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# A SURVEY OF THE DISTRIBUTION AND APPARENT ABUNDANCE OF RECRUITMENT SIZED PRAWNS *PENAEUS MERGUIENSIS* AND *P. MONODON* IN THE GULF OF PAPUA, DURING THE CLOSED SEASON, 1 FEBRUARY TO 15 MARCH 1995

by

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**A Survey of the Distribution and Apparent Abundance of Recruit-Sized Prawns *Penaeus merguiensis* and *P. monodon* in the Gulf of Papua, During the 1995 Closed Season, 1st February to 15th March.**

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Abstract During 1st February to 15th March 1995, recruit-sized banana prawns Penaeus merguiensis (of grades 51-60 and 41-50 prawns to the pound) appeared to be most abundant in the East Cape Blackwood fishing zones (6.15 kg of tails/trawl-hour), comprising 62.8 per cent of the total catch. Catch per unit of fishing effort (CPUE) of grade 51 and 41 prawns caught in the Purari fishing zone was the next greatest, at 4.68 kg/trawl-hour, and these recruits in total comprised a similar percentage of the total catch (62.1 per cent). After Purari fishing zone, Fly/Bamu fishing zone ranked third in importance in terms of CPUE of 52 and 41 grade recruits (4.32 kg/trawl-hour) but this only comprised 32.8 per cent of the total catch. Taurama/West Cape Blackwood ranked fourth in importance for CPUE of recruits (51+41 grades) with 4.31 kg/trawl-hour, with the recruits comprising a high percentage of the total catch (71.9 per cent). Kerema Bay ranked fifth with a CPUE of 2.44 kg/trawl-hour, comprising 66.2 per cent of the total catch. The mean depth trawled at East Cape Blackwood was 20.6 m (s.d. 2.3 m) and at Purari 9.7 m (s.d. 1.9 m). The mean depths trawled at Fly/Bamu, West Cape Blackwood, and Kerema Bay were 13.3 m (s.d. 3.0 m), 23.0 m (s.d. 4.3 m) and 7.3 m (s.d. 1.6 m), respectively. Recruit-sized P. merguiensis (51 and 41 grades) were caught in commercial quantities 15-18 miles from the coastline in the East Cape Blackwood Zone and 20-33 miles from the coastline in the West Cape Blackwood Zone. The observations suggest that the closed season of 1995 was appropriately timed in that it was coincident with the spatial and temporal distribution of P. merguiensis prawns in the fishing grounds. The relatively great distance from the shore that recruit-sized banana prawns were caught indicates that the Gulf of Papua Prawn Management Area should be changed and redesignated to include these offshore areas. A line from Parama Island to Cape Suckling is recommended for the new southern boundary of the management area. A timed area closure to include the East Cape Blackwood, Purari, Orokolo, West Kerema and Kerema Bay fishing zones from 1st January to the 15 of April is recommended for management of the Gulf of Papua Prawn fishery in 1996.

Recruit-sized (16-20 and 13-15 grades) black (giant) tiger prawns (Penaeus monodon) appeared to be by far the most abundant in the Kerema Bay fishing zone in 6-7 metres of depth (CPUE = 7.97 kg of whole animal/trawl-hour), and appeared to be the next most abundant in Freshwater Bay and Purari (2.35 and 1.6 kg/trawl-hr respectively). In the Freshwater Bay fishing zone, black tiger recruits were chiefly found off the Lakekamu Estuary and Mopu Inlet and in Port Chalmers). In Kerema Bay, the recruit-sized prawns formed 86.2 per cent of the total catch of black tigers. The mean depths at which black tiger prawns were caught in these zones were 6.6 m (s.d. 1.5 m), 6.4 m (s.d. 1.1 m) and 9.8 m (s.d. 0.9 m) respectively. Wooden debris (small black twigs and branches) were found in these three zones, which each had a firm mud substrate. This information indicates that Kerema Bay, Lakekamu Estuary, Mopu Inlet and the Purari delta are likely nursery areas for black tiger prawns and that Kerema Bay may be especially important in this regard. Similarly, the East Cape Blackwood and Purari zones have special significance for the recruitment of white banana prawns.

## Introduction

### Background

A comprehensive management plan for the Gulf of Papua prawn fishery was agreed with industry in December 1995 and a six week closed season was introduced in 1996, from 1st February to the 15th of March, based on the progression of grades observed from a ten year average of catch per unit of fishing effort (Polovina and Opnai, 1989). The aim was to increase the number and size of prawns caught during the rest of the year, and to provide a time when vessels could be slipped and repair and maintenance carried out, without the pressure of competition in the fishing industry. The Gulf of Papua prawn fishery is chiefly based upon the banana prawn Penaeus merguiensis which comprises over half of the catch. The area from Parama Island to north of Yule Island has traditionally been worked since the mid 1970's (Fig. 1).

### Previous Research

The distribution and apparent abundance of recruit-sized prawns (grade 51-60) was studied in 1980 by Gwyther (1980). Recruit-sized prawns occurred in a temporal and spatial sequence from the west (East Cape Blackwood and Purari) in January and February to the east (Kerema Bay) in May and June (Annexe 1). This provided

useful additional information to consider in making management recommendations for a timed area closure.

Recruitment of banana prawns in the Gulf of Papua was studied by Polovina and Opnai (1989). Modal progression was apparent in a ten-year average of the CPUE of each grade of prawns caught by the industry (Annexe 2). Polovina and Opnai postulated that an annual pulse of juvenile recruitment to the fishing grounds around February each year results from postlarval settlement the previous November, though settlement and recruitment occurs at lower levels on a year-round basis.

Materials and Methods

Two vessels were chartered from the fishing fleet on the basis of the prawn operators keeping the catch. Trawling was entirely a commercial operation as described in Evans and Opnai (1995). The vessels `surveyed' and worked the grounds together, one in shallower depths (Keauta) and on in Deeper depths (Gulf Star 5) searching across depth contours with only the try net deployed until a concentration of prawns was found. Then the two vessels fished this concentration, each trawling along the depth contour.

The vessels started commercial operations at Parama Island, Fly River during the first week of February, and surveyed eastward to Cape Possession. They then surveyed back to Parama Island, where they returned eastward again, finally ceasing commercial operations and returning to Port Moresby towards the end of the closed season. A third vessel the Larimori was also chartered on the same basis for the remainder of the closed season, to take over from the Keauta which had a shorter range than Gulf Star 5.

The prawns caught were headed, sorted by species, and graded in the usual commercial operation, packed in 2 kg cartons in saltwater and snap-frozen to - 20 degrees Centigrade. On Gulf Star 5, some prawns were also packed with head on, but the majority was headed. On Keauta, all the banana prawns and endeavour prawns were headed. Black tiger prawns Penaeus monodon were not headed on either vessel, and were also packed in 2 kg cartons. The crew recorded the number of cartons packed of each grade of each species in each trawl of the main nets (2-4 hours duration) and these were copied by the scientists on board. The positions of the trawls were also recorded (position winched down and winched up). The details of the try net operations and catches were also recorded by the scientists, including the depth every 15 minutes or 20 minutes. From this information the mean

depth trawled in each zone, and the catch per unit of fishing effort in each zone, was calculated, for 51, 41, and 51+41 grade banana prawns, and for the total banana prawn catch. The same was done for 16, 13 and 16+13 grade black tiger prawns.

Results

Table 1 presents the results of analyses of CPUE by grade and average depth trawled, by fishing zone, for white banana prawns. CPUE of banana prawn recruits (51+41 grades) was greatest in the East Cape Blackwood fishing zone (6.15 kg of tails/trawl hour) (Fig. 2), and the catch of recruits in the zone comprised 62.8 per cent of the total banana prawn catch. CPUE of grade 51 and 41 prawns caught in the Purari fishing zone (Fig. 3) was the next greatest, at 4.68 kg/trawl-hour, and these recruits comprised a similar percentage of the total catch (62.1 per cent) (Table 1). After Purari fishing zone, Fly/Bamu fishing zone ranked third for CPUE of recruits (4.32 kg/trawl-hour), 32.8 per cent of the total catch (Table 1). Taurama/West Cape Blackwood, west of the Oil Rig (Fig. 2), ranked fourth with 4.31 kg/trawl-hour, with 71.9 per cent of the total catch (Table 1). Kerema Bay (Fig. 4) ranked fifth with a CPUE of 2.44 kg/trawl-hour, 66.2 per cent of the total catch (Table 1). The mean depth trawled at East Cape Blackwood was 20.6 m (s.d. 2.3 m) and at Purari 9.7 m (s.d. 1.9 m). The mean depths trawled at Fly/Bamu, West Cape Blackwood, and Kerema Bay were 13.3 m (s.d. 3.0 m), 23.0 m (s.d. 4.3 m) and 7.3 m (s.d. 1.6 m), respectively (Table 1). In the present study, recruit-sized P. merguiensis (51 and 41 grades) were caught in commercial quantities 15-18 miles from the coastline in the East Cape Blackwood Zone and 20-33 miles from the coastline in the West Cape Blackwood Zone (personal observations).

The CPUE of recruit-sized (16-20 and 13-15 grades) black (giant) tiger prawns (Penaeus monodon) was greatest in the Kerema Bay fishing zone in 6-7 metres of depth (CPUE = 7.97 kg of whole animal/trawl-hour) (Table 2), and was the next greatest in Freshwater Bay and Purari Zones (2.35 and 1.6 kg/trawl-hr respectively). In the Freshwater Bay fishing zone, black tiger recruits were chiefly found off the Lakekamu Estuary and Mopu Inlet and in Port Chalmers) (Fig. 4; field records of the present study). In Kerema Bay, the recruit-sized prawns formed 86.2 per cent of the total catch of black tigers (Table 2). The mean depths at which black tiger prawns were caught in these zones were 6.6 m (s.d. 1.5 m), 6.4 m (s.d. 1.1 m) and 9.8 m (s.d. 0.9 m) respectively (Table 2). Wooden debris (small black twigs and

branches) were found in these three zones, which generally had a firm mud substrate (personal observations).

Grade 61-70 prawns were also captured during the survey by Gulf Star 5 (with 2" mesh cod-ends) during the closed season in Purari Zone (Southeast Purari, at Panaroa, at 6-11 metres depth (Fig. 3) during late February/early March 1995: the total hours trawled were 34 and the catch of 61 grade banana prawns was 44 kg. The CPUE was 1.29 kg/trawl hour. GS 5 also captured 2 kg of 61 grade banana prawns on 26th February 1995 at 24-27 metres depth in the West Cape Blackwood Zone: hours trawled = 3.5, CPUE = 0.57 kg/trawl-hour).

The vessel Larimori also landed 4 kg of 71 grade banana prawns from grid reference 05 50 on 14th March 1995, but these were clinging to the outside of the 2.25" mesh cod-end (personal observations). The vessel Keauta (with 2.25" mesh cod-ends) caught no 61 or 71 grade prawns during the closed season.

Discussion

The observations suggest that the closed season of 1995 was appropriately timed in that it was coincident with the spatial and temporal distribution of P. merguiensis prawns in the fishing grounds. The relatively great distance from the shore that recruit-sized banana prawns were caught indicates that the Gulf of Papua Prawn Management Area should be changed and redesignated to include these offshore areas. A line from Parama Island to Cape Suckling is recommended for the new southern boundary of the management area (Fig. 5).

The information indicates that Kerema Bay, Lakekamu Estuary, Mopu Inlet and the Purari delta are likely nursery areas for black tiger prawns and that Kerema Bay may be especially important in this regard. Similarly, the East Cape Blackwood and Purari zones appear to have special significance for the recruitment of white banana prawns. Commercial prawn trawling in the East Cape Blackwood, Purari and Kerema Bay fishing zones should be prohibited during January to April, based upon the information in the present study, the parallel studies of banana prawn and black tiger prawn size frequency distributions (Kare et al, 1995) and the earlier studies by Gwyther (1980) (Annexe 1 attached) and Polovina and Opnai (1989) (Annex 2 attached).

A timed area closure to include the East Cape Blackwood, Purari, Orokolo, West Kerema and Kerema Bay fishing zones from 1st

January to the 15 of April is recommended for management of the fishery in 1996 (Fig. 6).

The mesh size should be regulated to 2.25" in the cod-end, to exclude 61-grade banana prawns from being captured in the cod-end.

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## Table 1: Analysis for CPUE of the recruit-sized banana prawns in the Gulf of Papua, 1st February to 15th Match 1995.

| ZONE | GRADE | TOTAL HOURS TRAWLED | TOTAL CATCH (kg) | CPUE (kg/hr) | MEAN DEPTH (m) | MEAN DEPTH ST.DEV. (m) | PER CENT WT OF CATCH |
|---|---|---|---|---|---|---|---|
| Fly/Bamu | | | | | | | |
| | 51 | 115.25 | 68 | 0.59 | 13.3 | 3.0 | 4.5 |
| | 41 | 115.25 | 430 | 3.73 | 13.3 | 3.0 | 28.3 |
| | 51+41 | 115.25 | 498 | 4.32 | 13.3 | 3.0 | 32.8 |
| | All | 115.25 | 1518 | 13.17 | 13.3 | 3.0 | 100.0 |
| Taurama/ W. Cape Blackwood | | | | | | | |
| | 51 | 80.8 | 116 | 1.44 | 23.0 | 4.3 | 24.0 |
| | 41 | 80.8 | 232 | 2.87 | 23.0 | 4.3 | 47.9 |
| | 51+41 | 80.8 | 348 | 4.31 | 23.0 | 4.3 | 71.9 |
| | All | 80.8 | 484 | 5.99 | 23.0 | 4.3 | 100.0 |
| East Cape Blackwood | | | | | | | |
| | 51 | 35.1 | 108 | 3.08 | 20.6 | 2.3 | 31.4 |
| | 41 | 35.1 | 108 | 3.08 | 20.6 | 2.3 | 31.4 |
| | 51+41 | 35.1 | 216 | 6.15 | 20.6 | 2.3 | 62.8 |
| | All | 35.1 | 344 | 9.80 | 20.6 | 2.3 | 100.0 |
| Purari | | | | | | | |
| | 51 | 163.25 | 292 | 1.79 | 9.7 | 1.9 | 23.7 |
| | 41 | 163.25 | 472 | 2.89 | 9.7 | 1.9 | 38.4 |
| | 51+41 | 163.25 | 764 | 4.68 | 9.7 | 1.9 | 62.1 |
| | All | 163.25 | 1230 | 7.53 | 9.7 | 1.9 | 100.0 |
| Orokolo | | | | | | | |
| | 51 | 0 | 0 | - | - | - | - |
| | 41 | 0 | 0 | - | - | - | - |
| | 51+41 | 0 | 0 | - | - | - | - |
| | All | 0 | 0 | - | - | - | - |
| West Kerema | | | | | | | |
| | 51 | 10.95 | 0 | 0.00 | 11.5 | 3.0 | 0.0 |
| | 41 | 10.95 | 20 | 1.82 | 11.5 | 3.0 | 55.6 |
| | 51+41 | 10.95 | 20 | 1.82 | 11.5 | 3.0 | 55.6 |
| | All | 10.95 | 36 | 3.27 | 11.5 | 3.0 | 100.0 |
| Kerema Bay | | | | | | | |
| | 51 | 35.23 | 34 | 0.97 | 7.3 | 1.6 | 26.2 |
| | 41 | 35.23 | 52 | 1.48 | 7.3 | 1.6 | 40.0 |
| | 51+41 | 35.23 | 86 | 2.44 | 7.3 | 1.6 | 66.2 |
| | All | 35.23 | 130 | 3.69 | 7.3 | 1.6 | 100.0 |
| Freshwater Bay | | | | | | | |
| | 51 | 72.65 | 26 | 0.36 | 6.6 | 1.1 | 5.8 |
| | 41 | 72.65 | 124 | 1.71 | 6.6 | 1.1 | 27.6 |
| | 51+41 | 72.65 | 150 | 2.06 | 6.6 | 1.1 | 33.3 |
| | All | 72.65 | 450 | 6.19 | 6.6 | 1.1 | 100.0 |
| Iokea | | | | | | | |
| | 51 | 5.6 | 0 | 0.00 | 16.6 | 9.0 | 0.0 |
| | 41 | 5.6 | 6 | 1.07 | 16.6 | 9.0 | 16.7 |
| | 51+41 | 5.6 | 6 | 1.07 | 16.6 | 9.0 | 16.7 |
| | All | 5.6 | 36 | 6.43 | 16.6 | 9.0 | 100.0 |

Table 2: Analysis for CPUE of the recruit-sized black tiger prawns in the Gulf of Papua, 1st February to 15th Match 1995.

| ZONE | GRADE | TOTAL HOURS TRAWLED | TOTAL CATCH (kg) | CPUE (kg/hr) | MEAN DEPTH (m) | MEAN DEPTH ST.DEV. | PER CENT WT OF CATCH |
|---|---|---|---|---|---|---|---|
| Fly/Bamu | | | | | | | |
| | 16 | 2.0 | 0 | 0 | 15 | - | 0 |
| | 13 | 2.0 | 0 | 0 | 15 | - | 0 |
| | 16+13 | 2.0 | 0 | 0 | 15 | - | 0 |
| | All | 2.0 | 4 | 2.0 | 15 | - | 100.0 |
| Taurama/ W. Cape Blackwood | | | | | | | |
| | 16 | 5.0 | 2 | 0.4 | 32.75 | - | 20.0 |
| | 13 | 5.0 | 4 | 0.8 | 32.75 | - | 40.0 |
| | 16+13 | 5.0 | 6 | 1.2 | 32.75 | - | 60.0 |
| | All | 5.0 | 10 | 2.0 | 32.75 | - | 100.0 |
| East Cape Blackwood | | | | | | | |
| | 16 | 4.0 | 2 | 0.5 | 21.6 | - | 33.3 |
| | 13 | 4.0 | 2 | 0.5 | 21.6 | - | 33.3 |
| | 16+13 | 4.0 | 4 | 1.0 | 21.6 | - | 66.7 |
| | All | 4.0 | 6 | 1.5 | 21.6 | - | 100.0 |
| Purari | | | | | | | |
| | 16 | 42.42 | 14 | 0.3 | 9.8 | 0.9 | 10.9 |
| | 13 | 42.42 | 54 | 1.3 | 9.8 | 0.9 | 42.2 |
| | 16+13 | 42.42 | 68 | 1.6 | 9.8 | 0.9 | 53.1 |
| | All | | | | | | |
| Orokolo | | | | | | | |
| | 16 | 0 | 0 | - | - | - | - |
| | 13 | 0 | 0 | - | - | - | - |
| | 16+13 | 0 | 0 | - | - | - | - |
| | All | 0 | 0 | - | - | - | - |
| West Kerema | | | | | | | |
| | 16 | 0 | 0 | - | - | - | - |
| | 13 | 0 | 0 | - | - | - | - |
| | 16+13 | 0 | 0 | - | - | - | - |
| | All | 0 | 0 | - | - | - | - |
| Kerema Bay | | | | | | | |
| | 16 | 25.08 | 54 | 2.15 | 6.6 | 1.5 | 23.3 |
| | 13 | 25.08 | 146 | 5.82 | 6.6 | 1.5 | 62.9 |
| | 16+13 | 25.08 | 200 | 7.97 | 6.6 | 1.5 | 86.2 |
| | All | 25.08 | 232 | 9.25 | 6.6 | 1.5 | 100.0 |
| Freshwater Bay | | | | | | | |
| | 16 | 71.41 | 14 | 0.20 | 6.4 | 1.1 | 4.5 |
| | 13 | 71.41 | 154 | 2.16 | 6.4 | 1.1 | 49.0 |
| | 16+13 | 71.41 | 168 | 2.35 | 6.4 | 1.1 | 53.5 |
| | All | 71.41 | 314 | 4.40 | 6.4 | 1.1 | 100.0 |
| Iokea | | | | | | | |
| | 16 | 0 | 0 | - | - | - | - |
| | 13 | 0 | 0 | - | - | - | - |
| | 16+13 | 0 | 0 | - | - | - | - |
| | All | 0 | 0 | - | - | - | - |