Chapter 5
Northern Prawn Fishery

J Larcombe and A Bath

FIGURE 5.1 Relative fishing intensity in the Northern Prawn Fishery, 2016
### TABLE 5.1 Status of the Northern Prawn Fishery

<table>
<thead>
<tr>
<th>Status</th>
<th>2015</th>
<th>2016</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biological status</strong></td>
<td><strong>Fishing mortality</strong></td>
<td><strong>Biomass</strong></td>
<td><strong>Fishing mortality</strong></td>
</tr>
<tr>
<td>Red-legged banana prawn (<em>Fenneropenaeus indicus</em>)</td>
<td></td>
<td></td>
<td>Recent catches have been very low. No recent stock assessment and significant uncertainty around status.</td>
</tr>
<tr>
<td>White banana prawn (<em>Fenneropenaeus merguiensis</em>)</td>
<td></td>
<td></td>
<td>High natural recruitment variability is primarily linked to environmental factors. Harvest strategy aims to provide for adequate escapement.</td>
</tr>
<tr>
<td>Brown tiger prawn (<em>Penaeus esculentus</em>)</td>
<td></td>
<td></td>
<td>Effort is below $E_{\text{MSY}}$, and catch is below MSY. Spawner stock size is above the LRP of $0.5S_{\text{MSY}}$.</td>
</tr>
<tr>
<td>Grooved tiger prawn (<em>Penaeus semisulcatus</em>)</td>
<td></td>
<td></td>
<td>Effort is near $E_{\text{MSY}}$, and catch is below MSY. Spawner stock size is above the LRP of $0.5S_{\text{MSY}}$.</td>
</tr>
<tr>
<td>Blue endeavour prawn (<em>Metapenaeus endeavouri</em>)</td>
<td></td>
<td></td>
<td>Catch is below the estimate of MSY. Spawner stock biomass is above the LRP of $0.5S_{\text{MSY}}$.</td>
</tr>
<tr>
<td>Red endeavour prawn (<em>Metapenaeus ensis</em>)</td>
<td></td>
<td></td>
<td>No current stock assessment.</td>
</tr>
<tr>
<td><strong>Economic status</strong></td>
<td>NER were estimated at $5 million in 2012–13 and continued to improve in 2013–14 to $12 million as a result of improved prawn prices. Despite lower catch levels, NER in 2014–15 were forecast to remain at 2013–14 levels as a result of lower fuel prices and increasing banana prawn prices. In 2015–16, catch of tiger prawns increased by 88%, with proportionately less effort, raising the contribution of this high-value species to the overall gross value of production for the fishery. This, combined with higher prices received for tiger prawns and lower fuel prices, indicates positive signs for NER in the fishery in 2015–16.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** $E_{\text{MSY}}$, Effort that achieves MSY. LRP Limit reference point. MSY Maximum sustainable yield. NER Net economic returns. $S_{\text{MSY}}$, Spawner stock size at MSY.

**Fishing mortality:**
- Not subject to overfishing
- Subject to overfishing
- Uncertain

**Biomass:**
- Not overfished
- Overfished
- Uncertain
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5.1 Description of the fishery

Area fished

White banana prawn (Fenneropenaeus merguiensis) is mainly caught during the day on the eastern side of the Gulf of Carpentaria, whereas red-legged banana prawn (F. indicus) is mainly caught in Joseph Bonaparte Gulf (Figure 5.1). White banana prawns form dense aggregations (‘boils’) that can be located using spotter planes, which direct the trawlers to the aggregations. The highest catches are taken offshore from mangrove forests, which are the juvenile nursery areas. Tiger prawns (P. esculentus and P. semisulcatus) are primarily taken at night (daytime trawling has been prohibited in some areas during the tiger prawn season). Most catches come from the southern and western Gulf of Carpentaria, and along the Arnhem Land coast. Tiger prawn fishing grounds may be close to those of banana prawns, but the highest catches come from areas near coastal seagrass beds, the nursery habitat for tiger prawns. Endeavour prawns (Metapenaeus endeavouri and M. ensis) are mainly a byproduct, caught when fishing for tiger prawns.

Fishing methods and key species

The Northern Prawn Fishery (NPF) uses otter trawl gear to target a range of tropical prawn species. White banana prawn and two species of tiger prawn (brown and grooved) account for around 80 per cent of the landed catch. Byproduct species include endeavour prawns, scampi (Metanephrops spp.), bugs (Thenus spp.) and saucer scallops (Amusium spp.). In recent years, many vessels have transitioned from using twin gear to mostly using a quad rig comprising four trawl nets—a configuration that is more efficient.

Management methods

The NPF is managed through a series of input controls, including limited entry to the fishery, individual transferable effort units, gear restrictions, bycatch restrictions, and a system of seasonal and spatial closures. The fishery has two seasons: a 6–12-week predominantly banana prawn season starting in April, and a longer tiger prawn season, running from August to November. Two distinct components of the NPF harvest strategy are used to manage the two seasons of the fishery, because only a few tiger prawns are landed in the first season. Both operate within the management system of input controls (Dichmont et al. 2012), and use season length controls that are informed by the real-time monitoring of catch and catch rates. The harvest strategies have been subjected to management strategy evaluation testing (Buckworth et al. 2013; Dichmont et al. 2006), to assess their performance against the objectives of the Commonwealth Fisheries Harvest Strategy Policy (HSP; DAFF 2007).

The merits of two NPF management systems—input (effort) and output (total allowable catch)—have been intensively evaluated for several years. In late 2013, mainly because of the difficulty in setting catch quotas for the highly variable white banana prawn fishery, the Australian Fisheries Management Authority (AFMA) determined that the fishery would continue to be managed through input restrictions and units of individual transferable effort. The harvest strategies will be reviewed every five years.
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Fishing effort

The NPF developed rapidly in the 1970s, with effort peaking in 1981 at more than 40,000 fishing days and more than 250 vessels. During the next three decades, fishing effort and participation were reduced to the current levels of around 8,000 days of effort and 52 vessels. This restructuring of the fishery was achieved through a series of structural adjustment and buyback programs, and the implementation of management measures to unitise and control fishing effort. Total catches also fell during this period, but by a much smaller percentage, illustrating the clear transformation of the fleet to more efficient vessels.

Catch

Total NPF catch in 2016 was 5,807 t, comprising 5,432 t of prawns and 375 t of byproduct species (predominantly squid, bugs and scampi). Annual catches tend to be quite variable from year to year because of natural variability in the banana prawn component of the fishery.

TABLE 5.2 Main features and statistics for the NPF

<table>
<thead>
<tr>
<th>Fishery statistics a</th>
<th>2015 fishing season</th>
<th>2016 fishing season b</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stock</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana prawns</td>
<td>3,931</td>
<td>$62.9 million</td>
</tr>
<tr>
<td>Tiger prawns</td>
<td>3,168</td>
<td>$34.8 million</td>
</tr>
<tr>
<td>Endeavour prawns</td>
<td>554</td>
<td>$8.6 million</td>
</tr>
<tr>
<td>Other catch (prawns)</td>
<td>43</td>
<td>$0.5 million</td>
</tr>
<tr>
<td>Other catch (not prawns)</td>
<td>129</td>
<td>$1.6 million</td>
</tr>
<tr>
<td><strong>Total fishery</strong></td>
<td>7,825</td>
<td>$108.4 million</td>
</tr>
<tr>
<td><strong>Effort</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana season</td>
<td>2,249 boat-days</td>
<td></td>
</tr>
<tr>
<td>Tiger season</td>
<td>5,940 boat-days</td>
<td></td>
</tr>
<tr>
<td><strong>Fishing permits</strong></td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td><strong>Active vessels</strong></td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td><strong>Observer coverage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crew member observers</td>
<td>1,058 days (12.9%)</td>
<td></td>
</tr>
<tr>
<td>Scientific observers</td>
<td>159 days (1.94%)</td>
<td></td>
</tr>
<tr>
<td><strong>Fishing methods</strong></td>
<td>Otter trawl</td>
<td></td>
</tr>
<tr>
<td><strong>Primary landing ports</strong></td>
<td>Darwin (Northern Territory), Cairns and Karumba (Queensland). Much of the catch is offloaded onto motherships at sea.</td>
<td></td>
</tr>
<tr>
<td><strong>Management methods</strong></td>
<td>Input controls: individual tradeable gear units, limited entry, gear restrictions</td>
<td></td>
</tr>
<tr>
<td><strong>Primary markets</strong></td>
<td>Domestic: fresh and frozen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>International: Japan—frozen</td>
<td></td>
</tr>
<tr>
<td><strong>Management plan</strong></td>
<td>Northern Prawn Fishery Management Plan 1995 (amended 2012)</td>
<td></td>
</tr>
</tbody>
</table>

a Fishery statistics are provided by fishing season, unless otherwise indicated. Real-value statistics are by financial year. Therefore, changes in catch may appear to be inconsistent with changes in value. b Fishing season predominantly for banana prawns: 1 April to 9 June; predominantly for tiger prawns: 1 August to 20 November.
5.2 Biological status

**Red-legged banana prawn** (*Fenneropenaeus indicus*)

**Stock structure**

Red-legged banana prawn is widely distributed across the Indo-West Pacific Ocean. In Joseph Bonaparte Gulf, a single stock is assumed for assessment purposes.

**Catch history**

Most of the NPF red-legged banana prawn catch is taken in Joseph Bonaparte Gulf, with a smaller proportion taken in the wider NPF to the east. A small amount of catch is also taken in regions adjacent to the NPF. The catch of red-legged banana prawn is usually a relatively small component of the total banana prawn catch in the NPF. Catch was 886 t in 2014, which was the highest since 1997, but dropped substantially to under 50 t in both 2015 and 2016 (Figure 5.2).

![Figure 5.2](chart.png)
Stock assessment

Estimates of maximum sustainable yield (MSY) and its corresponding spawning biomass level ($B_{MSY}$) are difficult to derive for short-lived, variable stocks such as red-legged banana prawns. Typically, yield is determined largely by the strength of annual recruitment, and therefore annual sustainable yields can be expected to fluctuate widely around deterministic estimates (Plagányi et al. 2009).

The most recent accepted assessment for the stock was undertaken in 2015 (Buckworth et al. 2015), and includes data up to and including 2014. The assessment model uses quarterly time steps of catch and effort. As a result, outputs from the model depend on the distribution of effort across fishing seasons, and sensitivity to this has been explored. The base case assumes that the distribution of future catches per quarter will be the average of the patterns seen in 2012 to 2014. The estimate of spawning stock biomass in 2014 was approximately 3.2 times the $B_{MSY}$ and also well above the biomass associated with maximum economic yield (MEY; proxy level $1.2B_{MSY}$) (Figure 5.3). Fishing mortality in 2014 was estimated to be below the level associated with MEY.

Very low levels of effort occurred in the 2015 and 2016 seasons in Joseph Bonaparte Gulf, and levels of catch were consequently very low. Catch rates were also low, but were poorly sampled because of the low effort. The stock assessment relies heavily on fishery-dependent catch and catch rates; for both 2015 and 2016, the model was not able to provide reliable estimates of stock status.

The Northern Prawn Resource Assessment Group (NPRAG) analysed the anomalously low Joseph Bonaparte Gulf catches of red-legged banana prawns in 2015 and 2016 (Plagányi et al. 2017). One hypothesis is that recruitment or availability was lower in 2015 and 2016 as a result of anomalous environmental factors. Preliminary work by Plagányi et al. (2017) found an association between catch rates and different combinations of El Niño conditions (Southern Oscillation Index) and seasonal rainfall. The model predicted low catch rates in both 2015 and 2016 as a result of El Niño conditions and below-median rainfall.

Another hypothesis for the low Joseph Bonaparte Gulf catches is the potential existence of more favourable fishing opportunities in other parts of the multispecies NPF, particularly for tiger prawn fishing in the Gulf of Carpentaria, thereby leading to low fishing effort in Joseph Bonaparte Gulf. Preliminary analysis found some association between lower Joseph Bonaparte Gulf catches and higher catch rates in the tiger prawn fishery, which would contribute to low effort in Joseph Bonaparte Gulf during years of unfavourable environmental factors, as explained above. So, low Joseph Bonaparte Gulf catches may result from a combination of both poor environmental conditions in Joseph Bonaparte Gulf and better fishing opportunities elsewhere.

Under the harvest strategy, when effort is below 100 days in one year, the fishery remains open in both seasons of the following year. There is no precedent for two consecutive years with such low fishing effort; consequently, NPRAG is reviewing the decision rules for red-legged banana prawn under the NPF harvest strategy, with a recommendation that the season opening be modified for years with less than 100 fishing days. The recommendation may also refer to the environmental conditions.
FIGURE 5.3 Estimated spawning biomass for red-legged banana prawn, 1980 to 2014

Source: Buckworth et al. 2015

**Stock status determination**

Recent (2015 and 2016) red-legged banana prawn catches of under 50 t are well below the estimated long-term average MSY range (750–900 t; Buckworth et al. 2015). Given this very low catch and associated low effort levels, the stock is classified as **not subject to overfishing**.

The most recent estimate of biomass (2014) was well above the target reference point. However, no assessment was made in 2015 and 2016 because of a lack of data following low catch-and-effort levels, and there is uncertainty and some concern about the cause of these lower catch levels. The biomass status of red-legged banana prawn stock is **uncertain**.

**White banana prawn (Fenneropenaeus merguiensis)**

Line drawing: FAO

**Stock structure**

The stock structure of white banana prawn is uncertain. In the NPF, there is some evidence of substock structuring associated with significant river mangrove areas, but, in the absence of clear information on biological stock structure, status is reported at the fishery level.
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Catch history

Catch in 2016 was 2,842 t (Figure 5.4). Seasonal catch is highly variable and is associated with rainfall in some areas (Venables et al. 2011).

![Figure 5.4: White banana prawn catch, 1990 to 2016](source: CSIRO)

Stock assessment

The environmentally driven variability of this resource means that a robust stock–recruitment relationship cannot be determined. Because annual yields are largely dependent on annual recruitment, it has not been possible to develop a stock assessment for white banana prawn. To explore the possibility of implementing total allowable catches for the fishery, CSIRO modelled the relationship between historical catch and rainfall, to investigate whether it is possible to predict the next year’s catch based on the most recent wet-season rainfall. Unfortunately, large uncertainties remain because in some years the model cannot accurately predict catch levels, particularly in recent years (Buckworth et al. 2013).

Harvest rates for white banana prawn in the fishery are understood to have been high (>90 per cent of available biomass) in some years (Buckworth et al. 2013), but banana prawns are believed to be resilient to fishing pressure, and recruitment appears to be more closely associated with seasonal rainfall than with fishing mortality. The harvest strategy for the stock has, inter alia, an objective to allow sufficient escapement to ensure an adequate spawning biomass and to allow subsequent recruitment. This is achieved by closing the season when catch rates fall below a trigger level, associated with permitting sufficient prawns to escape to ensure an adequate spawning biomass for subsequent recruitment (based on an analysis of historical data; Dichmont et al. 2012). In addition, the trigger is designed to achieve an economic outcome by closing fishing when catch rates fall below uneconomic levels.

Stock status determination

With the adoption of the harvest strategy, a relatively small fleet and a lack of evidence of recruitment overfishing, this stock is classified as **not subject to overfishing** and **not overfished**.
Brown tiger prawn (*Penaeus esculentus*)

**Stock structure**

Brown tiger prawn appears to be endemic to tropical and subtropical Australian waters. Some genetic evidence indicates that there are separate stocks on the east and west coasts (Ward et al. 2006). However, the biological stock structure in the NPF is uncertain, and the population in the Gulf of Carpentaria is assumed to be a single stock for management purposes.

**Catch history**

Brown tiger prawns are caught primarily in the first season in the southern and western Gulf of Carpentaria, but also in waters westwards towards Joseph Bonaparte Gulf. Catch of brown tiger prawn in 2016 was 898 t (Figure 5.5).

**FIGURE 5.5** Brown tiger prawn catch, 1970 to 2016

Source: CSIRO
Stock assessment

The stock assessment for the tiger prawn fishery uses a multispecies (covering brown and grooved tiger prawns, and blue endeavour prawn), weekly, sex- and size-structured population model, combined with a Bayesian hierarchical production model for blue endeavour prawn. It is integrated with an economic model that calculates MEY. Full assessments are made every two years, with data collected continuously in intervening years. For the most recent assessment (Buckworth et al. 2016), the base-case estimate of the size of the brown tiger prawn spawner stock at the end of 2015 as a percentage of spawner stock size at MSY ($S_{2015}/S_{MSY}$) was 175 per cent (range across sensitivities 151–178 per cent). The base-case estimate of the size of the spawner stock as a percentage of stock size at MEY ($S_{2015}/S_{MEY}$) was 162 per cent (Figure 5.6) (range across sensitivities 136–162 per cent).

For the most recent assessment, the estimate of effort in 2015 as a percentage of effort at MSY ($E_{2015}/E_{MSY}$) was 36 per cent. The estimate of effort in 2015 as a percentage of effort at MEY ($E_{2015}/E_{MEY}$) was 35 per cent. Catch of brown tiger prawn was 763 t in 2015 and 898 t in 2016 (Figure 5.5), substantially less than the base-case estimate of MSY (1,186 t).

FIGURE 5.6 Spawner stock size as a proportion of $S_{MEY}$ for brown tiger prawn, 1970 to 2015

Stock status determination

Effort in recent years has been less than the level associated with MSY and MEY, catches in recent years have been less than MSY, and the estimate of biomass (five-year moving average) for the base-case model (and all other sensitivities) was above the limit reference point ($0.5S_{MSY}$) in the most recent assessment. Brown tiger prawn in the NPF is therefore classified as not subject to overfishing and not overfished.
Grooved tiger prawn (*Penaeus semisulcatus*)

**Stock structure**

Grooved tiger prawn ranges across northern Australian waters, the Indo-West Pacific Ocean and the Mediterranean Sea. The biological stock structure is uncertain, but the population near the Gulf of Carpentaria is assumed to be a single stock for management purposes.

**Catch history**

Annual catches of grooved tiger prawn, which is primarily taken in the second season, peaked in the early 1980s at more than 2,500 t and have shown a declining trend since then (Figure 5.7). Catch of grooved tiger prawn in 2016 was 1,241 t, which was a substantial decrease from the 2015 catch of 2,405 t—the highest catch of this species since the early 1980s.

FIGURE 5.7 Grooved tiger prawn catch, 1970 to 2016

![Graph showing grooved tiger prawn catch, 1970 to 2016](source: CSIRO)
Stock assessment

For the most recent assessment (Buckworth et al. 2016), the base-case estimate of the size of the grooved tiger prawn spawner stock at the end of 2015 as a percentage of spawner stock size at MSY ($S_{2015}/S_{MSY}$) was 185 per cent (range across sensitivities 177–235 per cent). The base-case estimate of the size of the spawner stock as a percentage of spawner stock size at MEY ($S_{2015}/S_{MEY}$) was 171 per cent (Figure 5.8) (range across sensitivities 152–171 per cent).

For the most recent assessment, the estimate of effort in 2015 as a percentage of effort at MSY ($E_{2015}/E_{MSY}$) was 83 per cent. The estimate of effort in 2015 as a percentage of effort at MEY ($E_{2015}/E_{MEY}$) was 101 per cent. The catch of grooved tiger prawn in 2016 was 1,241 t (Figure 5.7), which was below the base-case estimate of long-term average MSY (1,605 t).

**FIGURE 5.8** Spawner stock size as a proportion of $S_{MEY}$ for grooved tiger prawn, 1970 to 2015

Stock status determination

Although the 2015 catch of grooved tiger prawn exceeded the estimated long-term MSY, the catch was supported by higher than average levels of recruitment in 2015. Additionally, in 2016, catch returned to levels below MSY. The spawning stock biomass for the base-case model (and all other sensitivities) is estimated to be well above the biomass levels associated with MSY and MEY, and therefore also above the limit reference point ($0.5S_{MSY}$). Grooved tiger prawn in the NPF is therefore classified as **not subject to overfishing** and **not overfished**.
Blue endeavour prawn (*Metapenaeus endeavouri*)

**Line drawing: FAO**

**Stock structure**

Blue endeavour prawn ranges across northern Australia waters and parts of the Indo-West Pacific Ocean. The biological stock structure is uncertain, but the population in the NPF is assumed to be a single stock for management purposes.

**Catch history**

Annual catches of blue endeavour prawn peaked in the early 1980s at more than 1,500 t, and again in the late 1990s at 1,000 t (Figure 5.9). Since 2002, annual catches have averaged around 300 t, and the 2016 catch was 279 t. Blue endeavour prawn is a byproduct of the tiger prawn fishery, and so catches are linked to changes in effort targeting tiger prawns.

**FIGURE 5.9 Blue endeavour prawn catch, 1970 to 2016**

Source: CSIRO

**Stock assessment**

Stock size is assessed using a Bayesian hierarchical biomass dynamic model, within the same overall bio-economic model system as used for the two tiger prawn species (Buckworth et al. 2016).

The base-case estimate of the size of the blue endeavour prawn spawner stock at the end of 2015 as a percentage of stock size at MSY ($S_{2015}/S_{MSY}$) was 77 per cent (range across sensitivities 77–97 per cent). The base-case estimate of the size of the spawner stock as a percentage of stock size at MEY ($S_{2015}/S_{MEY}$) was 80 per cent (Figure 5.10) (range across sensitivities 72–84 per cent). The catch of blue endeavour prawn was 348 t in 2015 and 279 t in 2016 (Figure 5.9), substantially less than the base-case estimate of MSY (813 t).
**Figure 5.10** Spawner stock size as a proportion of $S_{MEY}$ for blue endeavour prawn, 1970 to 2015

Source: Buckworth 2016

**Stock status determination**

The catch in 2016 was well under the estimated MSY, and the estimate of spawner stock size (five-year moving average) for the base case was above the limit reference point ($0.5S_{MSY}$). Blue endeavour prawn in the NPF is therefore classified as **not subject to overfishing** and **not overfished**.

**Red endeavour prawn** (*Metapenaeus ensis*)

Line drawing: FAO

**Stock structure**

Red endeavour prawn ranges across northern Australian waters and parts of the Indo-West Pacific Ocean. The biological stock structure is uncertain, but the population within the NPF is assumed to be a single stock for management purposes.

**Catch history**

Annual catches of red endeavour prawn have been variable over the history of the fishery, with peak annual catches in excess of 800 t in 1982 and 1997 (Figure 5.11). Since 1998, catches have been below 400 t, and the 2016 catch was 94 t. Red endeavour prawn is a byproduct of the tiger prawn fishery.
FIGURE 5.11 Red endeavour prawn catch, 1970 to 2016

Source: CSIRO

Stock assessment

Although attempts have been made to assess red endeavour prawn, no reliable assessment is available to determine stock status. Catches during recent years have been quite low compared with historical highs. This is most likely related to the overall decline in fishing effort directed at tiger prawn rather than any indication of a fall in red endeavour prawn biomass.

Stock status determination

Given the absence of information on the sustainability of catches or the state of the biomass, this stock is classified as **uncertain** with regard to the level of fishing mortality and biomass.
5.3 Economic status

Key economic trends

The gross value of production for the NPF fluctuated during the decade to 2015–16, peaking at $124 million in 2015–16 and reaching a low of $70 million (in 2015–16 dollars) in 2011–12 (Figure 5.12).

FIGURE 5.12 GVP for the NPF, 2005–06 to 2015–16

Since the early 1990s, ABARES has used data from economic surveys of the NPF to estimate the level of net economic returns (NER) earned in the fishery. The most recent survey in 2015 provided survey-based estimates of NER for the 2012–13 and 2013–14 financial years, and forecasts for the 2014–15 year (Bath & Green 2016).

The level of real NER in the NPF has varied considerably during the past 15 years (Figure 5.13). In 2000–01, real NER were estimated at $83 million. NER fell sharply in the following years to reach –$17 million in 2004–05 (in 2014–15 dollars). Between 2004–05 and 2006–07, real NER remained negative. During this time of declining profitability, three management changes occurred in the fishery: from 2004–05, the fishery began targeting MEY in the tiger prawn component of the fishery; the Securing our Fishing Future (SOFF) structural adjustment program (which concluded in 2006–07) was implemented, resulting in a 50 per cent reduction in the fleet; and management changes allowed the adoption of quad trawl gear. Together, these changes are likely to have assisted in improving the economic performance of the fishery since 2004–05.
The SOFF removed 43 class B statutory fishing rights from the fishery, reducing the already declining active vessel numbers from 86 in 2005–06 to 55 in 2007–08. Since then, except for 2011–12, real NER in the fishery have been positive each year, peaking at $13 million in 2009–10, while active vessel numbers have declined slightly, to 52 in the 2016 fishing season. This improvement was mainly driven by increasing revenue from higher landings of banana prawns (Skirtun et al. 2014), as well as a likely improvement in the fleet’s efficiency after structural adjustment and targeting of MEY. In 2011–12, real NER fell by approximately $10 million to −$4 million, as a result of lower landings of banana prawns. NER recovered to $5 million in 2012–13 and continued to improve in 2013–14 to $12 million as a result of improved prices. Despite lower catch levels, NER in 2014–15 were forecast to remain at 2013–14 levels as a result of lower fuel prices and banana prawn prices increasing from $11.96 per kg in 2013–14 to $13.58. In 2015–16, unit prices for banana and tiger prawns increased and fuel prices continued to decrease, showing further positive signs for NER in the fishery. Moreover, catch of tiger prawns increased by 85 per cent, with proportionately less effort, raising the contribution of this high-value species to the overall gross value of production for the fishery from 32 per cent to 59 per cent. These factors indicate positive signs for NER in the fishery in 2015–16.

**FIGURE 5.13** Real revenue, costs, NER and active vessel numbers for the NPF, 2004–05 to 2014–15

Total factor productivity (a measure of fishers’ ability to convert inputs into outputs over time) in the fishery increased from 2004–05 to 2010–11, at a rate robust enough to offset declining terms of trade from declining prices and high fuel costs (Bath & Green 2016; Figures 5.14 and 5.15). This trend was largely driven by growth in outputs and a slightly declining inputs index. Most of the increase in the outputs index coincides with increases in banana prawn catch per vessel; however, targeting MEY in the tiger prawn component of the fishery would also have supported this improved productivity at a time of declining terms of trade. Because the productivity index was not adjusted for stock effects, productivity growth also reflects favourable environmental conditions that allowed increases in catch, particularly for banana prawns, rather than just changes in efficiency measures and technology adopted by fishers.
Figure 5.14 Total factor productivity index, 2004–05 to 2013–14

Figure 5.15 Terms of trade index, 2004–05 to 2013–14
Management arrangements

The NPF is managed using input controls. The main control is individual tradeable gear units, which limit the length of headrope on trawl nets. Controls on season length, spatial closures and other gear restrictions are also applied.

An assessment of the impact of the structural adjustment package by Vieira et al. (2010) suggested that, for the benefits of the package to be preserved, management arrangements in fisheries targeted by the package need to be set in ways that prevent a repeated build-up of fishing capacity. For these reasons, AFMA recommended a range of amendments to the management arrangements in the fishery, to better align banana prawn catch levels with the MEY objective; these amendments were implemented throughout the 2014 and 2015 fishing seasons. In 2014, an MEY catch-rate trigger for banana prawn was introduced to the fishery (AFMA 2015).

Performance against economic objective

The tiger prawn component of the fishery has explicit MEY targets (across two tiger prawn species and one endeavour prawn species), and a bio-economic model is used to estimate annual fishing effort required to move towards spawning stock sizes at MEY ($S_{MEY}$). Stocks are assessed every two years. Spawning stock sizes of both species of tiger prawn were above $S_{MEY}$ at the end of the 2015 season (Buckworth et al. 2016). Spawner stock size of blue endeavour prawn for the same period was estimated to be below $S_{MEY}$. Effort levels as a proportion of effort at MEY for brown tiger prawn and grooved tiger prawn were estimated to be at or below effort at MEY. Current effort limits in the fishery are based on outputs from the fishery’s bio-economic model, and are designed to achieve an MEY (profit maximisation) target across a seven-year projection period (noting that the target changes with every assessment because of changes in biological and economic parameters).

Recruitment for all species is variable, particularly for white banana prawn, in which recruitment is closely associated with rainfall. Therefore, no $B_{MEY}$ target is defined for white banana prawn. Instead, an MEY-based catch-rate trigger, with mechanisms in place to adjust total annual effort levels to ensure that the fishery remains sustainable and profitable, was implemented for the 2014 banana prawn season (AFMA 2015).

Red-legged banana prawn, primarily caught in Joseph Bonaparte Gulf, was assessed in 2015 (Buckworth et al. 2015), using data up to and including 2014. Spawning stock biomass was estimated to be well above biomass associated with the proxy MEY in the 2014 season. Because of low levels of catch during the 2015 and 2016 fishing seasons, reliable assessments of the stock status could not be undertaken.

Targeting MEY in the fishery is consistent with the economic objective of maximising economic returns, and could be expected to increase NER in the fishery. Targeting MEY of the tiger prawn component of the fishery began in 2004–05. Despite declining terms of trade from 2004–05 to 2010–11, productivity and NER improved. Although the targeting of MEY over this period is likely to have supported these improvements, other factors, such as the structural adjustment package and improved banana prawns catch, also contributed. The banana prawn catch trigger targeting MEY has only been in place since 2014, so it is too early to determine its effect on NER.
5.4 Environmental status

The NPF was reaccredited under part 13 of the Environment Protection and Biodiversity Conservation Act 1999 on 20 December 2013. The current approval of a wildlife trade operation (part 13A) expires on 9 January 2019. Four recommendations accompanied the strategic assessment, including improvement of the monitoring systems for byproduct and refinement of bycatch mitigation measures.

The NPF was certified as a sustainable fishery by the Marine Stewardship Council in November 2012 (MSC 2012).

Ecological risk assessment of the NPF has assessed 9 target species, 135 byproduct species, 516 discard species (chondrichthians and teleosts only), 128 protected species, 157 habitats and 3 communities (AFMA 2008). Following review of the level 2 Productivity Susceptibility Analysis (PSA) risk rankings, using residual risk guidelines (AFMA 2008), 26 species remained at high risk. During and following the level 2 PSA work, selected taxonomic groups were the subject of level 2.5 studies (Brewer et al. 2007). Milton et al. (2008) estimated temporal trends in abundance of sea snakes in the NPF to provide a quantitative assessment of trawling on populations. Although most populations had been relatively stable, two species (spectacled seasnake [Hydrophis kingii] and large-headed seasnake [H. pacificus]) showed evidence of decline on the trawl grounds. Results from a level 3 Sustainability Assessment for Fishing Effects analysis of elasmobranchs in the NPF (Zhou & Griffiths 2011) indicate that, of the 51 species considered, fishing impacts may have exceeded the maximum sustainable fishing mortality harvest rate for 19 species, although these estimates were highly uncertain. Based on these risk assessments, three species are currently considered to be at high risk in the NPF: porcupine ray (Urogymnus asperrimus) and two species of mantis shrimp (Dictyo squilla tuberculata and Harpiosquilla stephensoni).

AFMA publishes quarterly reports of logbook interactions with protected species on its website. In the NPF in the 2016 calendar year, 55 turtle interactions were reported, and all turtles were released alive; 314 sawfish were caught, of which 177 were released alive and the remainder were dead; and 8,498 sea snakes were caught, of which 6,527 were released alive, 5 were injured, 5 had an unknown life status and the remainder were dead. Reports also indicate that 93 seahorses or pipefish were caught—73 were dead and 20 were released alive.
5.5 References


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