



Department of
**Primary Industries and
Regional Development**

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Western Australia.*

Fisheries Management Paper No. 265

**Prawn Resource of Exmouth Gulf
Harvest Strategy
2021-2026
Version 2.0**

June 2021

Version control

Version	Change description	Date
1.0	First published Fisheries Management Paper No. 265 Harvest Strategy for this resource.	November 2014
1.1	Amended to include blue endeavour prawns as a target species with reference levels and control rules and general update.	February 2018
2.0	Updated after first five-yearly review. Key changes include the incorporation of the Bycatch Action Plan, general structural changes and revised wording in the generic sections to ensure consistency with other harvest strategies. The Harvest Strategy title now refers to prawn resource instead of just the commercial prawn fishery.	June 2021

Important disclaimer

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List of acronyms

ALC	Automatic Location Communicator
ARMA	<i>Aquatic Resources Management Act 2016</i>
BAP	Bycatch Action Plan
BMP	Bycatch Monitoring Program
BRD	Bycatch Reduction Device
CMOP	Crew-Member Observer Program
DPIRD	Department of Primary Industries and Regional Development
EBFM	Ecosystem Based Fisheries Management
EGPMF	Exmouth Gulf Prawn Managed Fishery
EPBC (Act)	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERA	Ecological Risk Assessment
ESD	Ecologically Sustainable Development
ETP	Endangered, Threatened and Protected (species)
FED	Fish Exclusion Device
FRMA	<i>Fish Resources Management Act 1994</i>
FRMR	<i>Fish Resources Management Regulations 1995</i>
HCR	Harvest Control Rule
MFL	Managed Fishery Licenses
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
NGO	Non-Government Organisations
OCP	Operational Compliance Plan
OPMF	Onslow Prawn Managed Fishery
PRI	Prawn Recruitment Impairment
SLA	Service Level Agreements
SRR	Spawning stock Recruitment Relationship
TED	Turtle Exclusion Device
TPSA	(Central) Tiger Prawn Spawning Area
VME	Vulnerable Marine Ecosystem
VMS	Vessel Monitoring System
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council

WTO

Wildlife Trade Operation

1.0 Introduction

Harvest strategies for aquatic resources in Western Australia (WA), managed by the Department of Primary Industries and Regional Development (DPIRD, the Department) are formal documents that support decision making processes and ensure these are consistent with the principles of Ecologically Sustainable Development (ESD; Fletcher 2002) and Ecosystem Based Fisheries Management (EBFM; Fletcher et al. 2012). The objectives of ESD are reflected in the objects of the *Fish Resources Management Act 1994* (FRMA), Section 3, and the *Aquatic Resources Management Act 2016* (ARMA), Section 9, which will replace the FRMA once enacted.

This Harvest Strategy has been developed in line with the Department's Harvest Strategy Policy for Aquatic Resources (Department of Fisheries 2015) and is consistent with relevant national Harvest Strategy policies and guidelines (e.g. Sloan et al. 2014; Department of Agriculture and Water Resources 2018a, b). It makes explicit the performance indicators, reference levels, and Harvest Control Rules (HCRs) designed to achieve the specific long and short-term management objectives for the resource, and the broader goals of ESD and EBFM. This version of the Harvest Strategy also includes the Bycatch Action Plan (BAP) (refer to Appendix 3), formerly a standalone document.

Publication of this Harvest Strategy is intended to make the decision-making considerations and processes for the management of specified aquatic resources publicly transparent. It will also provide a basis for informed dialogue on management actions with resource users and other stakeholders (Department of Fisheries 2015). The strategy provides guidance for decision makers, but does not derogate from or limit the exercise of discretion required for independent decision making by the Minister for Fisheries, the Director General of DPIRD, or other delegated decision makers to meet the objectives of the FRMA.

Consistent with the Department's Stakeholder Engagement Guideline (Department of Fisheries 2016), formal stakeholder consultation with industry members and peak commercial and recreational fishing sector bodies, as well as public consultation processes was carried out in the development of this document. It has been approved by the Minister for Fisheries.

1.1 Review Process

The WA Harvest Strategy Policy recognises that fisheries change over time and that a review period should be built into each Harvest Strategy to ensure that it remains relevant (Department of Fisheries 2015). This is the third version of the Harvest Strategy for the Exmouth Gulf Prawn Managed Fishery (EGPMF) which was independently assessed and third party certified as sustainable by the globally recognised Marine Stewardship Council (MSC) in 2015 and recertified without conditions in 2020. This Harvest Strategy, which is focused on the broader prawn resource in Exmouth Gulf, will remain in place for a period of five years, after which

time it will be fully reviewed. If required, however, this document may be subject to review and amended within this five-year period.

2.0 Scope

This Harvest Strategy relates to the prawn resource of Exmouth Gulf in WA, and the fishing activities influencing this resource. Prawns in Exmouth Gulf are primarily harvested by the commercial EGPMF using low-opening otter trawls. The key target species of the EGPMF are brown tiger prawns (*Penaeus esculentus*), western king prawns (*Penaeus latisulcatus*) and blue endeavour prawns (*Metapenaeus endeavouri*). The fishery also retains a variety of minor prawn species, including banana prawns (*Penaeus merguensis*) and coral prawns (various species but primarily *Metapenaeopsis crassissima*).

This Harvest Strategy considers the impact of commercial trawl fishing activities, as the primary sector targeting the prawn resource in Exmouth Gulf. Recreational and customary fishing for prawns is permitted, however, catches are considered negligible in the context of managing harvest of the prawn resource of Exmouth Gulf.

In addition to considering fishing impacts on the key target species (i.e. brown tiger prawns, western king prawns and blue endeavour prawns), this Harvest Strategy also considers impacts on other retained species, bycatch, endangered, threatened and protected (ETP) species, habitats and other ecological components. Potential risks for all factors identified within the ecological risk assessment (ERA) (refer to Section 3.6.2.3) are managed effectively through the implementation of this Harvest Strategy, control rules (refer to Table 1) and BAP (refer to Appendix 3).

2.1 Environmental Context

The Exmouth Gulf prawn resource occurs within the Gascoyne Coast Bioregion of WA, which represents a transition between the tropical waters of the north west shelf and the temperate waters of the lower west coast. Exmouth Gulf is a large (~4,000 km²) and shallow (predominantly <20 m) tropical gulf, which is open to the north and enclosed by the Cape Range and large sandy beaches to the west and a narrow band of mangroves bordering extensive salt flats to the east and south (Johnstone 1990; Wilson 1994; McCook et al. 1995). Key habitats within Exmouth Gulf include mangroves, intertidal mudflats, coral reef, seagrass and mud/sand bottom areas. The Gulf supports a number of tropical fish and invertebrate species, as well as protected species such as dolphins, marine turtles, elasmobranchs (e.g. sawfish), sea snakes and sea horses and pipefish.

Exmouth Gulf and the EGPMF are situated adjacent to the Ningaloo Coast World Heritage Area – NCWHA, Ningaloo Marine Park (NMP) and Muiron Islands Marine Management Area (MIMMA) (Figure 1). A portion of the EGPMF overlaps with these areas, within general use zoning (refer to Figure 2), where sustainable commercial fishing, including the EGPMF, is allowed.

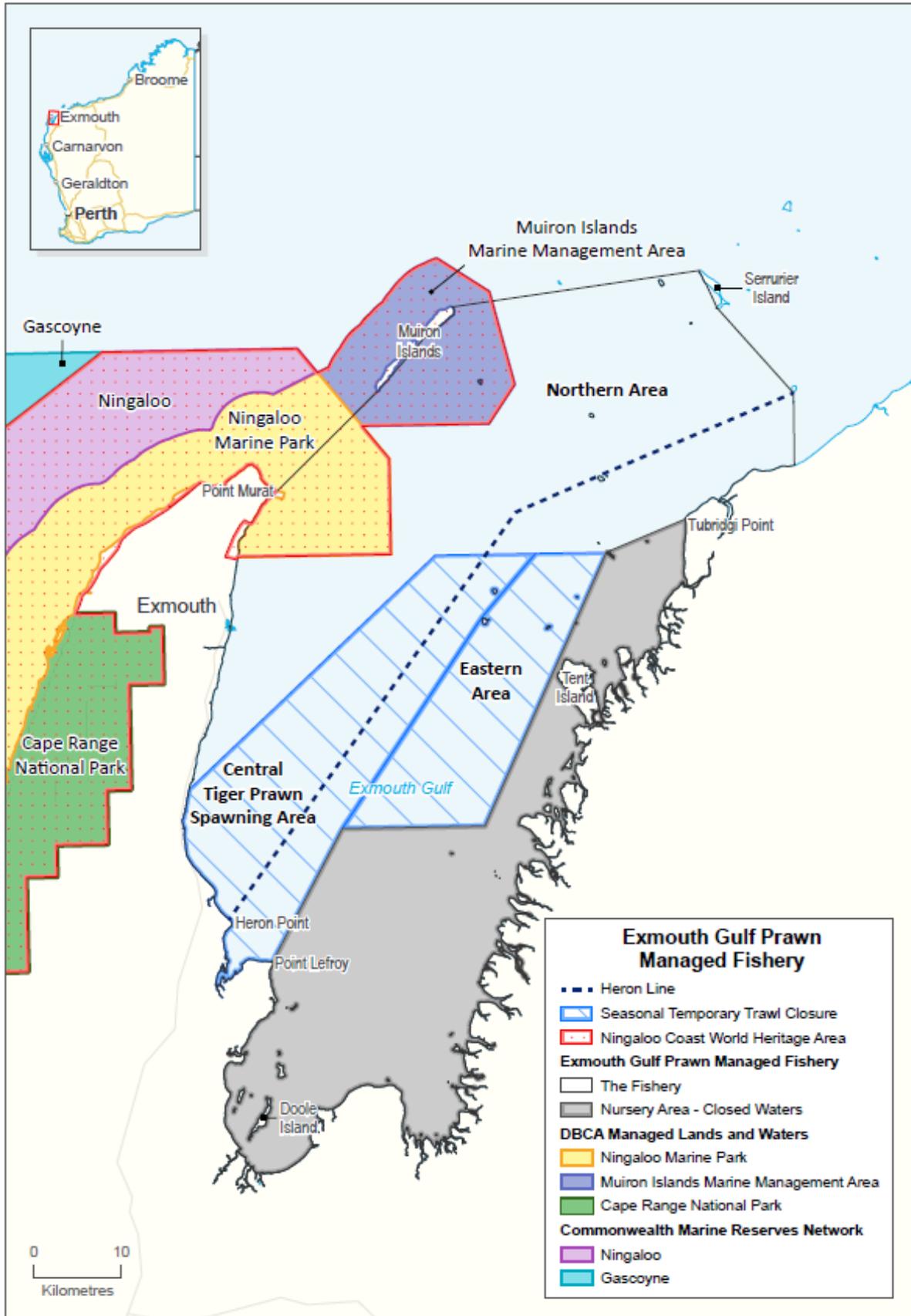


Figure 1: Exmouth Gulf Prawn Managed Fishery management areas, boundaries and adjacent areas of significance.

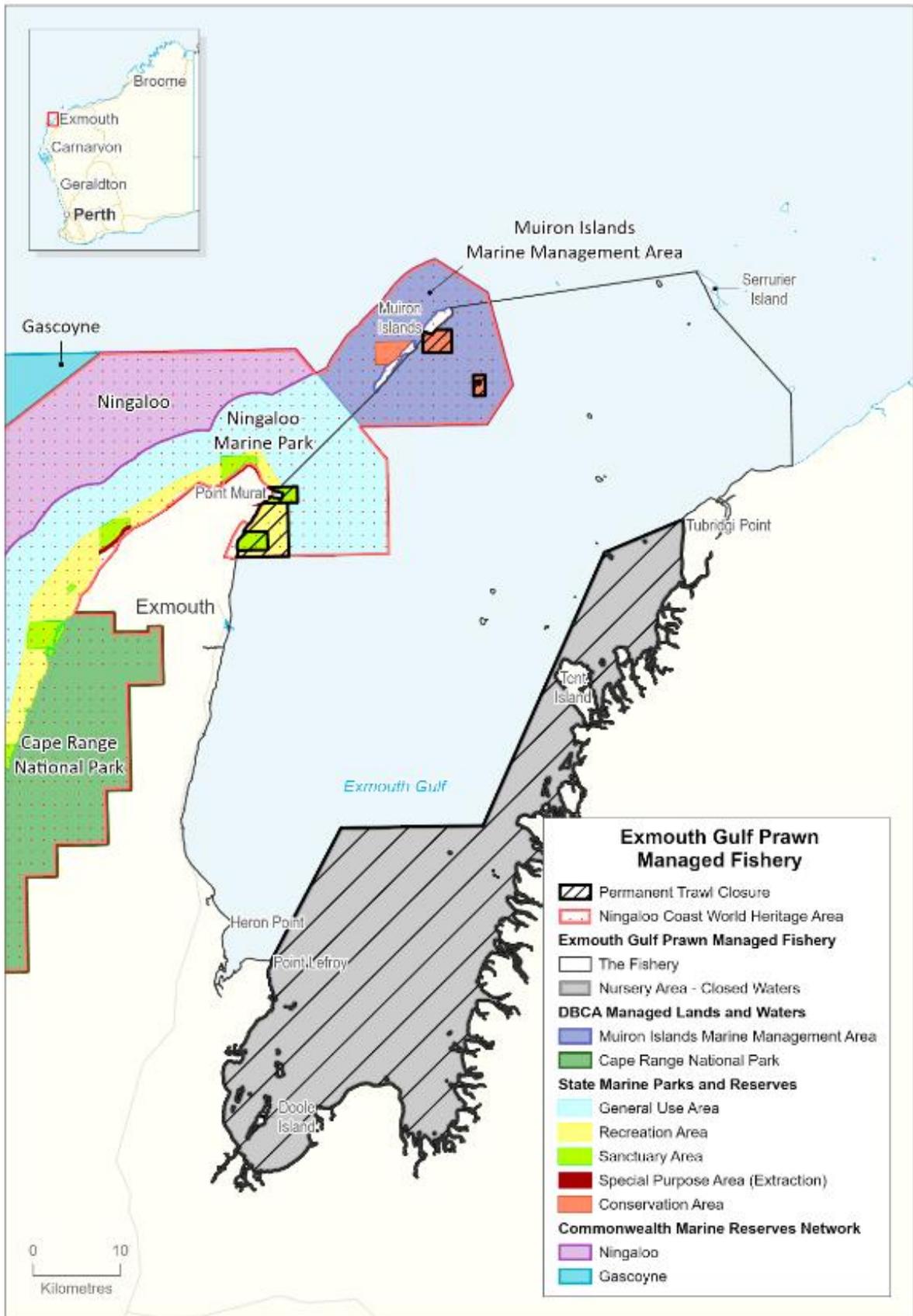


Figure 2: Exmouth Gulf Prawn Managed Fishery management areas, boundaries and trawl closure areas.

Water depths in Exmouth Gulf range from intertidal flats along the southern and eastern shores to ~20 m in the northern and western regions. Rainfall and river runoff in the area are extremely low and with rare flooding events, primarily driven by summer tropical cyclones, altering the water quality of the gulf, e.g. salinity and turbidity, from what is normally a relatively stable hydrological environment (Penn & Caputi 1986). The Leeuwin Current affects the inshore and offshore waters of Exmouth Gulf, particularly during strong winter flows, with elevated water temperatures, depressed levels of dissolved nutrients and particle concentrations inhibiting the growth of macroalgae (Hatcher 1991). Consequently, fisheries production relies on nutrient sources from benthic habitats in nearshore waters, rather than from oceanic ecosystems (Lenanton et al. 1991).

2.2 Target Species

The primary target species of the EGPMF are brown tiger prawns, western king prawns and blue endeavour prawns. These decapod crustaceans belong to the family Penaeidae and are short-lived, fast growing with highly variable recruitment that is environmentally driven. In Exmouth Gulf, juveniles of the three target species spend about three to six months in the inshore nursery grounds before they reach maturity and migrate into deeper, waters further offshore to spawn. Spawning in Exmouth Gulf occurs primarily between May and October. The peak spawning season varies between the three species, mainly driven by water temperature.

Although the populations of the three target species in Exmouth Gulf are considered to function as independent self-sustaining stocks, with distinct adult and juvenile habitats and independent variations in recruitment and abundance, there may be some mixing of larvae and juveniles with the coastal waters north of the Gulf. Here, the Onslow Prawn Managed Fishery (OPMF) also harvests them.

2.3 Fishing Activities

2.3.1 Governance

The Exmouth Gulf prawn resource can be targeted by commercial, recreational and customary fishing sectors. The Department manages these fishing sectors under the following legislation, as a minimum:

- *Fish Resources Management Act 1994* (FRMA, will be replaced by the ARMA once enacted);
- *Fish Resources Management Regulations 1995* (FRMR);
- FRMA Part 6 — *Exmouth Gulf Prawn Managed Fishery Management Plan 1989* (EGPMF Management Plan);
- FRMA Section 43 Order — *Prohibition on Commercial Fishing (Ningaloo Marine Park) Order 2005*;
- FRMA Section 43 Order — *Prohibition on Commercial Fishing (Muiron Islands Marine Management Area) Order 2008*; and
- FRMA Section 7 Instruments of Exemptions.

Fishers must also comply with the requirements of the:

- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);*
- *Marine Safety (Domestic Commercial Vessel) National Law Act 2012;*
- *Western Australian Marine Act 1982;*
- *Western Australian Biodiversity Conservation Act 2016;*
- *Western Australian Conservation and Land Management Act 1984;* and
- Any other legislation governing the use of the marine environment in which fishing activities occur.

2.3.2 Commercial Fishing

Commercial catches of prawns in Exmouth Gulf commenced in 1963, initially taken by 12 vessels. Limited entry to the fishery was first introduced in 1965, with the trawl fleet developing incrementally to a maximum of 23 vessels in 1979 (Penn et al. 1997). Fishers could initially operate at anytime, anywhere within the Exmouth Gulf, but they primarily fished in the central areas. As the fishery developed and the understanding of spatial and temporal variation in prawn abundance increased, closed nursery areas and closed seasons over part of the fishing grounds were introduced to permit prawns to grow to an acceptable market size before being harvested (Meany 1979). There are currently 15 Managed Fishery Licences (MFLs) in the EGPMF, all of which are held by a single licensee. The fleet currently consists of six boats using quad-rig demersal otter trawl gear. Each boat is equipped with on-board processing and freezing facilities.

The EGPMF is subject to an input control management system. Overall effort in the fishery is constrained by a cap on the number of licences/vessels (limited entry), limits on fishing gear (headrope capacity), restrictions on the number of available fishing days each year (seasonal closure) and restricted trawl hours (predominantly night-time trawling). Monthly moon closures of at least five days around each full moon and significant permanent and temporary closed areas throughout the fishery also reduce the effective fishing effort. Fishing activity is monitored using the Vessel Monitoring System (VMS) (see Section 5.3 for more detail).

The EGPMF has been assessed under the provisions of the EPBC Act (Part 13A) and has been found to meet the Australian Government Guidelines for the Ecologically Sustainable Management of Fisheries (Commonwealth of Australia [CoA] 2007). Initial assessment of the fishery took place in 2002, with the most recent reassessment and approval granted in August 2015[1]. As such, the EGPMF is an approved Wildlife Trade Operation (WTO) permitted export product until 30 May 2025.

The fishery received third party MSC accreditation in 2015, and was recertified in 2020, demonstrating its achievement of high standards in relation to sustainability of fish stocks, the minimisation of environmental impacts and effective management.

2.3.3 Recreational Fishing

Recreational fishers are permitted to catch prawns in Exmouth Gulf using a single hand dip net, hand scoop net, hand throw net, or prawn hand trawl (drag) net that is not more than four metres across with a mesh of not less than 16 mm, and must not

be attached to a boat or set. In 2015/16, prawns comprised 3% of the total catch (by numbers) of boat-based fishers in the Ningaloo zone of the Gascoyne Coast Bioregion, which comprises Exmouth Gulf (Ryan et al. 2017). In 2017/18, the most common invertebrate species fished in the Ningaloo zone were squid and Blue Swimmer Crab, and prawns were not listed (Ryan et al., 2019).

2.3.4 Customary Fishing

Although there is no quantitative information available on the customary catch of prawns in the Exmouth Gulf, these activities are likely to be negligible in the context of managing harvest of the prawn resource of Exmouth Gulf.

2.3.5 Catch Share Allocations

The prawn resource in Exmouth Gulf has historically been fished mainly by the commercial sector, without an explicit catch share allocation with recreational and customary fishing sectors.

3.0 Harvest Strategy

This Harvest Strategy is structured to describe, hierarchically:

- 1) The high-level, long-term objectives of management (Section 3.1);
- 2) The short-term, operational objectives (Section 3.2); and
- 3) How these translate into the management approach used for this fishery (Section 3.3).

This is followed by a more detailed description of the:

- 4) Processes for assessing ecological sustainability (Section 3.4);
- 5) Processes for assessing fishery performance (Section 3.5); and
- 6) Specific monitoring and assessment procedures used to ascertain if objectives are being met (Section 3.6).

3.1 Long Term Objectives

In addition to ensuring the biological sustainability of all captured aquatic resources, this Harvest Strategy includes broader ecological objectives for each ecosystem component, as well as a social and economic objective for the EGPMF as a whole. It is important to note that the social and economic objective is applied within the context of ESD.

3.1.1 *Ecological Sustainability*

- 1) To maintain spawning stock biomass of each target species at a level where the main factor affecting recruitment is the environment;
- 2) To maintain spawning stock biomass of each other retained species at a level where the main factor affecting recruitment is the environment;
- 3) To ensure fishing impacts do not result in serious or irreversible harm to bycatch species populations;
- 4) To ensure fishing impacts do not result in serious or irreversible harm to ETP species populations;
- 5) To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function; and
- 6) To ensure the effects of fishing do not result in serious or irreversible harm to ecological processes.

3.1.2 *Economic and Social Benefits*

To maximise breeding stock of prawns and ensure fishers can maintain or enhance their livelihood through optimising the value of their catch, within the constraints of ecological sustainability, by considering the ability of fishers to retain prawns at times when it is most economically favourable (based on the size and quality of prawns).

3.2 Operational Objectives

Long-term management objectives are typically operationalised as short-term (e.g. annual or periodic) objectives through one or more performance indicators that can be measured and assessed against pre-defined reference levels to ascertain actual performance. Within the context of the long-term ecological objectives provided

above, operational objectives aim to maintain each resource above the threshold level (and, where relevant, close to the target level), or rebuild the resource if it has fallen below the threshold or the limit levels.

3.3 Harvesting and Management Approaches

This Harvest Strategy for the Exmouth Gulf prawn resource is based on a constant escapement approach, which includes permanent closure areas (e.g. nursery grounds) and net escapement that aims to:

- Ensure that the spawning biomass does not fall below the minimum level required to maintain sufficient abundance of prawns prior to spawning;
- Provide a robust way of determining annual yield; and
- Ensure fishing does not exceed the potential productivity of the stock.

The management activities related to this approach have been developed over time based on a comprehensive understanding of the targeted prawn species in Exmouth Gulf. The annual cycle of operation depends on the strength and timing of prawn recruitment, which is highly variable; with management measures set for each fishing season based on established reference levels (see Section 3.4.1). The large, permanently closed nursery areas and full moon period closures provide additional protection to all species.

3.3.1 Season Arrangements and within Season Guidelines

The prawn-fishing season in Exmouth Gulf generally extends from April through to early December each year, with specific season opening and closing dates set according to the lunar phase and annual season arrangements (see Figure 3 and Appendix 2 for an overview).

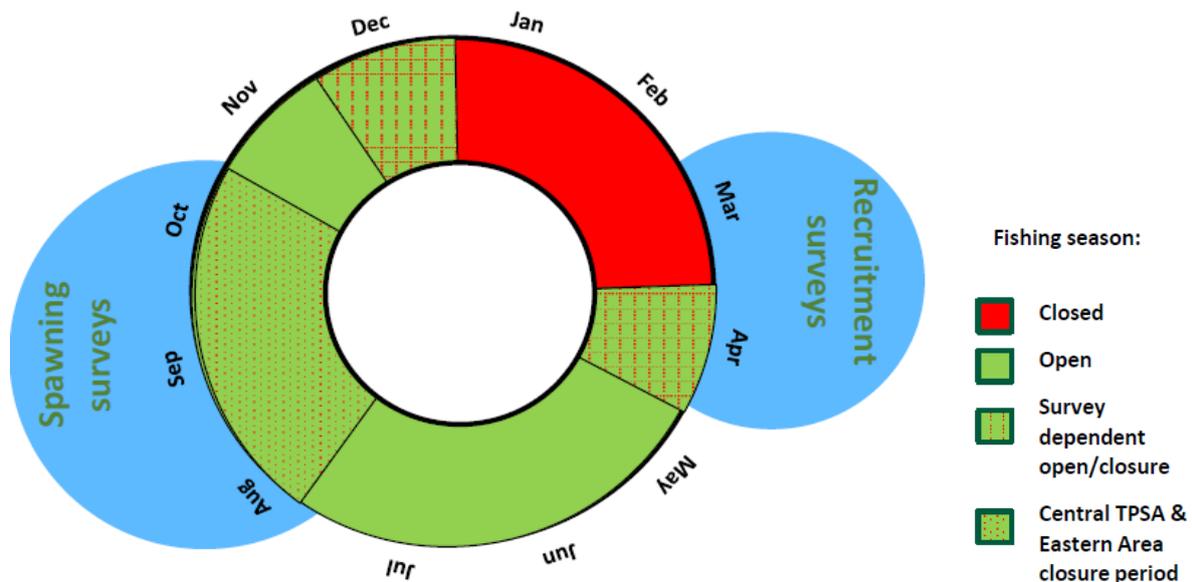


Figure 3: Schematic of the Exmouth Gulf Prawn Managed Fishery annual season arrangements and timing of the two annual survey periods.

Season arrangements are developed in collaboration with industry and the Department. After the season opening, the actual commencement date and extent of fishing in particular management areas (see Figure 1) is determined based on:

- Fishery-independent monitoring (recruitment and spawning stock surveys),
- Real-time fishery-dependent monitoring (commercial catch rates), and
- Focussed 'industry-based' surveys of areas that have been kept closed during the season (not permanent closures).

Decision making to guide operational within season opening and closures for the season and the Central TPSA and Eastern Area are provided in Guidelines for in-season decision-making in Appendix 2.

Annually, the Department:

- Meets with industry to review the previous season and develop and agree to proposed season arrangements for the coming season;
- Issues an annual season arrangements notice and proposed season planning dates to industry; and
- Conducts annual Management Meetings with industry.

As the distribution of the blue endeavour prawn overlaps with those of both brown tiger and western king prawns, their protection in turn protects blue endeavour prawns. When brown tiger recruitment is low, the recruitment level of blue endeavour prawns is also generally below average. Thus, a significant portion of the blue endeavour spawning stock is also protected by phased area openings and a conservative fishing strategy throughout the year for brown tiger prawn and the annual brown tiger prawn spawning closure. As blue endeavour prawns migrate onto western king prawn grounds from August/September onwards, the cessation of fishing for the season based on western king prawn size also further protects the blue endeavour prawn breeding stock at the end of the year, as their spawning period is more protracted than the other two species.

In addition to the in-season closures implemented to achieve ecological objectives, a series of rolling spatial openings and closures within the management areas are implemented to manage fishing effort on smaller prawns to meet the economic objectives of this fishery (see Section 4.0).

3.4 Ecological Sustainability

A formal, resource-level review process is undertaken by the Department to assess the status of relevant target stocks and performance in relation to each other ecological management objective. Suitable indicators have been selected to describe the status of the Exmouth Gulf prawn resource, and other ecological assets, against defined reference levels established to separate acceptable from unacceptable performance (Section 3.4.1).

Where relevant, these levels include the following, defined and illustrated within Figure 4:

- Target level (i.e. where you want the indicator to be);
- Threshold level (i.e. where you review your position); and
- Limit level (i.e. where you do not want the indicator to be).

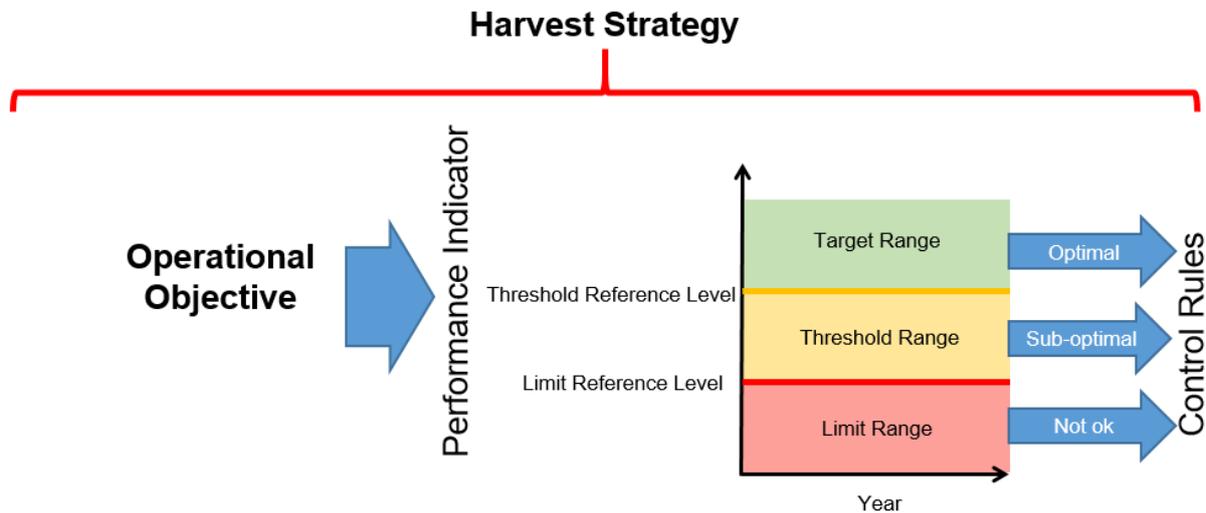


Figure 4: Performance indicators, limits, thresholds and targets.

HCRs define the management measures that should occur in relation to the value of each indicator compared to the reference levels (Section 3.4.2). The HCRs aim to maintain each resource at their target level, and return the resource to this level when a threshold or limit level has been breached. A summary of the management objectives, performance indicators, reference levels and HCRs is provided in Table 1.

3.4.1 Performance Indicators and Reference Levels

3.4.1.1 Target Prawn Species

The status of the Exmouth Gulf prawn resource is assessed annually using fishery-independent and fishery-dependent data to monitor relative stock levels of the key target species at multiple times during the year. A weight-of-evidence assessment of all available information is undertaken at the end of each fishing season to evaluate the status of each stock, with the outcomes used to determine the broader management arrangement for the next fishing season. As new information becomes available during the fishing season, these data are reviewed and, if necessary, used to adjust the extent of fishing effort within the different areas of the fishery.

The primary performance indicators used to measure the abundance of the target species are primarily derived from annual recruitment surveys undertaken in March and April, and spawning stock surveys undertaken for brown tiger prawns and blue endeavour prawns in August, September and October. The spawning index for western king prawns is currently based on commercial (fishery-dependent) catch rates, however, a fishery-independent survey commenced in 2015 and will be used to provide the spawning index for this species in the future.

The recruitment indices for brown tiger prawns and western king prawns are compared to associated threshold reference levels to inform if fishing can occur in the key management areas prior to the spawning period, or if any particular areas dominated by small prawns need to be further protected (Table 1). The ability of the management arrangements to protect pre-spawning prawns is then measured by the spawning index for each target species. Providing a robust measure of the current status of each target stock, the indices of spawning stock abundance are used to determine the extent of fishing during the latter part of the season, as well as inform the arrangements for the following season (Table 1).

The limit reference level (Blim) for the target species is considered to represent conservative estimates. For the spawning stocks, the limit is set at a point where recruitment impairment (PRI) has been demonstrated for brown tiger prawns, or at the lower end of the range of historical observations for western king and blue endeavour prawns for which a spawning stock recruitment relationship (SRR) is not as evident. Given the naturally highly variable recruitment of prawns, the target level for each target species is considered as the range of index values at or above the associated threshold levels, which biomass dynamic modelling has indicated is close to the stock level consistent with Maximum Sustainable Yield (BMSY).

3.4.1.2 *Other Ecological Components*

Other ecological assets incorporated in this Harvest Strategy include other retained species, bycatch, ETP species, habitats and ecosystem processes that may be affected by commercial prawn trawling in Exmouth Gulf (Table 1). In addition to prawns, the EGPMF also retains several other species, including cephalopods (squid, cuttlefish and octopus); blue swimmer crabs (*Portunus armatus*) and bugs (*Thenus* spp.).

Where reliable quantitative information is available, reference levels used to monitor performance against management objectives relating to these ecological assets have been set based on data available from ongoing monitoring. The impact of prawn trawling on habitats is monitored by estimating the annual spatial trawl footprint of the prawn fishery whereby the performance indicators relate to the extent of the area trawled within the entire fishery area (Table 1; see also Section 3.6.2.2- Habitats). Although the fishery generally operates over mud and sandy areas, (mapped as 70.5 % of fishing effort in 2018) to target prawns, and avoids areas that can damage fishing gear (e.g. reefs), there is potential for the fishery to interact with other benthic habitats which may be vulnerable to trawl fishing, such as sponges, seagrasses and soft corals.

A small area of the Exmouth Gulf is trawled every year (approximately 22%) while 21% of the Gulf, which contains sensitive habitats or Vulnerable Marine Ecosystems (VMEs), including filter feeder habitat (sponge gardens), coral reefs and seagrass dominated habitat (possess at least functional significance, fragility, structural complexity) is permanently closed to trawling, (as part of the nursery area). DPIRD and the Licensee collaborated to locate sensitive habitats and VME areas during broad scale habitat mapping conducted in 2006 and validated in 2018. It is anticipated that habitat mapping work will be repeated every five years.

The NMP and MIMMA also include habitat protection zones for filter VMEs where trawling does not occur, as such approximately 88% of VMEs in the fishery boundaries are protected. In 2018, the fishing effort interacted with 21.9 % of the mixed assemblage habitats, 6.2 % of filter feeder communities and no coral reefs communities. The limit reference level relates to the extent of fishing within the entire fishery area to account for potential changes in fishing patterns.

For all ecological components, reference levels have also been set to differentiate acceptable fishery impacts from unacceptable fishery impacts according to the risk levels defined in Fletcher (2015). An ERA for the EGPMF was undertaken in September 2019 to inform these components of the Harvest Strategy (Table 1), with these risk scores to be reviewed after no more than five years (see Section 3.6.2.3).

3.4.2 Application of Harvest Control Rules

For each ecological performance indicator and reference level, an accompanying HCR directs the management needed to meet the sustainability objectives (Table 1). These HCRs are designed to maintain the resource above the threshold level (i.e. within the target range), or rebuild it where it has fallen below the threshold (undesirable) or the limit (unacceptable) levels.

Where an indicator suggests that the fishery impact on a resource is no longer acceptable, the HCR typically initiates a review of all available information to determine an appropriate management response. The extent of management action taken is determined by the extent to which a performance indicator has breached a reference point, increasing in line with an increasing risk to the resource. This review process also includes consideration of future research and monitoring to ensure the indicator returns to the target level, as well as the compliance response needed to ensure management changes are adequately enforced.

Although a wide range of management measures may be used to achieve the management responses outlined by the HCRs (Table 1), examples for the Exmouth Gulf prawn resource include:

- Delaying the opening of the fishing season to maximise the opportunity for prawns to spawn;
- Reducing the spatial extent of fishing in Central TPSA and Eastern Area to protect areas dominated by juvenile prawns; and/or
- Ceasing fishing earlier in the season where prawn recruitment is low to maximise their contribution to next year's catch and the spawning stock.

Implementing these changes is normally through agreement between industry and Government via the fishery's cooperative management framework.

3.4.2.1 Recovering Depleted Stocks

A resource that has fallen below the acceptable level and for which suitable management adjustments have been implemented to reduce catch and/or effort (as outlined in the HCRs) is considered to be in a recovery phase. For target stocks that fall below the limit reference level, a recovery strategy will be developed and implemented to ensure that the resource can rebuild at an acceptable rate. Where

the environmental conditions have led, or contributed significantly, to the resource being at an unacceptable level, the strategy needs to consider how this may affect the speed and extent of recovery (Department of Fisheries 2015).

3.4.3 *Bycatch Action Plan*

The EGPMF Bycatch Action Plan (BAP) and associated information is provided in Appendix 3. The BAP details the program of actions to address current bycatch issues, in accordance with the fishery's Harvest Strategy, other relevant legislation and any voluntary agreements. The focus of the EGPMF BAP is on developing management responses required to address unacceptable ecological risks associated with the fishery (as assessed through periodic ERAs) and developing management actions to minimise fishery interactions with ETP species listed under the EPBC Act.

Additionally, the EGPMF also needs to continue to demonstrate how bycatch issues are monitored and managed to maintain its MSC third party certification.

Table 1. Harvest Strategy performance indicators, reference levels and control rules for the Exmouth Gulf prawn resource, and associated ecological assets that may be impacted by fishing activities targeting prawns within Exmouth Gulf.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Target species	To maintain spawning stock biomass of each target species at a level where the main factor affecting recruitment is the environment.	Brown tiger prawns	Index of recruitment (mean catch rate of brown tiger prawns from March and April surveys)	Target: ≥40 kg/hr	If the index of recruitment target level is met, fishing may commence in the Central TPSA and Eastern Area.
				Threshold: <40 kg/hr	If index of recruitment is less than the threshold level, review options for fishing and consult with industry regarding the timing and spatial extent of fishing operations (also influenced by prawn size).
				Limit: ≤10 kg/hr	If the index of recruitment is at or below the limit, no fishing occurs in the Central TPSA and Eastern Area.
			Index of spawning stock abundance (mean catch rate of brown tiger prawns)	Target: ≥25 kg/hr	If the target level is met, no change to season management arrangements required for the following season.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
			from Aug-Oct spawning surveys)	Threshold: <25 kg/hr	If index of spawning stock abundance is less than the threshold, review season management arrangements and monitoring systems to investigate the reasons for the variation. If findings show that sustainability is considered to be at risk, consider implementing changes to ensure breeding stock returns to target level.
				Limit: ≤10 kg/hr	If the catch rate is at or below the limit, review information on the abundance and size of prawns and implement management measures to <ol style="list-style-type: none"> 1. limit fishing in the affected areas as soon as possible, and 2. ensure arrangements for the next season are sufficiently precautionary¹ to return the stock to the target level.

¹ Precautionary arrangements may include actions or management measures to return the catch rate to the target, following a review to assess the potential cause of the decline in catch rate. Arrangements will be fishery and species dependent, and may include increased monitoring, avoiding particular areas, delaying season or area openings or closing the season earlier, etc.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Target species	To maintain spawning stock biomass of each target species at a level where the main factor affecting recruitment is the environment.	Western king prawns	1. Index of recruitment (catch rate of western king prawns from April surveys), and 2. Size of western king prawns from April survey.	Target: ≥30 kg/hr, and 50% of western king prawns are larger than 21/30 grade (count per pound).	If the target levels are met, fishing can commence in the Northern Area.
				Threshold: <30 kg/hr	If the index of recruitment is less than the threshold review options for delaying fishing or modifying the spatial extent of fishing operations within the Northern Area.
				Limit: ≤15 kg/hr	If the catch rate is at or below the limit, no fishing to occur in the Northern Area (unless additional surveys indicate that catch rates have improved).
			Mean commercial catch rate of western king prawns in fishing grounds R1 and S2 during August and September (proxy index of spawning stock abundance)	Target: ≥25 kg/hr	If the target level is met, no change to season management arrangements required for the following season.
Threshold: <25 kg/hr	If the catch rate is below the threshold, review season management arrangements and monitoring systems to investigate the reasons for the variation. If findings show that sustainability is considered to be at risk, consider implementing changes to the following season's arrangements.				

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
				Limit: ≤10 kg/hr	If the catch rate is at or below the limit, review information on the abundance and size of prawns and implement management measures to 1. limit fishing in the affected areas as soon as possible, and 2. ensure arrangements for the next season are sufficiently precautionary ² to return the stock to the target level.
Target species	To maintain spawning stock biomass of each target species at a level where the main factor affecting recruitment is the environment.	Blue endeavour prawns	Index of spawning stock abundance (mean catch rate of blue endeavour prawns from Aug-Oct spawning surveys in fishing grounds Q1 and Q2).	Target: ≥9 kg/hr	If the target level is met, no change to season management arrangements required for the following season.
				Limit: ≤4.5 kg/hr	If the catch rate is at or below the limit, review information on the abundance and size of prawns and implement management measures to 1. limit fishing in the affected areas as soon as possible, and 2. ensure arrangements for the next season are appropriate to return the stock to the target level.

² Precautionary arrangements may include actions or management measures to return the catch rate to the target, following a review to assess the potential cause of the decline in catch rate. Arrangements will be fishery and species dependent, and may include increased monitoring, avoiding particular areas, delaying season or area openings, closing the season earlier, etc.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Other retained species	To maintain spawning stock biomass of each other retained species at a level where the main factor affecting recruitment is the environment.	All other retained non-target species (e.g. minor prawn species, cephalopods, blue swimmer crabs and bugs).	Periodic risk assessments incorporating: <ul style="list-style-type: none"> • current management arrangements, • annual fishing effort and catch • species information, and • other available research. 	Target: Fishing impacts are expected to generate an acceptable level of risk (i.e. moderate risk or lower) to all retained species' populations.	Continue management aimed at achieving ecological, economic and social objectives.
				Thresholds: A potentially material change to risk levels is identified; and/or Fishing impacts are considered to generate an undesirable level of risk (i.e. high risk) to any retained species' populations.	Review the reasons for this variation within three months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk (i.e. severe risk) to any retained species' populations.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Bycatch (non-ETP) species	To ensure fishing impacts do not result in serious or irreversible harm to bycatch species populations.	All bycatch species (including prawns)	Periodic risk assessments incorporating: <ul style="list-style-type: none"> • current management arrangements, • annual fishing effort and catch (including discards), • review of alternative measures to minimise unwanted catch, • species information, and • other available research. 	Target: Fishing impacts generate an acceptable level of risk (i.e. moderate risk or lower) to the bycatch species assemblages.	Continue management aimed at achieving ecological, economic and social objectives.
				Thresholds: A potentially material change to risk levels is identified; and/or Fishing impacts are considered to generate an undesirable level of risk (i.e. high risk) to the bycatch species assemblages.	Review the reasons for this variation within three months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk (i.e. severe risk) to the bycatch species assemblages.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
ETP species	To ensure fishing impacts do not result in serious or irreversible harm to ETP species' populations.	All ETP species	Periodic risk assessments and annual reporting incorporating: <ul style="list-style-type: none"> • current management arrangements, • annual fishing effort and catch, • number of reported ETP species interactions, • species information, and • other available research. 	Target: Fishing impacts are expected to generate an acceptable level of risk (i.e. moderate risk or lower) to all ETP species' populations.	Continue management aimed at achieving ecological, economic and social objectives.
				Thresholds: A potentially material change to risk levels is identified; and/or Fishing impacts are considered to generate an undesirable level of risk (i.e. high risk) to any ETP species' populations.	Review the reasons for this variation within three months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.
				Limit: Fishing impacts are considered to generate an unacceptable level of risk (i.e. severe risk) to any ETP species' populations.	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
Habitats	To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function.	All habitats.	1. Extent of area trawled annually, and 2. Periodic risk assessments incorporating: <ul style="list-style-type: none"> • current management arrangements, • annual fishing effort, • extent of area trawled annually, and • other available research. 	Target: Total area trawled annually is <60% of the permitted trawl area in Exmouth Gulf; and Fishing impacts are expected to generate an acceptable level of risk (i.e. moderate risk or lower) to all benthic habitats.	Continue management aimed at achieving ecological, economic and social objectives.
				Thresholds: Total area trawled annually is >60% of the permitted trawl area in Exmouth Gulf; and/or A potentially material change to risk levels is identified; and/or Fishing impacts are considered to generate an undesirable level of risk (i.e. high risk) to any benthic habitats.	Review the reasons for this variation within three months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
				<p>Limit: Total area trawled annually is $\geq 70\%$ of the permitted trawl area in Exmouth Gulf; and/or Fishing impacts are considered to generate an unacceptable level of risk (i.e. severe risk) to any benthic habitats.</p>	Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.
Ecosystem	To ensure the effects of fishing do not result in serious or irreversible harm to ecological processes.	Community structure and function.	Periodic risk assessments incorporating: <ul style="list-style-type: none"> • current management arrangements, • catch levels, • number of reported ETP species interactions, • extent of area trawled annually, and • other available research. 	<p>Target: Fishing impacts are expected to generate an acceptable level of risk (i.e. moderate risk or lower) to the ecosystem.</p>	Continue management aimed at achieving ecological, economic and social objectives.
				<p>Thresholds: A potentially material change to risk levels is identified, and/or Fishing impacts are considered to generate an undesirable level of risk (i.e. high risk) to the ecosystem.</p>	Review the reasons for this variation within three months and implement an appropriate management response to reduce risk to an acceptable level as soon as practicable.

Component	Management objectives	Resource / Asset	Performance Indicators	Reference Levels	Control Rules
				<p>Limit: Fishing impacts are considered to generate an unacceptable level of risk (i.e. severe risk) to the ecosystem.</p>	<p>Initiate an immediate management response to reduce the risk to an acceptable level as soon as practicable.</p>

3.5 Fishery Performance

Defining annual tolerance levels for fisheries provides a formal but efficient basis to evaluate the effectiveness of current management arrangements in delivering the levels of catch and/or effort specified by the HCRs and, where relevant, any sectoral allocation decisions (Fletcher et al. 2016). In line with the principles of ESD, this fishery-level review process can also consider the performance against any objectives relating to the economic and social amenity benefits of fishing. Where possible, and in due consideration of ecological sustainability, fisheries management arrangements can be adjusted or reformed to help meet these economic and/or social objectives.

A broad catch tolerance range of 436 – 1,347 t has been developed for the EGPMF, based on historical variations in fishing operations and species landings. For the individual target species, these are:

- Brown tiger prawns; 250-550 t,
- Western king prawns; 100-450 t; and
- Blue endeavour prawns; 120-300 t.

The catch relative to these tolerance levels are reviewed annually and published in the State of Fisheries and Aquatic Resources Report and in the Department's Annual Report to the WA Parliament. If the annual catch falls outside the tolerance range and this cannot be adequately explained (e.g. clear environmental or market-induced impacts), the performance is termed 'Unacceptable'. This result would trigger a review to determine if management arrangements are still appropriate and if a re-assessment of resource status is necessary to inform adjustments to HCRs and/or tolerance levels.

Performance against the economic objective for the EGPMF, to provide industry the opportunity to optimise the economic returns generated by the fishery within a sustainable fishery framework, is currently measured through industry submission to the Department. Where impediments to industry optimising efficiency are identified and raised, the Department will consider proposals from industry to improve their economic efficiency subject to these not adversely affecting meeting of the sustainability objectives. If Industry considers the fishery has failed to meet economic objectives, notwithstanding that sustainability objectives have been met, a report on the economic conditions of the industry and why economic objectives cannot be met should be compiled.

3.6 Monitoring and Assessment Procedures

3.6.1 Information and Monitoring

3.6.1.1 Commercial Fishing Information

Fishers are required to report all retained (target and non-target) species catches, effort, any ETP species interactions and fishing location (detailed shot-by-shot longitude and latitude) in statutory daily logbooks, which have been in place since the fishery began in the 1960s. These logbooks are used to provide information on

the daily catch (kg) and grade categories of each target species and effort (hours trawled) expended in specific fishing areas. Verification of catches recorded in logbooks has been undertaken against processor returns, which are submitted to the Department by the processor on a monthly basis.

The Department uses the VMS to monitor all fishing activities in the fishery as part of its compliance plan (see Section 5.0) and to determine the spatial extent of the fishery.

3.6.1.2 Recreational Fishing Information

Surveys of all boat-based recreational fishing in WA to provide bioregional estimates of recreational boat-based catches have been undertaken since 2011/12, with only minor prawn catches reported in the Gascoyne Bioregion (Ryan et al. 2013, 2015, 2017, 2019).

3.6.1.3 Fishery-Independent Information

Fishery-independent trawl surveys are undertaken in Exmouth Gulf each year to monitor the recruitment and spawning stock levels of brown tiger, western king and blue endeavour prawns. Monitoring is conducted by Departmental staff using commercial fishing boats, with the intention to use the same boat(s) throughout the year for all surveys. These operate under a Service Level Agreement between the Department and the licensee.

The timing of surveys and the sites sampled have been determined based on the understanding of the biology and movement patterns of the brown tiger and western king prawns in Exmouth Gulf, historical fishing patterns, early research surveys and the natural topography of the Gulf. These sites also encompass a significant proportion of the distribution of blue endeavour prawns and a current PhD research project on blue endeavour prawns will further document the spatial overlap of the blue endeavour with the brown tiger and western king prawn grounds.

At each survey site, the actual catch of each prawn species and their size grade is recorded, and a representative sample of each species is collected from each trawl to provide information on size composition and sex ratios. During spawning stock surveys (see below), data are also collected on the reproductive stage of female prawns in the survey catch.

3.6.1.4 Recruitment Surveys

Recruitment surveys are undertaken in Exmouth Gulf each year during March and April (around the quarter moon periods) to monitor the annual recruitment of brown tiger, western king and blue endeavour prawns to the fishery area. These surveys cover the fishing grounds adjacent to and within the permanent nursery area closure, where brown tiger prawn recruits migrate around this time, and within the Northern Area, where western king prawns occur around this time (refer to map of survey areas in Appendix 4). Both the brown tiger and western king prawn survey sites also contain blue endeavour prawns and the abundance at these combined sites are used to construct a recruitment index for blue endeavour prawns.

At each survey site, catch rates and size structure information (grades and length frequencies) are collected for brown tiger, western king and blue endeavour prawns. The mean catch rate data for each of the target species from the recruitment surveys^[3] are used as indices of recruitment strength and provide an indication of likely catch ranges for the season. This information is also used to inform the timing of the rolling openings of the defined management areas within the fishery for the fishing season.

3.6.1.5 *Spawning Stock Surveys*

The spawning stock surveys monitor the annual spawning stock biomass of brown tiger and blue endeavour prawns in the fishery area. Spawning stock surveys are undertaken in the key brown tiger prawn spawning area (Central TPSA; refer to map of survey areas) in August, September and October each year where blue endeavour prawns also occur. Since 2016, a spawning stock survey has also been conducted in western king prawn grounds during August and September, which also records the abundance of brown tiger, and blue endeavour prawns within these grounds.

The mean catch rates of each species from the surveys (for each of the months undertaken) are used to assess the annual performance of the fishery and may provide an early indicator of how to manage the stocks in the forthcoming season. The brown tiger prawn catch rate information from the first two surveys is also used to determine if the Central TPSA and Eastern Area will re-open to fishing following the spawning period closure. If the catch rates for brown tiger prawns are adequate to allow reopening of the Central TPSA and Eastern Area, then the catch rates of endeavour prawns are also assessed to see if the Eastern Area can reopen.

3.6.2 **Assessment Procedures**

3.6.2.1 *Target Species*

The stock status of brown tiger and western king prawns in Exmouth Gulf is assessed primarily on the basis of inter-annual and within-season trends in spawning stock abundance, recruitment levels and catch whilst the key indicator for blue endeavour prawns is spawning stock abundance. This measure is most appropriate for blue endeavours as recruitment continues well beyond March and April for this species and historically, blue endeavour prawns were only retained when the abundance of brown tiger and western king prawns were low and/or there was specific marketing demand for the species. In the last five years, blue endeavours have been retained more consistently due to improved and regular markets and higher abundance on trawl grounds.

Spawning stock abundance of all prawn species is determined based on fishery-independent catch rates during spawning stock surveys in the specific grounds

^[3] Only catch rates from the P2 and Q3 survey sites are included in the brown tiger prawn recruitment index, as these areas have been found to best reflect the levels of recruits moving onto the trawl grounds from the closed nursery areas. Catch rates from P2, Q1 and Q2 and the Northern Area is used for the blue endeavour prawn index.

associated with each species. Spawning stock abundance of western king prawns is also determined based on the commercial catch rate of western king prawns in the R1 and S2 fishing grounds (see Appendix 4) during August and September. This performance indicator has a longer time-series for comparison whilst the fishery-independent measures for western king prawns have only been collected since 2016. The spawning stock indices for the target stocks are assessed annually against reference levels in order to determine the success of the season's arrangements in maintaining an adequate spawning stock biomass of each species.

While it is important to maintain an adequate spawning stock abundance, the actual recruitment is mainly affected by environmental (or other) impacts on mortality and growth. In order to ensure adequate in-season operations, annual recruitment of brown tiger and western king prawns is assessed using the catch rate and prawn size information collected during fishery-independent recruitment surveys during the start of the fishing season. Data collected as part of these annual recruitment surveys are also used to forecast the catch for the season. The actual catch of each species at the end of each season is then compared to this predicted catch and historical catch ranges (for the period 1989 – 1999), when recruitment was not impaired. Although spawning stock abundance is the primary indicator for fishery impacts on stock biomass, fluctuations in the annual catch may provide insight on any environmental factors affecting recruitment that may need to be considered in future season arrangements.

3.6.2.2 *Habitats*

The spatial extent of fishing in the EGPMF is calculated annually using fishery-dependent logbook data and the Department's VMS. The spatial location of fishing is plotted using the VMS data, which is trimmed, to the start and end times of fishing, as recorded in the fishery-dependent logbook data. This fine-scale spatial effort data can be used to determine the annual footprint of the fishery, to ensure it does not exceed the annual threshold level of 60% of the EGPMF permitted trawl area. This spatial extent of EGPMF effort is then overlaid on available full-scale habitat data to measure and assess the fisher's potential interaction with habitats.

3.6.2.3 *Ecological Risk Assessments*

The Department uses a risk-based EBFM framework to assess the impacts of fishing on all parts of the marine environment, including the sustainability risks of target species, other retained species, bycatch, ETP species, habitats and ecological processes. This framework has led the development of a periodic risk assessment process, which is used to prioritise research, data collection, monitoring needs and management actions for fisheries and to ensure that fishing activities are managed both sustainably and efficiently.

An ERA for the EGPMF was most recently undertaken in September 2019 (DPIRD 2020). The formal risk assessment phase of the process was consistent with Standard AS/NZS ISO 31000, adapted for use in a fisheries context. The results of the ERA found that most components had a negligible or low risk, with some exceptions. All three primary target species were considered medium (acceptable)

risk, as was banana prawns. Of the bycatch and protected species, only sawfish were considered medium risk, while the only habitat component scored as medium was “filter feeding communities”. No components were assessed as unacceptable (i.e. high or severe) risk.

Risk assessments for the EGPMF will continue to be undertaken periodically (every three to five years) to reassess any current or new issues that may arise in this fishery. A new risk assessment can also be triggered if there are significant changes identified in fishery operations or management activities or controls that are likely to result in a change to previously assessed risk levels.

4.0 Management Measures and Implementation

4.1 Management Measures

Table 2 presents the management measures in place for the Exmouth Gulf prawn resource. These measures can be amended as needed to ensure management objectives are achieved, however, they do not preclude the consideration of other options.

Table 2. Management measures and instrument of implementation for the fisheries that target the Exmouth Gulf prawn resource

Measure	Description	Instrument
Limited entry	A limited number of Managed Fishery Licenses (15) are permitted to operate in the EGPMF.	EGPMF Management Plan
Effort restrictions	The fishery currently operates under a maximum headrope capacity restriction of 395.02 metres (216 fathoms).	EGPMF Management Plan
Gear controls	Include controls on mesh size (≤ 60 mm) of nets, boat length, size of the ground chain (≤ 10 mm diameter) and the dimensions of the otter boards, including metal shoes.	EGPMF Management Plan FRMA (Section 7 exemptions)
Bycatch Reduction Devices (BRDs)	The fleet is required to have BRDs in the forms of grids and fish exclusion devices (FEDs), such as square mesh panels, in all standard nets.	MFL Condition
Annual closed season & cap on fishing days	The fishery is closed to fishing between December and April each year, with the aim of a maximum of ~200 total fishing days each year.	EGPMF Management Plan (clause 10 annual notice)
Spatial closures	The south-eastern area of Exmouth Gulf is permanently closed to trawling activities to preserve seagrass and other sensitive habitats that are essential nursery areas for prawns and other species. There is a Port Area Closure in place within three nautical miles of Exmouth. There are permanent trawling closures in place as part of the Ningaloo Marine Park and Muiron Islands Marine Management Area. Non-statutory rolling spatial closures in the management areas are used throughout the season to contain and direct overall fleet effort, control effort on brown tiger prawns, and provide industry the opportunity to maximise economic returns.	EGPMF Management Plan FRMA (Section 43 orders) Co-operative arrangement (non-statutory)
Temporal closures	Fishing is only permitted between 1800 and 1000 hours the following day, as prawns are nocturnal. Fishing closures also occur for a minimum of four days around each full moon.	EGPMF Management Plan (clause 10 annual notice) Co-operative arrangement (non-statutory)
Reporting	Fishers are required to report all retained (target and non-target) species catches, effort, ETP species interactions and fishing location in statutory daily logbooks. Fishing activities are also monitored via the satellite Vessel Monitoring System (VMS).	FRMR (regulation 64) EGPMF Management Plan

4.2 Implementing Changes to the Management Measures

Decision-making processes can be triggered following the identification of new or potential issues as part of an ERA (generally reviewed every three to five years), results of research, management or compliance projects or investigations, monitoring or assessment outcomes (including those assessed as part of the Harvest Strategy) and/or expert workshops and peer review of aspects of research and management.

There are two main processes for making decisions about the implementation of management measures and strategies for the Exmouth Gulf prawn resource:

- Annual decision-making processes that may result in measures to meet the operational objectives (driven by the Harvest Strategy); and
- Longer-term decision-making processes that result in new measures and / or strategies to achieve the long-term fishery objectives (i.e. changes to the management system).

However, if there is an urgent issue, stakeholder meetings may be called as required to discuss the issue and determine appropriate management action.

4.2.1 Consultation

Management changes are generally given effect through amendments to legislation, such as the commercial fishery management plan, regulations and orders. These changes generally require consultation with all affected parties and the approval of the Minister for Fisheries and/or the CEO (or appropriate delegates). In making decisions relevant to fisheries, the Minister for Fisheries may choose to receive advice from any source, but has indicated that:

- 1) The Department is the primary source of management advice; and
- 2) The peak bodies of the Western Australian Fishing Industry Council (WAFIC) and Recfishwest are the primary source of advice and representation from the commercial and recreational harvesting sectors, respectively.

Peak bodies are funded by Government to undertake their representation / advisory and consultation roles under Service Level Agreements (SLA).

4.2.1.1 Commercial Sector Consultation

Under its SLA with the Department, WAFIC has been funded to undertake statutory consultation functions related to fisheries management and the facilitation of annual management meetings for licensed fisheries such as the EGPMF. In addition, the licensee in the EGPMF is directly consulted regarding all decisions relating to the management of the fishery. The Department works closely with the licensee to develop annual season arrangements that achieve the operational objectives contained in the Harvest Strategy. A cooperative, real-time in-season management framework exists between the Department's Aquatic Science and Assessment Branch and the licensee to implement opening and closing of areas to maximise

economic return from the Exmouth Gulf prawn resource within the sustainable management framework.

Annual management meetings are held between the Department, WAFIC and EGPMF licence holders and are an important forum to consult on the management of the fishery. During these meetings, current and future management issues that may have arisen during the previous fishing season and any proposed changes to the management plan are discussed. Follow-up meetings may be held as required. The Department also consults directly with industry, where relevant, on specific management and operational issues and holds meetings on an “as needs” basis with the licensee. These meetings could be with the licensee or skippers and include activities such as season arrangement workshops and skipper’s briefings.

4.2.1.2 Annual Consultation and Decision-Making (Season Arrangements)

Annual seasonal arrangement decisions are based primarily on maintaining sustainable stocks, while providing the opportunity for industry to maximise economic returns from the prawn resource.

The Department consults with industry to discuss the previous season, develop and finalise the forthcoming season’s fishing arrangements including season opening and closing dates, moon closure periods, recruitment and spawning survey dates, closures to meet the ecological objectives and closures to meet the economic objective. The proposed season arrangements are then provided to the Deputy Director General for consideration and approval (with particular relevance to the opening and closing dates for the season).

Statutory aspects of the season arrangements are then outlined in a (statutory) notice in accordance with clause 10 of the EGPMF Management Plan.

4.2.1.3 In-Season Consultation and Decision-Making

Further to the permanent closures in the EGPMF, spatial closures are in place at the commencement of the season and are opened and closed in-season to control, manage and direct fishing effort. Decisions around in-season spatial areas opening and closing are primarily based on maintaining breeding stocks of brown tiger prawns (i.e. ecological objective), while providing the opportunity for industry to harvest optimum size/value prawns (i.e. economic objective).

The decision-making process is carried out in a similar way each year and is linked to the in-season Harvest Strategy reference levels and control rules. In-season closures designed to meet both ecological (i.e. closure of the Central TPSA and Eastern Area) and economic objectives (i.e. to manage fishing effort on small prawns) in the EGPMF are currently implemented on a non-statutory basis. If it is identified that an area needs to be closed statutorily, this can be achieved via a legislative instrument (see Section 4.2.1.4).

Working within a framework whereby ecological objectives will be met, a cooperative framework is applied for decisions predominantly aimed at meeting economic objectives. This consists of non-statutory “openings” and “closings” of the

management areas. In this case, determination of actual areas to be fished within the fishery is done through agreement with the licensee. The Department and the licensee collaborate to make decisions regarding the timing and extent of the areas to be fished, with outcomes communicated to all relevant staff (i.e. research, management, compliance and VMS). All of the non-statutory closures and openings are communicated to skippers via email on a daily basis or as required. The closures are monitored by VMS.

4.2.1.4 *Statutory Management Changes*

Statutory management changes are facilitated through amendments to legislative instruments, such as the fishery management plan, section 43 orders, exemptions and notices made by the Department's Deputy Director General.

The EGPMF Management Plan identifies those persons (i.e. the licensee) that the Minister must consult with prior to making an amendment. The statutory consultation function is presently conducted by WAFIC on behalf of the Department under a SLA.

Notices made by the Chief Executive Officer under clause 10 of the EGPMF Management Plan (generally used to open and close the fishery and various spatial areas) cannot be given effect without prior consultation with licence holders.

There are no statutory provisions as to the consultation requirements relating to amendments to management arrangements for instruments of section 7 exemptions or section 43 orders. In the absence of any statute specifying consultative procedures, the Department has regard for common law principles to afford natural justice to the licensee. As such, the Department will formally consult with the licensee when making changes to management arrangements via an instrument of exemption or an order.

4.2.1.5 *Consultation with Other Groups*

Consultation on prawn management with Recfishwest, customary fishers and non-fisher stakeholders, including Government agencies, conservation sector Non-Government Organisations (NGOs) and other affected/interested parties is undertaken in accordance with the Departmental Stakeholder Engagement Guideline (Department of Fisheries 2016). The Department's approach to stakeholder engagement is based on a framework designed to assist with selecting the appropriate level of engagement for different stakeholder groups and includes collaborating with and involving key stakeholders, seeking input from interested parties through a public consultation process and keeping all parties fully informed through the provision of balanced, objective and accurate information. Key fishery-specific documents such as harvest strategies, recovery plans and bycatch action plans are subjected to both formal key stakeholder consultation and public consultation processes.

5.0 Compliance and Enforcement

As the key regulatory agency, the Department's compliance role is to achieve sustainability, economic and social objectives by addressing:

- Our ability and capacity to influence compliance with the rules; and
- The effectiveness, capacity and credibility of the compliance program.

The Department's compliance model is based on the Australian Fisheries National Compliance Strategy 2016-2020 (the National Strategy). The Department's compliance program is aligned to support the three key compliance strategies recommended by the National Strategy:

- Maximising voluntary compliance;
- Effective deterrence; and
- Organisational capability and capacity

The Western Australian Fisheries Compliance Strategy (the Strategy; DPIRD 2018) provides the principles underlying the Department's compliance role and how its compliance services are delivered to the WA community. The Strategy aligns with, and complements the Department's Compliance Framework and Risk Assessment Policy, which informs the risk-based model, compliance planning and the governance structure applied to fisheries compliance services.

5.1 Operational Compliance Plans

Management arrangements for the EGPMF are enforced under an Operational Compliance Plan (OCP) that is informed and underpinned by a compliance risk assessment and is reviewed every one to two years. The objectives of the EGPMF OCP are to:

- Provide clear direction and guidance to officers regarding compliance activities that are required to support effective management of the fishery;
- Provide a mechanism that aids the identification of future and current priorities;
- Encourage voluntary compliance through education, awareness and consultation activities; and
- Review compliance strategies and their effective implementation.

5.2 Compliance Strategies

Compliance strategies and activities that are used in the fishery include:

- Land and sea patrols;
- Catch validation against managed fishery licences;
- Inspections of wholesale and retail outlets;
- Inspections at processing facilities;
- Inspections of vessels in port and pre-season briefings;
- At sea inspections of fishing boats; and
- Closed area/season monitoring via VMS.

Inspections may involve inspection of:

- All compartments on board the vessels;
- All authorizations;
- Logbooks; and
- Catch on board the boat.

5.3 Vessel Monitoring System

Boats operating within the EGPMF must be fitted with a device known as an automatic location communicator (ALC). The ALC is used to track the location of a boat by transmitting information such as the geographical position, course and speed of the boat to VMS compliance officers at the Department.

The use of VMS in the EGPMF allows the Department to carry out real-time monitoring of the EGPMF fleet's adherence to spatial closures, provides intelligence for investigations and provides information and analysis to research and management branches on vessel activities and patterns.

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Appendix 1

Overview of typical Exmouth Gulf Prawn Managed Fishery annual operations

APRIL	<p><u>Season opens</u></p> <p>Date determined based on prawn biology and migration onto the trawl grounds, considering the lunar phase.</p>
MARCH TO APRIL	<p><u>Recruitment surveys</u></p> <p>Brown tiger, western king and blue endeavour prawn mean catch rate and prawn size information from surveys used to predict catches for the current season and inform the temporal and spatial extent of rolling area(s) openings. Refer to Guidelines for in-season decision-making (Appendix 2).</p>
PRIOR TO AUGUST	<p><u>Central TPSA and Eastern Area closed to fishing</u></p> <p>When the brown tiger prawn commercial catch rate falls below the threshold reference level for two consecutive nights, prior to August</p>
	<p><u>Central TPSA and Eastern Area closed to fishing during key spawning period</u></p> <p>When the brown tiger prawn commercial catch rate is above the threshold reference level for two consecutive nights, prior to August, (specific date dependent on lunar phase).</p>
AUGUST TO OCTOBER	<p><u>TPSA Tiger prawn spawning stock surveys (August to October)</u></p> <p>Mean brown tiger prawn catch rate from the first two surveys used to inform potential re-opening of the Central TPSA and Eastern Area. Refer to guidelines for in-season decision making (Appendix 2). Blue endeavour prawn catch rate used to inform potential reopening of the Eastern Area.</p>
OCTOBER TO NOVEMBER	<p><u>Closure of Central TPSA and Eastern Area</u></p> <p>Following re-opening of Central TPSA and Eastern Area, daily monitoring of commercial catch rates of brown tiger prawns is used to inform closure. Refer to guidelines for in-season decision making (Appendix 2).</p>
NOVEMBER	<p><u>Closure of Northern Area</u></p> <p>If, at any time during the fishing season, the majority of western king prawns in commercial catches are small-sized (i.e. >50% size grade 21/30 or smaller), cease fishing in Northern Area.</p>
NOVEMBER/ DECEMBER	<p><u>Season closes as per season arrangements (November/December)</u></p>

Appendix 2

Guidelines for in-season decision-making

The Central TPSA and Eastern Area is closed annually to protect brown tiger prawn spawning stock during the key spawning period. Timing of opening and closure of the Central TPSA and Eastern Area is based on commercial and spawning stock survey catch rates and a threshold reference level of 25 kg/hr., as summarized in Table 1. Maintaining prawn catch rates at or above this threshold reference level ensures sufficient spawning biomass during the key spawning period.

Cessation of fishing in each season is triggered using commercial fleet catch rates and/or size grade information within the fishing grounds, provided by industry to the Department on a daily basis (refer to Table 1 for triggers). Table 3 summarises the EGPMF season arrangements and triggers for the annual opening and closure of spatial.

Table 3: Season arrangements – annual opening and closure triggers

IF	THEN
The commercial catch rate of brown tiger prawns in the Central TPSA falls below the threshold reference level of 25 kg/hr. for two consecutive nights prior to August:	Close the Central TPSA and Eastern Area early (prior to August).
The commercial catch rate of brown tiger prawns in the Central TPSA is above the threshold reference level of 25 kg/hr. for two consecutive nights prior to August:	Close the Central TPSA and Eastern Area during the key spawning period (August through October, specific dates dependent on lunar phase).
The brown tiger prawn spawning stock survey catch rate in the Central TPSA is less than 25 kg/hr during the first two spawning surveys (August and September):	Do not reopen the Central TPSA and Eastern Area to fishing after the September survey.
The brown tiger prawn spawning stock survey catch rate in the Central TPSA is greater than 25 kg/hr during the first two spawning surveys (August and September):	Open the Central TPSA and Eastern Area to fishing after the September survey.
The blue endeavour prawn spawning stock survey catch rate is less than 4.5 kg/hr during the first two spawning surveys (August and September):	Do not open the Eastern Area for the remainder of the season.
August and September spawning survey results are marginal:	Reconsider the re-opening of the Central TPSA and Eastern Area after the final spawning survey conducted in October.
The Central TPSA and Eastern Area re-opens:	Close the fishing season when the brown tiger prawn catch rate falls below 25 kg/hr prior to 1 November, or reaches 19 kg/hr after 1 November.
50% or more of western king prawn commercial grade is 21/30 or smaller:	Close the Northern Area after October for the remainder of the season.

Appendix 3

Bycatch Action Plan 2021-2026

Bycatch is described as the part of the catch, which is returned to the sea (usually referred to as non-retained or discarded) either because it has no commercial value or because legislative requirements preclude it being retained. In the EGPMF, this includes unmarketable finfish and invertebrate species, along with ETP species such as marine mammals, reptiles and some elasmobranchs. Further information on the fishery's bycatch and interactions with ETP species is provided in the ERA (DPIRD 2020).

In line with Government policy to minimise bycatch in all commercial fisheries, Bycatch Reduction Devices (BRDs) have been mandatory in trawl nets used by the EGPMF since 2002/03. The fishery also aims to return to the water any bycatch alive and in the best possible condition. Some species are less robust than others, with survival rates of returned finfish thought to be lower than many invertebrates (e.g. crustaceans; Kangas et al. 2007). Predatory fish feeding on discards may also have a marked impact on survival rates. The introduction of Fish Quip sorting and processing equipment (hoppers) on the EGPMF trawlers in 2002 has had a substantial impact on the number of non-target species returned to the water alive.

This EGPMF Bycatch Action Plan (BAP), summarised in Table 4, is designed to address risks to non-retained species identified in the most recent ERA, EPBC assessment (WTO export approval) and the 2020 MSC assessment. The objective of this plan is to:

- Develop and implement cost-effective strategies to pursue continual improvement in reducing bycatch;
- Review relative changes in bycatch due to bycatch mitigation and extend information on best practice to industry;
- Develop measures to further reduce interactions with, or impacts on, ETP species;
- Respond to adverse impact on Exmouth Gulf ecology from prawn fishing activity; and
- Develop measures to better utilize the component of the catch that would otherwise be discarded.

Key ongoing elements of the BAP include the following, which are described in more detail below:

- 1) Gear controls.
- 2) A Bycatch Monitoring Program (BMP) to validate the mandatory reporting of ETP species by the fishery;
- 3) A research program to evaluate the diversity of the bycatch in Exmouth Gulf and to facilitate species identification in the BMP; and

- 4) Better reporting of interactions with sawfish, focussing on species identification and indication of condition status, and continued high-quality reporting for sea snakes.

Gear Controls

Gear controls in place that are linked to bycatch reduction include:

- A maximum ground chain link diameter of (10 mm) to address the impact the chain has on benthic habitat and non-target species,
- A maximum otter board height to restrict the vertical net opening and facilitate escapement of non-target species over the top of the net,
- A maximum board length to address shoe contact with the benthic habitat and non-target species,
- The use of a Texas drop chain arrangement to promote passage of unwanted flora and fauna underneath the net,
- The mandatory use of turtle exclusion devices (TEDs) (grids) in all nets, and
- The mandatory use of fish exclusion devices (FEDs) (square mesh panels) in all nets.

Bycatch (Non-retained) Monitoring Program

The BMP is an ongoing collaborative program between the Department and the commercial fishing industry. The key objectives of the BMP are to:

- Use the results of ongoing monitoring programs to determine if the results from previous assessments remain relevant; and
- Develop protocols to improve consistency of reporting of all ETP species interactions in the fishery.

The information collected on bycatch and ETP species interactions will be used to assess whether the risk to Exmouth Gulf marine communities potentially posed by the fishery are acceptable or not through ongoing ERA processes.

Monitoring of bycatch species will be conducted through a combination of sampling methods to provide the most cost-effective approach to assess the sustainability of all major bycatch groups, including:

- Fishery-dependant monitoring (via mandatory crew logbook reporting) of all ETP species, with particular emphasis on improved reporting of sea snake and sawfish interactions and return status of all ETP animals;
- Fishery-independent monitoring of ETP species interactions to validate fishery-dependant reporting;
- Fishery-independent surveys to collect non-ETP bycatch species composition data every five years; and
- Support for the industry-led Crew-member observer program (CMOP).

The most recent quantitative ERA conducted in 2019 assessed the fishery-induced risks to selected bycatch and ETP species. The continued development and undertaking of ERAs will ensure targeted measures can be developed to address remaining ecological risks in the EGPMF. ERAs are repeated every five years, to

ensure they remain relevant and provide accurate and ongoing demonstration of sustainability for all bycatch species. ERAs can be conducted sooner, under the following circumstances:

- Where new species-specific data may improve the assessment for species already identified as 'high-risk'; and/or
- Following any major change to fishing gear and/or effort distribution patterns.

Reference levels, triggers and management actions will be developed as needed based on ERA outcomes. Alternative management strategies may also need to be developed for rare species that cannot be robustly assessed using the above BMP.

The BMP will be reviewed periodically as part of the ERA review process and adapted to reduce bycatch while addressing the cost effectiveness of the program and needs of fishery management. This includes the removal or addition of species in the monitoring program according to their revised risk levels and the use of upgraded risk assessment techniques.

Research Program

The Department have collaborated with the fishing industry and academic institutions in developing research projects to assess the sustainability of bycatch and reduce capture of ETP species.

These research programs aim to:

- Improve the understanding of fishery impacts to ETP species (particularly sea snakes and sawfish); and
- Provide support for further BRD development and testing of effectiveness for reducing bycatch.

Capture of large ETP species, such as sea turtles, has been greatly reduced with the use of grids in trawl nets, an outcome of a previous research project. Reports are conflicting on the benefits of grids to sea snakes; therefore, to decrease the impact of the fishery on sea snakes, an industry education program was developed. The program aimed to increase awareness of the importance of sea snake and sawfish protection, promote sensible handling techniques and improve species identification through training in sea snake identification to the species level. This program has formed an ongoing part of the implementation of a CMOP.

Table 4: Bycatch Action Plan for the EGPMF (2020 – 2025)

Component	Fishery objective	Current information	Current activities	ERA risk ranking	Proposed additional activities
Bycatch (non-ETP species)	To ensure fishery impacts do not result in serious or irreversible harm to bycatch species populations.	<ul style="list-style-type: none"> • Bycatch data (species lists and level of bycatch) from BRD trials in 2000 – 2003. • Bycatch interactions as reported by fishers in daily logbooks. • Fishery independent survey data. 	<ul style="list-style-type: none"> • Conduct fishery-independent surveys (i.e. Departmental staff) to collect bycatch (non-retained) species composition data every five years. • Continue to develop and test the effectiveness of BRDs and alternative bycatch mitigation measures in reducing fishery bycatch in accordance with the industry-lead MSC continuous improvement program. • Investigate measures to reduce incidental mortality of captured bycatch species. 	Negligible-to-low for all bycatch species.	None.
ETP species	To ensure fishing impacts do not result in serious or irreversible harm to ETP species' populations.	<ul style="list-style-type: none"> • ETP species group's interactions as reported by fishers in daily logbooks; return status also monitored for some species. • Fishery independent survey data. 	<ul style="list-style-type: none"> • Continue to use ETP interactions in fishery independent surveys (i.e. Departmental staff) to validate fishery dependant ETP data. • Continue to develop and test the effectiveness of BRDs and alternative bycatch mitigation measures in reducing ETP interactions in accordance with the industry-lead MSC continuous improvement program. • Investigate measures to reduce incidental mortality of captured ETP species. • Provide species level identification and training materials for skippers and crew. 	Negligible-to-low for all bycatch species, with the exception of Sawfish, which was ranked medium.	<ul style="list-style-type: none"> • Ongoing investigation to reduce sawfish interactions. • Continued investigation into the use of sawfish tranquiliser and development of a suitable trial.

Component	Fishery objective	Current information	Current activities	ERA risk ranking	Proposed additional activities
			<ul style="list-style-type: none"> • Engage with external stakeholders to estimate impacts of the fishery on ETP species within Exmouth Gulf. • Investigate crewmember observer program (CMOP) as an ongoing data collection system. 		
Habitats	To ensure the effects of fishing do not result in serious or irreversible harm to habitat structure and function.	<ul style="list-style-type: none"> • VMS data. • Logbook data. 	<ul style="list-style-type: none"> • Monitor and report on annual trawl footprint, overlaid with benthic habitat maps, assessing the fishery's potential interactions with habitat types. 	Negligible-to-low for all habitat types, with the exception of filter feeding communities, which was ranked medium.	Periodically monitor benthic habitats to assess fishery interactions with vulnerable communities.
Ecosystem	To ensure the effects of fishing do not result in serious or irreversible harm to ecosystem processes.	Biodiversity and community composition data for trawled and untrawled areas of Exmouth Gulf from 2004.	<ul style="list-style-type: none"> • Fishery impacts monitored at component level (as part of harvest strategy). • Conduct fishery-independent surveys (i.e. Departmental staff) to collect bycatch (non-retained) species composition data every five years. 	Negligible-to-low for all ecosystem structures.	None.

Table 5: Exmouth Gulf Prawn Bycatch Mitigation Summary

Bycatch mitigation in place	Planned action
Grids (TEDs)	<ul style="list-style-type: none"> • Monitor on ongoing basis
Fish Escape Panels (FEDs)	<ul style="list-style-type: none"> • Monitor on ongoing basis • Experiment with variations and available options
Reporting of ETP and bycatch species	<ul style="list-style-type: none"> • Extent and uniformity of use to be reviewed. • Improve species identification. • Improve completeness and accuracy of mandatory reporting
Use of return hoppers	<ul style="list-style-type: none"> • Ongoing.
Independent observer data collection and verification program	<ul style="list-style-type: none"> • Formalise, implement and observe
Seasonal and/or spatial closures	<ul style="list-style-type: none"> • Monitor on ongoing basis • Experiment with variations and available options
Industry education and promotion	<ul style="list-style-type: none"> • Extent and uniformity of use to be reviewed. • Formalise, implement and secure funding
Monitoring of new bycatch reduction strategies and technology	<ul style="list-style-type: none"> • Ongoing
Return of bycatch ASAP to minimise mortality, injury or other adverse impacts	<ul style="list-style-type: none"> • Monitor on ongoing basis
Limit total area trawled	<ul style="list-style-type: none"> • Monitor on ongoing basis • Experiment with variations and available options

Appendix 4

Recruitment and spawning stock survey sites in the Exmouth Gulf Prawn Managed Fishery

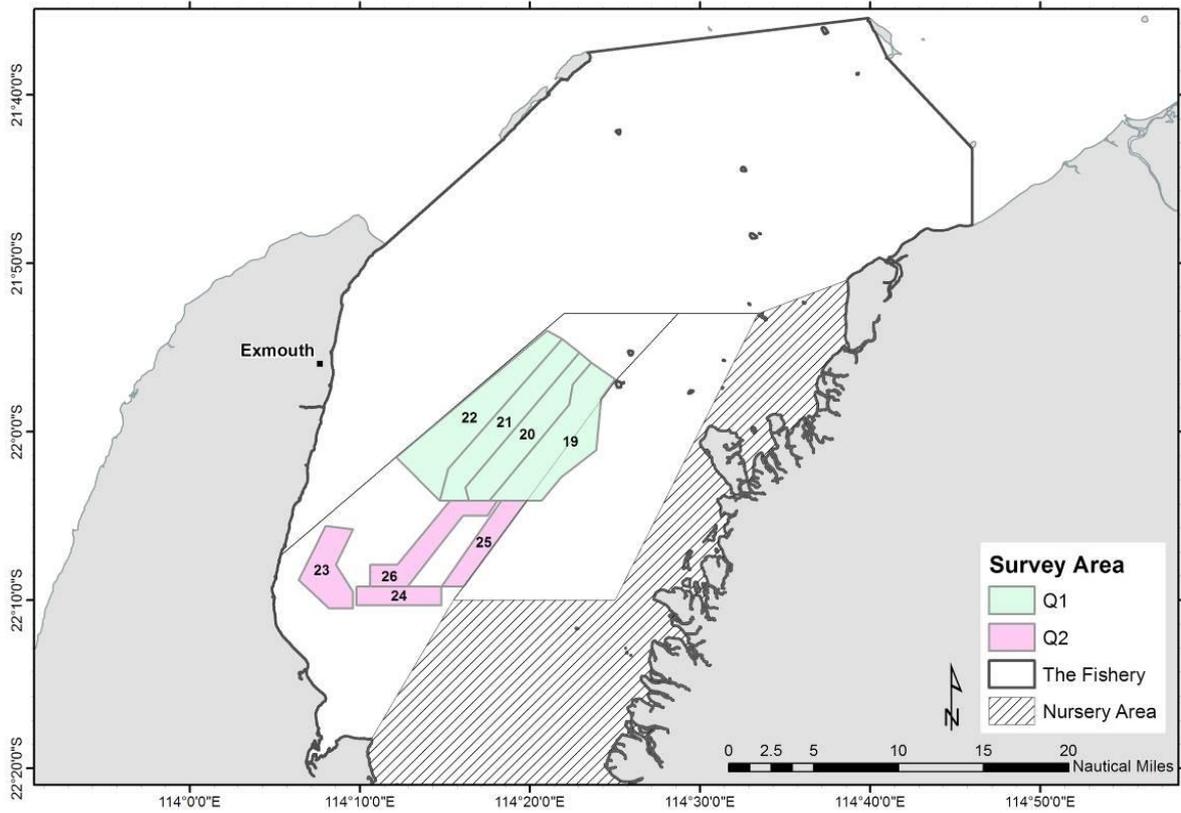


Figure 5: Brown tiger and blue endeavour prawn spawning stock survey sites.

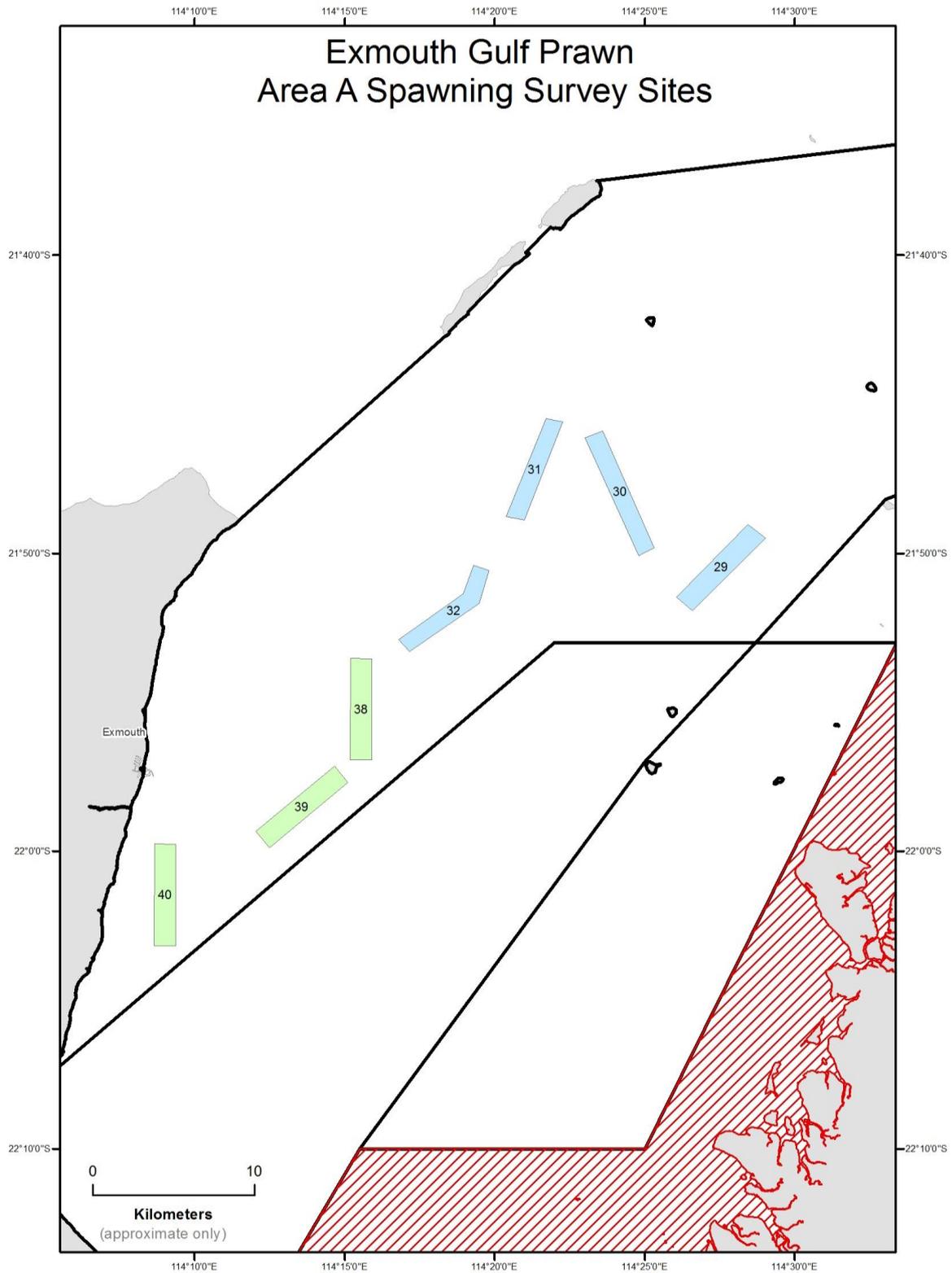


Figure 6: Western king prawn spawning stock survey sites.

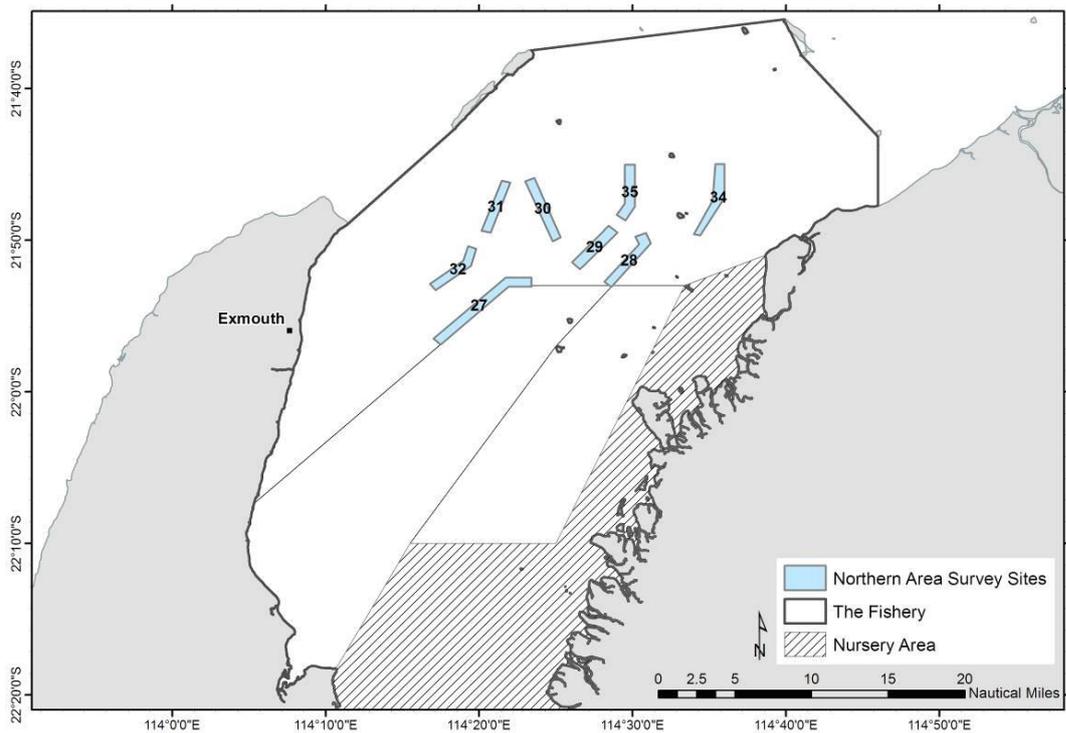
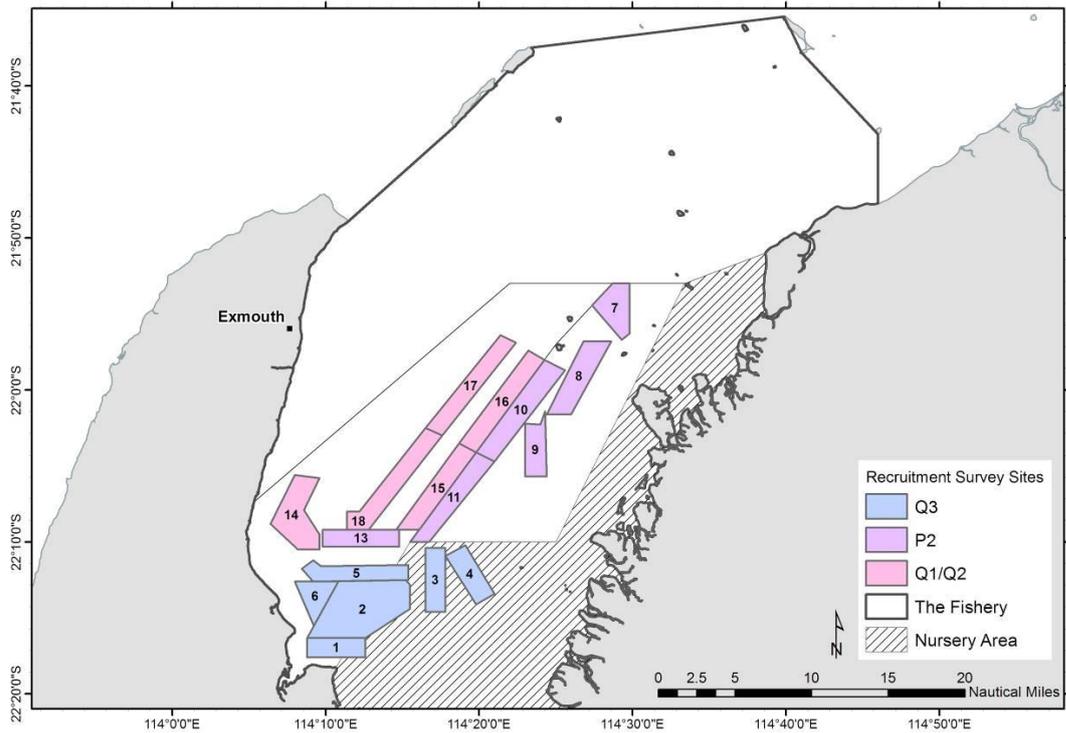


Figure 7: Brown tiger, blue endeavour and western king prawn recruitment survey sites.

Appendix 5

Fishing grounds in Exmouth Gulf used for analysis of monthly catch and effort data

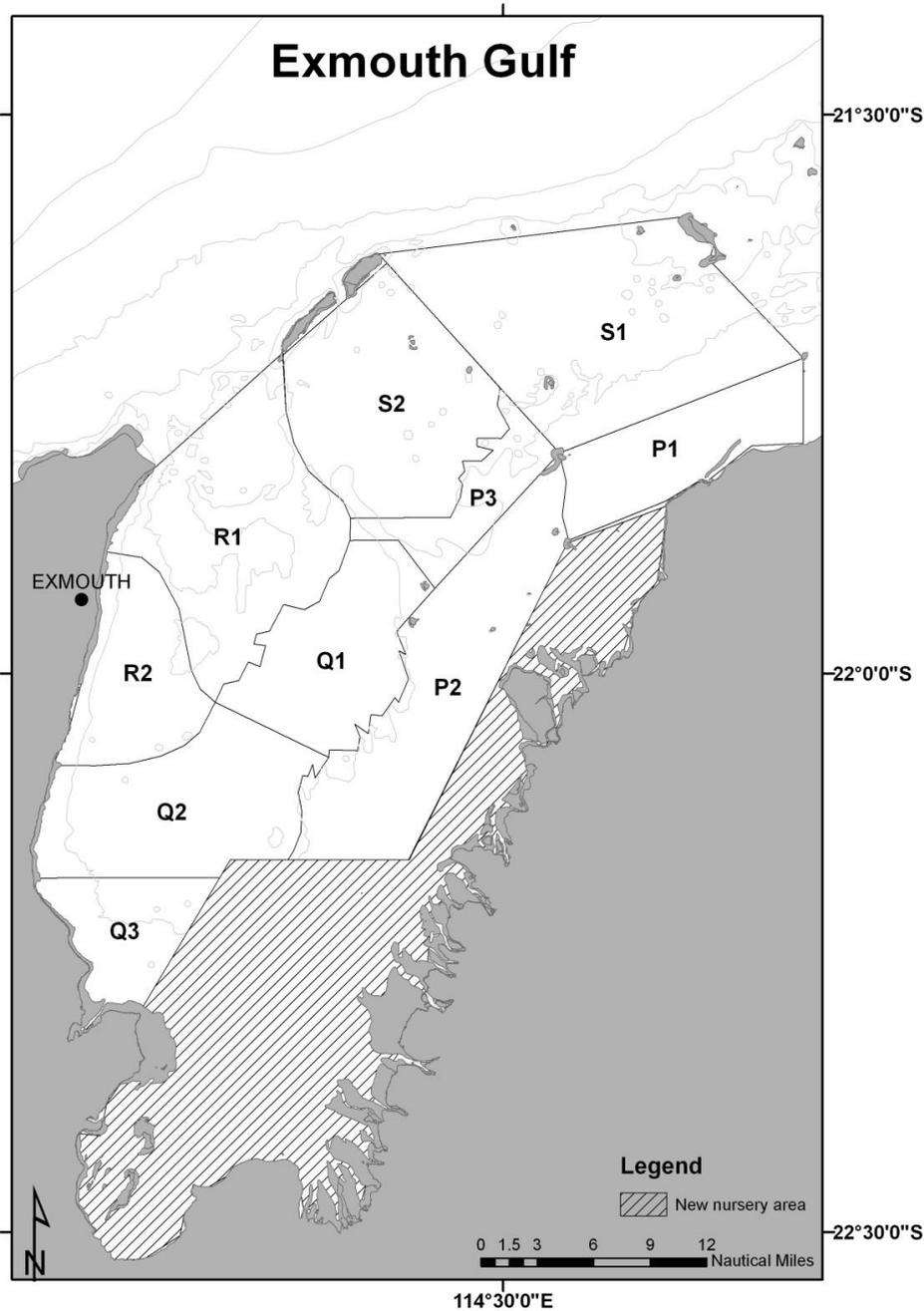


Figure 8: Fishing grounds in Exmouth Gulf use for analysis of monthly catch and effort data.

Q1 and Q2 are considered the main brown tiger prawn fishing grounds, whereas R1 and S2 are considered the key fishing grounds for western king prawns. Blue endeavour prawns occur primarily over Q1, P2, P3 and R1 and S2 fishing grounds.