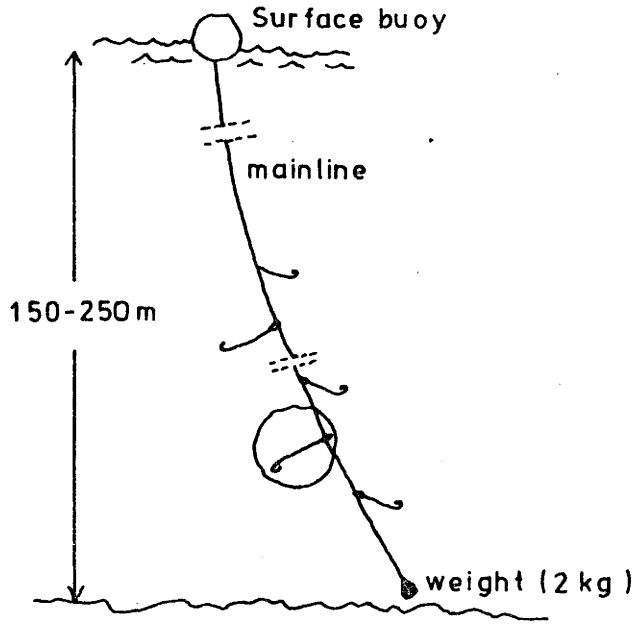


Fig. 15.2a: Vertical longline gear used at Kavieng.

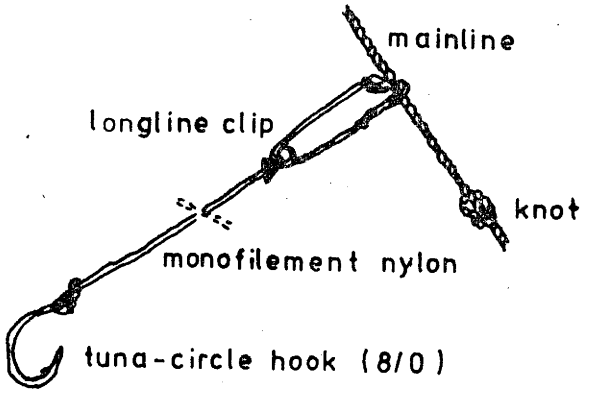


Fig. 15.2b: Inset of the gear shown above, illustrating the arrangement of the snood clips on the mainline.

16.0 DEEP-WATER SNAPPER RESOURCE INVESTIGATIONS

Deep water snappers, predominantly Pristipomoides spp. and Etelis spp., taken on the outer reef slopes are recognised as having considerable potential for fisheries development in P.N.G.

In Wewak and Kupiano, deep water drop-line fishing using wooden handreels from locally built canoes has already been successfully introduced.

During 1984, the analysis of the Kavieng drop-line data was completed and additional biological data on the dominant fish species in catches was collected in Wewak and Kavieng. Research was carried out to assess the magnitude of deep water reef fish stocks and their potential yields under various levels of fishing pressure.

16.1 Catch rates and average fish weight variations with depth and time of day

The analysis of data collected from the July 1982 to September, 1983 Kavieng dropline survey was completed during 1984. The methods were described in the 1983 Annual Report. Dropline fishing was performed using wooden handreels in seven depth ranges (at 30 m intervals) from 80 to 290 m at various fishing sites. There were three main fishing areas; the southern coast of Baudessin Island, the area west of Kavieng and Panapai Bay (Fig. 16.1).

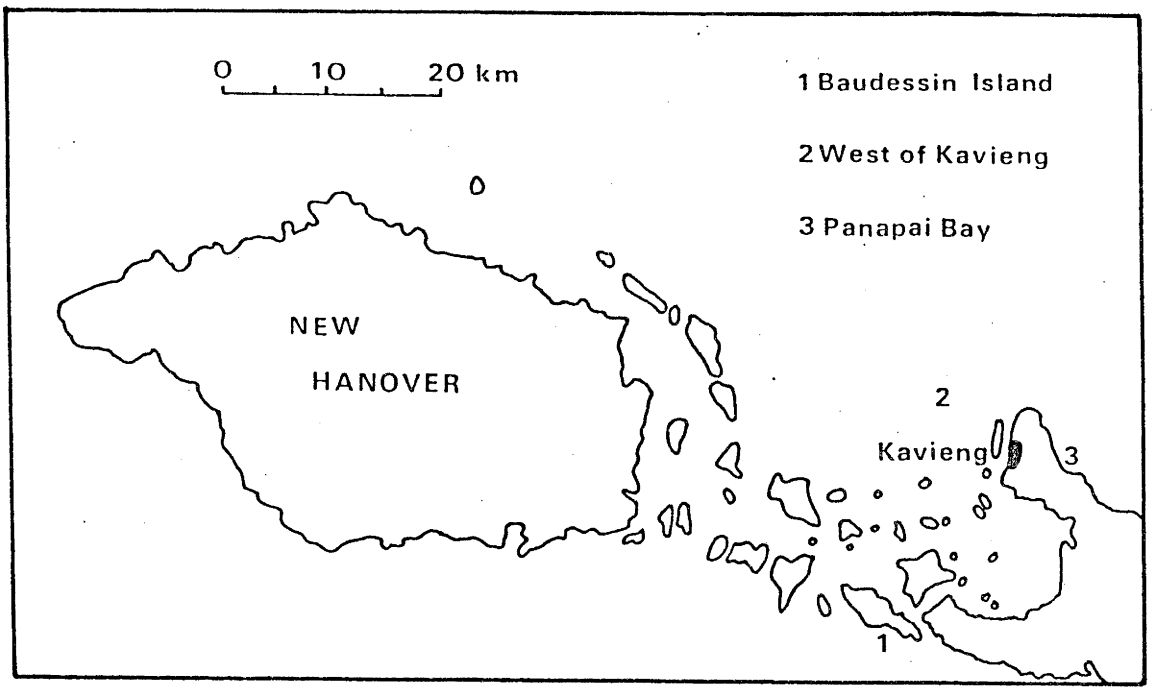


Fig. 16.1: The location of the study area. See Fig. 2.1 for the location of this area within P.N.G.

The results showed that there are significant differences in catch rates between the various depths and the various times of day. Some of these differences can be summarised as follows: the catch rate was lower at 110-140 and 230-260 m than at most other depth ranges and the catch-rate was higher between 1200 and 1800 h than during most of the rest of the day. There was also a significant interaction between depth and time of day with regard to catch rate. Some combinations of depth and time of day yielded increased catch rates.

There was a significant difference in average fish weight for different depths, while no significant difference could be found with regard to time of day. The average fish weight was significantly higher in deeper waters.

16.2 Analysis of species groupings

Catch data from the Kavieng deep water fishing programme have been analysed to determine possible species clusters confined to depth and time of the day, and to assess abundance and weight values in relation to depth and time of day for the five most common species.

The analysis of the species abundance and weight values revealed groupings of species. There are species confined to shallow and deep water respectively and there are species associated with either day or night fishing. There is, in general, a decreasing number of species with increasing depth (Fig. 16.2).

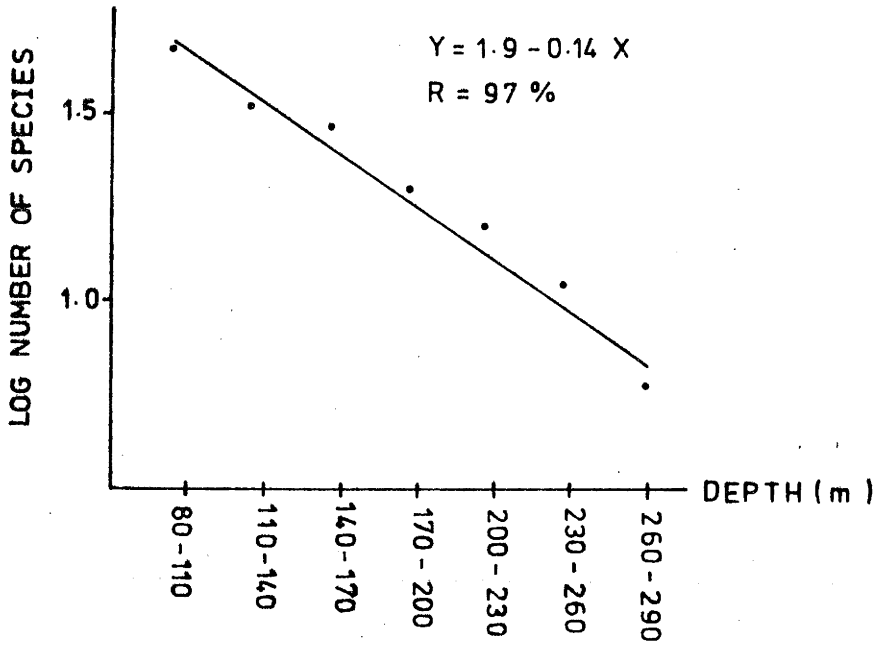


Fig. 16.2: The relationship between log species number and depth for deep water snapper catches.

16.3 Pinnacle Fishing near Kavieng

The objectives of this research are to assess the effects of sustained fishing pressure on deep water demersal reef fish stocks and to collect information which will allow an estimate to be made of the maximum sustainable yield of these stocks. It is unlikely that current levels of exploitation in P.N.G. are having a significant impact on deep water reef fish communities. However, it has been the experience of established deep water demersal fisheries elsewhere that a decline in catch rates soon accompanies sustained fishing pressure. In order to obtain an estimate of potential yields from deep waters, a programme of fishing isolated seamounts has been initiated. Assuming that fish stocks on seamounts are similar in abundance and composition to deepwater communities, results from this programme may provide information on the stability and size of deepwater reef stocks.

Some suitable pinnacles are located near Kavieng, and each will be fished once a week using droplines hauled by wooden handreels. Approximately 40 line hours of effort will be expended during each fishing trip. Catch rates will be analysed to determine the rate at which they decline with increasing effort.

17.0 BAIMURU ESTUARINE ARTISANAL FISHERY

The biological data collection programme which commenced in 1982 was completed in 1984. This data, which is still to be analysed, will form the basis for a full description of the fish stocks in the Baimuru estuarine fishery.

17.1 The fishery in 1984.

The total weight of landings recorded was 50.9 tonnes (Table 17.1) which was much lower than had been expected. Earlier in the year (January-February), there was a major break-down in the main storage freezer at Baimuru which caused some fishermen to stop fishing and many catches were sold to private buyers. There were no records kept of fish going to these outlets. The cyanide spillage early in June at the mouth of the Fly River also had its effect. Although there was no sign of physical effects on the fish in the Baimuru and Kikori area, the general panic caused by the media did much damage in reducing the commercial and subsistence fisheries. A public awareness campaign undertaken by the Division's staff explained the nature of cyanide poisoning and its effects on fish. This contributed to the recovery of the fishery in August (Table 17.2).

Table 17.1: Total landings (t) recorded in Baimuru and Kikori during 1979 to 1984.

Species	1979	1980	1981	1982	1983	1984
Barramundi	5.4	21.7	21.4	11.0	32.3	30.3
Threadfin	0.9	4.1	4.1	-	25.0	7.0
Jewfish	-	-	-	-	7.3	4.8
Catfish	-	0.2	3.0	6.3	-	4.1
Shark	1.8	5.8	7.8	17.3	22.1	2.4
Mixed fish	2.3	2.9	6.7	26.1	7.4	2.2
Total	10.4	34.7	43.0	60.7	94.1	50.9

17.2 Composition of the landings.

Barramundi has always been the major species landed because of its high value (90 toea kg^{-1}). Barramundi composed 59.7% of the fish landings in 1984 (Table 17.2). Because of the break down of the main freezer from January to March, only barramundi were purchased in large quantities due to limited storage space. Sharks caught were generally consumed in villages and only landed if caught the night prior to visiting the fish plant. Much of the fish not sold to the Baimuru fish plant was consumed by fishermen or sold in village markets.

Table 17.2: Landings (t) as recorded by Fisheries Research at Baimuru and Kikori Fish Plants during 1984.

Month	Barra	Threadfin	Jewfish	Catfish	Shark	Mixed-Fish	Total
January	1.2	0.9	0.1	0.2	0.3	0.1	2.8
February	0	0	0	0	0	0	0
March	3.2	1.3	0.8	0.5	0.6	0.3	6.7
April	2.2	1.2	0.4	0.3	0.2	0.2	4.5
May	2.5	1.7	0.5	0.5	0.2	0.2	5.6
June	2.3	0.1	0.4	0.3	0.02	0.089	3.2
July	1.3	0.043	0.5	0.5	0.032	0.069	2.4
August	4.0	0.042	0.5	0.6	0.3	0.24	5.7
September	3.2	0.025	0.4	0.4	0.2	0.24	4.5
October	6.0	0.6	0.7	0.4	0.2	0.5	8.4
November	2.2	0.3	0.2	0.3	0.2	0.1	3.3
December	2.3	0.8	0.3	0.1	0.1	0.2	3.8
Total	30.4	7.0	4.8	4.1	2.4	2.2	50.9
Percentage	59.7	13.8	9.4	8.1	4.7	4.3	100.0

17.3 Fishermen's catch per unit effort (C.P.U.E.)

Generally, there has been an increase in the C.P.U.E. (Table 17.3) during 1984 compared with previous years. Much of the increase could be attributed to improvements in fishing techniques such as the clearing of nets at regular intervals.

Table 17.3: Mean estimated catch rates achieved by fishermen (kg per standard net per night). A standard net is one of assumed area as indicated below in parentheses.

	Mesh Size (mm) (area of standard net, m^2)				
Month	178 (196.5)	152 (182.8)	127 (141.7)	102 (219.4)	76 (164.5)
January	16.1	9.3	3.8	8.1	24.1
February	N.a	N.a	N.a	N.a	N.a
March	16.5	8.6	11.6	20.5	14.7
April	20.9	6.8	10.4	13.1	-
May	15.2	8.7	18.7	16.4	22.2
June	6.9	6.0	2.9	5.5	8.3
July	3.6	5.2	5.6	6.1	10.4
August	12.7	6.1	9.6	7.6	3.0
September	14.3	77.5	71.4	5.3	-
October	15.7	9.8	17.2	8.3	16.3
November	39.8	17.3	25.7	4.6	4.6
December	17.4	-	13.0	19.7	-
Mean	16.3	15.5	17.3	10.5	13.0
Standard deviation	9.2	22.0	19.3	5.9	7.8

17.4 Future work.

Base-line data has been collected on the present fishery. Future work will concentrate on investigating fishing methods and improving catch rates. The International Fund for Agricultural Development (I.F.A.D.) has contracted a "master fisherman" who will be looking at experimental fishing in the villages in collaboration with Research and Surveys Branch in an attempt to increase catches with the minimum expense possible. Future work will also investigate the potential for small-scale prawn fishing in this area.

18.0 TROPICAL SPINY LOBSTER

The fishery for spiny lobster, Panulirus ornatus, was managed under an interim joint management agreement between Australia and Papua New Guinea during the critical migratory season in 1984. This was the first time a joint management plan had been implemented, and its success was important for the recovery of lobster stocks in Torres Strait and the Gulf of Papua. As a consequence of the joint management plan the fishery was not exploited by Australian prawn trawlers in Torres Strait and only a research quota was taken by one trawler in the Gulf of Papua.

In 1984, lobster stocks in Torres Strait appeared to be at or near their lowest ever level. This is reflected in the catch levels shown in Table 18.1. Total landings for the year were well below average with only 174 tonnes being taken. It is unlikely that the ten year average could have been maintained, even with unrestricted trawling.

Table 18.1: Total production figures (tonnes tail weight) for the various lobster fisheries. (Note: The Yule Island season normally runs from December of that year to March of the following year).

Year	Daru	Trawl	Yule Is.	Aust. Dive	Aust. Trawl
1973	19.8	218	6.8	100 e	N/A
1974	27.8	48	31.2	100 e	N/A
1975	23.0	80	5.2	100 e	N/A
1976	18.0	88	0.0	100 e	N/A
1977	27.0	49*	13.0	100 e	N/A
1978	15.4	70*	0.4	109	N/A
1979	20.5	0*	4.2	114	N/A
1980	35.0	221	0.5	115	8
1981	36.0	100	0.3	150	49
1982	38.0	149*	0.7	193	70
1983	32.0	42*	0.0	122	51
1984	31.8	10.4	0	130	0

* trawl quota in effect. e = estimate

18.1 Management steps taken.

During the joint fisheries technical meeting in November, 1983, a total allowable catch (T.A.C.) of 265 tonnes tail weight was recommended for the Torres Strait Protected Zone fishery, including the Gulf of Papua fishery. It became clear that stocks would not support this level of catch and a joint technical meeting was convened in June, 1984, which reduced the T.A.C. to 180 tonnes. Also during June, plans to control trawling of lobster during the migratory period were developed by Australia and P.N.G. and administered independently but with the support of the other country. On the Australian side, the plan called for all lobsters to be returned alive to the sea in an area which encompassed all known and significant trawling grounds in the Great Northeast Channel. This restriction was effective from 6th August until 14th October. On the Papua New Guinea side, prawn trawlers were required to return lobsters to the sea. However, there was provision between September 14 and November 25 for a single trawler to take 10 tonne in the Gulf of Papua for research purposes.

A three year moratorium on trawling has been imposed for lobsters in the Gulf of Papua following the 1984 season.

18.2 Research during 1984

In contrast to 1983, a large part of 1984 was spent doing field work. The tagging study of Podomaza reef, near Parama Island, was completed in February. A total of 515 lobsters were tagged of which the Branch recovered 25 and Parama fishermen another 38. A final analysis of the data has not been completed. Briefly, it was found that the population of breeding females on Podomaza reef during the 83/84 breeding season was small, in the order of a thousand or less. The population structure indicated that the lobsters remaining on the reef were probably residents which stayed behind while most of the population had migrated into the Gulf of Papua. The female to male ratio was 1:1.8 whilst in the Gulf of Papua migration in 1983 it was 1.54:1. The average size at breeding was approximately 95 mm carapace length which is considerably smaller than the mean size at breeding at

Yule Island. Local fishermen continued to return tagged lobsters during the 1984 migration. One tag was recovered in the Gulf of Papua. A single tag recovery, from the northern Warrior Reefs, of a female lobster tagged at Podomaza reef was the first south westerly movement documented from this area.

Joint tagging work was carried out with CSIRO, from May 26 to July 12 and from September 1 to October 2 in Torres Strait. The first trip was aboard a CSIRO chartered vessel and covered the reefs of western and southern Torres Strait. The programme had the following aims:

a. to determine the origin of migrating lobsters in the Great Northeast Channel, and in the Gulf of Papua,

b. to determine the southern boundary of the Torres Strait stocks,

c. to study recruitment into the Torres Strait dive fishery,

d. to study movements within Torres Strait.

A total of 2510 lobsters were tagged during this work. A total of 105 have been recaptured by divers in Torres Strait. None were recaptured in the Great Northeast Channel, although six lobsters caught in Great Northeast Channel during September appeared to have had a regenerating pleopod, which may have been clipped during tagging operations for moult stage determination.

The aim of this work was to:

a. investigate the migration of lobsters through the Great Northeast Channel and determine their ultimate destination.

b. investigate predation on lobster returned to the sea after trawling and to assess the adequacy of this management policy.

c. to recapture tagged lobster released during the earlier joint tagging programme.

The second joint tagging operation was undertaken aboard the P.N.G. research vessel FRV 'Melisa' in the Great Northeast Channel.

During September, 532 lobsters were caught by FRV 'Melisa' of which 527 were tagged. A further 1362 lobsters were received aboard 'Melisa' from commercial prawn trawlers and these were tagged. Two DPI staff from Canberra tagged another 657 lobsters aboard commercial trawlers bringing the total number tagged in the Great Northeast Channel to 2,546. Twelve of these tagged lobsters were recaptured by other trawlers in the Great Northeast Channel and another 36 were recaptured in the Gulf of Papua. This and the earlier joint work are to be reported on more extensively in the proceedings of the Torres Strait Fisheries Seminar to be held in Port Moresby, February 11-14, 1985.

During July and August, 573 lobsters were tagged near Daru, mainly in the Gimini Reefs, 15 nm west of Daru. These were tagged in an effort to establish the relative contribution of lobsters from P.N.G., and Australian waters, to the migration through the Gulf of Papua. Four of these tagged lobsters were re-captured in the Gulf of Papua. These were caught with lobsters tagged in the Great Northeast Channel indicating that large groups of lobsters are formed from smaller groups of lobsters coming from different parts of Torres Strait.

18.3 The Trawl Fishery

The ten tonne tail weight quota was given to a single trawler, 'New Marine 5', in order to recapture lobsters in the Gulf of Papua that had been tagged in Torres Strait. The 'New Marine 5' had a D.P.I. observer on board to record the numbers, weight, sex ratio and size frequency of the catch and ensure that all tagged lobster were reported. To increase the chances of sampling more than a single group of migrating lobsters, while catching the ten tonne quota, the vessel was restricted to fishing the area between 144°10'E and 144°40'E. Daily catches were also limited

to a maximum of 1 tonne. The 'New Marine 5' started trawling for lobsters on October 1 and finished on November 8. A total of 10.394 tonnes of tails were landed.

FRV 'Kulasi' caught a total of 6515 lobsters which were released after a sample was measured and sexed. Seven tagged lobsters were recaptured by 'Kulasi'.

18.4 Daru Fishery

Monthly C.P.U.E. figures are presented in Table 18.2. Total landings for the year were 31.8 tonnes (tail weight). The fishery continued as a canoe-dinghy fishery based at Daru. No freezer boats operated in the fishery at any time during 1984.

Table 18.2: Catch per unit effort data for the Daru diver fishery (kg tail weight per man year).

Month	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Jan	-	-	-	-	2.5	2.2	-	4.2	2.6	2.6
Feb	7.0	3.0	4.7	3.8	2.5	3.0	-	2.3	2.0	2.3
Mar	6.9	3.5	5.9	3.5	2.3	-	-	3.1	2.0	2.3
Apr	-	2.5	3.0	4.2	2.8	-	2.3	2.9	2.0	2.2
May	4.3	1.6	6.2	3.3	2.4	-	3.6	2.7	2.4	2.6
Jun	7.6	2.5	1.7	2.8	2.1	-	3.8	2.4	3.6	2.5
Jul	3.9	6.0	2.6	2.7	2.5	-	4.3	2.4	2.9	2.0
Aug	3.9	2.2	-	1.9	3.0	-	3.7	2.1	3.3	2.9
Sep	-	4.4	-	1.0	1.9	-	1.1	2.2	2.7	2.8
Oct	5.5	-	-	1.2	6.3	-	3.3	2.1	2.2	3.2
Nov	7.7	-	-	2.2	7.5	-	3.0	2.1	2.3	1.7
Dec	-	6.0	3.2	2.7	6.6	-	3.3	3.4	1.7	2.4
Mean	5.8	3.5	3.9	3.0	3.5	2.6	3.2	2.6	2.5	2.5

18.5 Yule Island Fishery

Landings at Yule Island were the poorest ever recorded. A total of five individual lobsters were brought to the Yule Lobster Enterprise factory. This was far lower than the previous four seasons for which estimates of landings are now available (Table 18.1). During a one week diving survey of reefs in the area in January a total of ten lobsters were observed. Reproduction during the year was probably lower than during any previous year.

An attempt was made to introduce a simple logbook for selected fishermen to record catch and effort. This was not successful for a variety of reasons, but primarily because of lack of interest by the fishermen during a season when catches were negligible.

18.6 Future Research

A presence will be maintained on Yule Island during early 1985 to recover as many tagged lobsters as possible and to continue earlier work on the fate of migratory lobsters.

The area of larval settlement and the source of juvenile recruits remains poorly understood. Providing a suitable vessel is available several research cruises will be made to the western Torres Strait to examine these areas as possible sites for larval settlement.

During the 1985 migration through Torres Strait (the Great Northeast Channel), another attempt to assess the effects of trawling on migrating lobsters will be made. This will focus on predation and behaviour after release and will be important in assessing the adequacy of the management policy of the release of live lobsters by trawlers. While this management policy appeared to work during 1984, it may be less adequate for 1985 and for future seasons when the size of the migration is expected to be larger.

Monitoring of the Daru fishery will continue.

19.0 BARRAMUNDI

The main fisheries are in the Fly River/Lake Murray system (the "inland fishery") and along the coast from the mouth of the Fly River to Boigu, west of Daru (the "coastal fishery"). Most of the coastal landings are taken only from areas between Sui (on the mouth of the Fly River) and Torro Pass where freezer boats normally anchor. Local people fish from canoes in areas between Kadawa and Tureture villages and land their catch directly to Western District Seafoods (W.D.S.F.). The freezer vessels operate out of Daru and their landings are processed by W.D.S.F. The freezer boats are equipped with nets and have processing facilities. In the inland fishery, vessels have the option to fish themselves as well as issue nets to local fishermen. In the coastal fishery, vessels do not normally engage in fishing.

The year used in the barramundi fishery is September 1st to August 31st. Landing data for 1971 to 1984 are given in Table 19.1.

Table 19.1: Annual landings of the Daru based barramundi fisheries (tonnes, whole weight).

Season	Total	Inland	Coastal
1971/2	394	146	248
1972/3	241	50	185
1973/4	284	96	187
1974/5	352	31	321
1975/6	179	28	151
1976/7	210	26	184
1977/8	170	55	115
1978/9	207	34	173
1979/80	221	70	151
1980/1	308	117	191
1981/2	328	121	207
1982/3	187	49	138
1983/4	139	107	32

The catch for the 1983/4 season was even lower than the previous year. The reason for this further decline was that only two freezer vessels operated and only one of these operated consistently. Both vessels operated in inland areas resulting in the lowest landings ever recorded in the coastal fishery. Local canoes landed 76% of the 32 tonnes recorded in the coastal fishery. The lack of freezer boats also hindered the operation of local canoe fishermen and much fish was rejected by W.D.S.F. due to spoilage.

Details of monthly landings during 1983/4 are provided in Table 19.2.

Table 19.2: Monthly landings of the Daru based barramundi fisheries during 1984 (tonnes, whole weight). (NF = no fishing).

Month	Total	Inland	Coastal
Jan	3.62	1.49	2.13
Feb	16.49	13.44	3.05
Mar	28.19	28.11	0.08
Apr	5.67	5.51	0.16
May	28.38	28.30	0.08
Jun	28.40	28.29	0.11
Jul	0.25	NF	0.25
Aug	1.81	NF	1.81
Sep	24.36	15.33	9.03
Oct	24.92	NF	24.92
Nov	22.15	NF	22.15
Dec	19.34	7.44	19.34

The coastal fishery is dependent on the spawning migration of barramundi which starts in September/October.

Catch/effort data could only be collected for the freezer vessels. The collection of catch/effort data for fishermen has proven to be difficult to collect. Analysis of the catch/effort data will continue into 1985.

20.0 TRADITIONAL FISHERIES STUDY

This study started in September, 1984, and will continue until April, 1985, in the coastal communities of the Western Province. The objectives are to obtain information on the traditional activities of the local people, in terms of their fishing areas and methods, and to obtain information on the importance of the various marine resources to their livelihood. The study relates directly to the Torres Strait Treaty which is due for implementation in 1985. Article 10 of the Treaty established a "Protected Zone", the principal purpose of which is "to acknowledge and protect the traditional way of life and livelihood of the traditional inhabitants including their traditional fishing and free movement".

The study area covers nineteen communities including Daru (Fig. 20.1) and five language groups are involved.

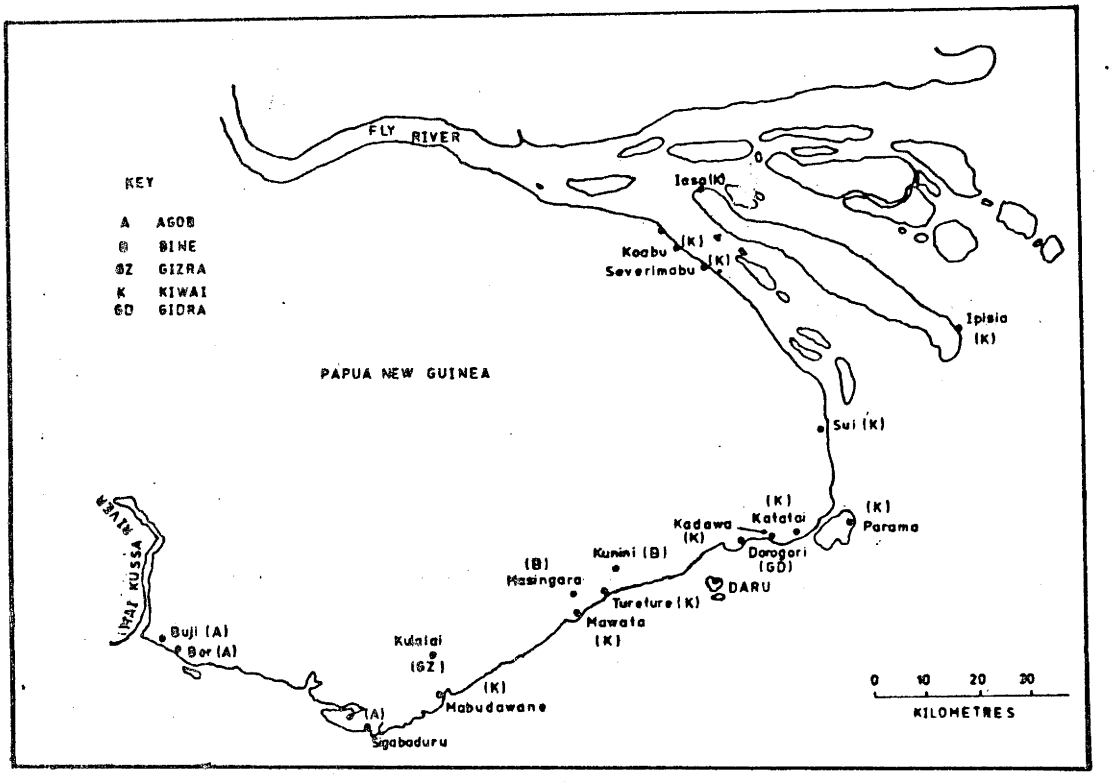


Fig. 20.1: The traditional fisheries study area showing villages and language groups.

Visits are being made to each community for periods of two to seven days and a large number of interpreters are being utilised. People are exhibiting a high level of knowledge of their reef systems and how their relationships with Torres Straits Islanders began. Historical records of fishing in this area are very limited but those that do exist provide valuable information.

The Treaty has important implications for the traditional inhabitants of the Torres Strait area. This survey will provide information enabling officials to properly implement the provisions of that Treaty. Full results will be analysed and presented during 1985.

21.0 OTHER SURVEYS

21.1 Fish and prawn survey of Milne Bay by FRV 'Melisa'

At the request of I.F.A.D., FRV 'Melisa', together with scientific staff, undertook a survey of the fisheries resources of Milne Bay during June, July and August, 1984. The project was funded mainly by the I.F.A.D. project.

The key purpose of the study was to investigate potential resources in the area that could be utilised by local fishermen with small craft. Two dories worked along-side 'Melisa' during the survey. Extensive sampling was done using a variety of gears. Unfortunately, only modest catches were achieved. This study was detailed in report number 84 - 11. The study provided information on which decisions for further investment in a fishery in the immediate region could be based.

Further surveys in Milne Bay Province are scheduled for 1985.

21.2 Lobster tagging work in the Torres Strait and Gulf of Papua

Both FRV 'Melisa' and FRV 'Kulasi' were involved in the major joint Australia/PNG lobster tagging project in the Torres Strait and Gulf of Papua during 1984. Essentially 'Melisa' was used to capture and tag lobsters in the Torres Strait, whilst 'Kulasi' was used to recapture tagged lobsters in the Gulf. Further details of this project are provided in section 18.0 of this annual report.

21.3 Survey of the Retail Price of Fish at Koki Market

A brief pilot survey of the retail price of fish was undertaken at Koki Market in November, 1983. Purchases were examined and weighed as private buyers left the market. All sampling was carried out between 16.00 and 17.30 hours on the 28th and 30th November. Fish sold averaged about K 1.64 per kg of whole fish. In P.N.G., small and medium sized fish are usually cooked whole. When cooked in this fashion, the total wastage is about 27%. The cost of fish consumed is, therefore, about K2.25 per kg. This

contradicts the popularly held view that fish at Koki is expensive. Such basic data on fish prices is important for planning purposes.

21.4 Deep - water Handreel Fishing at Kupiano

Between February and April, a fishing survey using deep-water handreels was undertaken at Kupiano, Central Province. The aims of this survey were to investigate deep-water fishing grounds in this area and to train local fishermen in the use of this method and in appropriate handling techniques, especially the use of ice.

FRV 'Maragili' was fitted with four deep-water reels, an echo-sounder and a deep-water anchoring system. Most of the fishing was carried out by local fisheries staff and local village fishermen, all relatively inexperienced in this fishing method. A fisheries technician supervised the fishing operations and gave the necessary training in finding and working the fishing grounds and the handling of the catch.

A total of 1,838 kg of fish was caught in 13 fishing trips. The catch per unit effort averaged 3.43 kg $line^{-1}$ h^{-1} and the average total catch per trip was 141 kg. Catch rates varied greatly, as did species composition, and both were related to depth and/or location.

A summary of the catch composition is given in Table 21.1. Pink Snapper and Red Emperor made up over three quarters of the total catch of good quality fish. Table 21.1 also shows the depths at which the most plentiful species were caught. In conclusion, target-fishing for either red emperor or pink snapper is feasible at the appropriate depth ranges.

Table 21.1: The catch composition of fish caught by deep-water handreels near Kupiano together with their depth ranges (sample size = 1540 kg).

Fish species	Number caught	Total wt. (kg)	% of Catch by weight	Depth-range
Pink Snapper (*Pristipomoides multidens* and *P. filamentosis*)	280	602.1	39.1	60-240 68% at 160-180
Red Emperor (*Lutjanus malabaricus*, *L. timorensis* *L. erythroperus*)	283	595.7	38.8	40-170 46% at 40-80
Golden Bream (*Wattsia mossambica*)	26	44.2	2.9	110-210 58% at 110-120
Stones Snapper (*Paracaesio stonei*)	28	40.4	2.6	100-210 77% at 160
Ruby Snapper (*Etelis carbunculus*)	7	38.1	2.5	100% over 200
Others: 20 species each comprising <2% by wt.	78	215.0	14.0	-----

A breakdown of the gilled and gutted weight of the main species caught in a sample of 1320kg is given in Table 21.2. As small fish are more easy to sell locally than larger fish, the size composition of the deep-water catch at Kupiano is well suited to the local market. As reported in the 1983 Annual Report large ruby snapper make up a high proportion of the catch around Port Moresby and this can give rise to marketing problems. There is not yet a sizeable market established in P.N.G. for high quality fillet other than barramundi.

Table 21.2: Weight gradings of the five most common species landed at Kupiano from deep-water handreels (sample size = 1320 kg).

Fish species	Number caught	Percentage by weight in each range (kg gutted, whole)			
		<2.5	2.5-5.0	5.1-10	>10
Pink Snapper	280	48	52	0	0
Red Emperor	283	58	39	3	0
Golden Bream	26	92	8	0	0
Stones Snapper	28	83	17	0	0
Ruby Snapper	7	15	26	0	59
Total	624	54	43	1.3	1.7

Towards the end of the survey several local fishermen fitted reels to their own double canoes and some achieved good catches. Most of these canoes are suitable for working only in relatively calm conditions. However, their interest in this alternative fishing method has continued. The quantity of fish handled by Kupiano Fisheries Station doubled in 1984 due to the landings of deep-water snapper.

The fishermen who participated in the survey were interested in the prospects of a new resource because they considered that their usual grounds were being overfished. Interest in the method has been sustained because catch rates have remained relatively high, the method requires less effort in terms of manpower, and the bulk of the species caught are easily marketed and command good prices. In addition, improvements in handling and transportation using ice-boxes have opened-up new markets in Port Moresby.

21.5 Small - scale Prawn Trawling in Western Province

The feasibility of village-level beam trawling was examined during a pilot study between 8-27th November, 1984. Technical assistance to the P.N.G. Fisheries Division was provided by D.P.I., Queensland and was financed by the South Pacific Commission. Local staff were instructed in the construction and the use of beam trawls.

Technical reports have been prepared by D.P.I. Queensland and the P.N.G. Fisheries Research and Surveys Branch. These will be available during 1985 and will give full details of the gear, vessels and methods used and the results obtained. An 11 m local sailing canoe, a 4.7 m aluminium dinghy powered by a 35 hp outboard motor and a 7.3 m work boat (dory) powered by a 30 hp diesel inboard were used to tow the nets. Due to the time involved in the construction of nets and the training of staff, a relatively small amount of fishing was carried out. However, the results were encouraging.

A total of 17.4 hours were spent trawling during which time 59 kg of prawns were caught, mostly Bananas (Penaeus merguiensis) of export quality size. The catch rates obtained by the different vessels are given in Table 21.3. A large proportion of the catch was composed of coral prawns , Parapenaopsis sculptilis, and endeavour prawns, Penaeus endeavouri, which are only acceptable on the local market. The value of the catch to the fishermen averaged K1.71 kg^{-1}.

Table 21.4 illustrates that, due to higher catch rates and savings in fuel, the sailing canoe was much more economical to operate. The sailing canoes were able to operate in shallow water (about 0.5 m depth) where prawns appear to be more abundant and they have no propellers which might tend to scatter the prawns.

Table 21.3: Catch rates achieved by the various vessels during the survey.

Vessel	Hours Trawled	Catch (kg prawn)	Catchper unit effort (kg h^{-1})
Week 1.			
Sailing Canoe	7.67	36.43	4.75
Dinghy (35 hp outboard)	2.5	7.7	3.08
Dory (30hp diesel)	1.6	5.3	3.31
Week 2. (after heavy rain)			
Sailing Canoe	1.67	1.55	0.93
Dory	4.0	8.1	2.02
Total	17.44	59.08	

Table 21.4: Some cost versus income analyses for three types of vessel used during the first week of the survey.

Vessel	Fuel used when trawling (l h^{-1})	Fuel Costs (Kina h^{-1})	Gross Income (Kina h^{-1})	Income less fuel costs (Kina h^{-1})
Sailing Canoe	Nil	Nil	8.12	8.12
Dinghy (35 hp outboard)	4.44	3.55	5.26	1.71
Dory (30 hp diesel) (estimate)	4.0	2.08	5.66	3.58

The results indicate the possibility of increasing landings of prawns in Daru by using low technology beam trawling and by utilising local sailing canoes, provided that the fish plant can handle the produce. The main constraint on this artisanal prawn fishery is the lack of skilled technical personnel in the Province to co-ordinate the work, and further input is required in this field.

21.6 Survey of the fishing craft of Milne Bay.

The International Fund for Agricultural Development (I.F.A.D.) is currently providing the P.N.G. Government with a loan to assist with the development of small-scale fisheries in Milne Bay Province and in parts of the Gulf of Papua. The I.F.A.D. Programme commissioned a consultant naval architect (Oyvind Gulbrandsen) in late 1984, to examine the fishery related craft in this area and to recommend improvements that could be made to existing craft. The conclusions of the survey are very relevant to the Branch's vessel appraisal programme. Although they refer mainly to the Gulf and Milne Bay Provinces, certain points are applicable to several other areas of P.N.G. A summary of the conclusions and recommendations is given below.

Where a fish marketing system is established that will justify an increased investment in craft, engines and fishing gear, investment increments should be small to encourage labour intensive, as opposed to capital intensive, fishing operations. Development should be aimed at fishing grounds not presently reached by paddling canoes. In much of Milne Bay Province this will involve increasing the mobility of canoe operators by using engine power. Non-motorised canoes can be towed by motorised vessels (as at present) and/or the larger canoes could be motorised.

The use of high-powered outboard motors, in the 15 to 25 hp range, for fishing boats is no longer viable except in urban areas which command high fish prices. This situation has arisen over the last few years because of the rapid increase in fuel prices , which has out-stripped the rate of increase in fish prices. For fishing methods not requiring high speed (and where

ice and ice boxes can be carried) outboard motors which produce around 4 hp at the propellor shaft are sufficient to power even large canoes provided the right propeller is selected to prevent overloading of the engine. This size of outboard represents the cheapest and simplest way of extending the operating range of the present canoes.

The survey showed that, in some areas, an increase in the seaworthiness of the present types of outrigger canoe is required. This can be done by increasing freeboard and providing a more buoyant outrigger. The survey recommended that prototypes be built to test out various approaches. Detailed plans of recommended improvements are being prepared, and are due early in 1985.

When a canoe with more of a transport function is required, the larger power requirement will favour a diesel engine rather than a petrol outboard motor. The type of diesel longtail unit currently under trial in the Sandskipper catamaran, is considered to be the most suitable. This type of engine can be mounted on larger canoes, fitted with an improved high-buoyancy outrigger, and on double canoes.

Some areas of P.N.G. are currently experiencing increasing difficulties in the supply of suitable logs for large transport/fishing canoes. Alternative ways of making planked plywood canoes in the village are possible and these should be explored. These could be either single outrigger canoes or double hulled craft powered by the diesel longtail unit mentioned above. All new craft tested should have good sailing performance for fuel economy and in case of engine breakdown. Prototype craft should be built to evaluate the new types of plank/plywood alternatives under a closely monitored vessel appraisal programme.

In relation to the existing 7 to 8m diesel launches (dories) currently operating in P.N.G., transport costs could be reduced per kilogramme (assuming capacity loads) by about 50% provided an improved design of longer vessel, up to 10m in length, is utilised. Such a vessel would require only the same size of

engine as the existing smaller craft provided that the propellor is correctly matched with the hull configuration and engine horse power.

A further recommendation was that a boatbuilder should be recruited for a period of two years to train extension workers in these new techniques. These people should, in turn, train the existing village boatbuilders in the Milne Bay Province.

22.0 PUBLICATIONS

The following are publications from staff of the Branch that were produced or in press during 1984:

COATES, D. (1984). An ulcer-disease outbreak amongst the freshwater fish population of the Sepik River system, with notes on some freshwater fish parasites. Department of Primary Industry, Fisheries Research and Surveys Branch, Report **84-02**, 21pp.

COATES, D. (1984). Fish yield estimates for the Sepik River floodplain. Department of Primary Industry, Fisheries Research and Surveys Branch, Report **84-09**, 22pp.

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RICHARDS, A. H. and TATAMASI, M. (1984). Evaluation of deep water bottom-set longline systems near Kavieng, New Ireland Province, Papua New Guinea. Department of Primary Industry, Fisheries Research and Surveys Branch, Report **84-15**, 24pp.

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RICHARDS, A. H. and WRIGHT A. (1984). Reef fishing in the Tigak Islands, New Ireland Province. Harvest, **10**(1), 15-20.

SUNDBERG, P. and RICHARDS, A. H. (1984). Deep water handlining in Papua New Guinea: An ordination study of species assemblages. Department of Primary Industry, Fisheries Research and Surveys Branch, Report **84-17**, 23pp.

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WRIGHT, A. (1984). Marine resource use in Papua New Guinea: Can traditional concepts and contemporary development be integrated? In: 'Traditional Management of Coastal Systems', Ruddle, K. and Johannes, R. E. (eds.). Proceedings of the UNESCO workshop, Jakarata, 5-9 December, 1983.