Torres Strait Prawn Fishery

Main features

**STATUS**
Tiger prawns **not overfished and not subject to overfishing**; endeavour prawns **uncertain**; king prawns **uncertain**

**RELIABILITY OF THE ASSESSMENT**
Good for tiger prawns; no current assessment for endeavour or king prawns

**CURRENT CATCH (2005 AND 2006)**
2005 total 1304 t (6032 fishing nights); endeavour prawns 598 t, tiger prawns 655 t and king prawns 51 t
2006 total 1285 t (4235 fishing nights); endeavour prawns 655 t, tiger prawns 584 t and king prawns 45 t

**LONG-TERM POTENTIAL YIELD**
Estimated maximum sustainable yields (MSY) for tiger prawns are 606 t (Ricker model) and 676 t (Beverton and Holt) per season; no current estimate for endeavour or king prawns

**MAIN MANAGEMENT OBJECTIVE**
To control effort in the fishery consistent with conservation and optimum use of the Torres Strait prawn resource; to encourage islander participation in the fishery; and to provide for catch sharing with Papua New Guinea. Formal reference points are to be adopted through development of a harvest strategy

**MANAGEMENT METHODS**
Input controls: limited entry, gear restrictions, time and area closures. To prevent overfishing, a cap of 9200 days (in effect ‘fishing nights’) was set for the 2006 season
Highlights

→ The Torres Strait Prawn Fishery is the most valuable fishery in Torres Strait with an estimated gross value in the 2005–06 financial year of A$13.2 million.

→ The potential for the activation of latent effort in the fishery has been reduced in 2005–06 through a number of effort removal processes.

→ Management arrangements for the 2006 season allocated access nights to individuals based on a proportion of the total allowable effort.

→ The cap of 9200 fishing nights for 2006 was in line with scientific advice on maximum sustainable effort (E_{MSY}) estimates for tiger prawn sustainable harvest.

→ Surveys are being undertaken to investigate the potential for continued fishing targeting endeavour prawns once the annual effort cap is reached.

Background

History of the fishery

The Torres Strait Prawn Fishery (TSPF) occurs mainly around Yorke Island, to the east of the Warrior Reefs complex (see map). The fishery is open from March to November each year. At a broad scale, the area fished is approximately 8000 km²—approximately 20% of the Torres Strait Protected Zone (TSPZ).

The fishery occurs in both Queensland and Commonwealth waters and is managed by the Protected Zone Joint Authority (PZJA), established under the Torres Strait Fisheries Act 1984 (TSF Act). Membership of the PZJA includes the Commonwealth Minister for the Department of Agriculture, Fisheries and Forestry, the Queensland Minister for Primary Industries and Fisheries and the Chair of the Torres Strait Regional Authority. The Torres Strait Prawn Management
Advisory Committee provides advice to the PZJA regarding management issues within the fishery.

The primary target species for the fishery are brown tiger prawns (*Penaeus esculentus*), blue endeavour prawns (*Metapenaeus endeavouri*) and red-spot king prawns (*Melicertus longistylus*). Byproduct species include Moreton Bay bugs (*Thenus orientalis*), saucer scallops (*Amusium pleuronectes*) and a number of squid species.

Endorsed vessels, with a maximum length of 20 m (as of 2 September 1997), usually tow two pairs of otter trawl nets (four nets total). Regardless of the net configuration, the combined head rope and footrope shall be no longer than 88 m. The trawlers primarily operate at night over areas of sand, mud and gravel seabed, with skippers using previous experience and technological aids to direct them to the fishing grounds that previously delivered the best catches. The Australian-licensed trawlers can remain on the Torres Strait fishing grounds for extended periods with support provided from mother-ships and fuel barges. The trawl fleet is also highly mobile: in 2006 there were 61 Australian vessels, most of which were also endorsed to operate in the Queensland East Coast Otter Trawl Fishery and some to operate in the Commonwealth Northern Prawn Fishery.

The efficiency of vessels within the fishery has progressed considerably over the years. Improvements are evident in most of the general vessel characteristics, including average engine horsepower, gearbox ratios, trawl speed, fuel capacity and consumption, and adoption of propeller nozzles. Global Positioning Systems (GPS) and computer mapping software are widely used throughout the fleet. Configurations of the trawl nets have also undergone change, characterised by a strong move from double and triple gear to quad gear. All nets must have turtle-excluder devices (TEDs) and bycatch-reduction devices (BRDs) fitted.

The prawn trawl fishery in Torres Strait began in the mid 1970s, with vessels moving northward from the prawn fishery off the Queensland east coast. At this time all east-cost prawn trawlers were entitled to fish in Torres Strait, which effectively gave access to all 1200 east-coast licensed vessels. Only about 500 vessels took up the option to have access because of the long travel distances from east-coast ports. Of these, approximately 150 have a history of fishing in the TSPF. Upon ratification of the Torres Strait Treaty in 1985, the fishery became separate from the east-coast fishery and a TSPF effort-reduction strategy was implemented. Further arrangements to reduce effort were introduced in 1993 when each prawn trawler was allocated a quota of transferable access days that limited the vessel’s total time in the fishery for a given season. Effort management measures resulted in the number of licensed vessels decreasing from 108 in 1993 to 77 by 2005 and 61 in 2006.

Papua New Guinea fishers are entitled to approximately 25% of the TSPF catch under the Torres Strait Treaty. In recognition of this entitlement, Australia endorsed six Papua New Guinea trawlers to fish in the Australian portion of the TSPZ in 2006; however, none of these licences were activated. Entitlements have been sporadically activated in the past but most Papua New Guinea activity has been confined to Papua New Guinea waters (north of the Australian Fishing Zone).

Three licences were allocated in 1989 for Torres Strait Islander participation in the fishery, but they were never activated and were surrendered in 2005.
**Biology**

Brown tiger prawn and blue endeavour prawn are endemic to tropical and subtropical Australia. Tiger prawn catches are typically taken on fine-grained mud bottom, and endeavour prawn catches on coarser, sandy sediments, but there is overlap in habitats used by both species. Red-spot king prawns have an Indo-west Pacific distribution and, in the Torres Strait, are generally found on harder substrates, near reefs.

These three target species are highly fecund and fast growing, and are sexually mature by about 6 months old with a life span of 1 or 2 years. The fishery targets adult prawns with management arrangements that incorporate seasonal and area closures to reduce the take of juveniles.

**The 2005 and 2006 fisheries**

In 2006, effort in the fishery was limited by the availability of access nights per individual vessel. The total allocation in 2006 was 9200 fishing nights (down from 13 454 in 2005). Australian vessels were allocated 6867 nights, with the remainder reserved for Papua New Guinea access, should it be activated. From March 2006, the minimum number of nights a TSPF operator must hold to participate in the fishery decreased from 50 to 34—to accommodate the pro-rata reduction in fishing effort resulting from the 9200 nights cap. Also during 2006, to assist industry to restructure, the PZJA suspended the boat-replacement policy that had previously seen a 20% reduction in allocated fishing days for operators introducing a more powerful vessel to the fishery.

The total catch of brown tiger prawns was 655 t in 2005 and 584 t in 2006, compared with the 1997–2006 average of 659 t. The endeavour prawn catches of 598 t (2005) and 655 t (2006) were lower than in previous years. The catch of red-spot king prawns continued to fall—to 51 t in 2005 and 45 t in 2006.

The total Australian fleet fishing effort for the TSPF was approximately 6032 nights in 2005 and 4235 nights in 2006, compared with a 1997–2006 average of 8615 nights. The 2006 fishing effort was well under the Australian allocation of 6867 nights, and approximately half of the total allocated fishing nights cap of 9200—there was no effort by Papua New Guinea vessels. In 2006, approximately 41% of Australian operators used all of their allocated fishing nights. A number of the remaining vessels used less than half of their allocations, and four vessels with large allocations did not fish in the TSPF.

The most recent tiger prawn assessment (see next section) and the analysis of trends in commercial catch and effort data indicate that the biomass of tiger prawns has steadily increased since 2000 as fishing effort has declined. Since 2002, the biomass has been higher than during the 1990s and the stock level required for MSY ($B_{MSY}$). As the biomass has increased, catch rates of tiger prawns have increased, maintaining the annual tiger prawn catch at close to the average of the last 10 years. The 2006 tiger prawn catch is down slightly, consistent with the relatively low 2006 fishing effort. The decline in endeavour prawn catch between 2001 and 2005 mainly reflects the reduction in effort. In addition, the low value of endeavour prawns and high fuel prices have probably led to greater targeting of tiger prawns in recent years.
Current monitoring and research

Catch and effort of the Torres Strait trawler fleet are monitored through the use of a mandatory logbook system, similar to that used in the Northern Prawn Fishery and the Queensland East Coast Otter Trawl Fishery. This facilitates data collection and comparison among these fisheries.

TSPF management incorporates time-area closures to protect juvenile stocks (see map). An area closure exists east of the Warrior Reefs from December to August. An evaluation of the effectiveness of this closure indicated that most small brown tiger prawns, and higher densities of small endeavour prawns, were inside the closure area in those months. Furthermore, it confirmed that tiger and endeavour prawns migrate out of the closed area and into the fishery as they increase in size during the fishing season.

Status of stocks

Previous stock assessments

Formal stock assessments of Torres Strait prawn stocks commenced in 1991. This was updated in 1994 using a simulation model and an assumed natural mortality rate of about 20% per month. This assessment estimated that the long-term sustainable yield for the fishery was 1903 t per year, comprising: 682 t of tiger prawns; 1035 t of endeavour prawns; and 186 t of king prawns. These are the only yield estimates that have been made for endeavour and king prawns.

Subsequent assessments have focused on the tiger prawn stock. Assessments undertaken between 2000 and 2002 used surplus production models (Schaefer and Fox) and delay difference models (Ricker and Beverton and Holt). The separate assessments estimated the equilibrium MSY for tiger prawns to range from 532 to 698 t, with $E_{MSY}$—the effort at MSY—ranging from 8170 to 11 353 fishing nights.

The 2004 tiger prawn assessment (published in 2006) was completed using data up to the end of the 2003 season and three modelling approaches: a monthly delay difference model (Deriso-Schnute, using both Beverton and Holt and Ricker stock recruitment relationships) and two types of surplus production model (Schaefer and Fox).

The surplus production models ignore age or size structure and do not explicitly consider natural mortality, growth and recruitment. These models estimate population growth rate, population carrying capacity (virgin stock size) and catchability.

A comparison of the factors contributing to increasing fishing power was undertaken, followed by a standardisation of the catch rates based on these factors. The annual average fishing power was estimated to have increased by 21–25% from 1980 to 2003 as a result of the adoption of new technology and gear.

The delay difference model used the available time series of standardised monthly catch rates to estimate harvest rates, which are then transformed into estimates of a monthly exploitable population biomass. This model captures the monthly dynamics of the prawn population, the seasonality within the fishery, and estimates of spawning and recruitment.

The delay difference model using Ricker stock recruitment estimated MSY for tiger prawns as 606 t, with an $E_{MSY}$ of 8245 boat nights. The corresponding Beverton and Holt model estimates were 676 t and 9197 boat nights.
2006 update

Formal reference points have not been adopted for the fishery but will be developed as part of a harvest strategy. Assessments estimate B_{MSY}, E_{MSY} and MSY as indicators of stock status.

The latest tiger prawn assessment builds on the models used in the 2004 assessment and includes data for the 2004–2006 period. The estimates of MSY and E_{MSY} from the updated assessment are similar to those of the 2004 assessment. Estimates of tiger prawn biomass indicate that it has been above the B_{MSY} reference level in recent years, with an increasing biomass trend since 2000. The confidence intervals are quite wide, especially for the estimate of E_{MSY}, so it is to be expected that assessment estimates will vary as additional years of data are added.

The average annual catch of tiger prawns in Torres Strait for the ten years from 1997 to 2006 (659 t) is within the range of these MSY estimates. The average effort for the last ten years is 8615 fishing nights, which is at the lower end of the E_{MSY} range. The 2005 and 2006 catches of 655 t and 584 t of tiger prawns, respectively, fall within the 90% confidence interval for both the Ricker and the Beverton and Holt model MSY. The 2005 and 2006 levels of effort in the TSPF—6032 and 4235 fishing nights respectively (provided through vessel-monitoring system [VMS] data compilation)—were also less than estimated E_{MSY}.

The status of endeavour prawns is uncertain. There are no new assessments for the endeavour prawn stock. The catch of endeavour prawns has generally been higher than tiger prawns since 1989, peaking at 1511 t in 1999, and in some years being more than double the tiger prawn catch. However, the endeavour prawn catch has declined with the reduction in effort, the fishery perhaps focusing on catching tiger prawns in recent years owing to the lower value of endeavour prawns.

The status of king prawns is uncertain, and there is no stock assessment of the king prawn stock. The catch of king prawns has been much lower than that of tiger and endeavour prawns: generally it has been less than 100 t, peaking at 165 t in 1999.

Reliability of the assessment

The high annual variability of prawn recruitment, which results from the large influence of environmental factors on such a short-lived species, impacts on the accuracy of stock assessments. Natural mortality—an important parameter in estimating sustainable yield—is difficult to determine accurately for the key commercial species in this fishery. A review of the tiger prawn assessment for the PZJA was undertaken in 2003 by David J. Die, an internationally recognised stock assessment expert. The review provided 21 recommendations to improve the future assessment of the fishery. Sixteen of the recommendations were incorporated into the 2004 stock assessment; four recommendations remain ongoing and one recommendation was unachievable owing to lack of data.

Estimates of E_{MSY} are variable across the models used in the assessment, ranging from about 8000 to 13 500 fishing nights. Results for the delay-difference models are highly dependent on the assumed stock recruitment relationship.

The current assessments cover the stock in the Australian area of jurisdiction, which includes waters within the TSPZ and in the ‘outside but near area’ to the south of the TSPZ. The data are primarily from Australian vessels fishing in TSPZ waters. A full-time fishery has not developed in the Papua New Guinea area of the TSPZ. The latest assessment incorporated data from the limited fishing that has been undertaken in this jurisdiction.

The development of more intensive fishing pressure in the Papua New Guinea jurisdiction of the Torres Strait could have an impact on the stocks on the Australian side through a reduction in recruitment to the fishery. It is therefore possible that the present assessment could be optimistic, but this will not be known until more scientific data become available from within the Papua New Guinea jurisdiction.
There have been significant improvements in the efficiency of prawn trawlers since 1980—fishing power for tiger prawns increasing at an average rate of 1.39% each year. This is an important factor for the reliability of the assessment and the estimation of $E_{\text{MSY}}$ for the fishery.

**Future assessment needs**

While there is a robust TSPZ assessment of the brown tiger prawn, there are no similar assessments for the other target species, namely endeavour and red-spot king prawns. Although the catch of endeavour prawns has often exceeded the catch of tigers, there does not appear to be any indication of overfishing. There are plans to do an assessment of endeavour prawns in the Torres Strait so that a multi-species model for both tiger and endeavour prawns can be integrated with a spatial model of the fishery and stocks. Future stock assessments will probably continue to rely on data from fishery independent surveys.

A set of biological reference points for the TSPF is being formulated to help in the application of decision rules and the development of a harvest strategy. A management plan for the fishery is also being developed.

**Environmental issues**

Prawn trawling is a relatively non-selective fishing method and takes a broad range of bycatch and byproduct species. Bycatch composition for prawn trawl fisheries can include a large component of teleost (bony) fishes, as well as cephalopods, crabs, rock lobsters, scallops, sharks and rays. The bycatch also includes some protected species, such as turtles and sea snakes. Prawn trawling also has the potential to impact benthic communities. This impact is not always evident from the bycatch that is brought on deck.

An Ecological Risk Assessment process has been underway to examine the impact of the fishery on all species, including bycatch and byproduct. The first results of this are expected to be finalised in 2007.

In July 1999, the Torres Strait PZJA endorsed a bycatch action plan for the TSPF, and in late 2001 agreed to mandate the use of TEDs from the start of the 2002 season. In 2004, the use of BRDs became mandatory in the fishery and six BRD designs are currently recognised for use. Despite this, the fishery still takes a wide range of bycatch species. An observer programme initiated in 2005 and logbook reporting requirements facilitate data recording and compilation to inform management of the current level of bycatch.

Three annual research surveys conducted between 2004 and 2006 collected independent information on the composition, distribution and catch rates of bycatch in the TSPF and included an assessment of the impact of prawn trawling on the bycatch communities. These surveys were conducted within the main prawn trawling grounds and also in the adjacent areas seasonally or fully closed to trawling (east and west of Warrior Reefs Closures). Bycatch for the Torres Strait was found to be typical of tropical prawn trawl bycatch, being highly diverse and consisting of predominantly fish and invertebrates (most of which occurred rarely). The dominant fish species and families have changed little since studies done in the mid 1980s, and the catch rates of bycatch have not markedly altered in two decades. Nearly all of the species occurred throughout all areas surveyed and most of the species had a distribution that ranged across the Indo-Western Pacific oceans.

Torres Strait prawn trawling does not appear to have had any marked effect on the bycatch species composition or abundance. The surveys found no major differences in the bycatch community structure among areas open, partially closed and entirely closed to trawling; however, there was some difference in dominance in bycatch species between the open and/or closed areas. These differences in distribution were thought to be more likely a result of the environmental variables of depth, current stress and sediment type than of prawn trawling.
At a broad scale, trawling in the TSPF covers about 20% of the entire TSPZ. As a result, there are thought to be spatial refuges for bycatch species in areas that are not impacted by trawling.

There is ongoing research into BRDs and the use of onboard processing systems such as hoppers, which together can reduce the amount of bycatch caught in the trawl net and increase the survivability of those species caught.

There are bycatch limits on the take of sharks (the limit is the lesser of 5 sharks or 30 kg of shark) as well as a prohibition on the removal of fins.

The fishery has been strategically assessed and accredited by the Department of the Environment and Water Resources under the Environmental Protection and Biodiversity Conservation Act 1999. The fishery has also been approved as a Wildlife Trade Operation until November 2008.

Further reading


Management performance

The stated objectives for fishery management in the TSPF are ‘to control effort in the fishery and provide for catch sharing with Papua New Guinea; to achieve a level of fishing effort consistent with conservation and optimum use of the Torres Strait prawn resource; and to encourage islander participation in the fishery’.

A cap of 9200 boat days (equivalent to nights) for the 2006 season was announced in November 2005, based on the estimated number of nights needed achieve the MSY for tiger prawns. Total effort of Australian and Papua New Guinea fleets fell below this effort limit for both 2005 and 2006.

Allocation of the 9200 nights’ effort is split between Australia and Papua New Guinea at a ratio of 3:1, respectively, in line with the Torres Strait Treaty. The assessment suggests that the biomass of tiger prawns has been increasing since 2000, corresponding with a period of reduced fishing effort.

Management arrangements important to the persistence of this fishery include the closure of the entire fishery between 1 December and 1 March of the following year; a ban on possession of prawns in the entire fishery between 15 December and 1 March of the following year; the closure of an area east of Warrior Reefs between 1 March and 31 July each year; a permanent closure of the area west of Warrior Reefs and an area around Murray and Darnley Islands; restrictions on the carriage of equipment in closed areas and through the Thursday Island-Cape York transit corridor; and the compulsory carriage of an operational VMS.

A workshop was held in July 2005 to allow fishers, scientists and managers to examine alternative management strategies for the fishery, in particular to evaluate strategies that would sustain tiger prawns while permitting additional fishing of endeavour prawns. A project plan that includes fishery-independent surveys is currently in development.