

3. FISHING PATTERNS OF THE TORRES STRAIT PRAWN FLEET

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3.1 Introduction

Commercial prawn trawling has occurred in Torres Strait since 1974 and now produces 1000 tonnes annually (Section 1). Three main species of penaeid prawns are taken commercially: *Penaeus esculentus*, the brown tiger prawn, *Metapenaeus endeavouri*, the endeavour prawn and *P. longistylus*, the red spot king prawn. *P. esculentus* and *M. endeavouri* together make up 90% of prawn landings for Torres Strait. *P. esculentus* dominates prawn catches and are the most sought after because the highest export prices are paid for this species.

Fishing effort in the Torres Strait Prawn Fishery is concentrated in the early months of the year. This coincides with a peak in recruitment of small *P. esculentus* (Section 5). Prior to implementation of seasonal closures to fishing, fishing effort was more evenly applied throughout the year.

The Torres Strait Prawn Fishery is subject to an international treaty which calls for joint catch-sharing and management arrangements between Australia and Papua New Guinea. Total allowable catch quotas, closed fishing seasons, vessel and gear restrictions and closed areas are employed in its management. The geographical extent of the fishery, the location of those areas currently closed and the areas of national jurisdiction are shown in Figure 1.

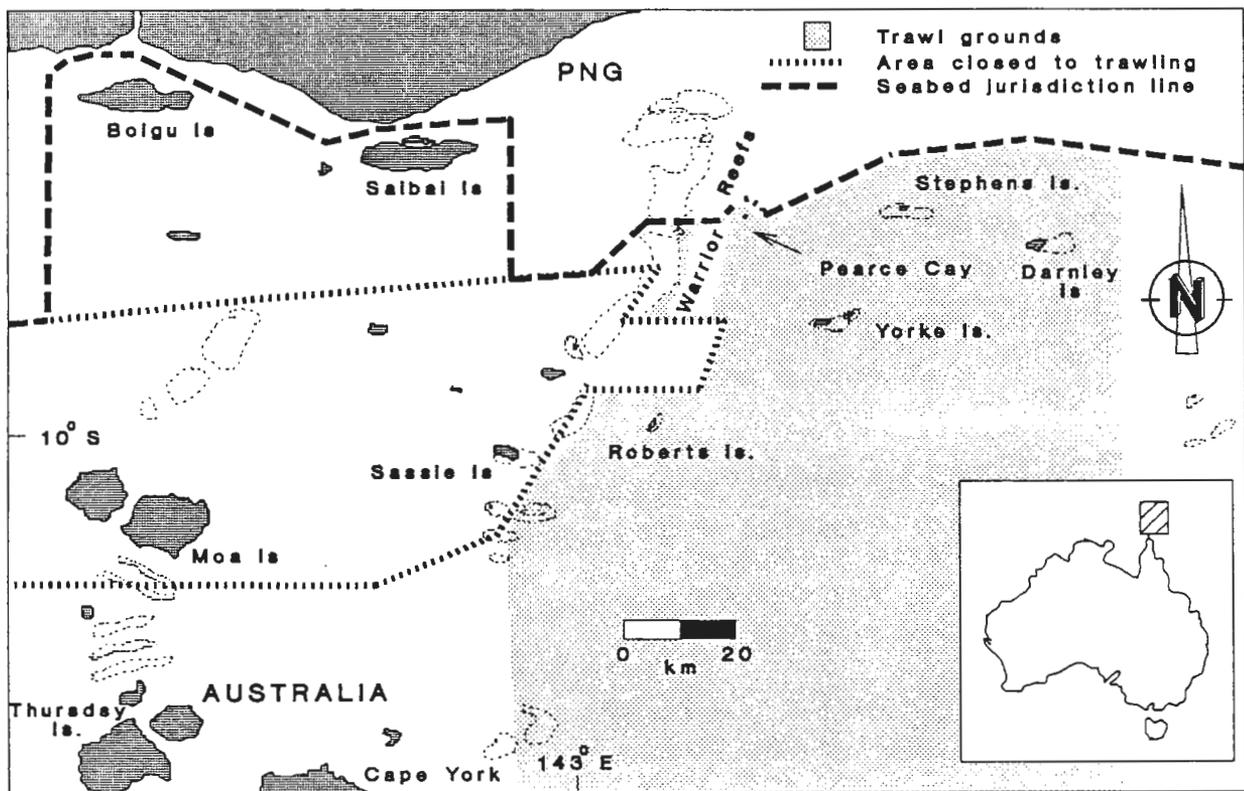


Figure 1. Location of Torres Strait showing trawling grounds, seabed jurisdiction lines, and area in Australian waters closed to trawling.

Fisheries management requires detailed catch and effort data over a long time so that trends can be observed and possible population changes can be predicted, and the disaster of a failed fishery hopefully avoided. The Northern Prawn Fishery (NPF) logbook data is the only source of information which permits analysis of spatial and temporal trends of catch and effort in the Torres Strait Prawn Fishery (Section 2).

Logbook records provide total effort (hours trawled) and catch (kg) data for *P. esculentus*, *M. endeavouri*, *P. longistylus*, and other unidentified species of prawns at a spatial resolution of about 11 km². Records are available from 1980 to the present.

This study examines the spatial and temporal fishing patterns of the Torres Strait prawn fleet from 1980-86 based on NPF logbook records and relates these fishing patterns to *P. esculentus* recruitment patterns (Section 5).

3.2 Materials and Methods

Information on fishing effort and catch was extracted from NPF logbooks and unloading (export inspection service) records. To facilitate larger scale spatial comparisons of fishing effort the 11 km² grids were combined into five larger areas (Figure 2).

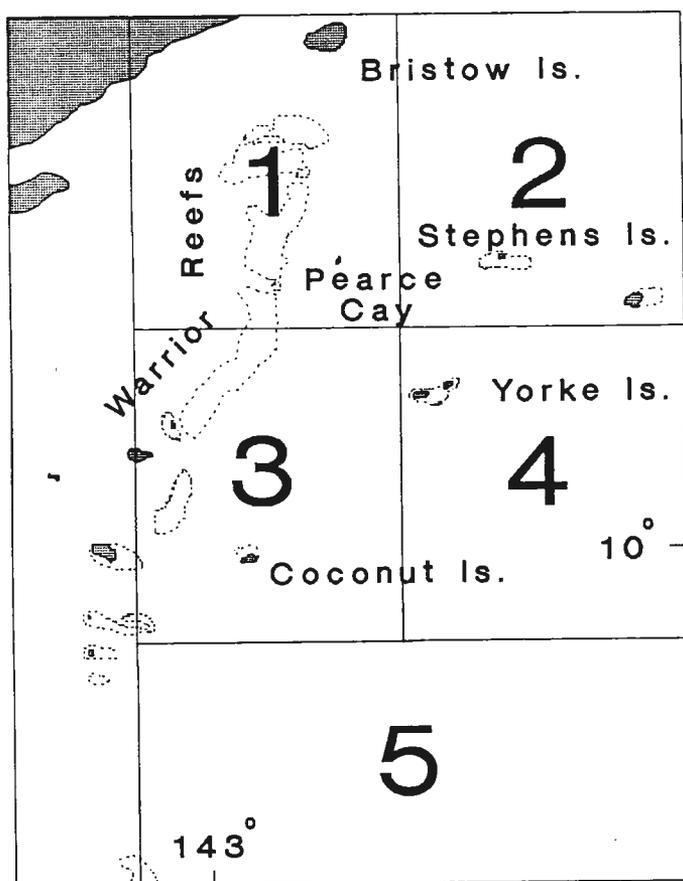


Figure 2. Map of the Torres Strait fishing grounds showing the five defined areas used in the analysis of effort distribution.

3.3 Results and Discussion

3.3.1 Catch composition

The percentage that *P. esculentus* catches comprised of the total catch varied markedly from year to year for most of the defined areas (Figure 3). *P. esculentus* usually accounted for more than 50% of the catch from areas 1 and 4, conversely, other prawn species, principally *M. endeavouri*, often dominated in areas 3 and 5. In area 2, catches were comprised of about equal quantities of *P. esculentus* and *M. endeavouri*.

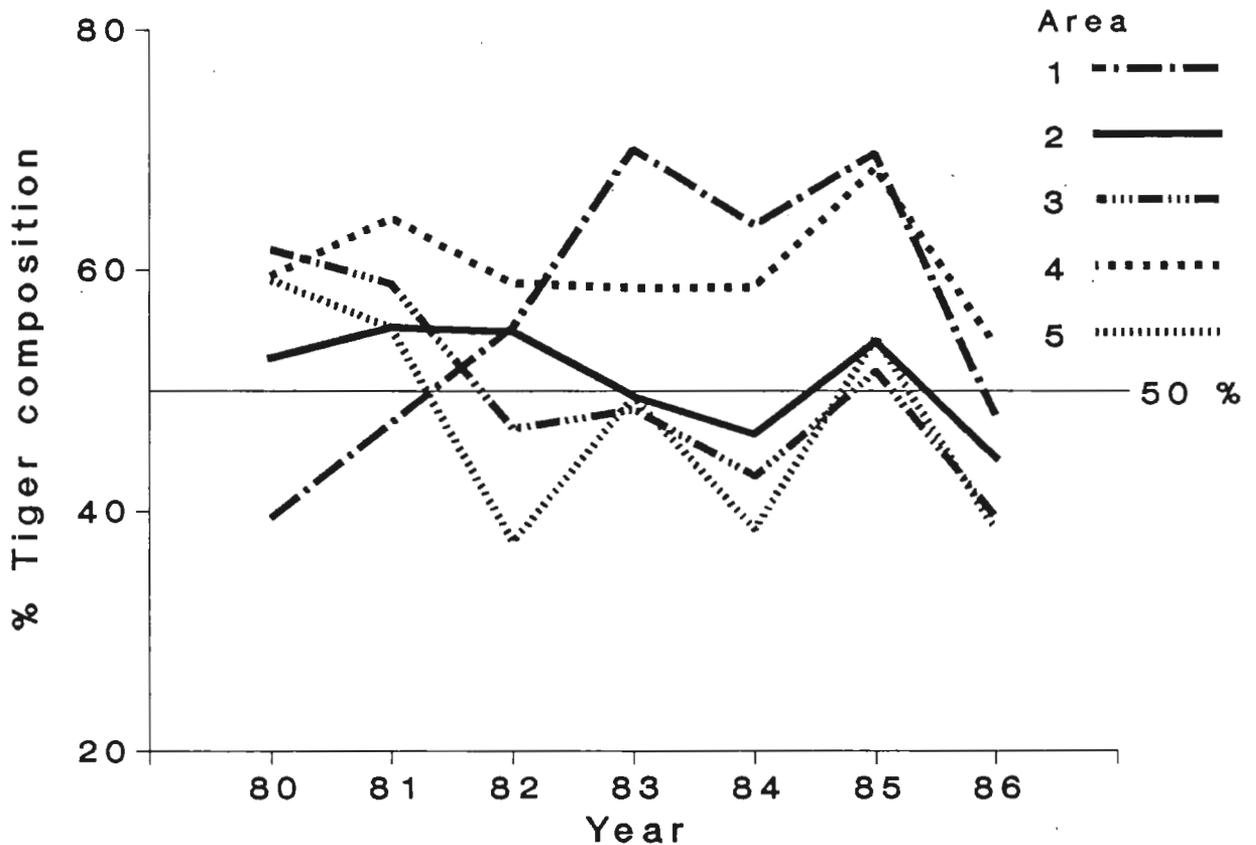


Figure 3. Percentage composition of *P. esculentus* from the total catch (1980-86) over five defined areas.

Based on unloading records, the annual catch of *P. esculentus*, as a percentage of the total weight of the catch, has declined since 1978 (Section 2). *P. esculentus*, as shown by both unloading records and by NPF logbook data, fluctuated annually between 41% and 61% by weight of the total prawn catch (Figure 3). The remainder of the catch was comprised mostly of *M. endeavouri*. Catches of *P. longistylus* prawns have remained relatively small and stable.

The fluctuation in the contribution made by *P. esculentus* to the total annual prawn catch may be related to either closures to fishing, which alter the spatial and temporal distribution of fishing effort, or to environmental factors which can affect the abundance or catchability of this species.

Environmental factors such as currents and weather could possibly regulate the number of prawn recruits entering the fishery during any one year. Different species may be affected to varying degrees which could alter the catch composition. Little information is available on this topic and is beyond the scope of this report.

We do know that seasonal closures can affect effort patterns, which may in turn alter catch composition. Seasonal closures were in place at the beginning of 1985 and 1986. Area closures have prohibited fishing west of Warrior Reef since 1982 (Figure 1). These closures were designed to allow *P. esculentus* recruiting to the fishery more time to grow and move into the deeper south-eastern areas of Torres Strait (Section 5). At the start of each season, most fishing effort has been directed to the areas containing the highest level of recruiting tiger prawns in the catch (Figure 4 and Section 5). Closures, introduced to increase catch values, have forced fishing effort away from the Warrior Reef complex, the site of major *P. esculentus* nursery grounds (Section 4), as by the time the fishing season begins many prawns have already migrated further east (Sections 5 and 7). These changes in the spatial distribution of prawns may favour fishing in other areas as commercial operators attempt to optimize the value of their catch.

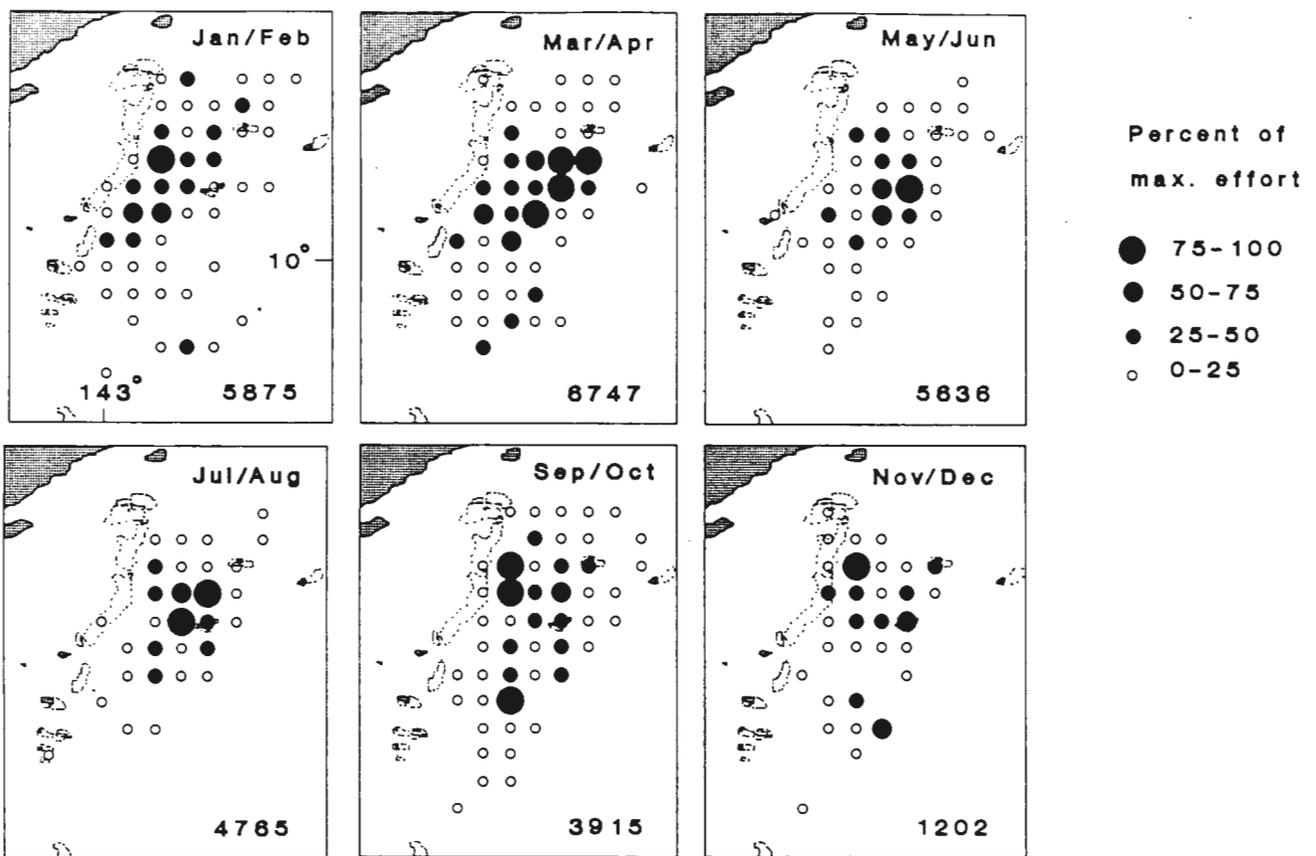


Figure 4. Torres Strait prawn fleet movement patterns for 1983. Total effort (hours trawled) for each two-month period is shown in the bottom right corner. Circle size represents percentages of maximum effort in each two month period.

3.3.2 Seasonal fishing patterns

The distribution of fishing effort in Torres Strait was examined on a bimonthly basis for the period from 1980 to 1986. During January and February in 1980 and 1981, most effort was applied to the south of the Warrior Reef complex (area 3, Figure 2). Later in the season, the fleet concentrated on the area around Stephens Island (area 2, Figure 2).

Fishing patterns changed in 1982 when, at the fishing industry's request, the area west of the Warrior Reef complex was closed to trawling for the protection of smaller-sized prawns (Section 1). Since then the pattern of the fleet's movements was similar from year to year until the introduction of seasonal closures at the end of 1984. During January to March of these pre-closure years, fishing effort was concentrated in areas close to the eastern side of the Warrior Reef complex, and extended south from Pearce Cay to Coconut Island (Figure 2). From March until September effort rapidly shifted eastward and centred around the Yorke Islands. Some effort returned to the southern-most grounds and the Pearce Cay area from September until December when the fishing season traditionally ended.

With the introduction of seasonal closures at the end of 1984 the fleet was denied access to the newly recruited prawns in the vicinity of the Warrior Reefs until March or April. Over this interval, these prawns grew and dispersed generally eastward (Section 7). This meant that when the fishing season began in March or April the fleet was more dispersed and generally further east.

3.3.3 Spatial effort distribution

Table 1 shows the geographical distribution of annual fishing effort according to the NPF logbook grids. In the 1982 season, the total area fished almost doubled. Following this the number of grids fished has remained fairly constant. Effort concentration has, however, varied widely from year to year. In 1982 effort was distributed over 70 different grids and only one locality (in area 3) received more than 8% of the total

annual effort (Table 1). Effort was more concentrated in 1984 and 1986, with two grids (in areas 3 and 4 respectively) exceeding this 8% value. Effort was more uniformly dispersed during 1983 and 1985, with most grids recording less than 4% of the total yearly trawling hours.

Table 1. Breakdown of Effort into grids for Torres Strait based on NPF logbook records for 1980 to 1986.

Year	Total grids	No. of Grids 0-4 % of totaleffort	No. of Grids 4-8 % of totaleffort	No. of Grids 8-12 % of total effort
1980	45	42	1	2
1981	36	29	7	0
1982	70	62	6	1
1983	78	70	6	0
1984	62	53	7	2
1985	75	66	9	0
1986	74	69	3	2

Changes in the distribution of effort can be related broadly to changes in the proportion of *P. esculentus* in the total catch. In a year with a high catch, such as 1985 (Section 2), when the proportion of *P. esculentus* in the catch was greater than 50% in all areas (Figure 3), effort was well dispersed. In a year with reduced catches such as 1984 when only areas 1 and 4 yielded catches comprising more than 50% of *P. esculentus*, the effort was concentrated in area 4 (53% of total yearly effort, Figure 5). This circumstance may be explained by a poor *P. esculentus* recruitment for that year into area 3. This proposition is supported by the lower proportion of *P. esculentus* in the catch (Figure 3) than in other areas.

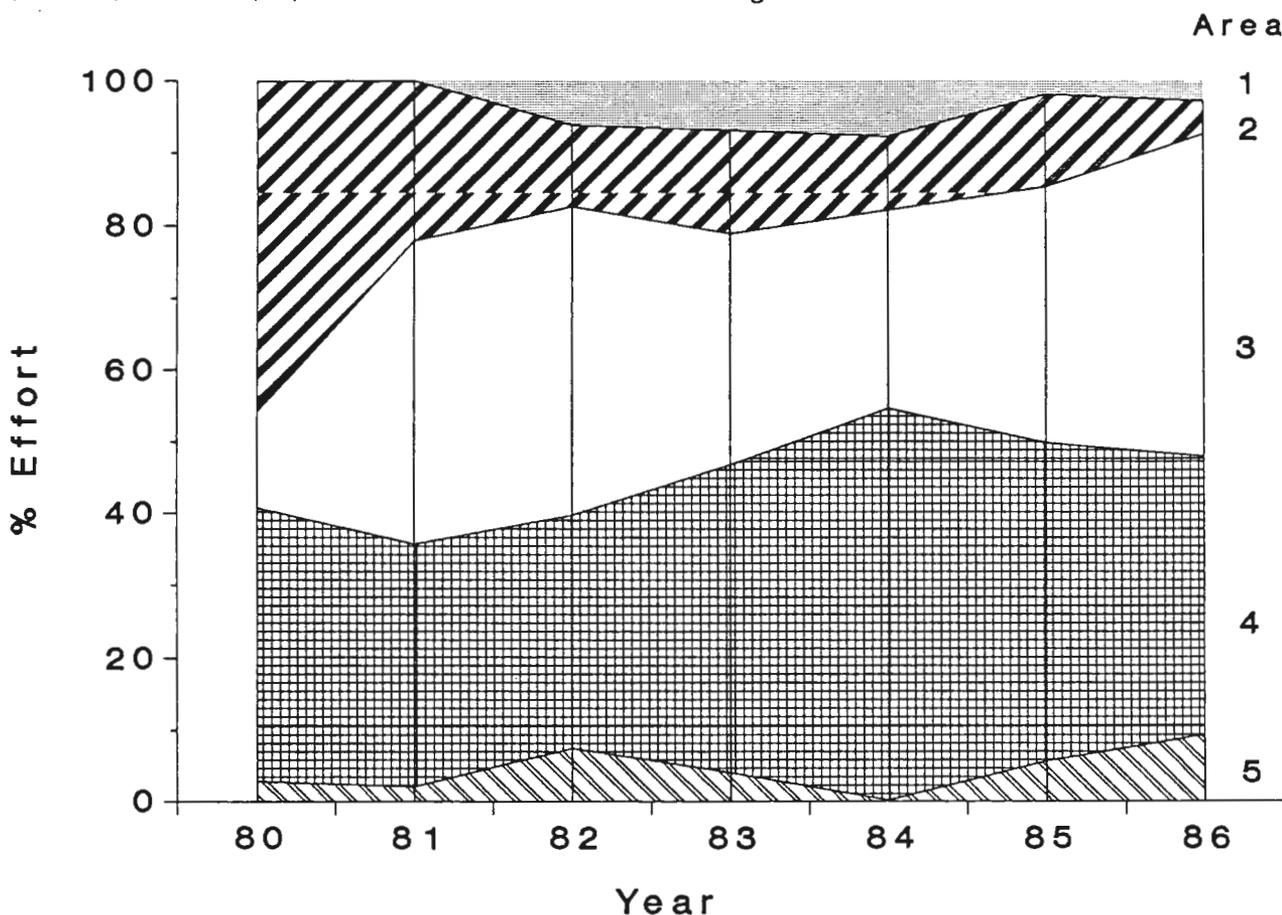


Figure 5. Yearly effort in five defined fishing areas as a percentage of the total yearly effort (1980-1986).

Fishing takes place where commercial operators can maximise their profit, convenience and safety. The distribution of the trawling fleet is controlled by these parameters, particularly the profit margin: the value of the catch versus the cost to land it. Catch per unit of effort (CPUE) primarily determines the spatial distribution of the trawl fleet through time. Records from NPF logbooks, show that the spatial distribution of annual average CPUE values has varied only slightly from 1980 to 1986. Short term changes in CPUE may occur very quickly and could be related to prawn behaviour. The catch rate for prawns may alter from hour to hour throughout the evening as prawn activity patterns change. Prawn species in Torres Strait are not catchable during daylight hours because they are dormant until evening. Consequently the parameter mostly likely to determine fishing patterns (CPUE) is not simply related to prawn density but also to prawn behaviour as it affects their catchability. The ability of managers and scientists to model this fishery and others requires not only a representative series of historical data but also an understanding of prawn behaviour, and its affects on catchability and CPUE.

3.4 Acknowledgements

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3.5 References

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