



Australian Government
Australian Fisheries Management Authority



Harvest Strategy

FOR THE TORRES STRAIT PRAWN FISHERY

2010

Glossary of Terms

B_{MEY}: Biomass at maximum economic yield. The average biomass corresponding to maximum economic yield as estimated from the assessment model applied.

B_{MSY}: Biomass at maximum sustainable yield. The average biomass corresponding to maximum sustainable yield as estimated from the assessment model applied.

B_{LIM}: Biomass limit reference point. The point that fishing ceases at as the risks to the stock are considered to be unacceptably high.

B_{TARG}: Biomass target reference point. The desired condition of the stock.

Byproduct species: species taken incidentally in a fishery that have some commercial value and are retained for sale.

E_{MEY}: Effort at Maximum Economic Yield. The long term effort associated with B_{MEY}.

E_{MSY}: Effort at Maximum Sustainable Yield. The long term effort associated with B_{MSY}.

MEY: Maximum economic yield. The catch that should produce economic returns. For most practical discount rates and fishing costs the equilibrium stock level associated with MEY is larger than that associated with MSY. In this sense, MEY is more environmentally conservative than MSY and should in principle help protect the fishery from unfavourable environmental impacts that may diminish the fish population.

MSY: Maximum sustainable yield. The maximum average annual catch that can be removed from a stock over an indefinite period under prevailing environmental conditions.

PZJA. Protected Zone Joint Authority.

Reference point: an indicator level of the level of fishing (or stock size) used as a benchmark for interpreting the results of an assessment.

TAE: Total allowable effort.

Target species: A species that is or has been specifically targeted and is, or has been a significant component of a fishery.



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1. Overview

1.1 The Commonwealth Harvest Strategy Policy

The development of the *Torres Strait Prawn Fishery Harvest Strategy 2010* was guided by the Commonwealth Fisheries Harvest Strategy Policy (2007). The objective of the Harvest Strategy Policy is the sustainable and profitable utilisation of Australia's Commonwealth fisheries in perpetuity ***through the implementation of harvest strategies that maintain key commercial stocks at ecologically sustainable levels and within this context, maximise the economic returns to the Australian community.***

A harvest strategy sets out the management actions necessary to achieve defined biological and economic objectives. As such, a harvest strategy must contain a process for monitoring and conducting assessments of a fishery's overall condition, as well as rules that control the intensity of fishing activity (known as control rules).

To meet the objective of the Commonwealth Harvest Strategy Policy, harvest strategies aim to pursue an exploitation rate that keeps fish stocks at a level equal to maximum economic yield (B_{MEY}) on average and ensure stocks remain above a limit biomass level (B_{LIM}) at least 90 percent of the time.

The Harvest Strategy Policy provides for the use of proxy settings for reference points to cater for different fishery circumstances. Proxies must be clearly justified and ensure both the conservation of a stock and the economic performance of a fishery are managed in accordance with the Harvest Strategy Policy. This balance between prescription and flexibility is designed to encourage the development of innovative and cost effective strategies to meet key policy objectives.

With a harvest strategy in place, fishery managers and industry are able to operate with greater confidence, management decisions are more transparent, and there will be fewer unanticipated outcomes.

Further detail on how to use harvest strategies is provided in the Guidelines to the Harvest Strategy Policy (*Commonwealth Fisheries Harvest Strategy Policy Guidelines 2007*).

1.2 The Torres Strait Prawn Fishery Harvest Strategy

Torres Strait fisheries are managed by the Protected Zone Joint Authority, a Commonwealth and State Joint Authority arrangement. The Commonwealth Harvest Strategy Policy does not automatically apply to Torres Strait Fisheries. Nonetheless, the Torres Strait Prawn Fishery (TSPF) Harvest Strategy has been guided by the Commonwealth Harvest Strategy Policy to the greatest extent possible.

The TSPF Harvest Strategy sets out the management actions necessary to achieve defined biological and economic objectives for the fishery; this includes a description of the rules to be applied when determining the recommended total allowable effort (TAE).

Although the PZJA would like to move to an economic target (B_{MEY}) under this harvest strategy in the future, it is not considered appropriate to do this at this time. This decision was made due to the following reasons. An accurate value of B_{MEY} is not currently known and will require an updated stock assessment which will cost an estimated \$80,000 to \$100,000. This approach is not considered to be cost effective given the low level of effort in the fishery at present. A proxy for B_{MEY} ($1.2 B_{MSY}$) can be used however, due to the low prawn prices, high fuel prices and minimal effort in the 2009 and 2010 fishing season, PZJA agencies have concerns that reducing the total allowable effort in the fishery to the level required for B_{MEY} (under a proxy – 7,050 days) will mean operators that are currently choosing to fish will have a reduced number of days, thus reducing the viability of them operating. Although these operators could choose to lease in additional fishing days, this would be at additional cost to operators and further economic pressure. This could result in some operators choosing to relinquish their rights. As annual management costs remain the same (levies are paid per unit of fishing capacity not per day), the management costs for the fishery would be distributed amongst a reduced group of licence holders. Although some operators might realise greater profits from operating at B_{MEY} , there is a reasonable risk that there could become a point where too few operators were sharing management costs, potentially

causing a domino effect where more operators relinquish their entitlements due to a decrease in economic viability.

Due to these concerns, and the current economic pressures on the fishery, The PZJA's priority for this harvest strategy is facilitate stability within the fishery. This will be facilitated through setting a short term harvest strategy target of B_{MSY} and a TAE in line with this, with a long term target of B_{MEY} which will be pursued when effort in the fishery increases (see section 6.1). This progression will be done within a flexible timeframe to help minimise financial pressures on the fishery and maximise stability.

One of the principal aims of a harvest strategy is to set up a clearly defined and transparent process for setting a fishery's TAE. As such, changing the target within a harvest strategy, albeit with triggers, is not a widely used approach. Consultation with the Torres Strait Prawn Management Advisory Committee (TSPMAC) though, revealed this to be the preferred option for the fishery at the present time.

The target and long term objectives of the TSPF Harvest Strategy will be reached through triggers and decision rules. The fishery will continue to fish at a level equal to B_{MSY} (currently 9,200 fishing days) until effort and/or catch triggers (section 6.2) are reached. When one or more of these triggers are reached for two (2) consecutive years, the fishery will be required to undertake additional research and revise the harvest strategy aim for MEY. Central to this will be a requirement to produce an updated stock assessment to calculate a more accurate estimate of B_{MEY} .

Current low levels of effort in the fishery combined with its low economic value and low sustainability risk to targeted stocks, has made it appropriate for the TSPF Harvest Strategy to be developed in a simple format. Setting the harvest strategy with an short term B_{MSY} target comes with an inherent risk that the fishery will overshoot B_{MEY} requiring stocks to be rebuilt through a reduced TAE. In order to minimise this risk, triggers outlined in the TSPF Harvest Strategy have been set at precautionary (low) levels.

The E_{MSY} value of 9,200 days is based on the rounded estimate of E_{MSY} from the 2004 Tiger Prawn¹ stock assessment (O'Neill & Turnbull 2006). The estimate of E_{MSY} was 9,197 days with a 90 percent confidence interval of 7,116 to 12,231 days. This calculation was based on catch and effort data from the years 1980 to 2003 and the Beverton-Holt stock recruitment relationship.

It is important to note that the biomass associated with B_{MEY} is higher than the biomass associated with B_{MSY} . In this sense, setting a harvest strategy based on B_{MEY} is more environmentally conservative than MSY and should in principle help protect the fishery from unfavourable environmental impacts that may diminish the population.

2. Background

The TSPF is managed under the *Torres Strait Fisheries Act 1984* (the Act) by the Torres Strait Protected Zone Joint Authority (PZJA) which was established by the Act and encompasses the Queensland Minister for Primary Industries, Fisheries and Rural and Regional Queensland and the Chair of the Torres Strait Regional Authority. The purpose of the Act is to give effect, in Australian law, to the fisheries elements of the *Torres Strait Treaty*. In particular, section 8 of the Act which outlines objectives to be pursued in the management of Torres Strait fisheries. Section 8 states:

“In the administration of this Act, regard shall be had to the rights and obligations conferred on Australia by the Torres Strait Treaty.”

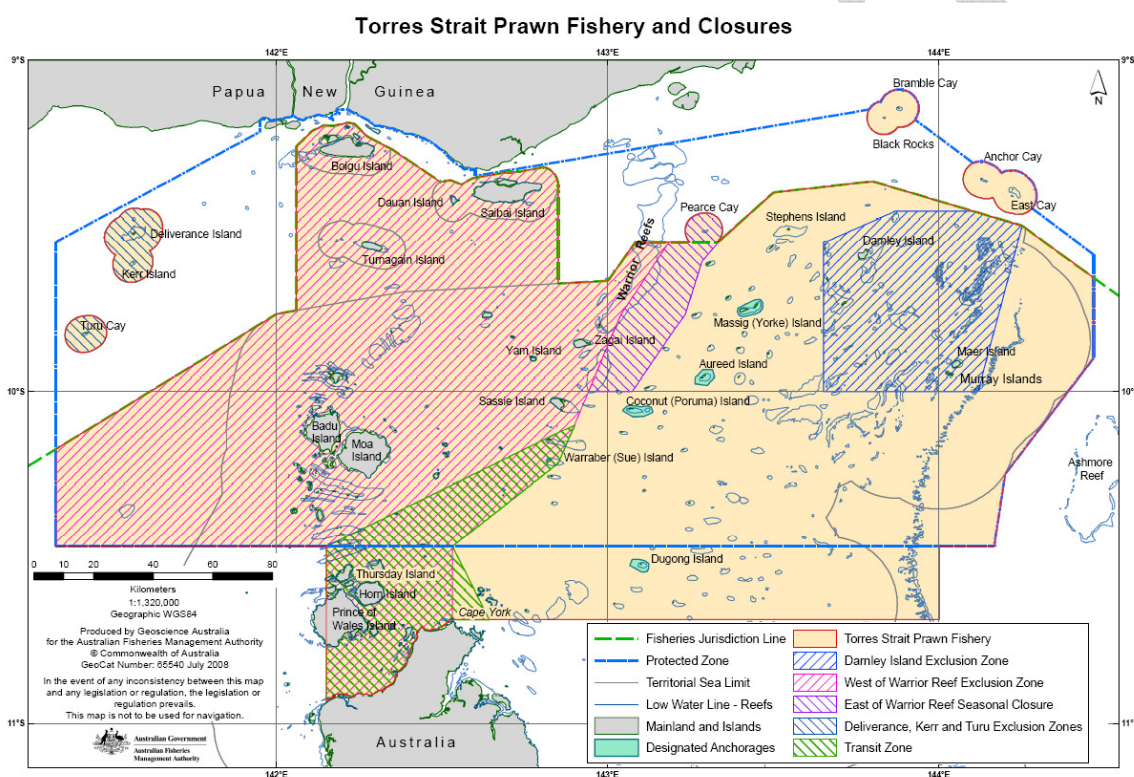
The TSPF Harvest Strategy has been developed in accordance with objectives outlined in both the Act and the *Torres Strait Prawn Fishery Plan 2009* (the Plan). Further details of the legislation underpinning the TSPF can be found at www.pzja.gov.au.

¹ Tiger prawn within this harvest strategy and the TSPF refer to three species including the brown tiger prawn (*Penaeus esculentus*), grooved tiger prawn (*Penaeus semisulcatus*) and kuruma (*Marsupenaeus japonicus*). The brown tiger prawn make up the majority of the catch.

The TSPF is situated in waters between Australia and Papua New Guinea (PNG) in the eastern part of the Torres Strait (Fig. 1). While it remains one of the most valuable commercial fisheries in the Torres Strait, its Gross Value of Production (GVP) has reduced since a peak in 1998-1999. The TSPF is a multi-species fishery targeting the Tiger prawn and the Endeavour prawn². The Red Spot King prawn (*Penaeus longistylus*) is also taken as a by-product species. Fishing is permitted in the TSPF from 1 March to 1 December each year and is limited by a TAE in the form of fishing days. In addition to this, there are a number of permanent closures (exclusion zones) to protect sensitive areas from trawling and/or seasonal closures for areas of temporal significance e.g. nursery sites.

prawn harvesting occurs at night, primarily using the otter trawl (quad) method where up to four nets are towed behind the vessel. The TSPF has a number of input controls that restrict both the type of gear and vessel including those associated with net size, boat size and mandatory use of Turtle Excluder Devices (TEDs) and Bycatch Reduction Devices (BRDs) (see Fisheries Management Instrument numbers 47, 71, 81 and 82 on the PZJA website for details).

Figure 1. Area encompassed within the Torres Strait Prawn Fishery including permanent closures (Exclusion Zones).



2.1 History of management of the fishery

The following represents a brief overview of changes made to management arrangements within the TSPF since 2005. A list of PZJA decisions relating specifically to the development of the TSPF Harvest Strategy are outlined in Appendix A. A detailed history of the TSPF before 2005 can be found in the TSPF Strategic Assessment on the PZJA Website (www.pzja.gov.au). Updates to the TSPF fishery post the implementation of this harvest strategy can be found in the annual TSPF handbooks.

On 3 November 2005 the PZJA agreed to introduce a total cap of 9,197 fishing days in light of scientific advice on the number of fishing days required to achieve the Maximum Sustainable Yield (MSY) of Tiger prawns. Tiger prawn is the species considered most vulnerable to over-fishing in the TSPF, and a stock

² Endeavour prawn within this harvest strategy and the TSPF refer to two species including the Blue Endeavour prawn (*Metapenaeus endeavouri*) and the Red Endeavour Prawn (*Metapenaeus ensis*). The blue endeavour prawn make up the majority of the endeavour prawn catch.

assessment indicated that activation of latent effort in the TSPF would likely lead to unsustainable harvest levels for the species. These findings were supported by an independent review of the stock assessment which found modelling used to produce the MSY estimate to be robust. As a consequence, the PZJA agreed to reduce effort in the TSPF to 9,197 days or MSY via a 31.8 percent pro-rata effort reduction to TSPF entitlement holders (Fig. 2).

Despite this, it is possible that future stock assessment advice will change and the number of days could vary from the current estimate for E_{MSY} (i.e. fishing effort to attain a biomass of MSY). Factors that may affect the estimate of E_{MSY} include changes in fishing practices, spatial or seasonal closures in some areas or a combination of these.

In December 2005, the Australian Government released a request for tender to Australian operators to fund payments for the voluntary surrender or reduction of fishing days in order to fully meet its obligations to PNG under the *Torres Strait Treaty*. The tender had the primary objective of surrendering 25 percent of the 9,197 days allocated in the TSPF for the 2006 season. These days were to be held in trust to allow for PNG's catch sharing entitlements under the *Torres Strait Treaty*. In February 2006 it was announced that the tender process had resulted in the removal of sixteen licenses from the fishery and the surrender of approximately 25 percent (2,333 allocated fishing days) of total fishing effort. The PZJA decided to round up the 9,197 days to an overall effort cap of 9,200 fishing days available in the TSPF for the 2006 season, of which 6,867 fishing days were available to Australian operators, 2,070 fishing days were available to PNG operators and 263 days were held in trust by the Australian Government.

License holders must hold a minimum number of days to operate in the fishery. Prior to the 2006 season, the minimum number required was 50 days. This however was reduced to 34 days following the total allowable effort reduction prior to the 2006 season. Despite these changes, there was still unused effort in the 2006 season with only 41 percent of Australian operators fishing their total allocated fishing days. A number of vessels used less than half of their allocated fishing days while four vessels with large allocations did not fish at all.

On 6 February 2009 the Plan was approved by the Hon Tony Burke, MP Commonwealth Minister for Agriculture, Fisheries and Forestry. This harvest strategy has been developed with the Plan's objectives in mind.

2.2 Current closures/Exclusion Zones

Management of the TSPF utilises both seasonal closures and spatial closures to achieve a number of objectives including; protecting juvenile and smaller sized prawns in order to attain better economic yield from the prawns harvested in the fishery; protecting areas of importance to the traditional sector such as fishing grounds for tropical rock lobster or pearl shell or breeding and feeding groups for dugong and turtle. . The entire fishery is closed from 1 December until 1 March until which time the new season commences.

The area of the fishery and closures can be found at figure 1.

3. Key Commercial Species or Stocks and their Ecological Risk Assessment (ERA) priority

Ecological Risk Assessments (ERA's) assess the potential direct and indirect impact that a fishery's activities may have on all aspects of the marine ecosystem. Impacts posed by a fishery are considered under five components:

- Impact to Target species
- Impact to Bycatch and byproduct species
- Impact to Threatened, endangered and protected (TEP) species
- Impact to Habitats (i.e. the environment that the fishery is operating within)

- Impact to Communities (groups of different species living together in an environment)

The assessments categorise the impacts under these five categories into low, medium or high risk based on their susceptibility to fishing activities and their ability to recover from fishing impacts. For example, certain species may be of lower risk due to; not occurring in the fishery area or being protected by closures etc, species not the right size or shape to be caught in fishing gear (selectivity) or there are bycatch mitigation devices that limit catch or the stocks are very resilient to fishing due to high productivity or fecundity.

The assessment methodology also uses a hierarchical approach to risk assessment involving:

- an initial scoping of the fishery – this determines the species that will be included in the assessment, the objectives that the risks will be evaluated against and the activities that occur in the fishery that need to be assessed are identified.
- Level 1 SICA (scale, intensity and consequence analysis) assessment – a comprehensive, qualitative assessment of risks in the fishery
- Level 2 assessment – a more focused, semi-quantitative assessment of the risk to species
- Level 3 assessment - a highly focused and fully quantitative risk assessment (i.e. a stock assessment)

The TSPF has only undertaken a level 1 assessment to date. This assessment was undertaken on a select group of species and communities. Only the key target species, Tiger prawn was assessed in the level 1 SICA as they are the more sensitive species. The secondary target species the Endeavour prawn will be considered in any future ERA assessments.

The following table identifies the key commercial species covered by the TSPF Harvest Strategy and their level of ERA assessment and risk score or priority.

Table 1. Key commercial species and their Ecological Risk Assessment (ERA) risk score (priority).

Taxonomic group	Scientific name	Common name	Highest Level of Assessment	Risk Score
Crustacea	<i>Penaeus esculentus</i> <i>Penaeus semisulcatus</i> <i>Marsupenaeus japonicus</i>	Tiger prawn	ERA Level 1 SICA	When the level 1 SICA was conducted in 2006, fishing was considered to have a moderate impact on Tiger prawn. However, effort in the fishery has greatly decreased since this time and further management arrangements have been put in place. As a consequence, this assessment is likely to change substantially when the level 2 PSA is undertaken.
Crustacea	<i>Metapenaeus endeavouri</i> <i>Metapenaeus ensis</i>	Endeavour prawn	ERA Level 1 SICA	Not ranked in level 1 assessment
Crustacea	<i>Melicertus longistylus</i>	Red-spot King prawn	ERA Level 1 SICA	Not ranked in level 1 assessment

The key commercial species in the TSPF are:

- Tiger prawn (*Penaeus esculentus*)³
- Endeavour prawn (*Metapenaeus endeavouri*)⁴

³ Although prawn tiger prawn (*Penaeus esculentus*), and blue endeavour prawn (*Metapenaeus endeavouri*) are the key target species under these genus, other species detailed in footnotes 1 and 2 are also caught in minimal quantities.

- Red-spot King prawn (*Melicertus longistylus*) which is treated as a by-product species

The Tiger and Endeavour prawn stocks have a very large spatial overlap. When species overlap to this extent, it is not possible to set different effort limits for the different species, as both species are caught within the same shot.

Performance measures from stock models indicate that Endeavour prawns are more resilient to fishing pressure than Tiger prawns at all levels of fishing effort. Therefore, as long as the more sensitive species the Tiger prawn is being fished sustainably under the harvest strategy, the less susceptible Endeavour prawns are also fished sustainably by default. The Red Spot King prawn is a by-product with relatively low levels of catch recorded. This species is also considered to be sustainable. In summary, although this harvest strategy does not set specific objectives, trigger points and decision rules to manage the Endeavour prawn (secondary target species) and the Red Spot King prawn (byproduct species) stocks, these stocks are indirectly managed by default due to the stock overlap and relationship to the Tiger prawn species discussed above.

3.1 Straddling Stocks

The Torres Strait prawn stock is considered a straddling stock as it is found in both the Australian and Papua New Guinea (PNG) area of jurisdiction in the Torres Strait Protected Zone (TSPZ).

The waters of the TSPZ and thus TSPF are divided into areas of Australian and PNG jurisdiction and the fishery is managed through the PZJA agencies comprising of:

- Fisheries Queensland, Department of Employment, Economic Development and Innovation;
- the Torres Strait Regional Authority (TSRA);
- the Australian Fisheries Management Authority (AFMA);
- the Department of Agriculture, Fisheries and Forestry (DAFF); and where appropriate
- in consultation with the Papua New Guinea, National Fisheries Authority (NFA).

The catch sharing arrangements for the fishery and stock are discussed annually at the Australian and Papua New Guinea Bilateral Fisheries meeting.

4. Objectives

The key objective of this harvest strategy is to maximize the profitability of the fishery and minimize any management impediments that affect the economic efficiency of fishers within biologically sustainable limits. As such, the TSPF Harvest Strategy is designed to facilitate a move towards B_{MEY} when effort and economic viability in the fishery has increased. This will allow the fishery to;

- reach a level of profitability which will support the recovery of funds through levies to undertake research necessary to calculate accurate values of B_{MEY} ;
- implement a comprehensive harvest strategy with B_{MEY} as the target reference point; and
- maximize the economic return to fishers and the Australian public whilst securing the long term sustainability of the fishery.

While pursuing these objectives, PZJA agencies will ensure that management strategies are as far as possible equitable among all industry members. This objective will be achieved through reviewing management regimes including input controls and monitoring their value in the fishery with respect to achieving objectives outlined in both the Act and the Plan.

4.1 Biological

- To ensure the Tiger prawn stock is maintained, at or above the B_{MSY} estimate of B_{28} .
- To maintain stocks above the limit biomass level (B_{LIM}), of B_{20} , at least 90 percent of the time.
- To ensure the Endeavour prawn and the Red-spot King prawn (*Melicertus longistylus*) stocks are maintained, at or above the B_{MSY} estimate of B_{28} . As explained in Section 3, although specific trigger rules and reference points have not been set to monitor the objectives of these two

species, as tiger prawn are the more sensitive species, these stocks are indirectly managed due to the stock overlap and relationship to the Tiger prawn.

4.2 Economic

Short term economic objective

- To establish conservative trigger events which minimises the risk of overshooting the value of B_{MEY} .
- Not allowing the TAE to be set at a level above 9,200 fishing days before trigger one (1) is reached under section 6.2 and an accurate value of B_{MEY} is calculated.

Long Term Economic objective

- To ensure that the Tiger prawn stock is maintained, on average, at B_{MEY} . This objective will not be pursued until the research trigger (trigger one) is hit under section 6.2.

When compared to external economic stresses, the risk of the TSPF collapsing due to unsustainable fishing effort or over-exploitation of fishing stocks is considered to be low. Evidently, Recent research (Turnbull *et al.*) and trends in the commercial harvest catch rates (Kertesz *et al.*) that stocks of both the Endeavour prawn and the more susceptible Tiger prawn are in good condition. As such, the PZJA considers one of the biggest short term risks to the fishery is a continued decline in effort due to non-biological stresses *i.e.* higher fuel prices and lower prawn prices.

In setting a short term target of B_{MSY} with a long term target of B_{MEY} , the harvest strategy aims to move the TSPF to B_{MEY} when effort in the fishery increases. This progression will be done within a flexible timeframe to help minimise short-term financial pressures on the fishery. There are two main reasons why the TSPF Harvest Strategy has adopted this approach:

1. An accurate value of B_{MEY} is not currently known and will require an updated stock assessment which will cost an estimated \$80,000 to \$100,000. This approach is not considered to be cost effective given the low level of effort in the fishery at present and the fact that it is a cost-recovered fishery.
2. The proxy for B_{MEY} ($1.2 B_{MSY}$) could be used to avoid this expense but would result in a TAE of about 7,050 days. Protected Zone Joint Authority (PZJA) agencies have concerns that the reduction in effort associated with achieving a biomass equivalent to the B_{MEY} proxy could result in some operators leaving the fishery and relinquishing their entitlements. As annual management costs remain the same (levies are paid per unit of fishing capacity not per day), the management costs for the fishery would be distributed amongst a small group of licence holders. This in turn would increase the management costs of each licence holder, potentially causing a domino effect where more operators to relinquish their entitlements due to a decrease in economic viability.

Once uptake of effort increases to a point where the TSPF has increased profitability (see section 6.2 for triggers), more research will be conducted and a review of target reference points, trigger rules and decision rules undertaken. Research is considered to be the first step towards transitioning the TSPF Harvest Strategy towards a B_{MEY} target and will be industry funded through levies. If effort does not increase to facilitate these triggers within the 4 year review period, PZJA agencies will reconsider the applicability of this Harvest Strategy to the TSPF fishery.

4.3 Social

- Continue setting the TAE for the fishery using B_{MSY} and setting the TAE for the maximum period allowable under the plan (3 years) at B_{MSY} (9,200 days) noting that the section 2.6(3) of the Plan allows for the TAE to be reduced by emergency determination if there is concern for the stock.
- Maintaining a viable fishery to provide employment opportunities.
- Ensure that the issues of significance to the traditional sector are considered when setting the TAE for the fishery, as per the TSPF Plan and Torres Strait Fisheries Act objectives.

5. Monitoring

The monitoring regime described below is associated with this harvest strategy based on achieving B_{MSY} . It is important to note that monitoring will be changed when triggers are reached, and the TSPF Harvest Strategy moves to an B_{MEY} target. At this time, periodic stock assessments will be undertaken to monitor biomass levels and how they are tracking against reference points.

The TSPF is a cost recovered fishery and as such any future research needs will be funded through a research component in the annual levies. The most significant need for the fishery is to undertake a stock assessment in order to calculate an accurate value of B_{MSY} and B_{MEY} . This requirement must be completed before the TSPF Harvest Strategy can be converted to a B_{MEY} target.

5.1 Stock Assessments

The Tiger prawn stock assessment is used to calculate values of B_{MSY} and E_{MSY} which is used as the total allowable effort for the fishery for a given fishing season.

The current stock assessment was undertaken in 2004 and updated in 2006 using logbook data. The assessment is based on catch and effort data from logbooks (section 5.2 below) for 1980 to 2006 using the Beverton-Holt stock recruitment relationship. At the time of the assessment, the stock level was estimated to be at 74 percent virgin biomass (B_{74}). Until the stock assessment is updated, it isn't possible to calculate an up-to-date estimate of the current biomass for the Tiger prawn stock. However, given the low level of effort in the fishery and the high catch rates for Tiger prawns, PZJA agencies are confident that stocks are around or above B_{74} . Although improved catch rates could be associated with increased vessel efficiency, however due to current gear restrictions, PZJA agencies are of the view that increased catch rates are most likely related to increased stock levels. Therefore, the risk of over fishing Tiger prawn stocks at present is considered to be low. Given this risk and current economic pressures facing the fishery, PZJA agencies in consultation with the TSPMAC decided that undertaking a new stock assessment would not be warranted until effort in the fishery increases. The trigger points under section 6.2 however, were set at precautionary effort levels to accommodate any risk associated with uncertainties surrounding current biomass levels.

5.2 Logbooks

It is mandatory for all Torres Strait prawn operators to complete logbooks. Logbooks are sent by operators to AFMA within two weeks after making port or two weeks after the season closes on 1 December. This information is then sent to the Assessment and Monitoring section of Fisheries Queensland who analyse the data to retrieve the statistics surrounding the annual and historical performance of the fishery. The statistics produced are commonly used to reflect:

- catch per unit effort;
- total catches throughout the season;
- actual effort; and
- catch and effort trends.

This data is used to conduct the stock assessments for the fishery and will also be used to monitor the catch trigger points within section 6.2 of this harvest strategy.

5.2 Vessel Monitoring System

It is a condition of licenses that the vessel has fitted a Vessel Monitoring System (VMS). VMS data is managed by the VMS unit of Fisheries Queensland, and is used to monitor effort in the fishery. Information on vessel activity can be retrieved within a week of submitting a request to the VMS monitoring section, allowing timely monitoring of effort. VMS also ensures that the vessels do not fish in restricted areas of the fishery. The PZJA also utilize this system to obtain information on total effort⁴ being used throughout the fishing season.

The effort in the fishery and effort triggers under section 6.2 will be monitored by the VMS system, with updates occurring approximately every four weeks. Once 3000 days of effort is achieved (approaching 4000 day trigger), monitoring will be increased to approximately weekly.

5.3 Observer Data

Observer coverage in the TSPF is set at 2.6 percent of the seasonal effort usage. The primary objective of the TSPF observer program is to collect fishery dependent data on by-catch and TEP (threatened, endangered and protected) species. However, biological information on commercial catch and species of significance to the traditional sector is also collected. This information is subsequently used to monitor catch rates and trends of bycatch and by-product species.

5.4 Fishery Independent Surveys

Fishery Independent Surveys were conducted by Fisheries Queensland (formally *Department of Primary Industries and Fisheries*) through their Long Term Monitoring Program until early 2009. Data from this program was used to provide supporting information for stock assessments in the past, however is not required to undertake actual stock assessments. Funding for the project ceased in 2009 and a budget to continue this work is not presently available.

6. Reference and Trigger Points and Decision Rules

How a stock (biomass level) is tracking against TSPF Harvest Strategy reference points will be monitored through a stock assessment model. Best practice suggests a stock assessment should be carried out every three years if there is little change to fishing operations. The most current stock assessment for the TSPF was completed in 2006. As such, there is a level of uncertainty with respect to the current stock biomass level and the long term effort required to reach each of the reference points.

As an updated stock assessment will not be undertaken until the trigger/s under section 6.2 are reached, PZJA agencies are not able to calculate an accurate biomass level for the stock or monitor it to determine how it is tracking against the target or limit reference points. Instead, PZJA agencies will monitor how the fishery is tracking against the trigger points under section 6.2. These points have been set at conservative levels (4,000 days compared to the current B_{MSY} estimate of 9,200 days) meaning effort and/or catch triggers should be met well before B_{LIM} (see section 6.2 for further detail).

See Appendix B for a summary table of the reference points and decision rules for each species.

6.1 Reference Points

Reference point 1: *To ensure Tiger prawn stocks are maintained at or above B_{MSY} of B_{28} .*

As the initial objective of the TSPF Harvest Strategy is to maintain the fishery at or above B_{MSY} , the original target biomass reference point (B_{TARG}) has been set as equaling B_{MSY} as calculated in the TSPF Tiger prawn stock assessment *i.e.* $B_{TARG} = B_{MSY} = B_{28}$ (Fig. 3).

Performance measures from stock modelling indicate that Endeavour prawns are more resilient to fishing pressure than Tiger prawns under a variety of different scenarios. Therefore there is less likelihood that this species will drop below B_{MSY} . Further, as the Endeavour prawn price is currently

⁴ Effort data from the Vessel Monitoring System is shown to be marginally higher than that of logbooks as some operators are incorrectly deducted VMS days when not fishing and choose not to contact the Fisheries Queensland to rectify this. Common practice is to always verify VMS data with logbook data prior to any official document being released to the public.

almost half the value of Tiger prawns and fuel cost is high, there is currently little incentive for the industry to target Endeavour prawns (even after the Tiger prawn spawning closure is implemented). As such, the TSPF is considered to be biologically sustainable for both species as long as the more susceptible Tiger prawn stock is managed sustainably. The Red-spot King prawn is a by-product with relatively low levels of catch recorded. The catch of this species is also considered to be at sustainable levels.

Reference point 2: To maintain stocks above the limit biomass level (B_{LIM}) of B_{20} at least 90 percent of the time.

A B_{LIM} value of B_{20} is the default limit reference point under the Commonwealth Harvest Strategy Policy.

6.2 Decision rules and trigger points

Decision Rule: TAE for the fishery to be set based on the MSY for Tiger prawn up to 9,200 days (maximum) for the maximum period allowable under the Plan (currently 3 years) unless triggers are reached.

Trigger 1: *If any one of the trigger points below is reached within the Australian area of jurisdiction each year over two (2) consecutive years:*

Trigger 1a – *If $\geq 4000^5$ days of TAE has been utilised in a season; and/or*

Trigger 1b – *If $\geq 680^6$ tonnes of Tiger prawns has been caught in a season; and/or*

Trigger 1c – *If $\geq 620^4$ tonnes of Endeavour prawns has been caught in a season; **then***

Decision Rule 1:

- PZJA agencies to commence identifying research requirements including updating of the stock assessment and bio-economic modelling;
- reconvene Harvest Strategy Working Group to oversee research and further development of the TSPF Harvest Strategy;
- estimate B_{MEY} using results obtained from both updated and historical research data; and
- revisit target reference points and trigger points to develop decision rules for setting the TAE based on B_{MEY} and taking into consideration the revised and updated research outputs, the current status of the fishery and social environment in which the fishery operates (including decisions rules detailing what is done when stock assessments are undertaken and when they aren't undertaken).

Trigger 2: *If total effort within the PNG area of jurisdiction reaches 720^3 days and/or catches reach 122^4 tonnes for Tiger prawns and/or catches reach 118^4 tonnes for Endeavour prawn; **then***

Decision Rule 2: initiate discussions with PNG regarding the catch sharing and management arrangements for the shared prawn stocks between Australia and PNG.

While PNG do not currently fish for prawn in either the Australian or PNG areas of jurisdiction, both the short term target of B_{MSY} and the long term target of B_{MEY} is set for the entire prawn stock. As such, if PNG begin to fish for prawn, discussions need to be initiated regarding shared management.

Reference points for trigger 3 were set in accordance with trigger points outlined for the Australian area of jurisdiction (under trigger 1). However, PNG trigger reference points were set proportionally lower to account for the area's lower total biomass percentage compared to the Australian jurisdiction. For instance the PNG area of jurisdiction makes up 18 percent of the TSPF area and contains up to 18

⁵ Effort triggers are monitored using VMS data.

⁶ Catch triggers are monitored through the logbook data.

percent of the Tiger prawn total biomass and 19 percent of the Endeavour prawn total biomass. Amounts used for the trigger reference points were calculated using CPUE data from the QPI&F research trawl data for 2007 to 2008. The triggers for this section were calculated as follows

PNG effort trigger – Australian effort trigger under trigger 1 (4000 days) x 18% = 720 days

PNG Tiger prawn trigger – Australian Tiger prawn trigger under trigger 1 (680t) x 18% = 122t

PNG Endeavour prawn trigger – Australian endeavour prawn trigger under trigger 1 (620t) x 18% = 118t

6.3 Rationale for decision rules

The trigger points within the TSPF Harvest Strategy were developed by PZJA agencies in consultation with both the TSPMAC and Harvest Strategy Working Group. It was agreed that there should be three triggers, one on effort, and one for each of Tiger prawn and Endeavour prawn total catch. Each of the three triggers were based on catching 75 percent of Australian portion of catch (tonnes) or effort (days fished) if the TAE was set at B_{34} ; the proxy for B_{MEY} ($1.2 B_{MSY}$ or $1.2 B_{28}$) as outlined under the Commonwealth Fisheries Harvest Strategy Policy (2007). This was considered to be a conservative level of catch / effort which posed a low level of risk with respect to the fishery overshooting B_{MEY} . Despite this precautionary approach, all three triggers enable effort and profitability in the TSPF to expand; thus increasing the fisheries capacity to fund future stock assessments.

While the short term target for the fishery is B_{MSY} , triggers were based on a B_{MEY} target as this is the long term target for the fishery. It is important to note though, that triggers based on B_{MEY} (B_{34}) are more conservative than triggers based on B_{MSY} (B_{28}). Therefore, the risk of overshooting B_{MSY} is reduced.

If B_{MEY} were to be implemented using just the $1.2 B_{MSY}$ proxy (equals B_{34} using the Beverton-Holt model), the total TAE for the TSPF would equal 7,045 fishing days. Of which, Australian operators would be entitled to 75 percent of the TAE or a total of 5,284 days. Given that B_{MEY} is the long-term target of the Harvest Strategy this value was used to calculate each of the respective triggers. This value however, was initially reduced by 25 percent to ensure trigger reference points were conservative enough to mitigate any concerns with the fishery overshooting B_{MEY} . For the Australian portion, 75 percent of the estimated B_{MEY} using the $1.2 B_{MSY}$ proxy equates to 4,000 days or the first effort trigger.

With respect to the two catch triggers, each were calculated by multiplying the 4,000 day effort trigger by the highest recorded catch rates for the species (Tiger prawns, 170t; Endeavour prawns, 156t) as this is the most conservative method. This resulted in the catch triggers of 680t for Tiger prawn and 620t for Endeavour prawns. In order to ensure that fishery profitability has consistently increased, it was agreed that a trigger should be reached for two consecutive years.

7. Research Needs

This harvest strategy recognizes that an updated stock assessment will need to be undertaken to determine a more accurate value of B_{MSY} and B_{MEY} . PZJA agencies can then evaluate if stocks need to be built up or fished down to achieve B_{MEY} for Tiger prawn.

The TSPF harvest Strategy has been purposely set up to instigate new research initiatives once the fishery is in a more viable position economically. The results obtained from this research will be essential to the development of this Harvest Strategy including moving to a B_{MEY} target, updating trigger points and decision rules.

8. Reporting

Reporting on the performance of the TSPF is done on an annual basis mainly through the PZJA annual report and relevant accreditation processes.

DEWHA Wildlife Trade Operation (WTO) accreditation occurs every three years from the previous assessment date. The previous assessment and approval occurred when the Plan was approved in 2009. The next DEWHA fishery assessment will take place in February 2012, although PZJA via AFMA has an added responsibility to provide DEWHA with annual updates on the strategic assessment in February.

The TSPF also has a responsibility to report to the various consultative processes of the PZJA which includes:

- PZJA;
- The PZJA Standing Committee;
- The TSPMAC.

Reporting on the monitoring of triggers will occur annually to the TSPMAC at its December meeting. The TSPMAC will discuss the effort and catch levels in the fishery and assess whether triggers have been reached. Once the triggers have been reached and the TSPF Harvest Strategy is amended with updated target and trigger points, this will be approved through the TSPMAC and the PZJA.

9. Review and Amendments

Review

The TSPF Harvest Strategy was designed to allow fishing effort to remain at the current levels, with PZJA agencies undertaking complimentary work to review and identify current management arrangements. The primary objective of this review is to identify any arrangements that may be limiting the capacity of the fishery to operate at its economic optimum. This approach is designed to help increase effort uptake in the fishery to allow an accurate value of B_{MSY} and B_{MEY} to be calculated.

The TSPF Harvest Strategy has a four (4) year review period, providing effort in the TSPF does not reach any of the triggers. If trigger one (1) or two (2) is reached prior to the four (4) year review, the review processes for the Harvest Strategy will be updated when it is amended at that point in time.

Amendments

Under certain circumstances, it may be necessary to amend harvest strategies in between reviews. These circumstances are if:

- there is new information that substantially changes the status of a fishery, leading to improved estimates of indicators relative to reference points; and/or
- drivers external to management of the fishery increase the risk to fish stock/s; and/or
- it is clear the strategy is not working effectively and the intent of the Harvest Strategy Policy is not being met.

Further explanation can be found in section 15 of the Commonwealth Harvest Strategy Policy Guidelines. The consultative and technical processes for amending harvest strategies are set out in the Commonwealth Harvest Strategy Policy Guidelines in section 2.5.

10. References

O'Neill, M. F. and C. T. Turnbull (2006). Stock assessment of the Torres Strait tiger prawn fishery (*Penaeus esculentus*). Queensland, Department of Primary Industries and Fisheries.

Turnbull, C.T., Tanimoto, M., O'Neill, M.F., Campbell, A. and Fairweather, C.L. (2009). Torres Strait Spatial Management Research Project 2007-09. Final Report for DAFF Consultancy DAFF83/06. Department of Employment, Economic Development and Innovation, Brisbane, Australia

Kertesz M., Cocking, L., Turnbull, C., Jacobsen, I., Hall, S., and Lui, S. (2010). Torres Strait prawn Fishery Handbook 2010. Australian Fisheries Management Authority. Canberra, Australia.

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Appendix A

Relevant PZJA Decisions

PZJA 20, 26 October 2006

At its 20th meeting on the 26th of October 2006, the PZJA made the following decisions regarding the Commonwealth's Harvest Strategy Policy:

20.9.1.1 The PZJA **NOTED** progress in developing a Commonwealth Harvest Strategy Policy (the Policy) for fisheries managed under the *Fisheries Management Act 1991* (Commonwealth Fisheries) and that:

- (a) a "20/40" harvest strategy is in place in Commonwealth Fisheries until the Policy is finalised;
- (b) although the Policy does not apply to Torres Strait Fisheries, the TSFMAC will provide advice to the PZJA on the utility and applicability of the Policy to fisheries managed by the PZJA after the guidelines have been released; and
- (c) in particular, the PZJA is interested in the TSFMAC and the TSPMAC views on where the Commonwealth Harvest Strategy policy should not apply in Torres Strait fisheries.

20.9.1.2 The PZJA further **NOTED**:

- (a) recruitment and, hence, stock levels in the Torres Strait prawn and Tropical Rock Lobster fisheries is highly variable and influenced by a range of factors not always related to traditional, recreational and commercial harvest;
- (b) given the variability of these stocks, the direct applicability of the 20:40 principles to these fisheries requires appropriate consideration; and
- (c) AFMA has an obligation to advocate the adoption of the principles of the Commonwealth Harvest Strategy Policy in internationally managed fisheries.

9.1.3 Subject to the finalisation of the Commonwealth Harvest Strategy the PZJA **NOTED** the objectives of the Commonwealth Harvest Strategy may be used as a guide, while exploring options to manage sustainable commercial harvest and pending agreement with jurisdictions and agencies with an interest in the Torres Strait Fisheries.

PZJA 21, 28 August 2007

At its 21st meeting on the 28th of August 2007, the PZJA made the following decisions regarding utilisation of the Torres Strait prawn Fishery:

3.5.1 The PZJA **NOTED** that:

- (a) Torres Strait Prawn Entitlement Holders Association (TSPEHA) raised concerns over the 31.8 percent effort cuts in the Torres Strait Prawn Fishery in 2006, proposed alternative management arrangements and concerns over government proposals to introduce leasing in to the fishery; and
- (b) PZJA government agencies agreed to work towards identifying solutions in regard to increased access for the 2007 and 2008 season.

3.5.2 The PZJA **NOTED** that:

- (a) the Australian Government negotiated access to unused 2007 season fishing days in the TSPF allocated to PNG under the Torres Strait Treaty;
- (b) PZJA agencies held a preliminary Harvest Strategy Workshop in July 2007 to consider the issues raised by the TSPEHA and identify alternative harvest strategy options for discussion at the TSPMAC in December 2007; and
- (c) Any adjustment to the 9200 days as part of a harvest strategy would be made consistent with sound scientific advice on the impact of additional effort on the status of the stocks and the impact on other stocks and the marine environment.

PZJA 22, 1 May 2008

At its 22nd meeting on the 1st of May 2008, the PZJA made the following decisions regarding the proposed Interim 2008 Harvest Strategy Proposal, relevant to the development of a Long-term Harvest Strategy for the fishery:

3.4.1 The PZJA **NOTED** that while it made no specific recommendations to the PZJA, the TSPMAC agreed:

- (a) that the development and implementation of an interim Harvest Strategy for 2008 should take precedence over the finalisation of the Plan; and
- (b) that a long term Harvest Strategy would be developed that is consistent with the management plan.

3.4.2 The PZJA **NOTED** the following information relating to strategies that may assist Torres Strait Prawn Fishery operators during 2008 prior to the management plan implementation in 2009:

- (a) that consistent with PZJA 21.3.5.1(b) and in response to the TSPMAC agreements listed at 3.4.1, PZJA agencies held stakeholder workshops in Mooloolaba, Cairns and Thursday Island in February 2008; and
- (b) subsequent to this consultation an interim Harvest Strategy, endorsed by stakeholders, was developed based on an increase in the Total Allowable Effort (TAE) to 12,000 days, complemented by a spatial management system.

3.4.3 The PZJA **NOTED** Standing Committee discussions on a harvest strategy for the remainder of 2008, which have resulted in the following scenarios being presented to the PZJA for consideration:

- (a) A spatial management system and an offer to industry equivalent to an increase in the TAE to 12,000 allocated fishing days;
- (b) A spatial management system and an offer to industry equivalent to an increase in the TAE to 10,700 allocated fishing days; or
- (c) Maintaining the status quo of 9,200 allocated fishing days.

3.4.4 The PZJA **RECOGNISED** the urgent need to build fishing effort in the Torres Strait Prawn Fishery in the 2008 fishing season.

3.4.5 The PZJA **AGREED** that its agencies will work with individual licence holders to understand their particular situation and to the extent possible allocate additional fishing effort for the 2008 fishing season.

3.4.6 The PZJA **AGREED** to retain 9,200 days as the basis of allocation for the 2008 fishing season.

3.4.7 The PZJA **DIRECTED** that this allocation will be kept under review during the 2008 season, and if further allocation of fishing effort is required this will be considered.

3.4.8 The PZJA **AGREED** that the TSPMAC will formally develop a long term Harvest Strategy with a range of rules that control the intensity of fishing activity according to the biological and economic conditions of the fishery consistent with the determination of reference points under the TSPF Draft Management Plan.

3.4.9 The PZJA **NOTED** community fisher group (CFG) representative's concerns regarding the trawl rubbish that has been discarded in the region of Yorke and Coconut Islands in the past and the agreement by PZJA management agencies to facilitate an assessment of the amount and type of trawl rubbish, including an estimate on whether it could be removed and at what cost.

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Appendix B

Harvest Strategy Summary Table

Species	Role in the fishery	Research priorities	Indicative additional cost	Trigger Point / Reference Point	Trigger / Reference Point function*	Information requirements to monitor Trigger / Reference Point	Control Rule
Tiger prawn (<i>Penaeus esculentus</i> (main target species), <i>Penaeus semisulcatus</i> and <i>Marsupenaeus japonicus</i>) (used as the indicator species for Endeavour prawn (see below))	Target species	Stock assessment	As of December 2009 Approx \$90,000 - \$100,000.	Biomass Limit ($B_{LIM} = B_{20}$)	Ensure biomass does not fall below B_{LIM}	VMS data. Logbook data.	All fishing activity in the TSPF ceases until stock is shown to be back up to harvestable levels.
				Biomass Target ($B_{TARG} = B_{28} = B_{MSY}$)	Ensure biomass is maintained at or above B_{28}	VMS data. Logbook data.	Maintain biomass at levels that provided maximum sustainable yield.
				≥ 4000 days of TAE has been utilised or 680 tonnes of Tiger prawns or 620 tonnes of Endeavour prawns at end of one season, for two consecutive years.	Operators fishing at levels that provide justification for funding research.	VMS data. Logbook data.	Conduct a TSPF Stock Assessment.
Endeavour prawn (<i>Metapenaeus endeavouri</i> (main target species) and <i>Metapenaeus ensis</i>)	Target species	NA	NA	Performance measures from stock modeling indicate that as long as the more sensitive Tiger prawn species is being fished sustainably under the harvest strategy, the less susceptible	although this harvest strategy does not set specific objectives, trigger points and decision rules to manage the Endeavour prawn (secondary target species) stocks, these stocks are indirectly managed due to the	NA	NA

				Endeavour prawns are also managed sustainably.	stock overlap and relationship to the Tiger prawn species.		
Red-spot King prawn (<i>Melicertus longistylus</i>)	Byproduct species	NA	NA	The Red Spot King prawn is a by-product with relatively low levels of catch recorded. This species is also considered to be sustainable.	although this harvest strategy does not set specific objectives, trigger points and decision rules to manage the Red Spot King prawn (byproduct species) stocks, these stocks are indirectly managed due to the stock overlap and relationship to the Tiger prawn species.	NA	NA

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