

# The Barramundi in New Guinea Waters.

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## Summary.

**B**ARRAMUNDI is the most abundant large commercial species in the waterways of Papua west of Port Moresby and it reaches maximum abundance in rivers, swamps and lagoons discharging into the Gulf of Papua where it is the dominant species. The Fly River and its tributaries support the largest stocks and barramundi have been recorded 600 miles above salt water and 450 miles above tidal waters.

The species is restricted to rivers discharging into the Southern Coastal Plains of Papua. It is a catadromous fish and spawning occurs from November to early March in the back waters of bays and estuaries out of the main run of the current, when very large catches are made. Subsequent to spawning the bulk of the stock moves away from coastal waters into brackish and fresh water. Small coastwise migrations occur during spawning and during flooding when the salinity of the sea water is reduced.

Male barramundi mature at a smaller size than the female and the sex ratio in favour of the male is approximately two to one. The male fish appears to be the more active.

Set mesh nets made from synthetic twines are highly satisfactory for the capture of this species. The more saline the water the more powerful is the fish and the stronger the net required for its capture. In fresh water the fish are much less active and light gill nets are sufficient.

## Introduction.

The occurrence of barramundi or giant perch [*Lates calcarifer* (Bloch)] in the estuaries and swamps on the southern coast of Papua has long been known to the local fishing population who call it by the Motu name of "Anama" meaning "Chief".

However, it was not until after intensified investigations by the Division of Fisheries of the Department of Agriculture, Stock and Fisheries, that a satisfactory understanding of the distribution, abundance and biology of the species was obtained. The investigations commenced in 1957 and consisted of fishing surveys in remote areas, and concentrated fishing at shore bases.

The majority of the rivers of Papua and New Guinea have been fished with strong mesh nets, and biological examination of netted barramundi was carried out in all cases. Marking of the species with opercular gill tags has also been commenced. Although to date no tagged fish have been captured and the movements and abundance of the species in the huge system of waterways in the Western and Gulf Districts are not fully understood, it is considered that the findings to date should be put on record and an interim report is justified.

## Occurrence.

Barramundi occur in all the rivers and estuaries of the Western and Gulf Districts and in most of the waterways of the Central District. It has been recorded at the eastern extremity of the Central District at Loupom (longitude 149 degrees 25 minutes East) but as yet has not been taken in any of the rivers discharging further east. Barramundi have not been taken in any of the rivers of the New Guinea mainland nor in any of the offshore islands.

In the Western District barramundi have been taken in small tidal creeks on the southern side of Bristow Island, eight miles offshore, and above Kiunga, approximately 600 miles from the mouth of the Fly River and 450 miles above tidal waters. Large numbers have also been taken in Lake Murray, 300 miles from the Fly River mouth.

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### *Distribution and Abundance.*

The barramundi are not evenly distributed throughout the waterways of the Southern Coastal Plains of Papua. Their abundance in part depends on the area of freshwater swamps, lagoons and rivers available for colonization. This freshwater acreage is influenced by the physiography of the coastline, the rainfall and the amount of run-off.

The southern coastal area of Papua can be divided into the Daru and Moresby coasts.

The Daru coast extends from the border of Papua and Netherlands New Guinea to the head of Deception Bay. It includes the Oriomo plateau which extends from the border to the Fly River and the Delta Embayment which extends from the Fly to the head of Deception Bay. The Moresby coast extends from Deception Bay eastwards almost to the China Straits. (The Resources of the Territory of Papua/New Guinea, 1951.)

The Delta Embayment is composed of the vast deltaic plains of the Fly, Strickland, Aramia, Bamu, Aworra, Turama and Purari Rivers. The various rivers have associated with them extensive systems of swamps and lagoons—Lake Murray which is 40 miles long and 3-4 miles wide is a huge lagoon draining into the Strickland River. This vast deltaic region, dominated by the Fly River, has formed one of the largest estuaries in the world. The lower reaches of the rivers are exceptionally low lying and there are great areas of mud. Nipa and sago are the dominant plant species above the mangrove areas at the mouth.

The catchment area and the rainfall of the Oriomo River are less than those of the Delta Embayment and the extensive system of swamps, lagoons and estuaries has not developed. The Moresby coast consists mainly of rocky headlands alternating with sandy beaches; the mountain range closely approaches the coastline and the rivers are generally fast flowing.

Barramundi are very plentiful and are the dominant large inshore and river species from the Netherlands New Guinea border to the head of the Gulf of Papua. It is in the Delta Embayment, particularly the Fly River, its tributaries and associated lagoons and swamps, that greatest numbers are found. The smaller rivers of the Oriomo Plateau support lesser numbers of barramundi.

Barramundi are generally not plentiful along the Moresby coast but some fair catches have been recorded at Abau, Marshall Lagoon, Galley Reach, Hall Sound, Kerema and Port Romilly where the estuaries are large and there is a constant discharge of fresh water (Table I).

In estuaries of similar size and discharge best catches have been recorded where the tidal variation is greatest. This increases from east to west and reaches 13-ft. 6-ins. at Daru. It is interesting to note that barramundi have not been recorded in the waterways of the Sepik District where the tidal variation is very slight.

### *Habitat of the Fish.*

The barramundi is found in salt, brackish and fresh water. Except during spawning movements, it is rarely taken in waters where the salinity exceeds 30 parts per 1,000. The major part of its life is spent in brackish and fresh water in rivers, lagoons and swamps, but during the spawning season the adult barramundi move down to coastal waters where they make small coastwise migrations. Some immature fish may also be taken in coastal waters during this period but apparently the majority remain in the freshwater swamps and lagoons.

Barramundi taken in the upper reaches of the rivers have a darkish colouration and they are sluggish and prefer slow moving or stagnant waters. The body cavities contain large amounts of fatty tissue and the flesh from such barramundi has a distinct muddy or earthy taste. In contrast, the fish taken near the mouths of rivers and in coastal waters have yellowish fins, are very active and the flesh is of first class quality.

### *Movements.*

During both spawning and non-spawning movements the bulk of the netted catch is taken during neap tides in very shallow water. At high water during the spawning season the barramundi move out from the mouths of the rivers and feed actively amongst the mangroves which are usually exposed at low water.

Adult fish approaching spawning occur in greatest numbers near shallow muddy outcrops in the back waters of bays or near the mouths of certain rivers. Examples of such rivers are the Aroa River, Keuru Creek, and the Oriomo River which are situated some distance from



Table I.  
Some Daily Barramundi Catches  
From Netting Surveys in Papuan Waters.

| Date.      | Locality.       | District. | Catch lb. | Nets used. |                  | Remarks.                                                                    |
|------------|-----------------|-----------|-----------|------------|------------------|-----------------------------------------------------------------------------|
|            |                 |           |           | yds.       | In. mesh         |                                                                             |
| 12.1.1959  | Aroa River      | Central   | 153       | 60         | x 7              | Snagging during day.                                                        |
| 1.9.1959   | Marshall Lagoon | "         | 269       | 120        | x 7              | Overnight set.                                                              |
| 4.9.1959   | " "             | "         | 152       | 120        | x 7              | " "                                                                         |
| 13.12.1959 | " "             | "         | 163       | 200        | x 7              | " "                                                                         |
| 15.1.1960  | " "             | "         | 146       | 120        | x 7              | " "                                                                         |
| 7.5.1960   | " "             | "         | 150       | 200        | x 7              | " "                                                                         |
| 17.6.1960  | Katatai Creek   | Western   | 402       | 100        | x $4\frac{1}{2}$ | Net set for 2 hours across tidal creek                                      |
| 2.8.1960   | Marshall Lagoon | Central   | 134       | 120        | x 7              | Overnight set during minor flood                                            |
| 13.8.1960  | Binature River  | Western   | 347       | 120        | x 7              | Overnight set.                                                              |
| 14.8.1960  | Marshall Lagoon | Central   | 216       | 120        | x $4\frac{1}{2}$ | All fish taken in 7 inch net.                                               |
| 26.10.1960 | Oriomo River    | Western   | 287       | 120        | x 7              | Overnight set.                                                              |
| 12.11.1960 | " "             | "         | 364       | 120        | x $6\frac{1}{2}$ | " "                                                                         |
| 22.11.1960 | " "             | "         | 1,000     | 120        | x 8              | " "                                                                         |
| 24.11.1960 | " "             | "         | 1,647     | 120        | x $6\frac{1}{2}$ | Snagging during day—13 barra. Daytime set—39 barra. Overnight set—21 barra. |
| 27.11.1960 | Hall Sound      | Central   | 175       | 120        | x 7              | 109 barramundi taken, 14 during daytime.                                    |
| 28.11.1960 | Oriomo River    | Western   | 2,440     | 120        | x 7              | Overnight set.                                                              |
| 6.12.1960  | " "             | "         | 1,325     | 120        | x $4\frac{1}{2}$ | 126 barramundi taken overnight.                                             |
| 9.12.1960  | " "             | "         | 2,029     | 120        | x 8              | Overnight set.                                                              |
| 31.12.1960 | " "             | "         | 561       | 120        | x 8              | " "                                                                         |
| 4.1.1961   | " "             | "         | 800       | 120        | x 8              | " "                                                                         |
| 6.1.1961   | " "             | "         | 1,183     | 120        | x 8              | " "                                                                         |
| 22.2.1961  | " "             | "         | 900       | 120        | x $6\frac{1}{2}$ | " "                                                                         |
| 23.2.1961  | " "             | "         | 528       | 120        | x 8              | " "                                                                         |
| 7.3.1961   | " "             | "         | 1,366     | 120        | x $6\frac{1}{2}$ | 32 barra. taken during day set. 32 taken during night set.                  |
| 9.3.1961   | " "             | "         | 914       | 100        | x 7              | 30 barra. taken during day set. 42 taken during night set.                  |
| 11.3.1961  | " "             | "         | 170       | 170        | x 8              | Overnight set.                                                              |
| 21.6.1961  | Lake Murray     | "         | 635       | 50         | x 7              | " "                                                                         |
| 24.6.1961  | June River      | "         | 636       | 50         | x 7              | " "                                                                         |
| 28.6.1961  | Lake Murray     | "         | 1,066     | 50         | x 7              | " "                                                                         |
| 29.6.1961  | " "             | "         | 618       | 50         | x 7              | " "                                                                         |
| 13.7.1961  | " "             | "         | 698       | 50         | x 7              | " "                                                                         |
| 15.8.1961  | Balimo          | "         | 624       | 100        | x 8              | " "                                                                         |
| 16.8.1961  | " "             | "         | 559       | 100        | x 8              | " "                                                                         |
| 20.8.1961  | " "             | "         | 472       | 100        | x 8              | " "                                                                         |



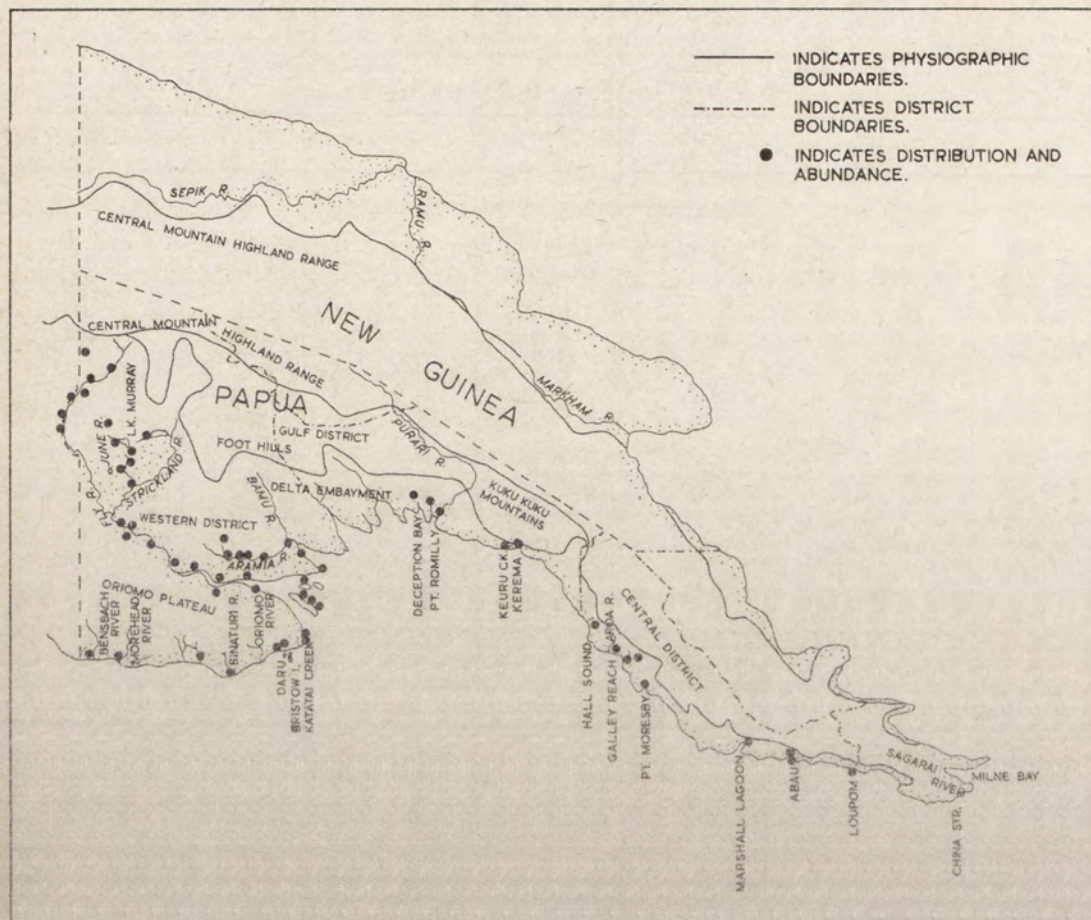


Figure 1.—Distribution of Barramundi in Papua.

the usual habitat of all the adult fish. This coastwise migration associated with spawning takes place against the set of the current.

#### Size.

Due to the high selectivity of mesh size of the nets used, it is not possible to give average sizes for barramundi in particular waters. In August, 1960, one set in a tidal creek near the mouth of the Oriomo River with a  $4\frac{1}{2}$  inch mesh net yielded 84 fish weighing 402 lb. At the mouth of the Oriomo River during the spawning run, three nets with mesh sizes of 6 $\frac{1}{2}$ , 7 and 8 inch captured 308 fish weighing 5,087 lb. and in Lake Murray the weight of 234 fish taken with a 7 inch net was 4,219 lb.

#### Biology.

During the period of investigation 1,261 barramundi taken by the Division of Fisheries were examined for the following biological factors—total weight, cleaned weight, total length, standard length, sex, gonad stage and stomach contents. In the majority of cases scale samples were also collected. The fish were captured in a wide variety of habitats over an area extending from the Netherlands New Guinea border to the eastern extremity of its range.

##### (a) Description.

(i) *Size*.—The bulk of the catch to date falls within one size group from 14 to 19 pounds. The smallest barramundi taken weighed less than



1 lb. and the largest 54 lb. although there are reports of much bigger fish having been caught on hand lines and by spearing. With stronger and larger mesh nets bigger fish will undoubtedly be captured.

(ii) *Colour and shape*.—Owing to the diversity of habitats of the barramundi, well marked differences in colour and shape are found and these are particularly noticeable when specimens from salt and freshwater are compared. In Thailand these two types are known locally by different names (Yingthavorn 1951). It is therefore not surprising that a large number of synonyms for this species has been listed (Fowler & Bean 1930). The description given by Weber & de Beaufort (1929) and by Dunstan (1959) is applicable to Papuan specimens. However, the following differences and additional points have been noted for both Papuan and Australian specimens :—

1. Rudimentary teeth are also present on the third and fifth basibranchials and in patches on the pharyngobranchials.
2. In larval and immediate post larval fry up to 4 inches long the maxillary reaches only to the vertical through the anterior border of the eye.
3. First year fish are characterized by a white stripe running antero-posteriorly from the tip of the snout on the dorsal surface, combined with a blotchy appearance on the flanks. This has been observed only in fish from fresh and brackish water. The presence of the white stripe is not permanent, the normal colour of the dorsal surface being dark.

(b) *Age Determination and Growth Rates*.

(i) *Petersen's method*.—The samples used in this investigation were based upon catches with mesh nets. In length, frequency, and distribution studies, multimodal curves of high variability are obtained, and inaccurate conclusions may be expected owing to the selective actions of these nets.

The action of a net of specified mesh depends on :—

- (a) the size and abundance of the population being sampled,
- (b) the strength of the mesh, and
- (c) the position of the net, whether sunken or floating.

The strength of the nets used for the capture of barramundi is related to the size of the mesh, the larger the mesh the stronger the net. The effectiveness of a net of specified mesh and strength is related to locality and salinity, the less saline and the cooler the water, the weaker is the fish and the more effective is the net.

Length frequency studies based on mesh net catches for approximately 2,000 barramundi taken over the whole of its Papuan range do not reveal any progression of monthly modes. Fifty per cent. of the total length of all barramundi taken fell within the 33 to 36 inch group. This was due to the selective action of the mesh, the sizes of which were 6½, 7 and 8 inches.

(ii) *Tagging*.—To date 300 barramundi (average length 33 inches) have been marked with opercular type clip tags over an area extending from the Bensbach River near the Netherlands New Guinea border to the Aramia River, including specimens taken in Lake Murray, Balimo and the Fly River. This work was commenced in early 1961 and is continuing. No tags have yet been returned.

(iii) *Scale reading*.—Representative scale samples have been collected from specimens captured. The structure of the individual scale, and scale anuli or breaks, are similar to those of *Mugil cephalus*, as described by Kesteven (1942). No determination of growth rates from scales has been attempted to date.

(c) *Spawning Season and Sex Ratio*.

(i) *Spawning*.—In Table II the seasonal distribution of gonad stages for 765 barramundi of both sexes is given, based on standard mullet maturation classification (Kesteven 1942) and determined by visual observation. Although in May, September and December, no fish were examined, it can be seen that maturation of the gonads commenced in August and spawning in November. In January and March near-spawning and spawning fish were taken in the backwaters of bays and estuaries, and in April, although only six fish were examined, the highest percentage of spent fish (Stage 8) was taken. The spawning season thus commences in November and lasts until March when the spent fish commence moving up-river away from coastal waters.

On the 13th February, 1960, a beach seine hauled in Marshall Lagoon took an 18½ lb. running ripe female barramundi during the full



Table II.  
Seasonal Distribution of Gonad Stages.

|           | I.  |      | II.   |       | III.  |       | IV.  |      | V.   |      | VI.  |      | VII. |      | VIII. |      | Total. |     |
|-----------|-----|------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|-------|------|--------|-----|
|           | M.  | F.   | M.    | F.    | M.    | F.    | M.   | F.   | M.   | F.   | M.   | F.   | M.   | F.   | M.    | F.   | M.     | F.  |
| January   | No. | 9    | 11    | 2     | 5     | 6     | 12   | 5    | 6    | 8    | 7    | 6    | 7    | 7    | 8     | 12   | 67     | 55  |
|           | %   | 16.4 | 16.4  | 3.5   | 7.4   | 11.0  | 17.9 | 9.1  | 9.0  | 14.4 | 10.5 | 11.0 | 10.5 | 12.6 | 11.9  | 22.0 |        |     |
| February  | No. | 1    | 3     | 2     | 4     | 1     | 4    | 1    |      |      |      |      |      |      | 3     | 8    | 7      | 20  |
|           | %   | 14.3 | 15.0  | 28.6  | 20.0  | 14.3  | 20.0 | 5.0  |      |      |      |      |      |      | 42.8  | 40.0 |        | 27  |
| March     | No. |      | 32    | 12    | 12    | 6     | 14   | 8    | 11   | 7    | 2    | 1    | 2    | 7    |       | 1    | 73     | 42  |
|           | %   |      | 43.9  | 28.5  | 16.4  | 14.3  | 19.1 | 19.0 | 15.1 | 16.7 | 2.7  | 2.4  | 2.7  | 16.7 |       | 2.4  |        | 115 |
| April     | No. | 1    |       |       |       |       |      | 1    |      |      |      |      |      |      | 1     | 3    | 2      | 4   |
|           | %   | 50.0 |       |       |       |       |      | 25.0 |      |      |      |      |      |      | 50.0  | 75.0 |        | 6   |
| May       | No. |      |       |       |       |       |      |      |      |      |      |      |      |      |       |      |        |     |
|           | %   |      |       |       |       |       |      |      |      |      |      |      |      |      |       |      |        |     |
| June      | No. |      | 125   | 3     | 1     |       |      |      | 1    |      |      |      |      |      | 1     | 10   | 128    | 13  |
|           | %   |      | 97.6  | 2.3   | 0.8   |       |      |      | 0.8  |      |      |      |      |      | 0.8   | 7.7  |        | 141 |
| July      | No. |      | 79    | 14    |       |       |      |      |      |      |      |      |      |      |       |      | 79     | 14  |
|           | %   |      | 100.0 | 100.0 |       |       |      |      |      |      |      |      |      |      |       |      |        | 93  |
| August    | No. |      |       |       | 10    | 8     |      |      |      |      |      |      |      |      |       |      | 10     | 8   |
|           | %   |      |       |       | 100.0 | 100.0 |      |      |      |      |      |      |      |      |       |      |        | 18  |
| September | No. |      |       |       |       |       |      |      |      |      |      |      |      |      |       |      |        |     |
|           | %   |      |       |       |       |       |      |      |      |      |      |      |      |      |       |      |        |     |
| October   | No. | 10   | 7     | 18    | 15    | 6     | 7    | 1    | 5    |      |      |      |      | 1    |       | 1    | 35     | 36  |
|           | %   | 28.5 | 19.5  | 51.4  | 41.4  | 17.3  | 19.5 | 2.8  | 14.0 |      |      |      |      | 2.8  |       | 2.8  |        | 71  |
| November  | No. | 38   | 5     | 20    | 3     | 23    | 6    | 15   | 5    | 18   | 9    | 3    |      | 1    |       |      | 133    | 39  |
|           | %   | 28.4 | 12.7  | 15.0  | 7.7   | 17.2  | 15.2 | 11.2 | 12.7 | 21.0 | 6.7  | 7.7  |      | 2.6  |       |      |        | 172 |
| December  | No. |      |       |       |       |       |      |      |      |      |      |      |      |      |       |      |        |     |
|           | %   |      |       |       |       |       |      |      |      |      |      |      |      |      |       |      |        |     |



moon period. The eggs were small (0.7 to 0.8 mm. in diameter) with a single oil globule 0.3 mm. in diameter and were demersal. There were no markings on the egg membrane and the perivitelline membrane was small or non-existent (A. M. Rapson).

There was no sign of gonad development in 128 adult specimens examined in Lake Murray. All mature fish and fish approaching maturity were taken in brackish, tidal and coastal waters. In some areas, particularly Balimo, a number of the lagoons are connected with rivers discharging into coastal waters only during exceptionally heavy wet seasons. During a poor wet season there may be insufficient flood water to release land-locked barramundi and consequently the number of spawners is less. A delayed wet season will result in a prolonged spawning season.

(ii) *Size at Maturity*.—The smallest male barramundi taken with enlarged gonads weighed 8 lb. and the smallest female 10 lb. Dunstan (1959) working on Queensland specimens and Yingthavorn (1951) in Thailand recorded similar figures.

(iii) *Sex ratio*.—Of 881 barramundi for which sex could definitely be determined, 619 were males and 262 were females, giving a ratio of 2.3 to 1 in favour of the male fish. The numbers and proportions for both sexes taken in brackish, salt and fresh water are given in Table III. The male barramundi appear to be the more active, the ratio of males to females moving the 300 miles to Lake Murray being approximately 11:1. In addition, at the commencement of the spawning season, the ratio of males to females was 3.4:1. During the spawning season this ratio was approximately equal, indicating that a greater proportion of females remain

in coastal waters for a longer period after spawning. Subsequent to spawning the sex ratio of adult barramundi was approximately equal.

(d) *Feeding Habits*.

Barramundi are carnivorous and predacious throughout the whole of their life cycle. Generally, they will prey on any fish or crustacean species smaller than themselves. Detailed stomach content analysis is often difficult owing to disgorging of ingested food after capture.

In Table IV the stomach contents of 1,001 barramundi are given. Fifty-eight per cent. of all stomachs examined were empty, twenty-nine per cent. contained teleost species and the remainder contained crustaceans. The greatest percentage of barramundi which had disgorged their prey and whose stomachs were empty were taken in salt water, the highest percentage containing crustaceans in brackish water, and the highest percentage containing unrecognizable fish remains in fresh water.

Detailed stomach content analysis for identifiable teleost and crustacean remains for the three different bodies of water are shown in Table V. The most common prey species for barramundi taken in salt and fresh water was the unicorn fish and in brackish-tidal water the ox-eye herring. Approximately fifty per cent. of all recognizable prey species identified were crustaceans, the highest percentage being recorded in brackish water.

(e) *Parasites and Earthiness*.

In addition to trematode larvae present in the pyloric caeca, the great majority of barramundi contained larval trypanorhynch cestodes. The degree of infestation is related to the age of the specimen and the medium in which it is found;

Table III.  
Sex Ratio of Barramundi Taken in Papuan Waterways.

| Locality.                                         | Type of Water.        | Season.                   | Males.    |        | Females.  |        |
|---------------------------------------------------|-----------------------|---------------------------|-----------|--------|-----------|--------|
|                                                   |                       |                           | Total No. | Ratio. | Total No. | Ratio. |
| Waterways of the southern coastal plains of Papua | Fresh, Brackish, Salt | Spawning and non-spawning | 619       | 2.3    | 262       | 1.0    |
| (a) Lake Murray                                   | Fresh                 | Non-spawning              | 307       | 11.4   | 27        | 1.0    |
| (b) Estuaries and lower river reaches             | Brackish-salt         | 1. Onset of spawning      | 133       | 3.4    | 39        | 1.0    |
| "                                                 | "                     | 2. Mid-spawning           | 74        | 1.0    | 71        | 1.0    |
| "                                                 | "                     | 3. Non-spawning           | 105       | 0.8    | 125       | 1.0    |



Table IV.  
Stomach Contents of Barramundi.

| Stomach Content.  | Salt water.               |                                                         | Brackish-tidal water      |                                                         | Fresh water.              |                                                         |
|-------------------|---------------------------|---------------------------------------------------------|---------------------------|---------------------------------------------------------|---------------------------|---------------------------------------------------------|
|                   | No. of stomachs examined. | Per cent. of stomachs empty or containing prey species. | No. of stomachs examined. | Per cent. of stomachs empty or containing prey species. | No. of stomachs examined. | Per cent. of stomachs empty or containing prey species. |
| Empty ....        | 369                       | 68.0                                                    | 92                        | 36.0                                                    | 117                       | 57.3                                                    |
| Fish remains .... | 81                        | 15.0                                                    | 74                        | 29.0                                                    | 72                        | 35.3                                                    |
| Identifiable fish | 32                        | 6.0                                                     | 21                        | 8.2                                                     | 8                         | 4.0                                                     |
| Crustacea ....    | 60                        | 11.0                                                    | 68                        | 26.8                                                    | 7                         | 3.4                                                     |
| Total ....        | 542                       | 100.0                                                   | 255                       | 100.0                                                   | 204                       | 100.0                                                   |

Table V.  
Stomach Content Analysis.

| Prey Species.                                   |                                          | Per cent. of stomachs containing prey species. |                 |        |
|-------------------------------------------------|------------------------------------------|------------------------------------------------|-----------------|--------|
| Common Name.                                    | Specific Name.                           | Salt.                                          | Brackish-tidal. | Fresh. |
| Unicorn fish ....                               | <i>Naso</i> sp. ....                     | 19.9                                           |                 | 20.0   |
| Ox-eye herring ....                             | <i>Megalops cyprinoides</i> (Broussonet) |                                                | 12.4            | 20.0   |
| Sardine ....                                    | <i>Sardinella</i> sp. ....               | 2.1                                            |                 |        |
| Trevally ....                                   | <i>Cavanx</i> sp. ....                   | 2.1                                            | 2.2             |        |
| Garfish ....                                    | <i>Hemiramphus</i> sp. ....              | 2.1                                            | 1.1             |        |
| Threadfin Salmon                                | <i>Polynemus sberidani</i> ....          |                                                | 2.2             |        |
| Leatherskin ....                                | <i>Chironemus lysan</i> (Forsk.)         | 1.1                                            |                 |        |
| Wolf herring ....                               | <i>Parapercis</i> sp. ....               |                                                | 1.1             |        |
| Whiting ....                                    | <i>Chirocentrus dorab</i> ....           |                                                | 2.2             |        |
| Catfish ....                                    | <i>Sillago</i> sp. ....                  |                                                | 1.1             |        |
| Pony fish ....                                  | Fam. <i>Tachysuridae</i> ....            | 1.1                                            | 1.1             |        |
| Indian anchovy ....                             | <i>Leiognathus</i> sp. ....              | 1.1                                            |                 |        |
|                                                 | <i>Stolephorus indica</i> (Van Hasselt)  | 2.1                                            |                 |        |
| Archer fish ....                                | <i>Toxotes</i> sp. ....                  | 1.1                                            |                 | 6.7    |
| Herring ....                                    | <i>Haringula</i> sp. ....                | 1.1                                            |                 |        |
| Freshwater mullet                               | <i>Cetraclys</i> , <i>Mugil</i> sp. .... |                                                |                 | 6.7    |
| Prawns, including greasy back, banana and tiger | <i>Penaeid</i> sp. ....                  | 49.9                                           | 52.9            |        |
| Crab ....                                       | <i>Matuta</i> sp. ....                   | 14.2                                           | 19.2            |        |
| Mantis shrimp ....                              | <i>Squilla</i> sp. ....                  | 2.1                                            | 4.5             |        |
| Freshwater prawn                                | <i>Macrobrachium</i> sp. ....            |                                                |                 | 46.6   |
| TOTALS ....                                     |                                          | 100.0                                          | 100.0           | 100.0  |

the older the fish and the more saline the water the heavier is the infestation. In many of the specimens from salt water larval stages were isolated from the liver and musculature. The parasitism of such organs indicates very heavy infestation (Dolfus 1942).

Specimens examined from stagnant fresh-water lagoons showed little or no trace of cestode parasitism but in waters containing large amounts of decaying organic matter a definite earthiness was apparent in the flesh. When the barramundi



migrates into tidal or salt water the earthiness which is thought to be due to *Actinomyces* (Thaysen 1936), disappears after about three days.

#### *Future Development.*

The development of a commercial fishing enterprise must be based upon fish taken in non-stagnant water. These fish are most easily available during their spawning run at the mouths of rivers and in the estuaries.

With modern gear catches of barramundi can be substantially increased in all the major rivers and estuaries within the range of the species. This particularly applies during the spawning season in the Western and Gulf Districts where the agricultural potential is poor.

A freezer has been erected at Daru and it is anticipated that large quantities of barramundi will be available for air-freighting to Port Moresby from November to March. During the nine months of operations by a fishing team based at Daru, ending in March, 1961, a total of 50,000 lb. of barramundi and shark was taken. Eighty per cent. of the barramundi catch was taken during the spawning season (22nd November, 1960, to 9th March, 1961). With increased local knowledge, more highly skilled fisheries trainees and improved gear, larger catches are expected.

4,219 lb. of barramundi were caught with one short length of net in a fishing survey of Lake Murray of eleven days duration (18th to 29th June, 1961). However, the development of an industry, except for smoked fish, does not appear feasible in this and similar areas because of their isolation and the earthy taint apparent in barramundi taken from stagnant fresh water. The introduction and distribution of European fishing gear in these areas would, however, result in increased protein consumption and general improvement in health standards.

In some waters the strong current will pre-vent the use of set nets throughout most of the can normally be fished with safety. These waters can only be found by trial. In Central and Northern Queensland and in the Northern Territory, fishing for barramundi is not seasonal, and during the non-spawning period operates on barramundi taken in fresh, brackish and tidal waters. The tremendous area of such waters in rivers discharging into the Gulf of Papua and the virgin stock must support sufficient fish for the establishment of an all-the-year-round fishery. Owing to the large tidal variation, the great numbers of waterways and the high fecundity of the species, it would be many years before overfishing would result in depletion of stocks.

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