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a study of the commercial fishery

R. G. Coles and J. G. Greenwood

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BAIT PRAWNS IN THE NOOSA RIVER:

A STUDY OF THE COMMERCIAL FISHERY

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FIRTA 78/39

Research on prawn populations in the Noosa River was supported by a grant from the Fishing Industry Research Trust Account and University of Queensland research funds, and compiled with the assistance of the Fisheries Research Branch, Department of Primary Industries.

This report presents the results of research intended to facilitate the management of the Noosa River fishery. It forms the basis of the final report submitted to the FIRTA committee. More detailed results are the subject of publications in appropriate scientific journals (see reference list).

The authors wish to acknowledge the assistance of Mr E. Lindsay in the collection of data and for his advice and assistance as a commercial fisherman. The assistance of Mr R.G. Pearson, Dr G.B. Goeden, Mr W. Lee Long and Ms. J.E. Mellors in the preparation of the manuscript was much appreciated.

ABSTRACT

The Noosa River supports a bait prawn fishery of up to 20 boats in a season lasting from October to April. Most of the prawn fishermen are also involved in mixed fish and mullet net fishing. This diversification of fishing effort combined with a night time and weekend closure in the river protects the prawn population from over exploitation.

Of the three common prawn species in the river only two, Metapenaeus bennettae and M. macleayi form a significant proportion of the commercial catch. Penaeus plebejus although present in large numbers leave the river at a size below that at which they would be caught in commercial nets. They are also not present in large numbers on the common commercial fishing grounds or during the day when commercial fishing is allowed.

The timing of the life history of the three common prawn species in the Noosa River is presented and is used to explain the seasonal nature of the fishery.

A comparison of day and night catches shows all three species were most commonly caught at night despite the fact that M. macleayi is usually considered a daytime active prawn. M. macleayi daytime catches were greatest in the months coinciding with the commercial season.

The conclusion is drawn that with present legislative restrictions the Noosa River bait prawn fishery is unlikely to compete for prawn resource with the offshore king prawn fishery and is unlikely to over exploit the bait prawn populations.

INTRODUCTION

The Noosa River estuary is one of several estuaries in south east Queensland that supports a viable beam trawl fishery for juvenile penaeid prawns. These fisheries were established in the 1950's before the potential for offshore trawling was realized and have continued almost unchanged to present times.

Concern for the future of these estuarine trawling fisheries in recent years has centered around three main points:

- To what extent does the capture of juvenile prawns within estuaries reduce the stock available to the offshore fishery?
- Should the number of trawlers be reduced to avoid the possibility of damage to estuarine habitats?
- Are fluctuations in the estuarine prawn catches an indication of overfishing and depletion or the result of other factors?

In addition, most of the estuaries involved are being developed, or will be developed in the near future as resort and tourist attractions. In the Noosa River in particular mangrove areas have been reduced, canal estates constructed, and the river mouth entrained. As this trend will undoubtedly continue for some time, it is important to record present population levels in order to determine the effects of future environmental changes. Estuaries provide an environment for the juvenile phase of the penaeid prawn life cycle. Serious disruption to this may result in a reduction in overall prawn catches and a lessening of income for the approximately 1 300 master fishermen involved in the Queensland prawn fishery.

Prior to this study little information was available on the beam trawl industry. The commercial catch data recorded by the Queensland Fish Board is not refined sufficiently to identify catches of individual species, or catches from specific areas. To provide data required for decisions concerning the industry a two year field research programme was carried out in 1978 and 1979. The Noosa River was chosen as it is shallow, protected from rough weather, easily trawled with experimental gear, and supports a number of prawn species representative of other beam trawl fisheries. Limited availability of personnel and finance prevented direct comparison with other estuaries during the course of the study. It would be expected, however, that the results from the Noosa River would reflect to a great extent the situation in nearby estuaries.

This report presents an analysis of data collected in the Noosa River. The intention has been to present the results in a context useful for industry members, and those involved in setting the necessary management regulations and controls. This study was financed by research funds from the University of Queensland and the Fishing Industry Research Trust Account, and has been supported by the Fisheries Research Branch, Queensland Department of Primary Industries.

THE NOOSA RIVER SYSTEM

The Noosa River and lakes system consists of a series of very shallow lakes (mean depth approximately 1 m) joined by a deeper and narrower river (Fig. 1). Entrance to the sea is by way of a narrow exposed bar which is navigable only in calm weather. Permanent water covers close to 5 900 hectares or 6.8% of the total catchment. The remainder consists of low lying sand or gravel of high porosity. Mackay (1975) suggests that a high proportion of the annual rainfall would run off, but that the maximum flow response would be small. Despite the summer seasonality of the rainfall and occasional cyclonic influence resulting in heavy rainfalls, freshwater flushing in the form of floods described for the Hunter River (Glaister, 1978) is not common in the Noosa River. During the study period fresh water runoff was never sufficient to reverse the normal tidal inflow.

Tides are semi-diurnal with a spring tide range of approximately 0.5 m at Munna Point. There is a continuous tidal diminution up to Lake Cootharaba which may not be truly tidal.

Salinities range from a mean of 30.6 ppt. near the river mouth to 5.3 ppt. at the northern tip of Lake Cootharaba 35 km from the sea (Fig. 2). Salinity changes for southern Lake Cootharaba and the river mouth for the period of the study are presented in Fig. 3. The sites from which salinities, temperature measurements and prawn samples were taken are described on page 15 and Fig 1.

Temperatures for the same sites, both of which have water depths in the order of one to 1.5 m, closely follow expected ambient temperature changes throughout the year (Fig. 4).

The lakes themselves are extremely shallow and bordered in many places by reed beds (Baunea sp.). Changes to the bar at the mouth of the river have led to an increase in the tidal range and a reduction in the mean water level of 17 cm at Munna Point (Mackay, 1975). This fall has led to problems for the larger trawlers and tourist boats, particularly in traversing Lake Cooroibah, and may eventually lead to an increase in the extent of the reed beds. In other places the lakes are bounded by sandy beaches or by fringing mangroves backed by stands of Melaleuca and Casuarina. The lake floor consists of deposited black silt mud broken only by the occasional overlay of sand or protruding rock outcrops.

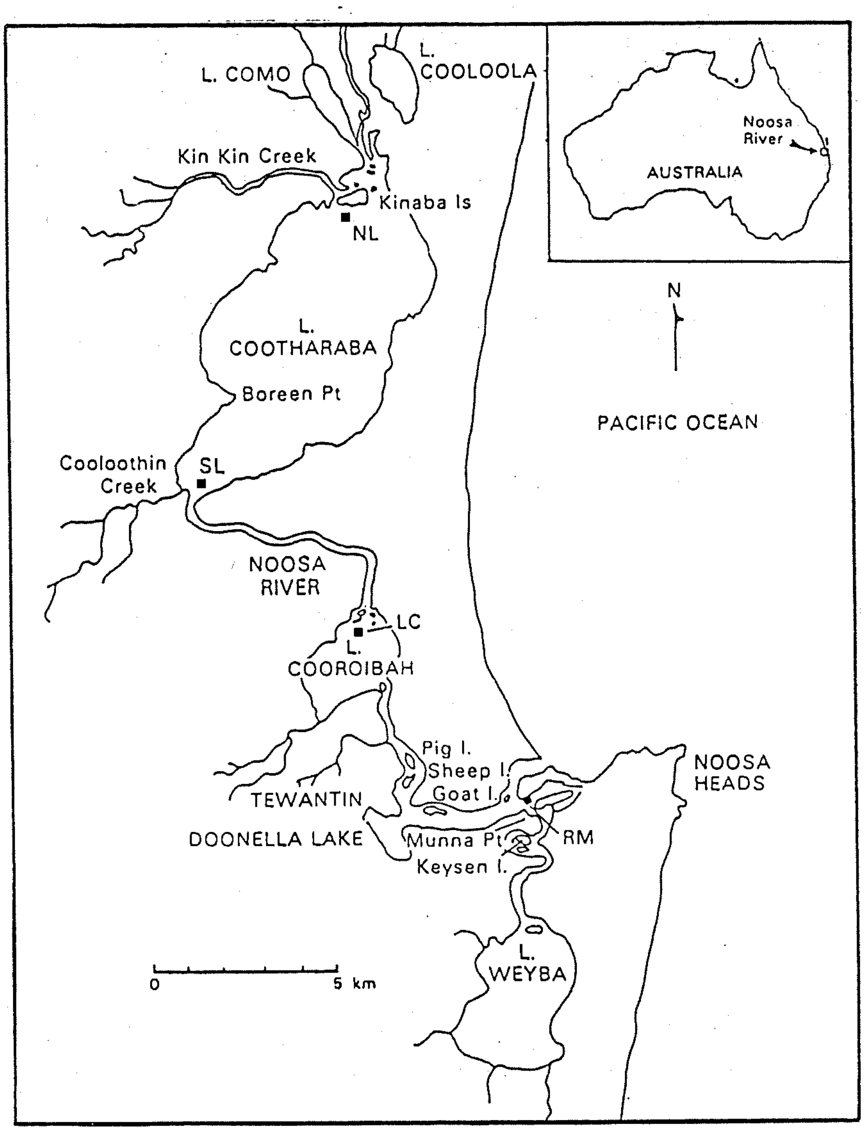


Figure 1. The Noosa River and lake system with the four study sites (NL, SL, LC and RM) marked. An inset map of Australia shows the position of the estuary on the Pacific coast.

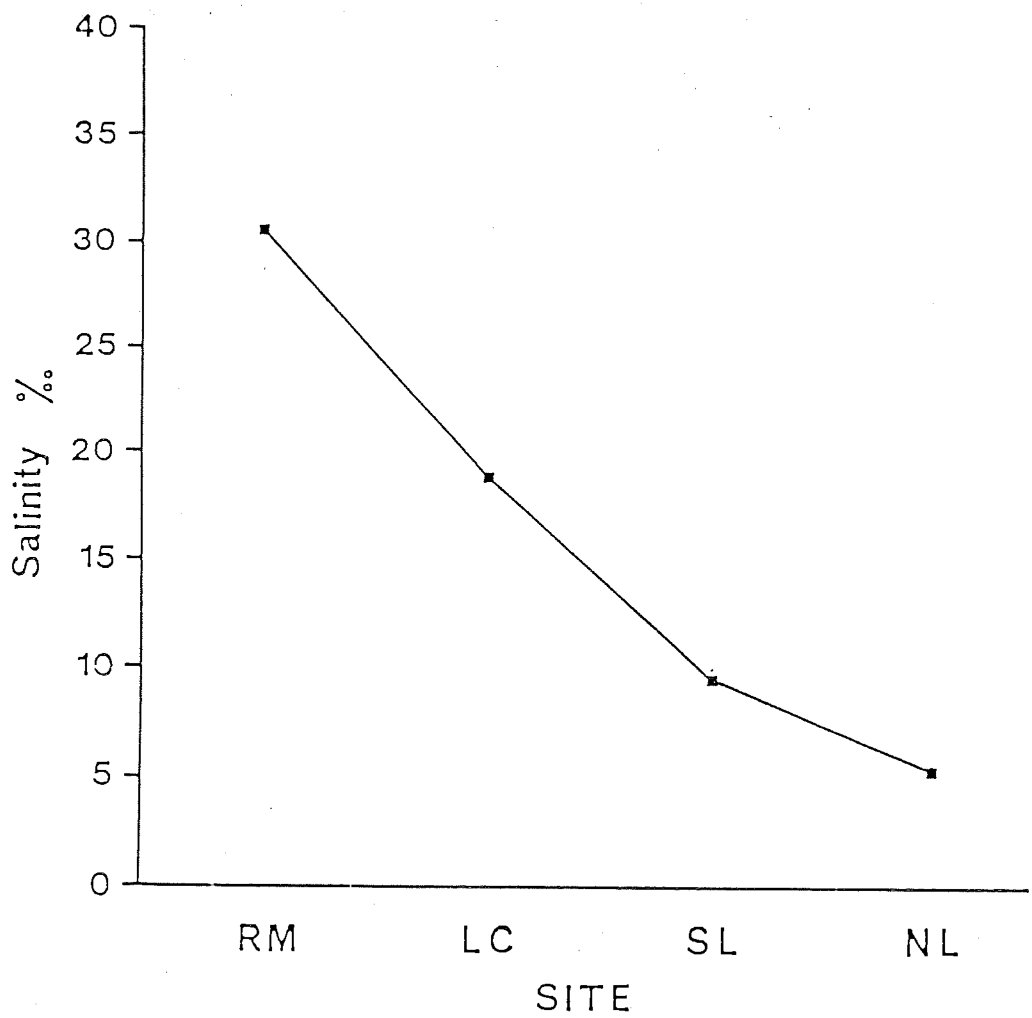


Figure 2. The mean of salinities at the four sampling sites (RM, LC, SL and NL) during the study period, March 1978 to June 1979.

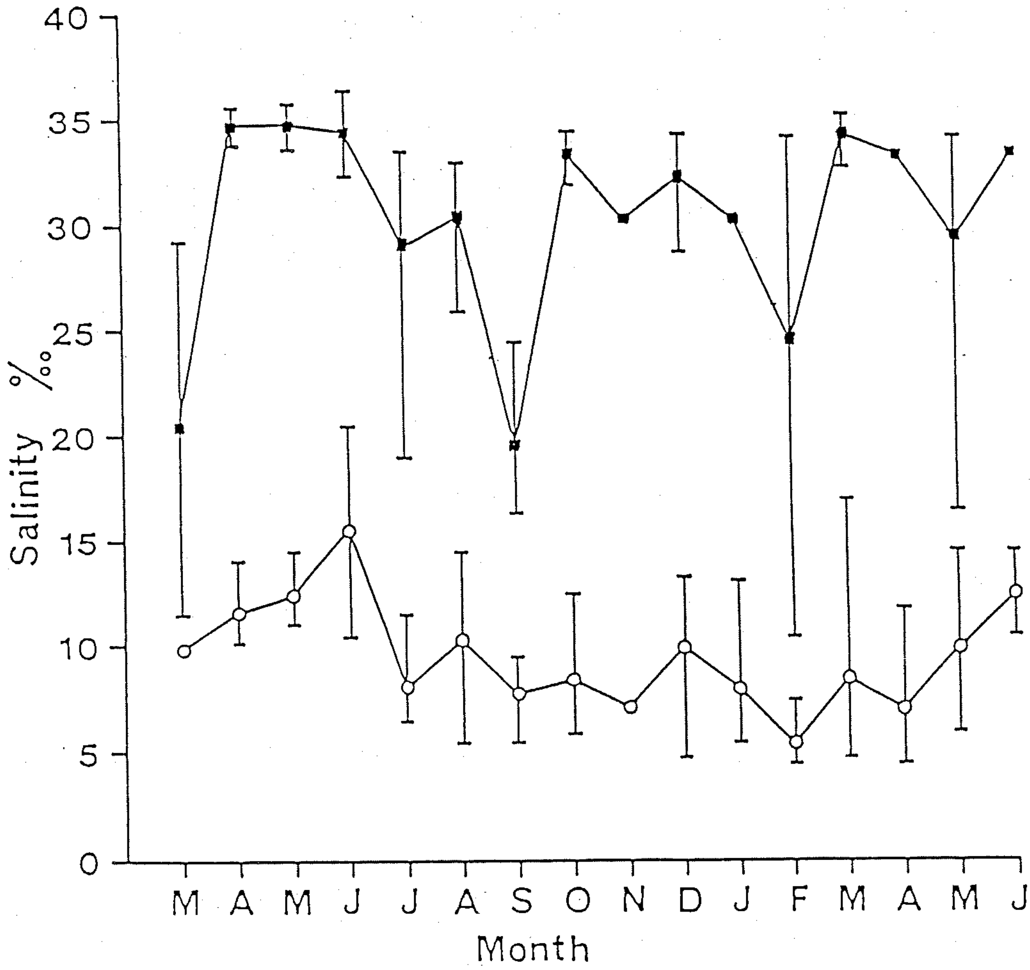


Figure 3. The mean and range of salinities at the south Lake Cootharaba (o) and river mouth (■) sites for the period, March 1978 to June 1979.

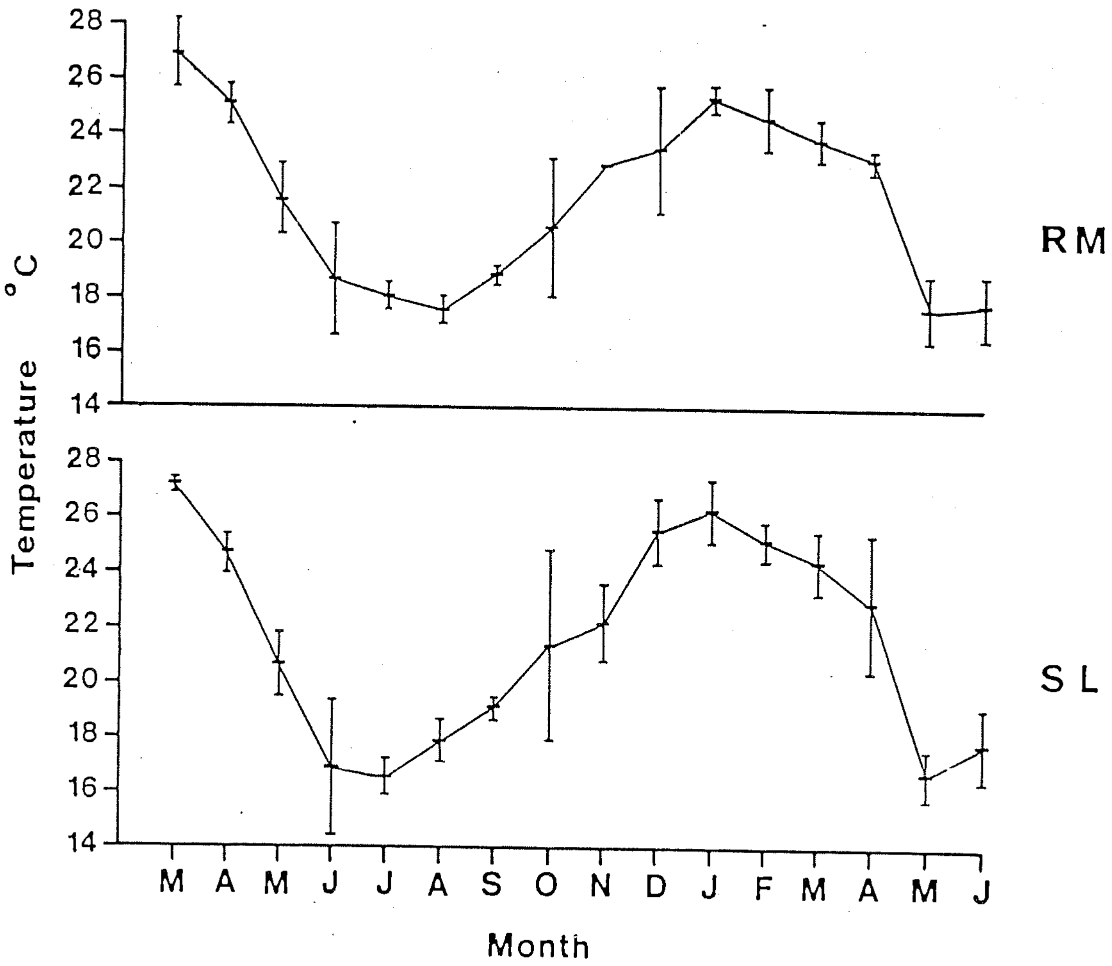


Figure 4. The mean and range of temperatures at the south Lake Cootharaba (SL) and river mouth sites (RM) for the period, March 1978 to June 1979.

THE FISHERY

During a season lasting from October to April the Noosa River supports from five to 20 prawn trawlers. The majority of these boats are based at the small village of Boreen Point (Fig. 1), with the occasional vessel coming from Tewantin. From moorings at Boreen Point it takes only a few minutes to reach the main trawling grounds in the southern half of Lake Cootharaba, which in turn are only approx. 15 km from Lake Cooroibah where, on occasions, commercial catches of prawns can be taken.

Vessels involved in the fishery range from 5 m open dinghies with petrol engines to mini trawlers of 9 to 10 m in length (Fig. 5). Engines range in power from 4 to 60 Kw with the majority below 30 Kw. In the period 1978 to 1980 only one trawler operator used winch equipment to haul in the beam trawl net, the remainder hauled in by hand.

Fishermen locate prawns using a small hand held 'try' net (Fig. 6). This is pushed down onto the substrate surface and periodically checked for prawns. When a sufficiently dense patch of prawns is located a marker buoy is dropped, the main beam trawl net set, and the area around the marker trawled thoroughly. To avoid clogging with debris stirred up by the propellor in shallow water, nets are usually towed in a curving path making a circuit of some 200 m in diameter.

The net design most used is mounted on a 5 m, galvanised iron pipe fitted with metal skids at each end. The net is made of polyethelyene or polyvinyl material with a minimum mesh aperture of 28 mm. Local fishermen build their own trawl nets and there is some variation in design. Most nets have a tickler chain or a thick weighted rope on the lower leading edge to sweep prawns from the soft bottom. The upper leading edge is supported either by the beam or by a series of floats. The body of the net is cone shaped, with a cod-end and tie off cord at the apex.

Regulations limit the length of the beam to 5 m, and the mesh aperture to 28 mm or more. Trawling is permitted only between five o'clock in the morning, and six o'clock in the evening, (that is the hours of daylight), and only Mondays to Fridays. Areas adjacent to the river mouth, Lake Weyba, Lake Doonella, and the Noosa River north of the Lake Como entrance are closed to fishing. Most of these measures are designed to limit conflict between commercial operations and the amateur line fishery which attracts large numbers of participants during the weekend and at night.

Figure 5. Beam trawlers anchored off Boreen Point township.

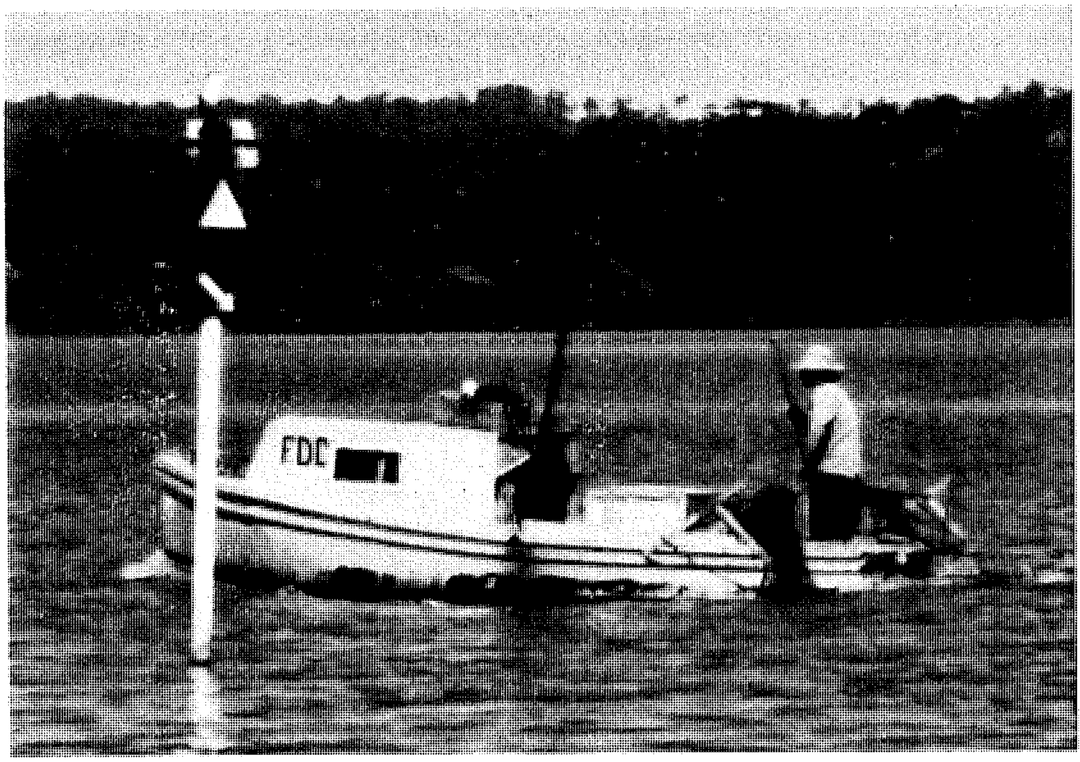


Figure 6 . A beam trawler with the beam and net mounted on the stern. The fisherman is using a hand held try net to locate prawns in southern Lake Cootharaba.

In season, prawn trawling operations usually commence between five and six o'clock in the morning and continue for four to six hours. Catches are held on ice in a deck mounted ice box. They are unloaded at Boreen Point and trucked (often on a co-operative basis) to the Fish Board depot at Tewantin, or occasionally to Tin Can Bay to the north. Catches of larger prawns may be cooked on the beach and sold for human consumption. At least one local fisherman cooks and peels prawns to obtain the higher prices offered for cooked prawn meat.

The fishermen supplement their income by estuarine ring netting for estuarine fish, and by beach netting for mullet in winter. When catches of prawns start to fall during the season the fishermen leave the grounds undisturbed for several days. This is a conscious process, the fishermen believing that the prawns need to regroup after heavy fishing pressure on the limited fishing grounds. This pattern of fishing results in catch statistics with intermittent large catches, accentuating the variability normally expected for penaeid prawn catches. It also means that within a season lasting seven or eight months the actual number of days of trawling may be less than 30% of the available days.

Data on prawn catches at Noosa have been collected by the Queensland Fish Board. The weight and value of the catch from 1956 to 1980 is presented in Fig. 7. Both the total catch and value vary considerably from year to year with no obvious long term trend apart from an apparent tendency for good catches and poor catches to alternate over approximate seven year periods.

The majority of prawns are made up into 250 g packs, and sold locally as bait for recreational fishing. With the growing popularity of the Noosa River, the demand for prawn bait is likely to continue.

BAIT PRAWN SPECIES

The Noosa River and lakes system supports a number of species of penaeid prawn. These include the eastern king prawn, *Penaeus plebejus* Hesse, the greasy back or greentail prawn, *Metapenaeus bennettae* Racek and Dall, the school prawn, *M. macleayi* (Haswell), the brown tiger prawn, *P. esculentus* Haswell, the banana prawn, *P. merguiensis* de Man, the leader prawn *P. monodon* Fabricus, and the endeavour prawn *M. endeavouri* (Schmitt). For the sampling period the catch comprised 56% eastern king, 12% greasyback, and 32% school prawn. Catch compositions for these species overall, and for the four sites (Fig. 1) are presented in Fig. 8. Catches of other species were restricted to occasional individuals, not sufficient in number for inclusion in the data analysis.

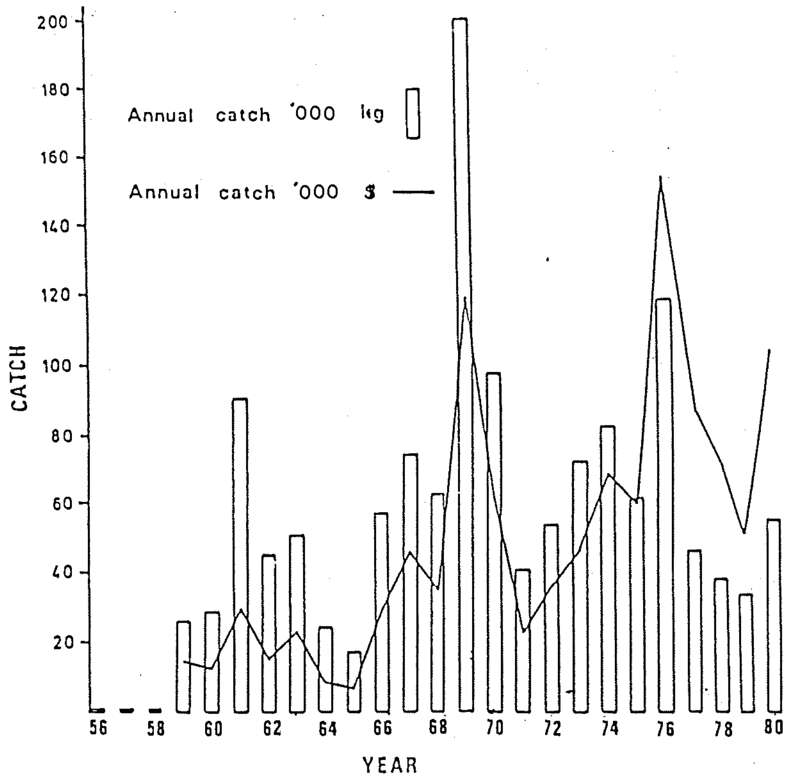


Figure 7. The annual, commercial bait prawn landings at the Queensland Fish Board depot, Tewantin, for the years 1956 to 1980 (after Tuma, 1979).

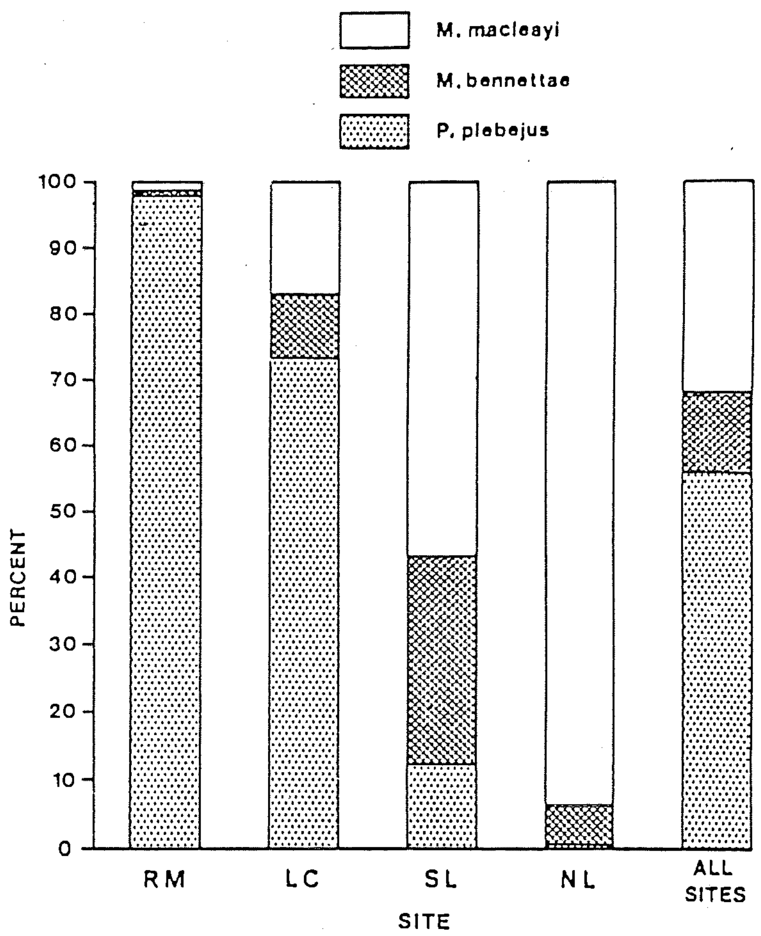


Figure 8. The percentage species composition in the Noosa River at four sampling sites, (RM, LC, SL and NL) and the combined sites for the period, March 1978 to June 1979.

Identification of prawns in the smaller size classes was made with the assistance of a key developed by Young (1977) for similar Moreton Bay prawns. A simplified key for the identification of prawns in the commercial bait prawn catch is presented here. The major morphological features are shown in Fig. 9.

A key to the common estuarine penaeid prawns in south east Queensland commercial bait prawn catches.

1. Ventral teeth absent from the rostrum 2

   Ventral teeth present on the rostrum 4

2. Lateral spines absent from the telson, rostrum straight, body with patches of minute hairs .... _M. bennettae_

   Lateral spines present on the telson 3

3. Four pairs of lateral spines on the telson, rostrum sigmoid with the anterior (distal) quarter free of teeth .... _M. macleayi_

   Three pairs of lateral spines on the telson, rostrum straight with teeth reaching to the end .... _M. endeavouri_

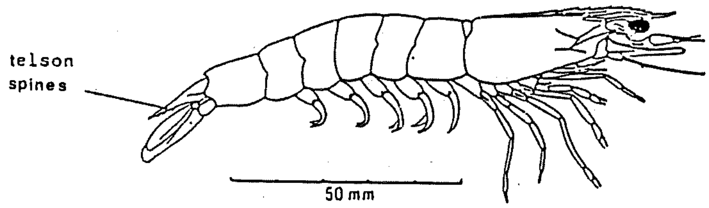
4. One ventral tooth on the rostrum, epigastric and two dorsal rostral teeth behind the posterior margin of the orbit .... _P. plebejus_

   Two or more ventral rostral teeth 5

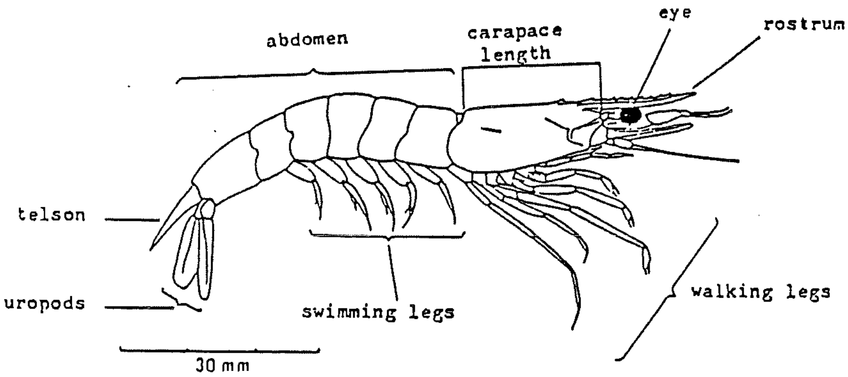
5. Adrostral carina usually ending between the first and second rostral teeth. Rostrum blade-like, with usually six to seven dorsal teeth, and four to five ventral teeth, body cream to yellow ...._P. merguiensis_

   Adrostral carina extending beyond or just reaching the epigastric tooth, body usually striped or blue green in colour 6

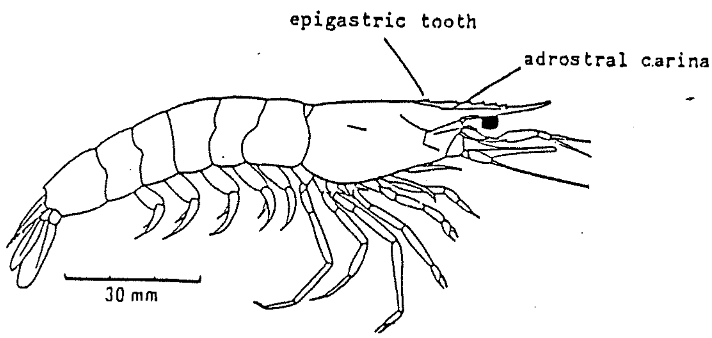
6. Rostrum with seven to eight dorsal teeth and two to three ventral teeth. Post rostral carina flat or weakly grooved. Carapace and abdomen transversely banded with greyish blue stripes on a light blue background. Fringing setae red .... _P. monodon_



Penaeus plebejus



Metapenaeus bennettae



Metapenaeus macleayi

Figure 9. The three species common in the Noosa River bait prawn catch.

7. Rostrum with five to seven dorsal teeth, three to four ventral teeth. Post rostral carina not grooved, carapace and abdomen transversely banded with brown stripes on a yellow or buff background. Small juveniles may be greenish, antennae with alternating white and brown bands .... *P. esculentus*

METHODS USED FOR COLLECTING EXPERIMENTAL DATA

Sampling gear

Results were obtained using an experimental beam trawl which was smaller than a commercial beam trawl. It was 1.5 m wide and 0.5 m high constructed with a 1.25 cm diameter steel rod frame based on 12 cm wide, and 47 cm long wooden shoes (Fig. 10). A 2 mm 'tickler' chain was slung between the shoes. The frame was designed so the lower leading edge was as close as practicable to the substratum and trailing the upper leading edge by 20 cm. The net itself was cone-shaped, 6 m in length, with a 1 m long cod-end. A multifilament terylene mesh much finer than commercial mesh with an aperture of 1.2 mm was used for the main body of the net combined with a stronger 1.0 mm mesh monofilament nylon cod-end. A light nylon sheet was attached to the lower leading edge and trailed under the net to prevent it being damaged as it passed over the bottom. The extended length of the net was necessary to allow water to flow through without an appreciable pressure wave at the entrance. Any disturbance caused by propellor turbulence was reduced by positioning the net 30 m behind the towing vessel. This also reduced the tendency common to small beam trawls of lifting off the bottom during trawling.

Sampling sites

Four sites were chosen within the estuary to represent the geographical range of penaeid prawns (Fig. 1). The river mouth site (RM) was located 1 km from the sea on the edge of a permanent sand mass which was exposed at all but the highest of spring tides. At Lake Cooroibah a site (LC) was chosen on the edge of a shallow sand bank to the side of the main boating channel, and approximately 12 km from the sea. A third site at the southern end of Lake Cootharaba (SL) was in a shallow area influenced by only reduced tidal flows, within 1 km of the southern edge of the lake and some 23 km from the sea.

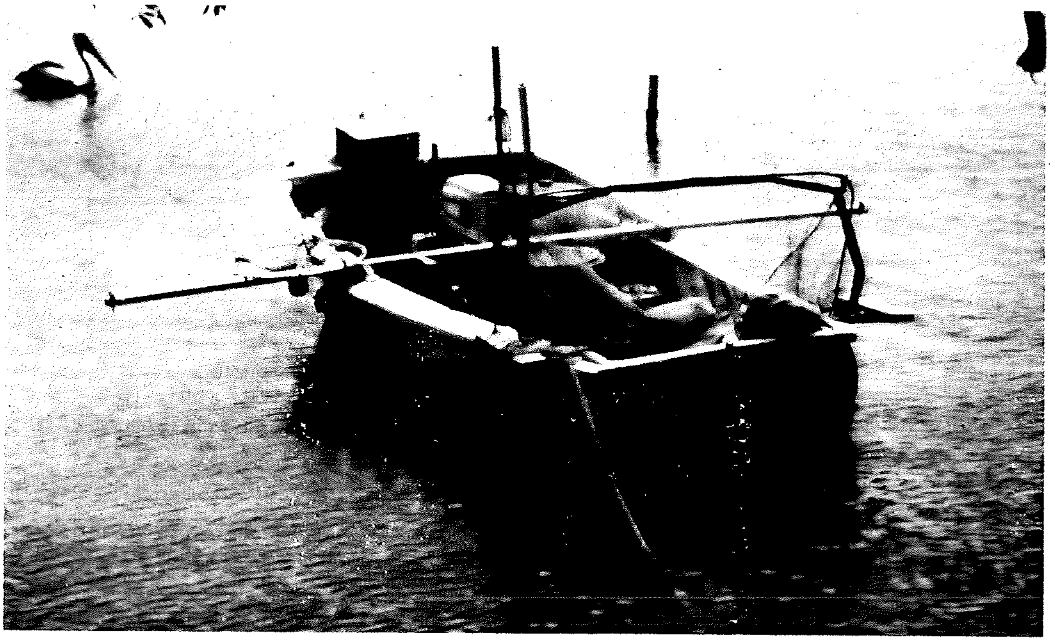


Figure 10. The beam trawl used to collect juvenile prawns.

The northernmost site in the north of Lake Cootharaba (NL) was close to the limit of saltwater penetration and within several kilometres of the limit of the distribution of penaeid prawns. The site was 0.5 km from the shore of Kinaba Island, 35 km from the sea, and on a sand bank covered with water to a minimum depth of 0.5 m.

Sites were chosen to be as similar in physical characteristics to each other as possible. All were relatively close to the shore with bottoms a mixture of silt and sand sediments and devoid of macroscopic bottom vegetation. The sites were representative of the prawn species composition of the general area in which they were located, and in positions where they were unlikely to be disturbed by commercial trawling operations or extensively used by amateur line fishermen. They were also to the side of major tidal channels and thus exposed only to slow tidal currents.

Sampling

Samples were collected from the four sites between 29-3-78 and 24-6-79. They were taken as close as possible to slack water, one during the day and one during the night. Samples were taken approximately fortnightly, always within three days of either a full or new moon. Each sample consisted of two individual trawls of 50 m in length, trawled over adjacent stretches of bottom. All trawls were taken against tidal currents when these were present. Water depths on the sampling sites ranged between 0.5 m and 1.25 m. At the completion of a trawl the net was hauled to the boat, the cod-end washed into a plastic bucket and the prawns removed and preserved in 5% formalin.

A 5 m beam trawler (Fig. 11) with a modified engine mount design (Coles, 1979) was used. This trawler provided both the speed and maneuverability required for experimental trawling.

Measurements

Prawns were sorted into species with reference to Dall (1957) and Young (1977). Size was determined by measuring carapace length using a binocular microscope and micrometer gauge. No prawns less than 1.1 mm in length were caught. Prawns longer than 1.1 mm were divided into 2 mm size classes, that is, 1.1 - 3; 3.1 - 5; 5.1 - 7; etc. This separation gave adequate numbers in each size class for each of the three species. Prawns immigrating into the estuary are referred to as postlarvae, prawns in the estuary less than 11 mm are considered juveniles, and those in the estuary in the 11.1 mm+ size classes are referred to as sub-adults.

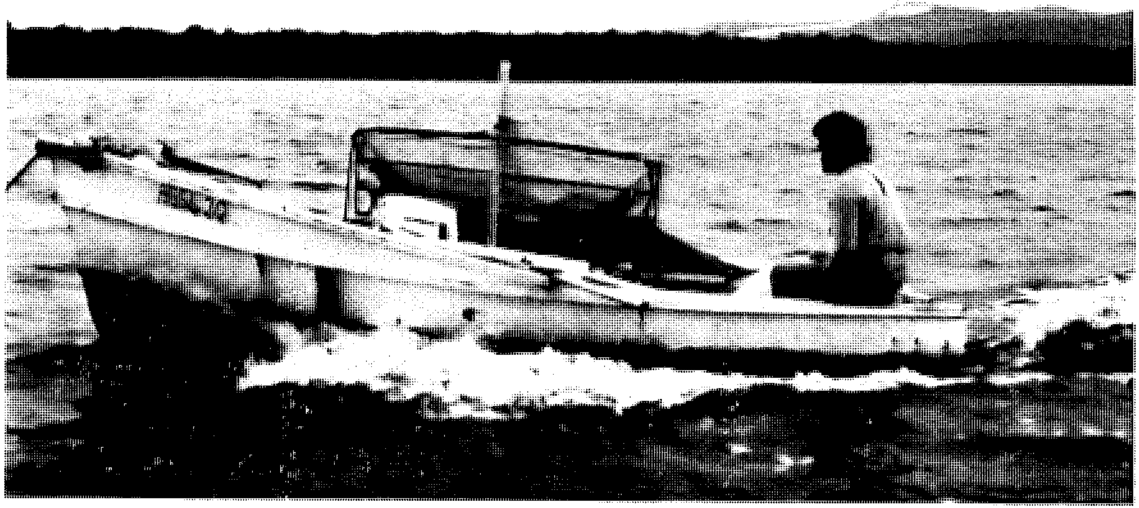


Figure 11. "Metapenaeus", a modified beam trawler, was designed for trawling in shallow confined waters.

THE LIFE CYCLE OF PENAEID PRAWNS

General life history

Racek (1959) has described a general life history for penaeid prawns based on species occurring in New South Wales which are similar to those at Noosa. Species forming the commercial catch at Noosa would be expected to conform to this description in most respects. A summary of Racek's description is presented below with the addition of size frequency graphs based on experimental catches at Noosa.

Penaeid prawns have a complex life cycle (Fig. 12) that involves many stages, some of which do not resemble adult prawns either in appearance or in behaviour. The stages may also be of short duration and are difficult to study and describe.

Adult females spawn in the open sea. The eggs are fertilised as they are released and fall to the bottom. A single female may release as many as 400 000 eggs with 100 000 to 200 000 being common. Eggs are usually yellow or pink in colour and in the order of 0.25 mm in diameter. The eggs usually hatch after 12 hours. The first stage of the prawn life cycle hatching from the egg is called a nauplius. This stage, which is about 1 mm in length, remains on or close to the bottom, and lasts for only 24 to 48 hours. The next stage is the protozoea which lives for some seven days and is approximately 3 mm in

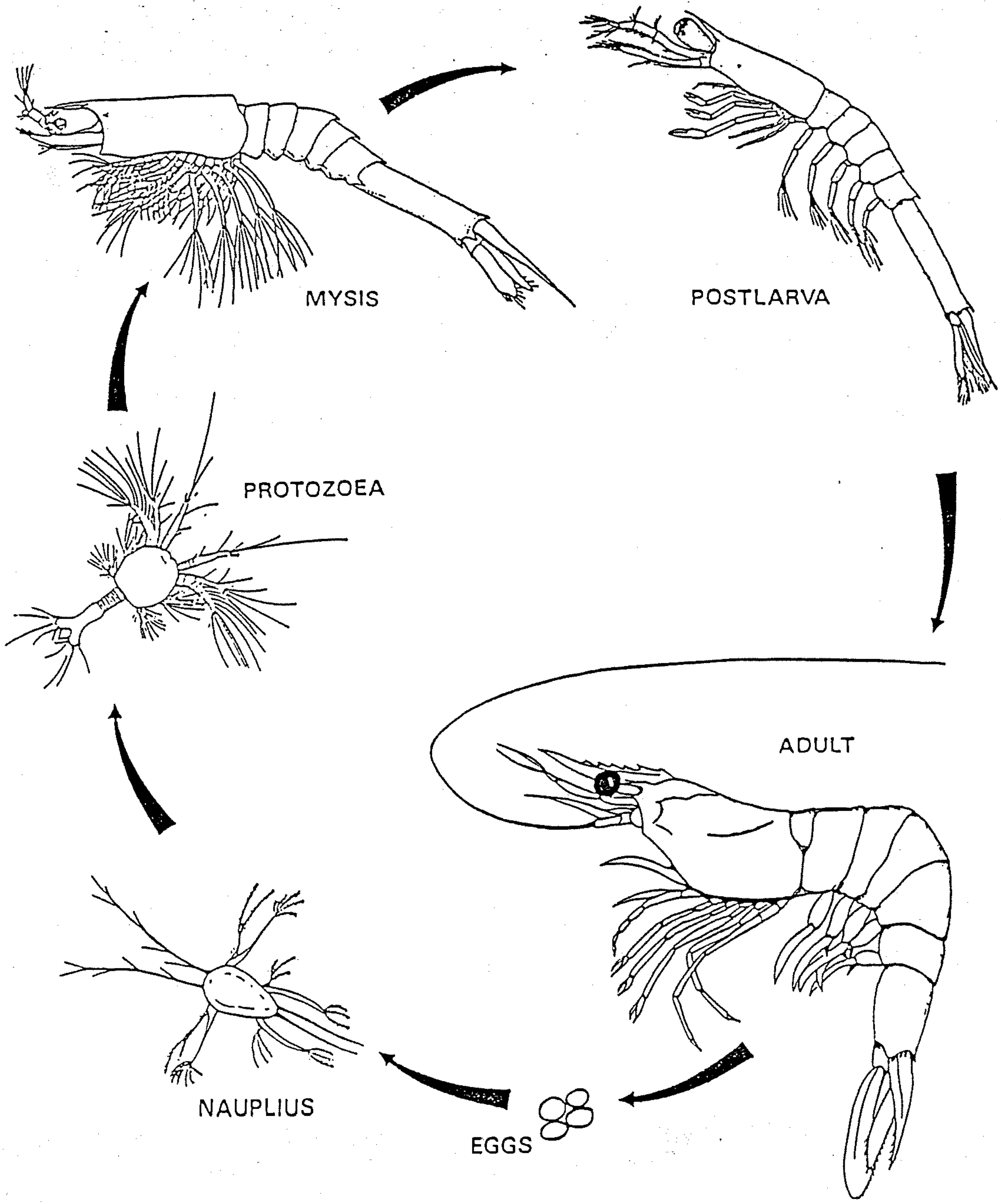


Figure 12. A diagrammatic representation of the life history stages of a penaeid prawn.

length. This is followed by a mysis stage which again lives for around seven days and grows to between 4 and 10 mm. Unlike the eggs and nauplius, the protozoea and mysis stages are planktonic. In these stages the larval prawns may be transported by tidal and wind generated water currents. These currents are necessary to carry the larval prawns into the sheltered inshore and estuarine 'nursery' grounds where the life cycle is completed. Failure of this process due to adverse weather conditions and currents may lead to a reduction in the number of prawns surviving to become adult and may lead to a subsequent poor fishing season. The next stage in the life cycle is termed the postlarva. This is the first stage that resembles an adult prawn. It is about 10 to 20 mm in total length and may live for around one month. Postlarvae settle on the bottom in sheltered, low salinity, shallow coastal and estuarine areas where, during late winter and early spring, they can be seen in large numbers. Over a period of three or four months postlarval prawns undergo a gradual change in morphology to become juvenile prawns eventually attaining a size of up to 15 cm in total length.

The timing of life history stages in the Noosa estuary

Size frequency data collected for P. plebejus at the four sites in the Noosa River are presented in Fig. 13. The presence of prawns with a carapace length of less than 3 mm indicates a recent immigration of postlarval prawns to the estuary. The presence of prawns in this size range throughout the year indicates that spawning and the resultant immigration occurs to some extent throughout the year. The presence of small numbers of large individuals during the year, and the absence of any well defined peak in their numbers suggests a small residual population of larger individuals remains in the river with the majority emigrating from the system at a relatively small size.

M. bennettae size frequency data for four sites within the Noosa River is presented in Fig. 14. Almost all M. bennettae less than 3 mm carapace length were caught between March and July, indicating that spawning of adult females must occur in late summer or autumn. From August to December there was a steady increase in the size of prawns in the estuary particularly at the sites in southern Lake Cootharaba where this species was most numerous. A reduction in the median size of prawns between December and February is evidence of emigration of juvenile and sub-adult prawns followed by the immigration of a new stock of postlarvae.

Size frequency data for M. macleayi are presented in Fig. 15. Prawns with a carapace length of less than 3 mm occurred occasionally throughout the year, but in greatest concentrations between April and July. There was a steady increase in the size of individuals from June to December. Emigration of juveniles and sub-adults occurred quite abruptly in March with a drop in the median size of prawns at

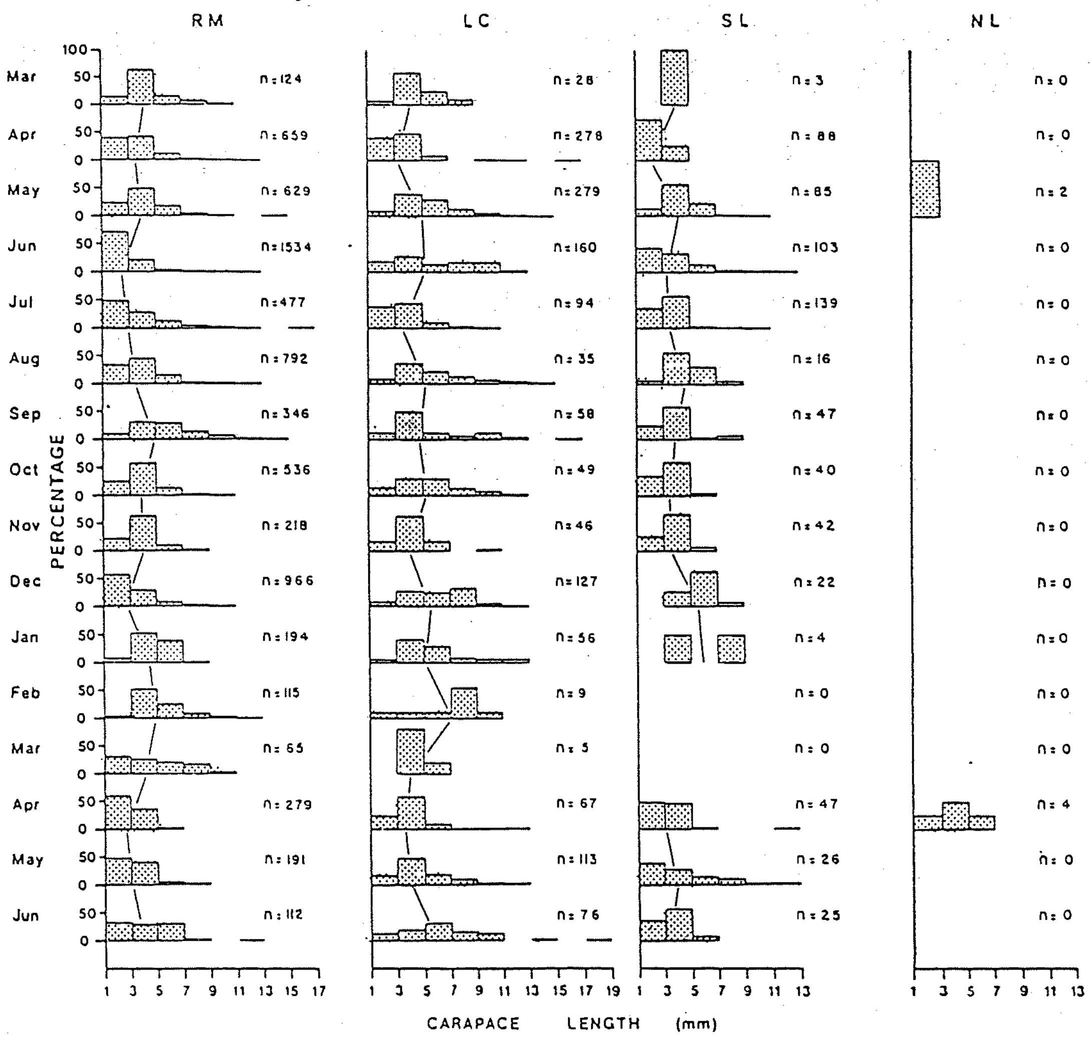


Figure 13. The size frequency distribution of P. plebebjus at the four sites (RM, LC, SL and NL) for the 16 month study period. The solid line joins the median value of each distribution, and 'n' is the total number of prawns caught in the month at each site.

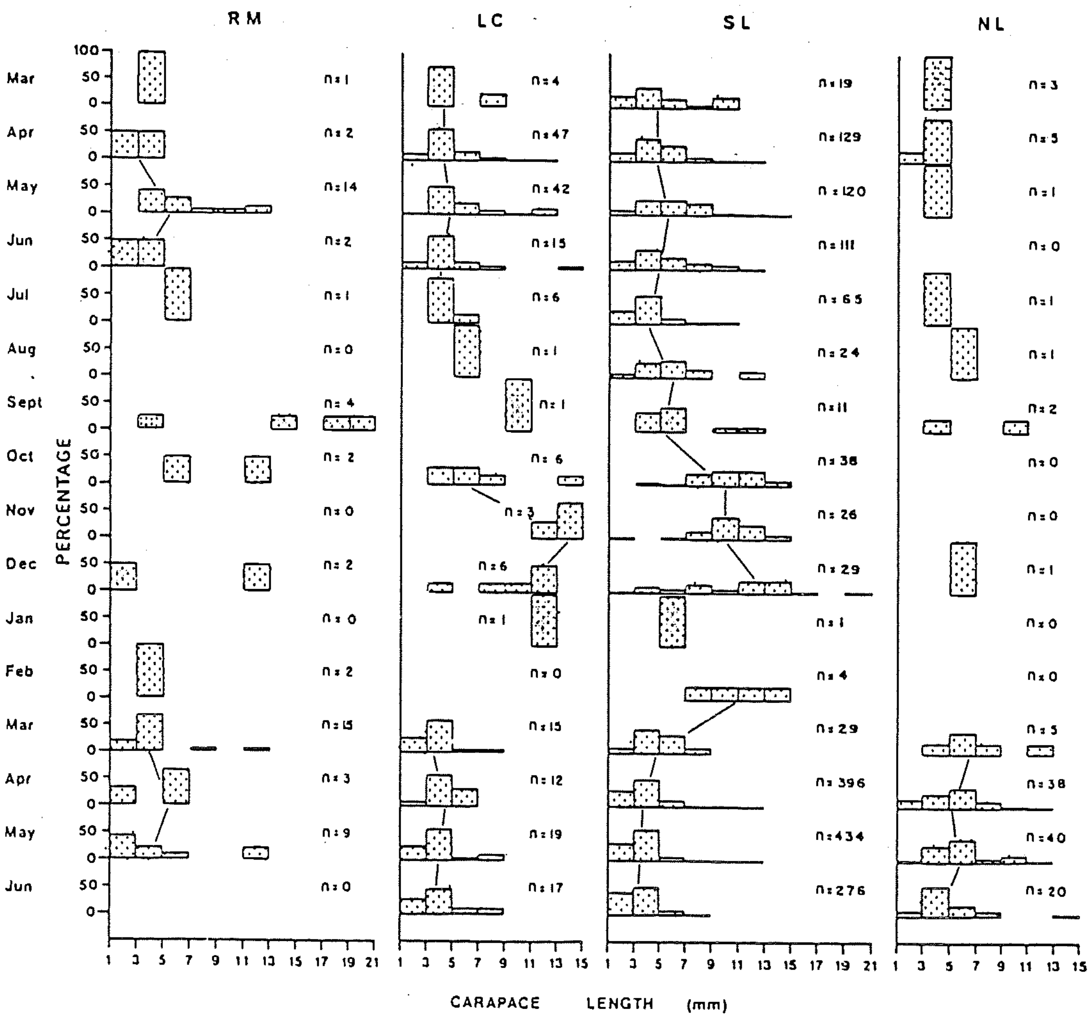


Figure 14. The size frequency distribution of <u>M. bennettae</u> at the four sites (RM, LC, SL and NL) for the 16 month study period. The solid line joins the median value of each distribution, and 'n' is the total number of prawns caught in the month at each site.

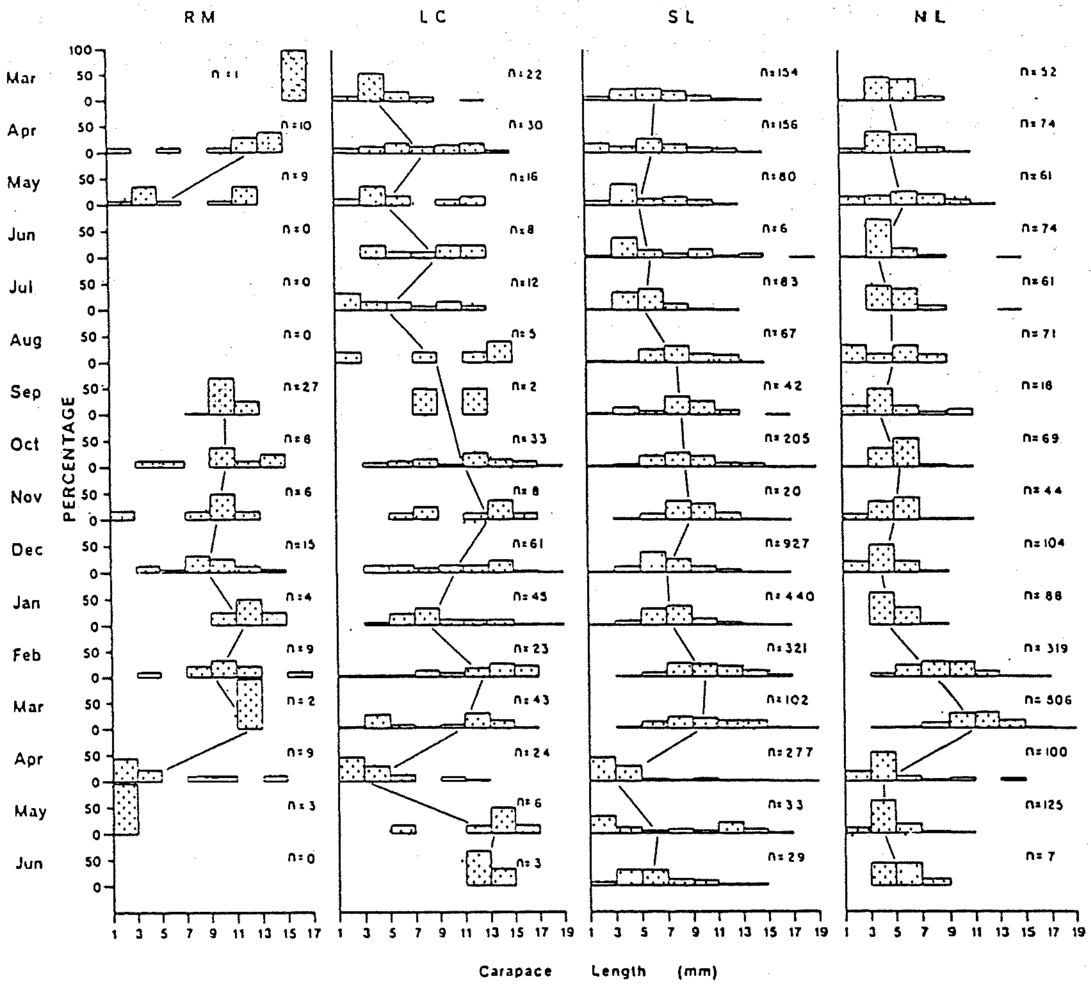


Figure 15. The size frequency distribution of M. macleayi at the four sites (RM, LC, SL and NL) for the 16 month study period. The solid line joins the median value of each distribution, and 'n' is the total number of prawns caught in the month at each site.

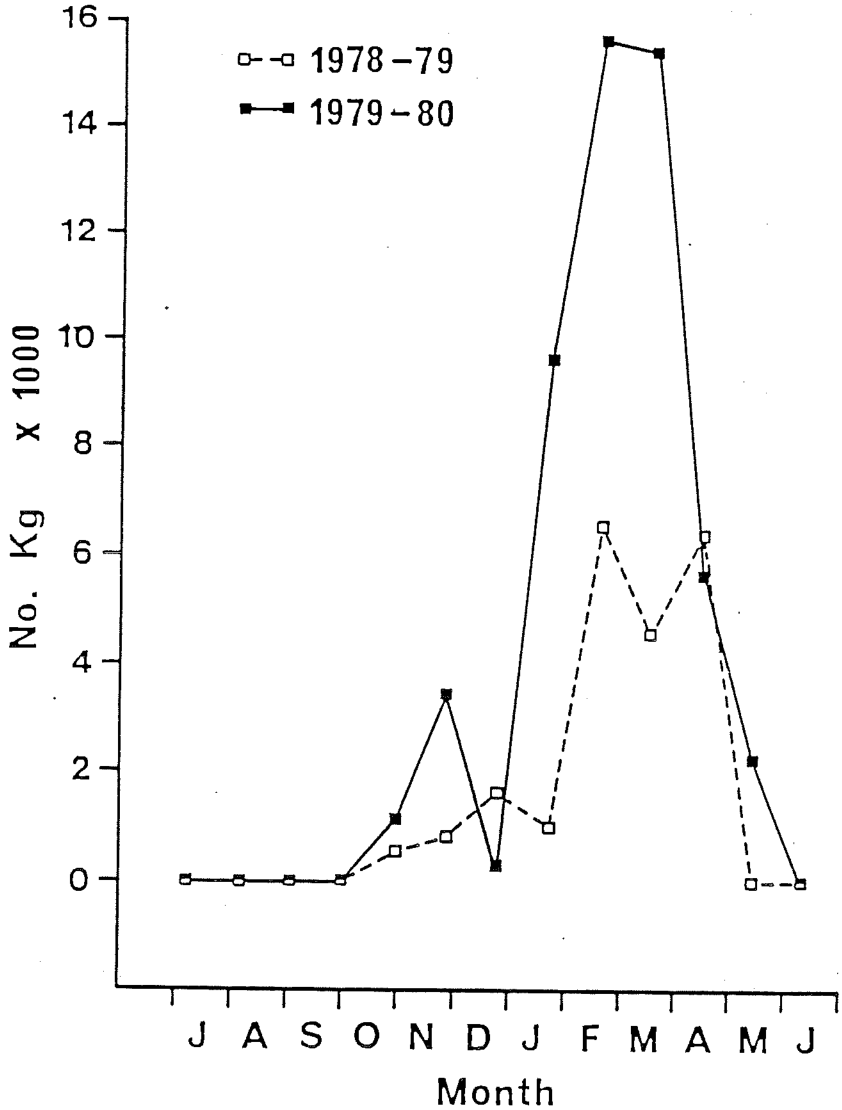


Figure 16. Monthly commercial bait prawn landings at the Queensland Fish Board depot, Tewantin, for the years 1978 to 1980.

all sites. The timing of this emigration is roughly coincident with the end of the commercial fishing season (Fig. 16). There is also some indication of a smaller emigration of juveniles and sub-adults between November and January.

Because of the many stages and complex factors involved in the life cycle it is difficult to predict the size of populations from year to year. The success of spawning, the recruitment of larval stages to the estuaries, the recruitment of juveniles to the population of adults, and the mortality during each stage all influence the number of prawns living to maturity in a prawn stock. The number of juveniles recruited to an adult population may bear no relationship to the size of the population that spawned them.

SEASONAL CHANGES AND A COMPARISON OF DAYTIME AND NIGHTTIME CATCHES

Catch rates for P. plebejus (Fig. 17) show that the majority of this species was taken at night with only incidental catches during the day. The largest numbers were taken in early winter and result from the immigration of prawns into the river mouth site at this time (Fig. 13). This species was comparatively numerous in the estuary with catch rates recorded for individual one minute trawls as large as 577 prawns (June 1977). This represents a bottom density of close to eight prawns per square metre.

The numbers of M. bennettae were smaller with the largest catch in a single trawl of 105 prawns taken in May 1979. This species was most numerous between March and June 1979 (Fig. 18). The largest catches were from trawls made during the night. Daytime catches were small except between March and June 1979 when larger catches were taken.

M. macleayi was present in the estuary throughout the year (Fig. 19) with the largest catches between October and May. The largest catch for an individual trawl was 198 prawns in December at the southern end of Lake Cootharaba. Between October and May, a period that is coincident with the commercial fishing season, catches during the daytime were comparable with those taken at night. At other times of the year catches were greater at night.

THE DISTRIBUTION OF PRAWNS WITHIN THE ESTUARY

Although P. plebejus was the most numerous penaeid prawn its size distribution and distribution within the estuary was such that it is only a small component of the commercial catch. The majority of this species were of a carapace length less than 5 mm (Fig. 20).

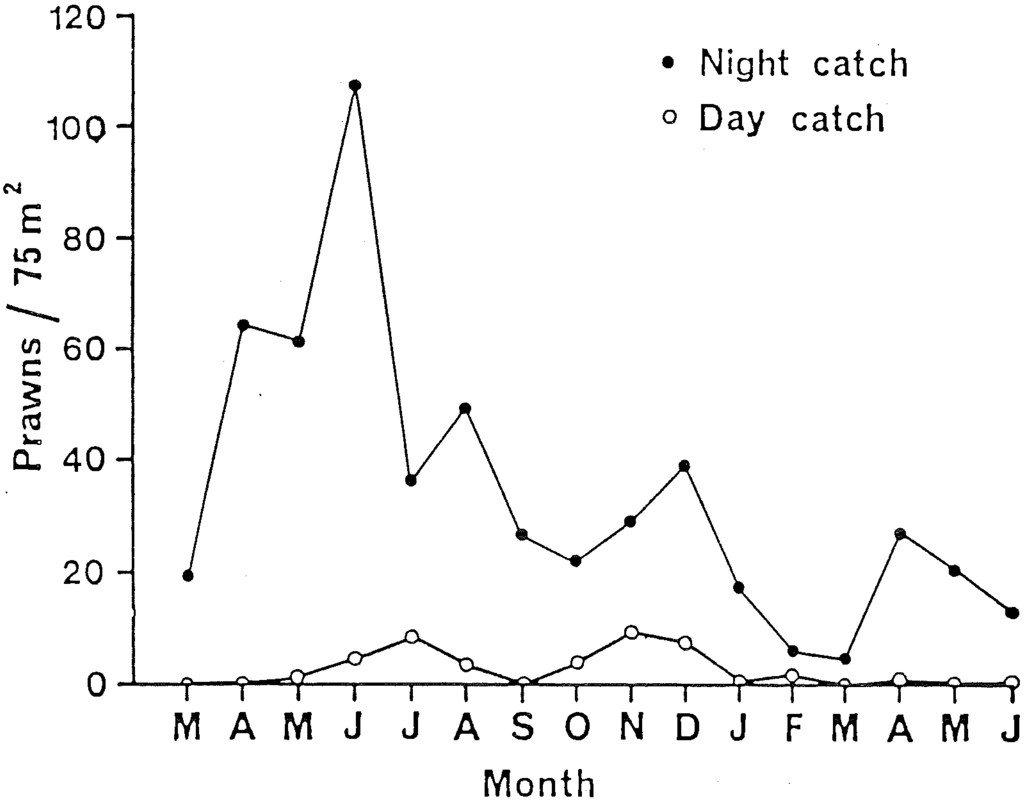


Figure 17. The number of P. plebejus caught at all sampling sites for the period, March 1978 to June 1979.

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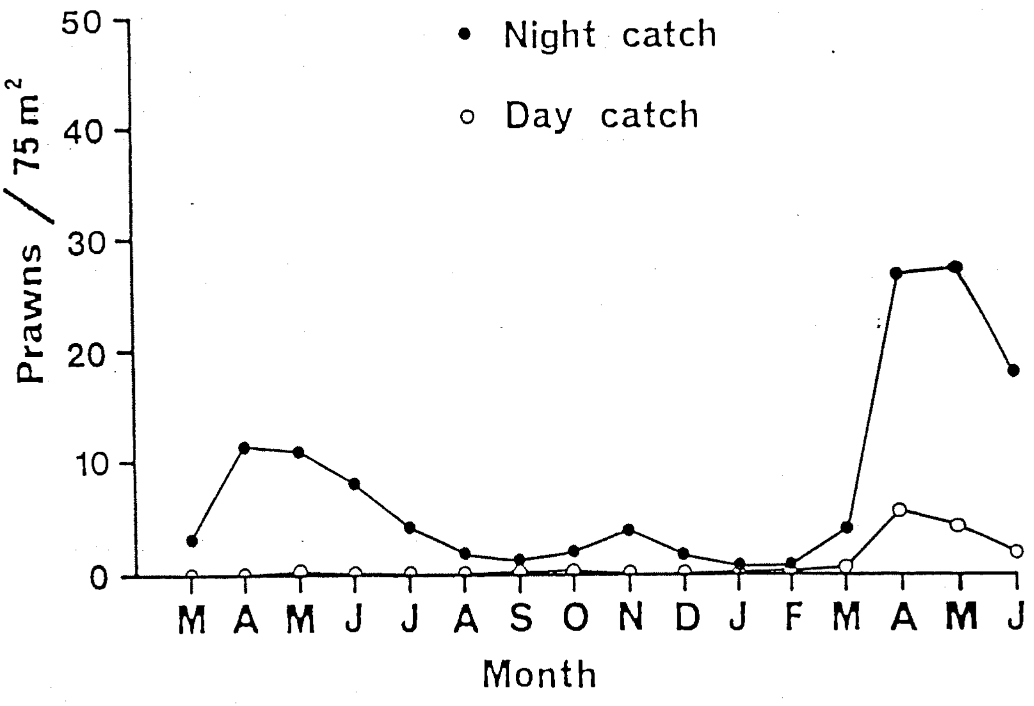

Figure 18. The number of *M. bennettae* caught at all sampling sites for the period, March 1978 to June 1979.

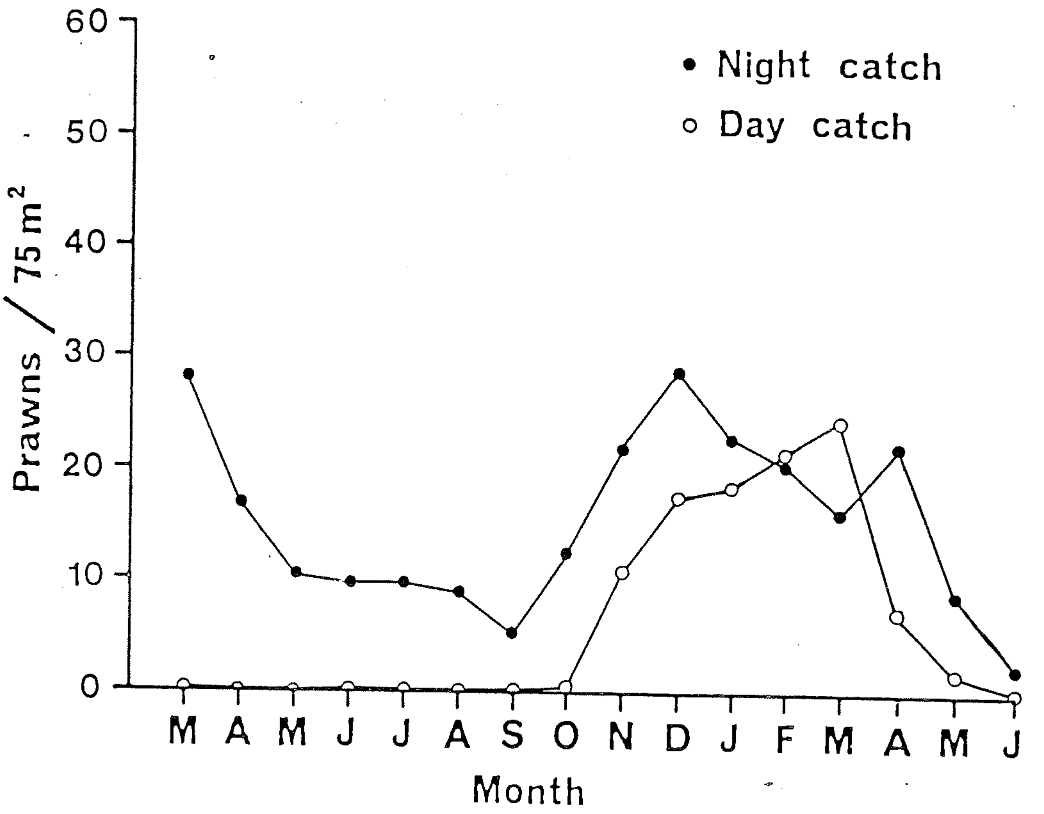

Figure 19. The number of M. macleayi caught at all sampling sites for the period, March 1978 to June 1979.

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The distribution of size classes at the four sites was similar. Only an occasional prawn with a carapace length greater than 9 mm was caught. Small numbers of this species in the commercial catch may also result from a distribution within the estuary that is skewed towards sites close to the river mouth (Fig. 21). Few P. plebejus were caught in southern Lake Cootharaba, the most heavily fished area, while in comparison, the catch near the river mouth where commercial prawn fishing is uncommon, consisted almost entirely of this species. The small numbers in the commercial catch would be a result of a combination of these factors.

A majority of M. bennettae in the estuary were less than 7 mm in length with size distributions similar at the four sites (Fig. 22). Larger prawns tended to account for a greater proportion of the catch at sites closer to the river mouth. This species was restricted in distribution within the estuary, and was common only at the sampling site in southern Lake Cootharaba (Fig. 21).

In contrast to both P. plebejus and M. bennettae the size class distribution of M. macleayi shows a predominance of larger prawns at all sites particularly at sites close to the river mouth (Fig. 23). This species was common at the two Lake Cootharaba sites (Fig. 21). The size distribution and distribution within the estuary both contribute to the predominance of this species in the commercial bait prawn catches in the Noosa estuary. This can be seen clearly in Fig. 24, which represents the distribution of prawns with a carapace length greater than 11.1 mm. These prawns are of a size available to the commercial catch. M. macleayi was predominant at the Lake Cooroibah and southern Lake Cootharaba sites.

RELATIONSHIP BETWEEN COMMERCIAL AND EXPERIMENTAL CATCHES

There is close agreement between the weight of prawns landed per month at the Fish Board (Fig. 16) for 1978 and 1980, and daytime catches of M. macleayi and M. bennettae made with experimental trawls (Fig. 18, 19).

Graphs of the experimental catches of M. macleayi with a carapace length in excess of 11.1 mm taken at the southern and northern ends of Lake Cootharaba are presented in Figs. 25 and 26. At the site at the southern end of Lake Cootharaba prawns exceeding 11.1 mm, which are available to commercial catches, were present throughout the year at night and between October and June during the daytime. Catches at the northern Lake Cootharaba site were restricted almost entirely to March, but when prawns were present they were in sufficient numbers, and of a size to warrant commercial interest (March, North Lake, Fig. 25). Local fishermen do not normally trawl in areas as far north as this yet acceptable quantities of prawns comparable in size to those on more commonly fished grounds may be present at certain times of the year.

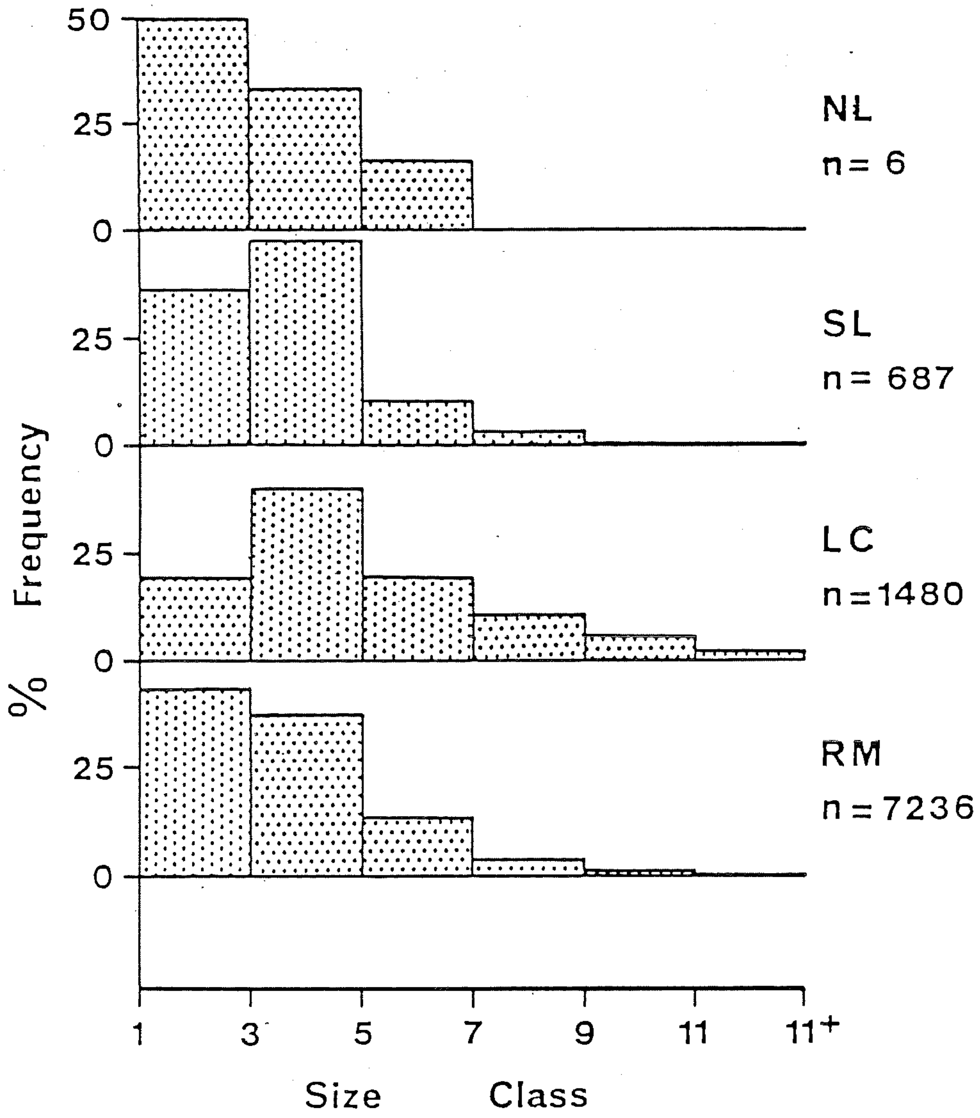

Figure 20. The size frequency distribution of P. plebejus at the four sampling sites (NL, SL, LC and RM) for the period, March 1978 and June 1979. n = the total number of prawns caught at each site.

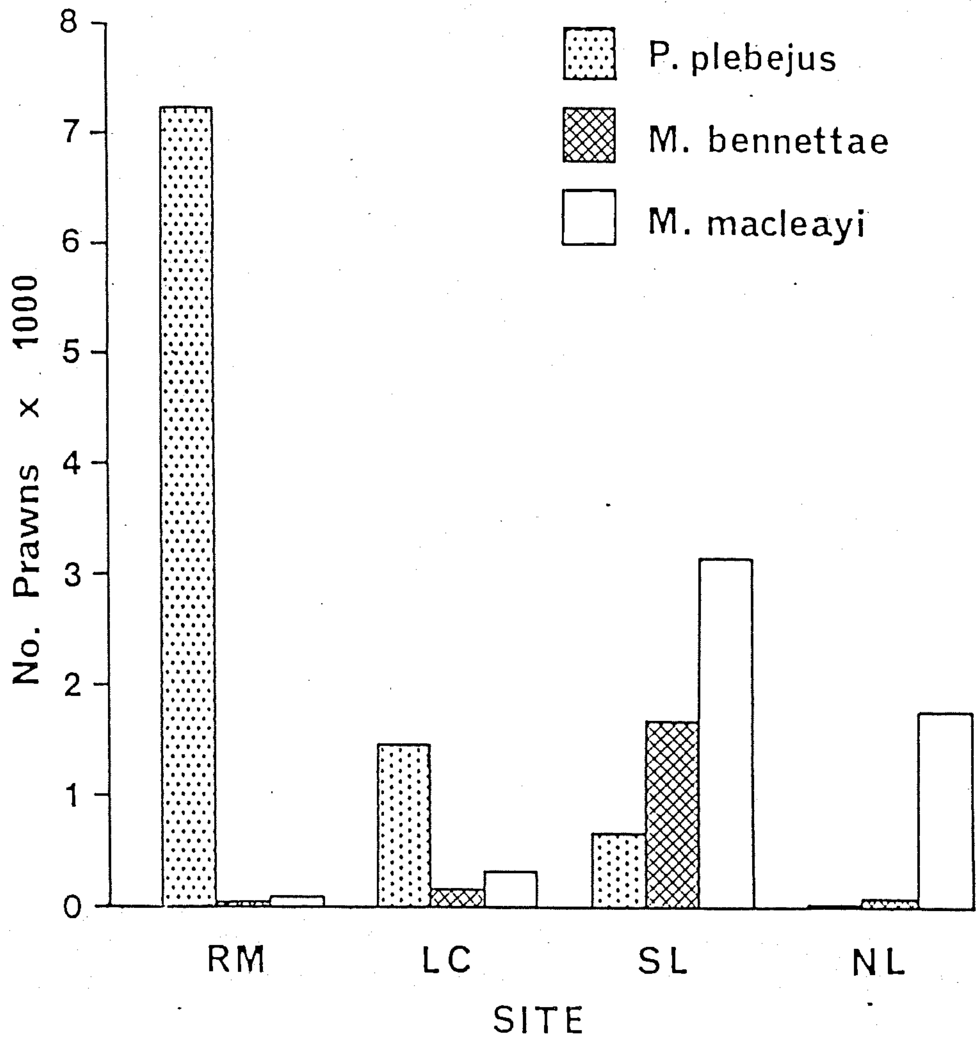

Figure 21. The relative number of the three species of prawns at the four sampling sites (RM, LC, SL and NL) for the period, March 1978 to June 1979.

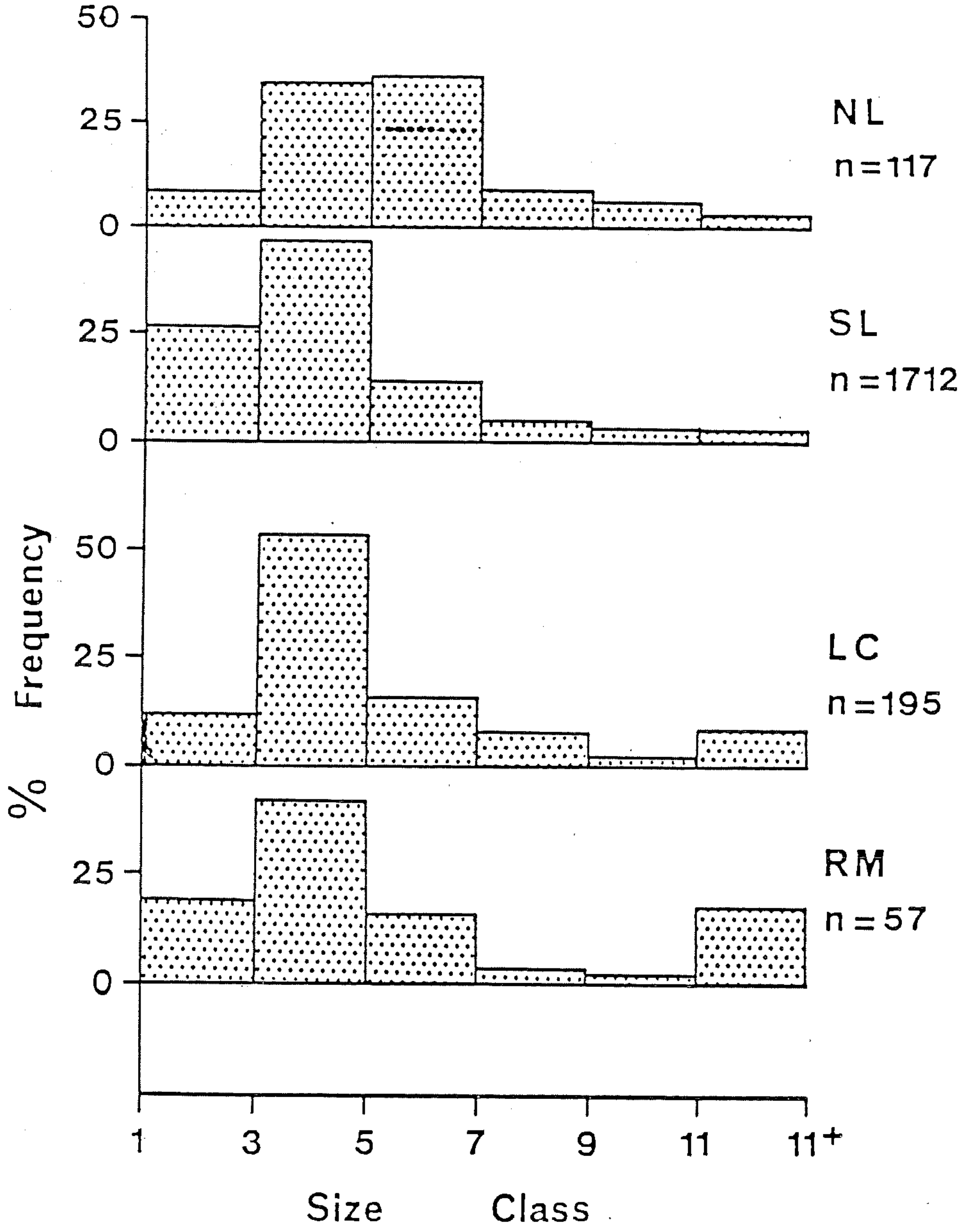

Figure 22. The size frequency distribution of *M. bennettae* at the four sampling sites (ML, SL, LC and RM) for the period, March 1978 to June 1979. n = the total number of prawns caught at each site.

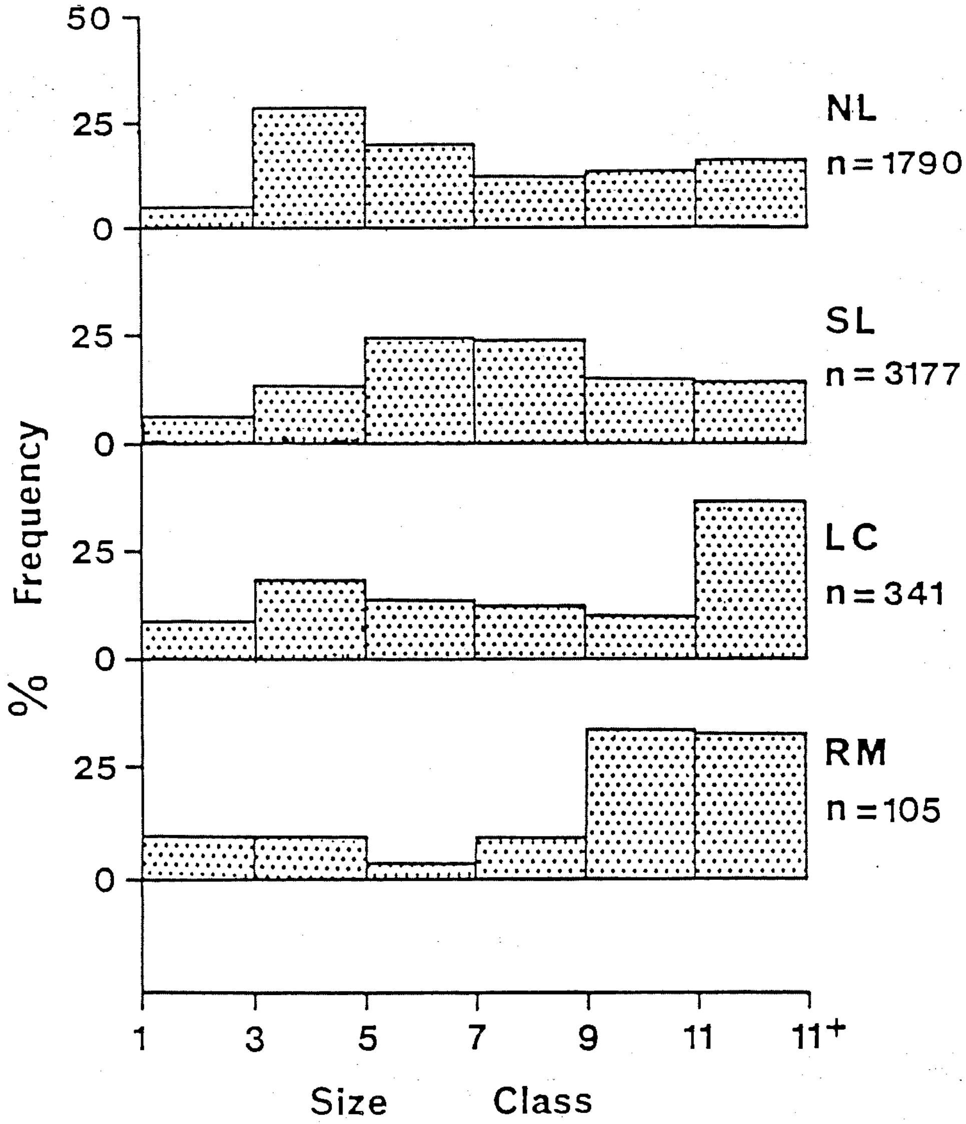

Figure 23. The size frequency distribution of *M. macleayi* at the four sampling sites (NL, SL, LC and RM) for the period, March 1978 to June 1979. n = the total number of prawns caught at each site.

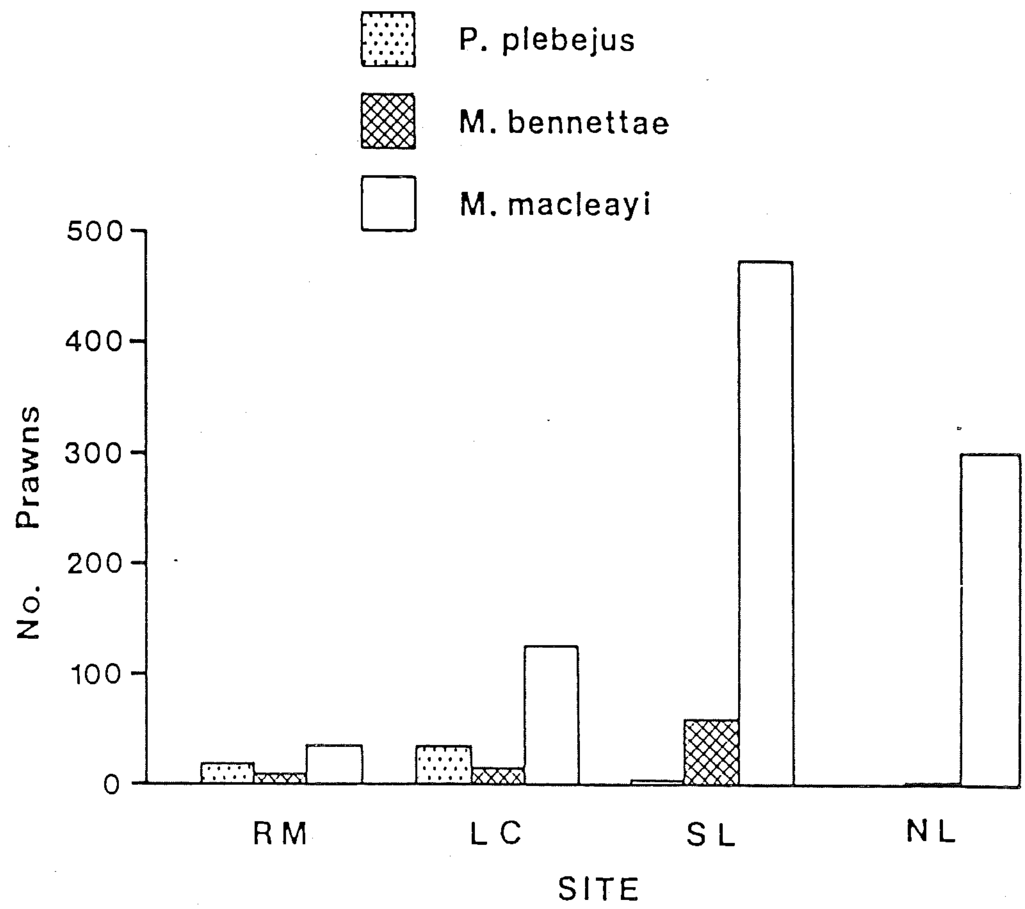

Figure 24. The relative number of prawns with a carapace length in excess of 11.1 mm at the four sampling sites (NL, SL, LC and RM) for the period, March 1978 to June 1979.

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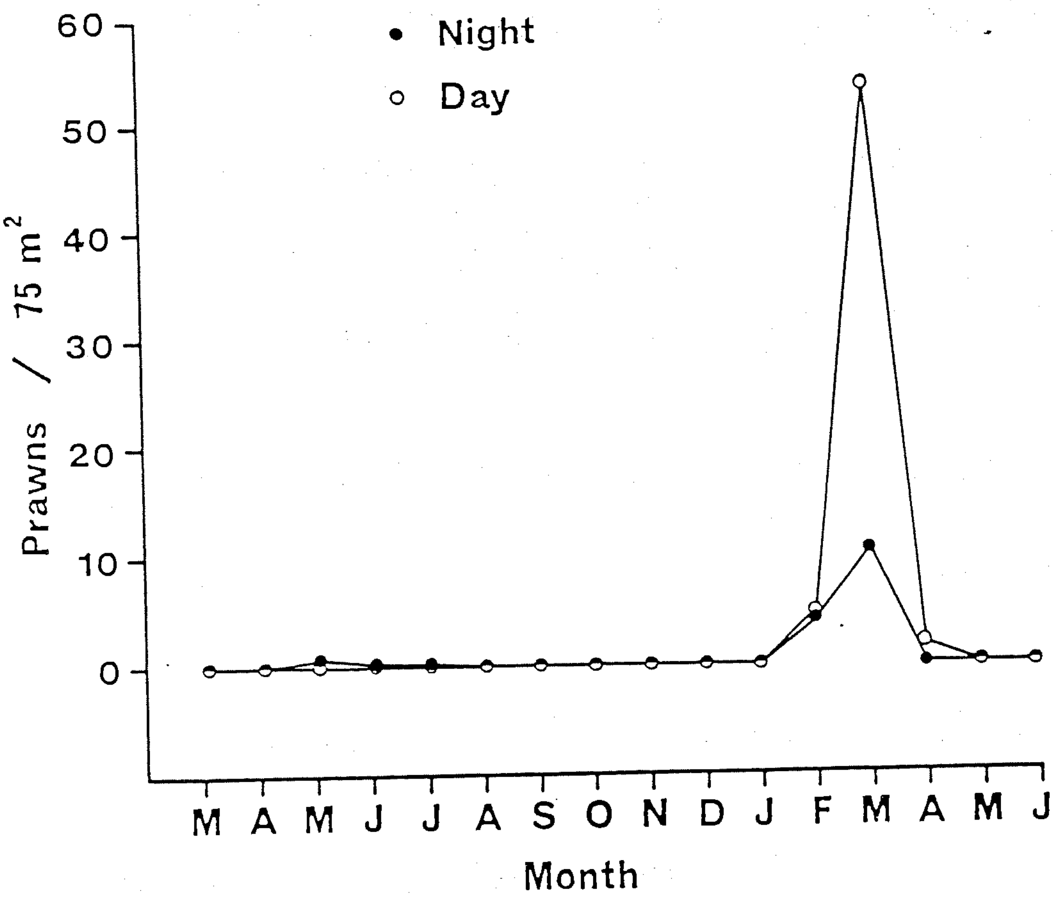

Figure 25. The number of *M. macleayi* with a carapace length in excess of 11.1 mm at the north Lake Cootharaba sampling site for the period, March 1978 to June 1979.

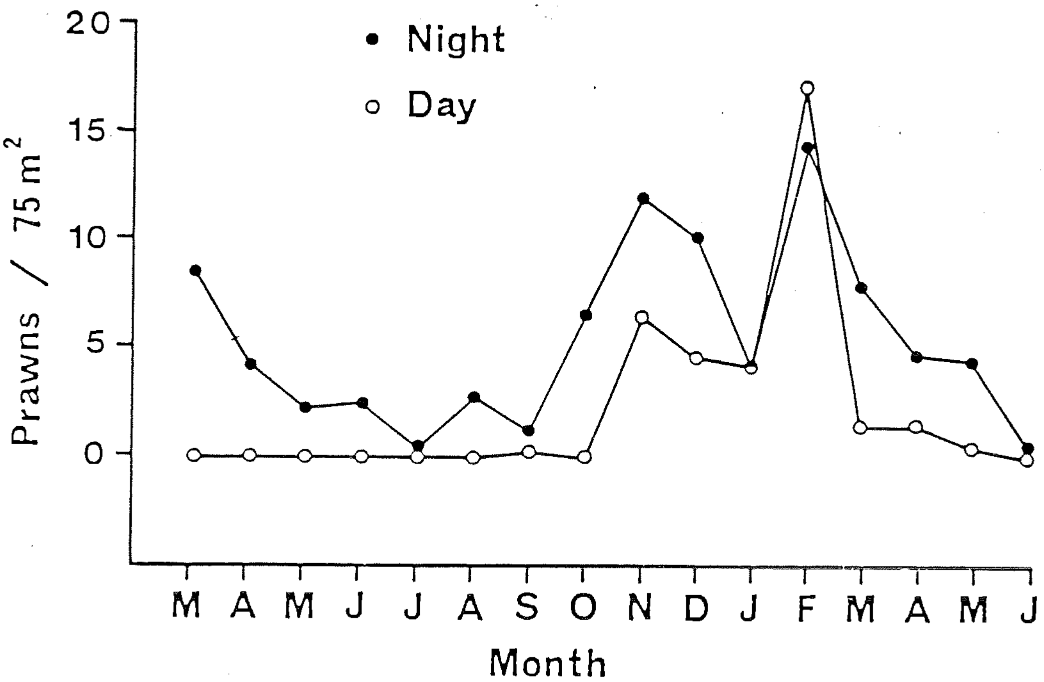

Figure 26. The number of M. macleayi with a carapace length in excess of 11.1 mm at the south Lake Cootharaba sampling site for the period, March 1978 to June 1979.

DISCUSSION

The results of tagging studies in New South Wales (Ruello, 1977) and studies in the Brisbane River (Dall, 1958) suggest that the majority of adult M. bennettae and M. macleayi leaving the Noosa Estuary would not migrate from the confines of the adjacent Lagoona Bay. This area is rarely fished due to patches of rough bottom and the difficulty of navigating the Noosa River bar. Even if these species escaped capture within the estuary they would not make an important contribution to the offshore fishery.

In contrast, P. plebejus spawn offshore and adults of this species form the basis of an extensive fishery extending from the New South Wales border north to Fraser Island. Present fishing methods, fisheries legislation, and the size range of juvenile P. plebejus protect them from being caught within the estuary. There is also little disturbance by commercial fishermen to the areas populated by juveniles of this species, and estuarine trawling in the Noosa River is unlikely to exert any influence on the size of P. plebejus populations offshore.

A similar situation is likely to exist in nearby estuaries such as Pumicestone Passage where similar fisheries occur.

This may not necessarily be the case for estuaries draining into Moreton Bay further south. Fishing in these estuaries must compete with the medium size 'bay' trawlers which catch M. bennettae and M. macleayi in areas adjacent to the river mouths. In turn the 'bay' trawlers catch juvenile P. plebejus reducing the stock available to the offshore fishery. Management decisions involving these fisheries could only be made after further scientific studies.

The size of the night time prawn catches at Noosa were unexpected. M. macleayi, the principal commercial species, has been considered a daytime active species, and the fishery a daytime one. Results from the Noosa River (Figs. 19, 25) show that night time catches were at least as large as daytime catches, and occurred over a longer period of time.

Opening the fishery to night trawling may have the desirable effect of extending the fishing season and thus avoiding the glut of prawns that occurs when catches are large over a short period of time. It is unlikely to increase total catches. The fishing grounds that are consistently worked are sufficiently limited in area that the prawns on these grounds are quickly captured. Total catch size is probably limited more by recruitment rates to these grounds than by the absolute size of the population. Allowing night time fishing would also involve increased conflict with the amateur line fishery and the noise would disturb local residents.

The fishery is less active than the number of fishermen involved and the length of season would suggest. Fishermen rarely trawl more than six hours per day and for only 50 to 60 days in the season. The season is short because most fishermen spend time at other fishing activities such as mud-crabbing, gill netting and beach netting, and because they 'hold-off' to allow prawn numbers to build up on the fishing grounds. In any one year these factors result in large intermittent catches followed by periods when no fishing occurs. The intermittent nature of the catch is also influenced to some extent by the limited fishing grounds within the estuary. Fishing is almost entirely confined to the soft mud bank areas in Lake Cootharaba south of a line due east from Boreen Point. Catches may occasionally be taken within a kilometre or so north of this line, and also from Lake Cooroibah when the depth is sufficient to allow trawling, but these areas are not heavily fished. The prawn population on the fishing grounds would be rapidly depleted when fishing pressure is heavy, and it would require several days for prawns from the extensive, untrawlable shallow areas to disperse to the fishing grounds. The limited nature of both fishing effort and the fishing grounds ensure that the habitat damage caused by bottom trawling operations would be minimal in terms of its impact on the estuary as a whole.

Studies of M. macleayi populations in New South Wales (Racek, 1959) describe this species as an inconsistent prawn species due to fluctuations in catches during a season and between consecutive seasons. There has been a tendency to apply this description to the prawn populations of the Noosa system without a thorough understanding of the species present or the nature of the fishery. There are in fact few similarities between the Noosa fishery and many of those fisheries based on M. macleayi in New South Wales. Prawns in the Noosa system appear to leave the estuary at a much smaller size, do not reach maturity in the lower reaches of the river, and are not flushed from the estuary by seasonal flooding to form the basis of an inshore fishery as they are in most New South Wales estuaries. The population size of juvenile prawns in the Noosa River has probably remained relatively stable since 1956. Fluctuations in the commercial catch are accentuated by fishing methods, the restricted nature of the fishing ground, and to some extent by the limitation of fishing only in daytime. Commercial catch data (Fig. 7) demonstrates that while total catch may vary from year to year as it does in most penaeid prawn fisheries, the long term trend shows a consistent level of catch with certainly no evidence of overfishing or depletion of stocks.

In purely biological terms there is no reason to restrict prawn fishing activity in the Noosa River. The demand for bait prawns is likely to continue in the forseeable future and the market for these prawns seems assured. Past management decisions and fishing methods have produced a fishery that does not compete with the offshore prawn fishery, has little influence on the estuarine environment, and should not interfere with development plans for the estuary.

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