Australian Government

Department of the Environment and Heritage

Assessment of the

Shark Bay Experimental Crab Fishery

November 2004

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ISBN: 0 642 55104 9

Disclaimer

This document is an assessment carried out by the Department of the Environment and Heritage of a commercial fishery against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. It forms part of the advice provided to the Minister for the Environment and Heritage on the fishery in relation to decisions under Parts 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999*. The views expressed do not necessarily reflect those of the Minister for the Environment and Heritage or the Australian Government.

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Assessment of the ecological sustainability of management arrangements for the Shark Bay Experimental Crab Fishery

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EXECUTIVE SUMMARY

Background

The Department of Fisheries, Western Australia (DFWA) has submitted a document for assessment under Parts 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The draft document *Final Application to the Australian Government Department of the Environment and Heritage on the Shark Bay Experimental Crab Fishery* (the submission) was received by the Department of the Environment and Heritage (DEH) in June 2004. A revised submission was received in August 2004. The submission was released for a thirty-day public comment period that expired on 13 September 2004. No public comments were received.

The submission reports on the Shark Bay Experimental Crab Fishery (SBECF) against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission and associated documents.

Table 1: Summary of the Shark Bay Experimental Crab Fishery

Area	Northern waters of Shark Bay, half way up the Western Australia coast in the Gascoyne region. A small area in the north west of the fishery extends into Commonwealth waters.
Fishery status	Unknown.
Target Species	Blue Swimmer Crab (*Portunus pelagicus*).
By-product Species	Coral crab (*Charybdis cruciata*) and Sand crab (*Ovalipes australiensis*). No recorded catch of sand crab in the SBECF.
Gear	Crab pots – design must be approved by DFWA.
Season	No closed season.
Commercial harvest 2002/03	389 tonnes.
Value of commercial harvest 2002/03	Shark Bay ECF catch valued at ≈ $ 1.7 million (45% of total WA catch worth $3.8 million). Beach prices vary between $4.00 - $6.00/kg live weight.
Recreational harvest 1998/99	3870 individual crabs taken from Gascoyne region, including Shark Bay[1].
Commercial licences issued	Currently 5 operators in the fishery – authorisations issued by exemption and/or permissive condition on the Fishing Boat Licence.
Management arrangements	Commercial sector: compulsory logbook reporting requirement, limited entry, gear restrictions (design, number and spatial distribution), spatial closures, protection of berried females, and minimum size limit (135 mm carapace width (CW)). Recreational sector: minimum size limit (127 mm CW), gear restrictions, bag limit (20/fisher/day), and protection of berried females.
Export	A large proportion of the Shark Bay catch is value added product with an increasing proportion destined for the developing export market.
Bycatch	Considered low. Likely to consist of finfish, octopus, other crabs and starfish
Interaction with Threatened Species	Considered low. Possible interactions with marine turtles.

[1] Adult blue swimmer crabs usually weigh about 500g (Kailola *et al*., 1993). Therefore, the recreational catch would equate to approximately 1935 kg in 1998/99.

The SBECF is located in the northern waters of Shark Bay, half way up the Western Australia (WA) coast in the Gascoyne region. The north-west corner of the fishery area extends into Commonwealth waters. The main fishing zone is referred to as the Carnarvon Experimental Crab Fishery, which extends from Quobba Point in the north, to Bernier and Dorre Islands in the west and south to Cape Peron. However, a limited amount of fishing also occurs in the lower gulfs of Shark Bay. The actual location of fishing activity is partly governed through controls on the placement of pots. Currently, 1500 pots are employed by the SBECF. Of these, 1100 must be used in the area of the Carnarvon Experimental Crab Fishery, while the remaining 400 can be used in the lower western and eastern gulfs of Shark Bay.

The fishery targets blue swimmer crab (*Portunus pelagicus*). Operators in the SBECF are also permitted to retain coral crabs (*Charybdis cruciata*) and sand crabs (*Ovalipes australiensis*) as by-product. However, while the abundance of coral crabs at certain times of the year allows them to be landed as by-product, there has been no record of sand crabs being caught or retained by operators in the SBECF.

The target species is common throughout the Indo-Pacific region; its distribution extending from the east coast of Africa across to Tahiti, northward to Japan and south to waters surrounding northern New Zealand. They are widely distributed around the Australian coastline, being found in coastal and estuarine waters of all mainland states and the Northern Territory. The species is found along the length of the WA coast, although the commercially fished stocks are concentrated in the coastal embayments of the Peel/Harvey Estuary in the south, and Shark Bay in the north.

Blue swimmer crabs live in a variety of inshore and continental shelf areas, including sandy, muddy or algal and seagrass habitats. Blue swimmer crabs move to deeper water as they mature and in response to water temperature and salinity. They are bottom feeding carnivores and scavengers, feeding most actively at sunset. Little is known about predation on this species, but marine turtles, sharks, rays and large fish are likely predators, with crabs being most vulnerable to predation immediately after moulting (Kailola *et al*., 1993).

Blue swimmer crab are a fast growing, early maturing and highly fecund species that exploits a broad ecological niche. Female crabs spawn up to 2 million eggs per batch, with larger crabs producing more eggs than smaller crabs. Female crabs may spawn several times a season (as frequently as 2 or 3 times over a few months) using sperm from one mating. The size at which maturity occurs varies with latitude and within individuals at any location (Kailola *et al*., 1993). The carapace width (CW) of the smallest crab found to have reached sexual maturity ranged from 61 mm in both Peel-Harvey Estuary and Shark Bay to 90 mm in Leschenault Estuary. In Shark Bay, the size at sexual maturity for the blue swimmer crab is approximately 100 mm CW.

Approximately 389 tonnes of blue swimmer crab were harvested in the SBECF in 2002-03, at an estimated value of AU$1.7 million. Catch in the SBECF constituted approximately 44% of the state's total catch of 890 tonnes (valued at $3.8 million). The fishery commenced in 1998, although there has been varying degrees of crab fishing in Shark Bay since the early 1990s. Landings in the SBECF have increased five-fold since its commencement in 1998, with effort increasing 3-fold and catch-per-unit-effort (CPUE) increasing by half. In 1998-99 total catch in the SBECF was 132 tonnes, compared to a total of 478 tonnes in 2001-02. In 2002-03 the fishery declined slightly to 389 tonnes. A large proportion of the Shark Bay catch is value added product with an increasing proportion destined for the developing export market. Good local markets are also developing.

The SBECF uses purpose-designed crab pots and a variety are currently being trialled to determine the most appropriate design for the local conditions (ie strong currents). As the SBECF is in the experimental phase, specifications on pot design have not been formalised, however all pot designs

must be approved by DFWA prior to use within the fishery. Pots are designed to enable the escape of non target species and undersized target species to a size of approximately 120 mm, mainly through a specialised design and through the requirement for escape gaps to be included in all pots used in the SBECF.

Management of the fishery is based on a mixture of input and output controls. Such controls include:

- Regulation of the number of licenses;
- Spatial restrictions;
- Fishing method and gear specifications;
- Prohibition on the harvest of berried females;
- Restrictions on species retained; and
- Minimum size limit (127 mm CW for recreational fishers and 135 mm CW for commercial fishers in Shark Bay).

An assessment of the effectiveness of these management arrangements is given in Parts I and II of this report.

The submission claims that few species are caught as bycatch and that the use of pots limits the potential for interaction with protected species. While other blue swimmer crab fisheries in Australia have shown that possible protected species interactions include entanglement of marine turtles in pot lines or capture in the pots themselves, such interaction is avoided in the SBECF through the use of 'hourglass' pots that have a series of small entrance slits in the 'waist'. Turtles are unable to enter the pot through these side entrances and as such cannot get caught. Bycatch and interactions with protected species are assessed under Principle Two of this report.

Take of blue swimmer crab by the indigenous and recreational sectors is not significant. Blue swimmer crabs are taken as by-product from a number of commercial trawl fisheries operating in the Shark Bay region; namely the Shark Bay Prawn, Shark Bay Scallop and Exmouth Gulf Prawn Managed Fisheries. In 2002, the Shark Bay Prawn Managed Fishery harvested 155 t of blue swimmer crab, the Shark Bay Scallop Managed Fishery took 8.5 t and the Exmouth Gulf Prawn Managed Fishery harvested 12 t of blue swimmer crab. The extent to which DFWA take removals of blue swimmer crab by other fisheries into account in the management of the SBECF is discussed in Part I.

The *Fish Resources Management Act 1994* provides the legislative framework to implement the management arrangements for the SBECF, which is currently managed through a combination of exemptions and conditions on Fishing Boat Licences. DFWA is in the process of developing an interim management plan, which is expected to be implemented by the end of 2005. DEH notes that the SBECF will need to be reassessed prior to the new plan coming into effect.

Overall assessment

The material submitted by DFWA demonstrates that the management arrangements for the SBECF meet most of the requirements of the Australian Government *Guidelines for the ecologically sustainable management of fisheries*. DEH recognises that the minimum legal size limit and prohibition on the take of berried females are conservative and that the life history characteristics of the blue swimmer crab render it somewhat robust to fishing.

While the fishery is relatively well managed, DEH has identified a number of issues that must be managed to ensure that their impacts are minimised:

- The ability of current management arrangements to ensure the fishery remains ecologically sustainable as effort and catch increase with the development and expansion of the fishery;
- Lack of compliance and enforcement resources directed to the SBECF;
- Lack of fishery specific objectives, performance measures and performance indicators, particularly for by-product, but also for bycatch and protected species and for ecosystem impacts; and
- Lack of an established sustainable yield for Shark Bay blue swimmer crab stocks.

Recommendations to address these issues have been developed to ensure that the risk of impact is minimised in the longer term. Through the implementation of the recommendations and the continuation of a responsible attitude to the management of the fishery, management arrangements are likely to be sufficiently precautionary and capable of controlling, monitoring and enforcing the level of take from the fishery while ensuring the stocks are fished sustainably.

Overall, the management regime aims to ensure that fishing is conducted in a manner that does not lead to over-fishing and for fishing operations to be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. The key challenge for this fishery will be the management of the fishery, as it continues to evolve, to ensure that catch levels are ecologically sustainable.

On balance, the fishery is being managed in an ecologically sustainable manner and is working to address existing problems and minimise environmental risks. The operation of the fishery is consistent with the objects of Part 13A of the EPBC Act. Given the conservative minimum size limit, the protection of berried females and the limited entry to the fishery, DEH considers that the fishery will not be detrimental to the survival or conservation status of the taxon to which it relates in the short term. Similarly, it is not likely to threaten any relevant ecosystem in the short term. DEH therefore recommends that the fishery be declared an approved Wildlife Trade Operation (WTO) with the actions specified in the recommendations to be undertaken by DFWA to contain the environmental risks in the long term. DEH considers that the fishery, as managed in accordance with the management regime, is not likely to cause serious or irreversible ecological damage over the period of the export decision. Specifically, the WTO declaration would allow the export of product from the fishery for a period of 3 years. The WTO declaration will require annual reporting on the progress of implementing the recommendations of this report and other managerial commitments. The implementation of the recommendations will be monitored and reviewed as part of the next DEH review of the fishery in 3 years time.

As the official fishery area encompasses Commonwealth as well as State waters, consideration under Part 13 of the EPBC Act is required regarding the impact of the fishery on listed threatened species, listed migratory species, cetaceans and listed marine species.

Protected species in the area of the fishery include marine turtles and dugongs. However, the relatively small scale of the SBECF and the specially designed gear used in the fishery limit the likelihood of interactions with protected species. Therefore, the actual and potential impact on Part 13 species under the management arrangements is considered low and adequate protection is provided. There are no listed threatened ecological communities in the fishery area.

DEH recommends that the SBECF management regime be declared an accredited management plan under Sections 208A, 222A, 245 and 265 of the EPBC Act. In making this judgement, DEH considers that the fishery to which the regime relates does not, or is not likely to, adversely affect the survival in nature of listed threatened species or population of that species, or the conservation status of a listed migratory species, cetacean species or listed marine species or a population of any of those species. DEH also considers that the management regime requires that all reasonable steps

are taken to avoid the killing or injuring of protected species, and the level of interaction under current fishing operations is low. On this basis, DEH considers that an action taken by an individual fisher, acting in accordance with the SBECF management regime, would not be expected to have a significant impact on a listed threatened species or listed migratory species protected by the EPBC Act.

The assessment also considered the possible impacts on the World Heritage values of the Shark Bay World Heritage Area. Given that areas of Shark Bay are closed to fishing, the fishery is relatively small in scale, and the fishing methods are relatively benign, it is considered that the fishery is unlikely to compromise the World Heritage values for which Shark Bay was listed. On this basis DEH considers that an action taken by an individual fisher, acting in accordance with the SBECF management regime, would not be expected to have a significant impact on the World Heritage values of the Shark Bay World Heritage Area.

The implementation of recommendations and other commitments made by DFWA in the submission will be monitored and reviewed as part of the next DEH review of the fishery in 3 years time.

Recommendations

1. DFWA to advise DEH of any material change to the SBECF's legislated management regime that could affect the criteria on which EPBC decisions are based, within three months of that change being made.

2. The ESD Report, including all performance measures, responses and information requirements to be incorporated into the management regime and decision making process.

3. DFWA to ensure, where appropriate, that any relevant indigenous, conservation, world heritage and recreational interests in the fishery are considered through consultative mechanisms.

4. By the end of 2006, DFWA to develop fishery specific performance measures for the target species (blue swimmer crab) and fishery specific objectives, performance indicators and measures, based on the best available information, for the two by-product species.

5. DFWA to incorporate into the management regime, an objective to minimise protected/listed species interactions, to minimise or maintain at sustainable levels the take of other non-retained species and to minimise impacts on the marine environment.

6. By December 2006, DFWA to conduct a compliance risk assessment to determine the most effective use of resources and to specify the measures needed to ensure adequate compliance with the management regime. DFWA to develop a compliance strategy for the fishery, to address compliance issues identified as high risk, that includes clear management actions and the means of measuring the performance of the strategy on a defined and regular basis.

7. DFWA, in its Annual State of the Fisheries Report, to report on the performance of the SBECF against performance measures that relate to the sustainability of the fishery, once developed.

8. DFWA to develop a research strategy for the fishery that:
    - Identifies research information needs and priorities to meet the management information, stock assessment and performance measurement needs of the fishery; and
    - Investigates potential synergies with other blue swimmer crab research.

9. Noting the pending development of the Interim Management Plan and the potential for fishing efficiency to increase and for the fishery to continue to evolve, DFWA to review the management arrangements of the fishery to ensure that blue swimmer crab stocks continue to be fished within ecologically sustainable levels.

10. DFWA to implement an education program to ensure that industry has the capacity to make protected species reports at an appropriate level of accuracy.

PART I - MANAGEMENT ARRANGEMENTS

The Shark Bay Experimental Crab Fishery (SBECF) is managed by the Department of Fisheries, Western Australia (DFWA).

The management regime is described in the following documents, all of which are, or will be publicly available:

- The *Fish Resources Management Act 1994*;
- Management regulations;
- Relevant Gazetted notices and licence conditions;
- Ecologically Sustainable Development Report (ESD Report); and
- The DFWA submission *Final Application to the Australian Government Department of the Environment and Heritage on the Shark Bay Experimental Crab Fishery*.

A number of other documents, including research reports and scientific literature, are integral to the management of the fishery.

The Department of the Environment and Heritage (DEH) considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Due to the importance of the management regime and documents referred to above to DEH's assessment of the fishery, an amendment could change the outcomes of the assessment and decisions stemming from it. Decisions resulting from this assessment relate to the arrangements in force at the time of the decision. In order to ensure that these decisions remain valid, DEH needs to be advised of any changes that are made to the management regime and make an assessment that the new arrangements are equivalent or better, in terms of ecological sustainability, than those in place at the time of the original decision.

Recommendation 1: *Department of Fisheries, Western Australia, to advise DEH of any material change to the SBECF's legislated management regime that could affect the criteria on which EPBC decisions are based, within three months of that change being made*.

An Ecologically Sustainable Development report (the ESD Report), on which the submission is largely based, is also an integral part of the management regime. It examines benefits and costs associated with the fishery. It also identifies and assesses risks posed to the fishery and environmental components. When finalised, the ESD Report will document the performance of the fishery and its management in terms of the ecological, economic, social and governance issues associated with the fishery. This report will be publicly available in document form and on the DFWA website. The management commitments specified in this report have been fundamental in DEH's assessment and consequent recommendations. The ESD report is not currently a formal component of the legislative arrangements. Although DEH is satisfied that this lack of a legislative base will not cause issues in the fishery in the short term, we recommend that the report be formally incorporated into the management regime and decision making process. DFWA have advised that they propose to formally publish the management objectives and performance measures for the fishery as part of a series of Ministerial guidelines, as an adjunct to the management plan that is currently being developed. The Ministerial Policy Guidelines will provide the policy framework for the management for each fishery. This document will reflect the management objectives, philosophy and guidance for decision making including the upcoming legislated management plan, the ESD report, and as relevant, reference to other documents.

Recommendation 2: *The ESD Report, including all performance measures, responses and information requirements to be incorporated into the management regime and decision making process.*

Because the SBECF is currently in the developmental phase, appropriate groups to be consulted on matters regarding the fishery have not been defined within a management plan. However, DFWA does consult with operators on any developments or changes to the fishery, and also meets with participants to discuss management, research and compliance issues within the fishery and to allow industry to raise any concerns. The fishery is mostly managed on a transparent basis, also incorporating consultation with the recreational sector and the wider community. Before amending or introducing any legislation DFWA consults with representatives of the recreational sector, the WA Fishing Industry Council and any other interested party, depending on the issue.

An interim management plan is currently being developed for the SBECF, and participants in the fishery have been consulted regarding its preparation. DEH considers that consultation with relevant groups is vital in ensuring stakeholder participation and transparency in management decision making. The development of an interim management plan for this fishery provides an ideal opportunity for consultation mechanisms to become formalised.

Recommendation 3: *Department of Fisheries, Western Australia to ensure, where appropriate, that any relevant indigenous, conservation, world heritage and recreational interests in the fishery are considered through consultative mechanisms.*

The ESD Report that is prepared by DFWA contains the objectives, indicators and performance measures for determining the effectiveness of the management for the various blue swimmer crab fisheries. While an objective and potential indicators have been developed for the target species of the SBECF, performance measures have not been explicitly set because the fishery is still in a developmental stage and catch rates are expected to increase. While DEH recognises this, it is considered that, due to the lack of information regarding the blue swimmer crab stocks in Shark Bay, precautionary performance measures should be set.

In addition, a management objective based on the portion of stocks that can be sustainably harvested has not been established for by-product species, and nor have performance indicators or measures for these species. While the amount of by-product taken in the SBECF is low (there has been no recorded catch of sand crab from Shark Bay and statewide, commercial catches of this species have remained below 700 kg over the last five years), reported catches of coral crab from Shark Bay has ranged from 205 kg in 2000-01 to a peak of 1705 kg in 2001-02. Given the large fluctuation in catch of this species, albeit against a low base, DEH considers that performance measures for by-product species need to be established to ensure that significant changes in catch levels, and therefore an increase in the risk to by-product species, can be detected and acted upon.

Recommendation 4: *By the end of 2006, DFWA to develop fishery specific performance measures for the target species (blue swimmer crab) and fishery specific objectives, performance indicators and measures, based on the best available information, for the two by-product species.*

In addition, no objectives, performance indicators or measures have been established for bycatch, protected species, or for ecosystem impacts. DEH believes that in the first instance, objectives need to be developed for these components to provide a strategic basis for management of the fishery. As the fishery develops, performance indicators and measures need to be developed so that the performance of the fishery can be measured and management action taken as required. This is necessary to facilitate an ecosystem based fisheries management approach.

Recommendation 5: *DFWA to incorporate into the management regime, an objective to minimise protected/listed species interactions, to minimise or maintain at sustainable levels the take of other non-retained species and to minimise impacts on the marine environment.*

DEH suggests that performance indicators and measures, once developed, should be capable of detecting and responding to changes in the fishery. This would require ongoing monitoring of the fishery against such performance measures and a clear process for responding to breaches of performance measures. DFWA have advised that if there is a breach in a performance measure, this will be reported in the State of the Fisheries Report. If a breach materially affects the sustainability of the target species or negatively impacts on by-product, bycatch, protected species or the ecosystem, the breach will be reported to the Minister for Fisheries within 3 months for subsequent management review and action with timeframes for implementation.

Fishery management arrangements include limits on the number and design of pots/traps that can be used, spatial closures (with areas of the SBECF being closed to fishing in relation to Marine Park Zoning), prohibition on the take of berried females, and minimum size limits. Differential size limits are in place throughout Western Australia, in an effort to provide a buffer between the recreational and commercial sectors. This measure is in place to prevent conflict between the two sectors, and is not intended as a management measure to protect blue swimmer crab stocks. The recreational minimum size limit is 127 mm CW, while commercial minimum legal sizes are set between 127 mm and 135 mm CW, depending on the location. The setting of minimum size limits provides an opportunity for crabs to spawn before becoming vulnerable to fishing. For instance, the average size at maturity in Shark Bay is less than 100 mm CW, while the legal minimum size limit for the commercial sector is 135 mm CW.

In addition to gear limitations, there is limited entry to this fishery. The number of Exemptions granted for access to this fishery is limited to five. DFWA is currently developing an interim management plan for the fishery, that is expected to be completed by the end of 2005, and it is proposed that under the future management plan the number of licencees will be limited to the same number of Exemption holders.

Few compliance resources are directed at the SBECF given the small size of the fishery. The submission argues that the geographically closed nature of the SBECF, and the fact that fishers use a limited number of boat ramps and operate within close proximity to one another allows compliance personnel to effectively target the limited compliance resources and also acts to self regulate since irregular activities are generally reported. In addition, the commercial market currently requires large crabs (greater then the legal minimum size) and hence there is little incentive for fishers to circumvent this management measure. While recognising this, DEH considers that a compliance risk assessment is necessary for this fishery given that it operates in a World Heritage Area and ecologically sustainable management relies mainly on compliance with legal size limits and protection of berried females. In addition, while the market requires larger crabs currently, it is generally not considered good practice for compliance within the fishery to be driven by market demand. That is, DFWA needs to consider the risks associated with demand possibly shifting toward smaller crabs, and these issues would be best addressed through a compliance risk assessment. In the submission, DFWA report that a risk assessment is expected to be completed within a few years, and that this will enable DFWA to better direct compliance resources and increase the effectiveness of compliance activities.

Recommendation 6: *By December 2006, DFWA to conduct a compliance risk assessment to determine the most effective use of resources and to specify the measures needed to ensure adequate compliance with the management regime. DFWA to develop a compliance strategy for the*

fishery, to address compliance issues identified as high risk, that includes clear management actions and the means of measuring the performance of the strategy on a defined and regular basis.

DFWA conducts an annual review of the performance of major aspects of WA fisheries through the completion of the *State of the Fisheries* report. This report is updated and published annually and is also periodically reviewed by the Office of the Auditor General. It forms an essential supplement to the Department's Annual Report and is available on the Departmental website. In addition, the ESD Report for the fishery will be completed and reviewed externally every five years.

DEH considers that the annual reporting conducted by DFWA provides valuable information about the status of fish resources under Western Australian management. However, reporting on the SBECF is currently included with all WA blue swimmer crab fisheries, rather than being reported as an individual fishery. DEH considers that public reporting of performance on a fishery-by-fishery basis would enhance transparency and public accountability. This is particularly important given that work on the genetic characteristics of blue swimmer crab have indicated that stocks in WA embayments may be regionally discrete. DEH therefore suggests that for the SBECF, DFWA publicly report against each fishery performance measure on an annual basis (note that a requirement for the development of performance measures for the fishery is expressed in **Recommendations 4 and 5**).

Recommendation 7: *DFWA, in its Annual State of the Fisheries Report, to report on the performance of the SBECF against performance measures that relate to the sustainability of the fishery, once developed*.

Fishery-dependent data relating to the target species are collected on a regular basis in the fishery. Some fishery independent information is also collected. Discussion of the information collection system can be found in Part II of this report.

While the use of crab pots is a relatively benign fishing method, species other than that targeted by the fishery can be captured. An analysis of the fishery's capacity for assessing, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which the target species lives and the fishery operates is contained under Principle Two of this report.

Blue swimmer crabs are distributed widely around Australia and fisheries targeting the species are located in WA, Queensland, New South Wales and South Australia. Further information regarding the distribution of blue swimmer crabs is provided under Principle 1 of this report. A 1997 national workshop at the South Australian Research and Development Institute showed that there was a general lack of knowledge about blue swimmer crabs throughout Australia. Increasingly, the research needs of WA are being included as part of a coordinated national approach to research into blue swimmer crabs. According to DFWA, future meetings between research representatives from Queensland, South Australia and WA will likely guide the direction of research in WA. DEH urges DFWA to use such a forum to pursue collaborative and/or complementary management arrangements across jurisdictions to ensure the sustainability of Australia's blue swimmer crab stocks.

DEH considers that the current management arrangements comply with all relevant threat abatement plans, recovery plans and the National Policy on Fisheries Bycatch. DEH expects that DFWA will also ensure compliance with any future plans or policies as they are developed.

No regional or international management regimes, to which Australia is a party, are of direct relevance to the fishery. The prime international regime affecting the fishery is the United Nations Convention on the Law of the Sea (UNCLOS). The management regime essentially complies with

this. Other international regimes are applicable to fisheries management but do not explicitly involve this fishery, for example the 1992 Convention on Biological Diversity and in particular the 1995 Jakarta Mandate requiring that, in relation to the sustainable use of marine and coastal biological diversity, the precautionary principle should apply in efforts to address threats to biodiversity. While these agreements are not specifically addressed in the submission, the fishery's compliance with their requirements can be assessed by examination of Part II of this report. The application of the International Convention for the Prevention of Pollution from Ships (MARPOL) to vessels operating in the fishery is explicitly discussed under Principle 2, Objective 3.

DEH considers it is incumbent on all authorities to develop a thorough understanding of the framework of national, regional and international agreements and their applicability to export-based fisheries for which they are responsible.

The SBECF has been operating within the area of the Shark Bay World Heritage Area since 1998, although there have been varying degrees of crab fishing in Shark Bay since the early 1990's. Under the EPBC Act, a person may not take an action that has, will have or is likely to have a significant impact on the world heritage values of a declared World Heritage property. People that are taking actions that are a lawful continuation of a use of land, sea or seabed, that was occurring immediately before the commencement of the EPBC Act, may continue to take those actions. An enlargement, expansion or intensification of a use is not a continuation of a use. While the SBECF does operate in a large area of the Shark Bay World Heritage Area, the small scale of the fishery and the relatively benign nature of the gear used means that the World Heritage values for which Shark Bay was listed are unlikely to be impacted. For this reason, and the outcomes of the assessment as listed throughout Part II of this assessment report, DEH considers that fishing activities as currently practiced in this fishery are unlikely to have a significant impact on the world heritage values of Shark Bay in the next three years. Any significant change to existing practices, which is likely to significantly impact on Shark Bay's World Heritage values, will require approval by the Commonwealth Minister for the Environment and Heritage, or his delegate.

Conclusion

DEH has made a number of recommendations to ensure that the SBECF management regime is documented, publicly available and transparent (**Recommendation 7**), and is developed through a consultative process (**Recommendation 3**). DEH considers that the management arrangements are adaptable and, through the implementation of **Recommendations 4 and 5**, will be underpinned by appropriate objectives and performance criteria by which the effectiveness of the management arrangements can be measured, enforced and reviewed.

The management arrangements are capable of controlling the harvest through a combination of input and output controls appropriate to the size of the fishery. Periodic review of the fishery is provided for, as are the means of enforcing critical aspects of the management arrangements.

The management regime takes into account arrangements in other jurisdictions, and adheres to arrangements established under Australian laws and international agreements.

DEH considers that there is scope to further refine the management arrangements and has provided a number of recommendations for improvements in the longer term.

PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES

Stock Status and Recovery

Principle 1: *'A fishery must be conducted in a manner that does not lead to over-fishing, or for those stocks that are over-fished, the fishery must be conducted such that there is a high degree of probability the stock(s) will recover'*

Maintain ecologically viable stocks

Objective 1: *'The fishery shall be conducted at catch levels that maintain ecologically viable stock levels at an agreed point or range, with acceptable levels of probability'*

Information requirements

Fishery dependent data are obtained from the commercial sector through purpose-designed logbooks that are currently used in the SBECF to monitor catch, effort and catch rates for the fishery. Fishers are required to record:

- Date;
- Each line fished (latitude and longitude);
- Number of pots set;
- Depth that pots are set;
- Catch in kg (including target and by-product species);
- Number of undersize blue swimmer crabs;
- Number of berried female blue swimmer crabs; and
- Weather conditions (voluntary).

Data collected are verified through voluntary logbooks and processor returns. Data are also obtained through the 'catch and effort statistics system', which all WA commercial fishers are required to participate in. Data from this system are provided on a monthly basis. The logbooks do not provide catch data on a lift-by-lift basis and DEH considers there is scope to improve the logbook recording system through the inclusion of a more accurate effort measure. DEH suggests that as part of the development of an interim management plan for the fishery that DFWA review existing information collection systems to ensure they provide comprehensive and meaningful information.

Information on take by the recreational sector is not collected on a regular basis due to the general isolation of the area, although a survey of recreational fishing in the Gascoyne bioregion of Western Australia was undertaken between 1998 and 1999. According to this study, an integrated approach where all bioregions are to be surveyed on a regular basis (about once every five-six years) is in place to allow for recording and monitoring of changes in recreational catch and effort (Sumner *et al*., 2002). Additional information on recreational harvest can be derived from the National Recreational and Indigenous Fishing Survey (NRIFS).

Information relevant to the SBECF has also been collected through fishery independent research programs. DFWA currently has one project underway that is examining the stock/recruitment relationship for blue swimmer crabs (Fisheries Research and Development Corporation (FRDC) project 01/068) and DEH expects that the results of this will be useful in evaluating the ecological sustainability of blue swimmer crab catch rates. An additional project has also been completed that examined the basic biology of crabs along the WA coast including catchability relationships, recreational catch surveys, commercial catch monitoring, discard mortality estimation and stock assessment modelling (FRDC project 1998/121).

Research is currently underway to accurately determine the size of the resource in Shark Bay but evidence to date (FRDC 01/068) suggests that crab stocks in Shark Bay are exploited well under the maximum sustainable level at this time.

Primary research initiatives underway include:

- Programs monitoring catch and effort in the Cockburn Sound, Shark Bay and Pilbara fisheries;
- Field surveys monitoring crab stocks in Cockburn Sound and Shark Bay;
- Further development and consolidation of research logbook programs;
- The development of a stock-recruitment relationship for Cockburn Sound; and
- A two-year survey of recreational crab fishing in Cockburn Sound.

DEH understands that an industry workshop on blue swimmer crabs held in South Australia in 1997, highlighted the need for a national approach to research and management of the blue swimmer crab fisheries. The workshop resulted in a national research strategy that identified a number of high priority areas for collaborative research. These were:

- An Australian wide analysis of the stock structure of blue swimmer crabs;
- National assessment of the recreational catch;
- Investigations into density dependent growth and mortality;
- Studies dealing with settlement processes; and
- Coordinated assessment of the stock(s).

DEH commends DFWA on its commitment to the collection of fishery independent data and urges DFWA to use the results of these projects in the development of the interim management plan for the SBECF. However, while the research programs that have been, or are in the process of being, completed are likely to provide useful results for the management of the SBECF, there are also likely to be a number of knowledge gaps that need to be addressed in relation to Shark Bay blue swimmer crab stocks specifically. Given that the SBECF is still in a developmental phase DEH considers that targeted and strategic research in priority areas is needed. While extensive research on the target species may not be possible, DFWA should have a clear idea of what research is essential for improved management of the fishery into the future. DEH suggests that DFWA identify the research needs and priorities for the fishery and clearly articulate these in a strategic research plan. DEH notes that the strategic research plan will need to be implemented within the constraints of available funds, and that an investigation of synergies with research done for other blue swimmer crab fisheries may result in savings in DFWA resources.

Recommendation 8: *DFWA to develop a research strategy for the fishery that:*

- *Identifies research information needs and priorities to meet the management information, stock assessment and performance measurement needs of the fishery; and*
- *Investigates potential synergies with other blue swimmer crab research.*

Overall, given the range of fishery dependent and independent data gathered by DFWA, DEH considers that there is a reliable information collection system in place appropriate to the scale of the fishery. Continuation of existing data collections and research programs, combined with some extension and refinement of such activities will be important for the future management of the fishery. The implementation of **Recommendation 8** is also likely to ensure that knowledge gaps in relation to Shark Bay blue swimmer crab stocks are identified and factored into future research planning for the fishery.

Assessment

No stock assessment on WA blue swimmer crabs has been conducted to date, however DFWA is currently completing an FRDC project that is examining the stock-recruitment relationship of the species. The submission notes that the minimum size limit for blue swimmer crabs and the catch ranges for the fishery will be reviewed upon completion of this project.

The submission argues that since blue swimmer crabs have been harvested in WA waters for more than a decade and catch levels have not declined since the implementation of the fishery, the impact of the fishery on blue swimmer crab stocks can be considered negligible. While the life history characteristics of blue swimmer crab, such as rapid growth, high fecundity and a relatively short life cycle, make them relatively robust to overfishing, DEH notes that the CPUE of blue swimmer crab in Shark Bay declined slightly from 1.77 kg/trap lift in 2000-01 to 1.48 kg/trap lift in 2001-02. While this decline was small, and the 2002-03 figures show that CPUE has again increased to 1.58 kg/trap lift, DEH is concerned that a decline in CPUE may become more pronounced given that catch rates are expected to increase as the fishery develops. DEH considers that the results of the project examining the stock-recruitment relationship of blue swimmer crab will be highly relevant to determining ecologically sustainable catch levels for this fishery and should be used in guiding future management of the SBECF.

The distribution of blue swimmer crabs in WA is well known and the species is found from Albany on the south coast, north along the whole coastline to the Northern Territory. The majority of commercially fished stock is concentrated in coastal embayments between the Peel/Harvey Estuary and Shark Bay.

A report to the FRDC by Chaplin *et al*. (2001) examined genetic determination of the stock structure of blue swimmer crabs in Australia. The study used microsatellite markers to investigate the genetic characteristics of Australian blue swimmer crab assemblages to determine if the assemblages were genetically differentiated and thus constituted different stocks. The results indicated that the Australian blue swimmer crab population is comprised of at least three genetically distinct groups (groups between which there is negligible gene exchange), differentiated by geographical location:

1. the east coast of Australia ranging from at least as far north as Mackay to at least as far south as Port Stephens;
2. the south coast of Australia; and
3. the west coast of Australia ranging from at least as far north as Exmouth Gulf to at least far south as Geographe Bay.

The report also indicated that the ‘west coast group’ may comprise distinct northern and southern groups. At a finer scale, the study provided strong evidence that the assemblages of blue swimmer crabs in different embayments on the west and south coasts of Australia often constituted independent breeding units (different stocks). This result indicates that it is unlikely there would be pronounced recruitment into these embayments from an outside source. Consequently, the overfishing of this species in an embayment could have a highly detrimental and long-term effect on the stock in that waterbody. DEH therefore considers that it is important that the blue swimmer crab stocks in Shark Bay, and fisher effort, are managed in such a way as to prevent depletion of the stock in Shark Bay. This issue is addressed under the ‘Management Response’ section (see **Recommendation 9**).

Potential removals from the blue swimmer crab population include direct harvest by the SBECF, recreational and indigenous harvest, removal as by-product and mortality from damage caused by

trawling operations, illegal harvest and discarding of the species in this fishery. Information collection systems, and their ability to provide reliable information on commercial harvest were discussed in the previous section.

A specific survey of the recreational take of blue swimmer crab in Shark Bay itself has not been undertaken. However, a survey of the Gascoyne region (of which Shark Bay is a part) was conducted in 1998-99, and this survey recorded a catch of 3870 individual crabs for the region as a whole. Based on an average weight of adult blue swimmer crabs of 500 g (Kailola *et al*., 1993), this catch equates to a weight measurement of approximately 1935 kg. The recreational catch in Shark Bay is expected to be less than this figure. The low recorded catch in the survey demonstrates that the recreational take of blue swimmer crab is insignificant when compared with the take by commercial fishers, and can be attributed to the isolation of the Shark Bay area. Indigenous take is considered to be non-applicable, according to the submission, although no surveys on indigenous take have been conducted.

Blue swimmer crabs are also taken as by-product by three trawl fisheries that operate in the area. In 2002, the Shark Bay Prawn Managed Fishery harvested 155 t of blue swimmer crab, the Shark Bay Scallop Managed Fishery took 8.5 t and the Exmouth Gulf Prawn Managed Fishery harvested 12 t of blue swimmer crab. Combined, take in the trawl fisheries is less than half of that taken by the dedicated SBECF. However, the trawl sector has a greater potential to indirectly impact on blue swimmer crab stocks through discard mortality. DEH strongly urges DFWA to take into account the removal of blue swimmer crabs by the trawl fisheries, including potential impacts on discarded blue swimmer crabs, in any future assessment of blue swimmer crab stocks.

Management response

The SBECF management regime aims to maintain ecologically viable stock levels through a range of input and output controls. These measures are outlined in Table 1 and Part I of this report. DEH considers that the combination of controls should ensure adequate protection of the target stocks, but notes that this is contingent upon effective compliance and enforcement measures. The completion of a compliance risk assessment, as required in **Recommendation 6** will assist in ensuring that such compliance is achieved. DEH also notes that DFWA is currently in the process of developing an interim management plan for the SBECF and expects that the implementation of such a plan will help to formalise the current management arrangements.

Currently, the blue swimmer crab stock in Shark Bay is managed through the prohibition on the take of berried females, gear restrictions and through the implementation of a precautionary minimum size limit. Blue swimmer crabs in Shark Bay are sexually mature at about 100 mm CW, and this size is usually achieved after about 18 months. The current minimum size limit of 135 mm CW for the commercial fishery allows crabs the opportunity to spawn before becoming vulnerable to fishing pressure, thus protecting the broodstock. The spawning stock is further protected through the prohibition on take of berried females. DEH considers that the management arrangements in place (particularly the prohibition on the harvest of berried females and the minimum legal size) limit the proportion of the total stock that is available to the fishery currently. However, DEH has concerns about the ability of current management measures to adequately control future effort in the fishery. These concerns stem mainly from the large increase in fishing effort that is occurring as the SBECF develops. In 2000-01 dedicated crab trap fishers in Shark Bay made 140, 430 trap lifts in 707 fishing days. This figure rose to 226, 092 trap lifts over 856 fishing days in 2001-02 and to 245, 600 trap lifts over 987 fishing days in 2002-03. While effort in the fishery is restricted by the number of participants and the number of pots that can be employed, there is potential for catch to increase as fishers become more knowledgeable and as the fishery evolves.

Although there are currently limits on the amount of gear used in the fishery, there has been no assessment of what can be sustainably taken. DFWA therefore needs to ensure that the management arrangements implemented at the development of the fishery continue to ensure that the fishery is managed in a precautionary way. DEH therefore considers that a review of the fishery management regime is necessary, given the potential for increasing effort and catch over time. Such a review should be part of the development of the interim management plan (expected to be completed by end of 2005).

Recommendation 9: *Noting the pending development of the Interim Management Plan and the potential for fishing efficiency to increase and for the fishery to continue to evolve, DFWA to review the management arrangements of the fishery to ensure that blue swimmer crab stocks continue to be fished within ecologically sustainable levels.*

DFWA recognises that stocks in Shark Bay may be an independent breeding unit, and therefore vulnerable to depletion. DFWA manages this risk by employing a highly precautionary minimum size limit, which ensures that egg production cannot be reduced below a level where recruitment overfishing would occur, even if all legal size individuals of the stock were removed.

The submission notes that due to insufficient time series data for catch in the commercial fishery, and the fact that catch is expected to increase given that the fishery is still in a developmental stage, it has not been possible to define acceptable catch ranges, performance measures and indicators for the SBECF. However, according to the submission, information that will allow acceptable catch ranges to be defined should be available within the next five years. The development of an interim management plan for this fishery provides DFWA with an opportunity to develop appropriate performance measures within which the fishery must operate. Such performance measures would be beneficial to the fishery, particularly given that DFWA has identified a number of management responses, including reduction in pot numbers and introduction of a seasonal closure. DEH considers that these management responses are appropriate and would benefit from being linked to performance measures. A recommendation to this effect has been made previously (see **Recommendation 4**).

Two crab species are allowed to be retained as by-product in the SBECF – the coral crab (*Charybdis cruciata*) and the sand crab (*Ovalipes australiensis*). Any other species caught must be returned to the water unharmed. Coral crabs are generally found in marine coastal waters on a range of bottom types including mud, sand, rock and seagrass in depths of up to 60 m. They are not targeted by the SBECF, but their abundance at certain times of the year, especially in the northern regions of the state, means they are sometimes landed. Over the last five years, reported catches of coral crab from Shark Bay have significantly fluctuated from 205 kg in 2000-01 to a peak of 1705 kg in 2001-02. Given the low level of catch, and because the species covers a vast area of the WA coastline, has a short lifecycle and high fecundity, the impact of the SBECF on the coral crab is considered to be negligible. Similarly, while fishers are permitted to retain sand crabs landed as by-product, there has been no recorded catch of sand crab from Shark Bay. Statewide, commercial catches of this species have remained below 700 kg over the last five years. Consequently, the impact from the SBECF on the sand crab population was also considered low. DEH concurs that the current level of harvest of these species from the SBECF is unlikely to significantly impact the stock status of these species, and notes that by-product is currently required to be recorded in commercial fishers logbooks in the SBECF. While this provides a good mechanism for monitoring the catch of by-product species, DEH considers that performance measures for by-product species should be established, particularly given the wide fluctuation in catch of coral crab. Such performance measures will allow DFWA to respond to any significant changes in catch of either

species if necessary. A recommendation for the development of such performance measures for by-product species was made previously (see **Recommendation 4**).

Conclusion

DEH considers that the management regime in the SBECF is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to over-fishing. DEH considers that the information collection system and management arrangements generally are sufficient to ensure that the fishery is conducted at catch levels that maintain ecologically viable stock levels with acceptable levels of probability.

DEH considers that there is scope to further refine some of the existing information collection, assessment and management responses and has provided a number of recommendations for improvements in the longer term.

Promote recovery to ecologically viable stock levels

Objective 2: *'Where the fished stock(s) are below a defined reference point, the fishery will be managed to promote recovery to ecologically viable stock levels within nominated timeframes'*

This objective is not applicable to the SBECF at present, however without established performance indicators and measures, the point at which blue swimmer crabs are considered overfished is not defined. As noted earlier, such performance measures and indicators have not yet been developed because the fishery is still in a developmental stage, and catch rates are still expected to increase. DFWA has identified potential management responses that could be implemented if stocks appear to be overfished, such as a reduction in pot numbers or the introduction of a seasonal closure. DFWA has the power to implement such changes within a season, or prior to the beginning of the next season. While these management responses are sound, DEH has made a recommendation (see **Recommendation 4**) that DFWA develop performance measures and indicators as part of the development of an interim management plan for the SBECF. The development of performance measures in this fishery is particularly important given the potential for catch to increase as the fishery develops and fishers become more efficient.

Conclusion

DEH considers that the blue swimmer crab stock is not below a defined reference point but should that occur in the future, the fishery is conducted such that there is a high degree of probability the stock would recover to ecologically viable stock levels within nominated timeframes.

Ecosystem impacts

Principle 2: *'Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem'*

Bycatch protection

Objective 1: *'The fishery is conducted in a manner that does not threaten bycatch species'*

Information requirements

Fishers in the SBECF are required to record bycatch in their logbooks, including discards of undersize and berried female blue swimmer crabs. Information has also been obtained through communication with the fishers in the SBECF and other similar fisheries, monitoring programs in other WA fisheries that utilise similar fishing methods, and through communication with the Department of Conservation and Land Management.

While no dedicated studies relating to bycatch associated with the SBECF have been conducted, DFWA suggests that an indication of the likelihood and impact of bycatch from the SBECF can be gained by comparing it with fisheries such as the 'Western Rock Lobster Managed Fishery' and the 'West Coast Deep Sea Crab Fishery'. DEH cautions against using these fisheries as a basis for risk assessment since these other fisheries operate in offshore, deep water areas and the composition and abundance of bycatch is likely to vary regionally and be significantly different to that taken in the SBECF.

An internal workshop was conducted by DFWA to complete the ESD report for the SBECF. This process identified six groups as potential bycatch from the SBECF – finfish, octopus, other crabs, starfish, whales, dolphins and turtles. All of these groups were considered to be at negligible risk.

While no fishery independent bycatch monitoring is conducted within the fishery, DEH accepts that DFWA can monitor changes in bycatch from fishery dependent data and that the specialised gear used in the fishery is likely to limit bycatch.

Assessment

Species that have been identified as being caught in crab pots occasionally, include Northwest (NW) blowfish (*Lagocephalus sceleratus*), NW Snapper (*Lethrinus nebulosus*), leather jackets, box fish, octopus, other crabs and star fish. A risk assessment was conducted for all groups of species identified, and each group was given a 'negligible risk' rating.

This rating was mainly based on the fact that crab pots are seen as an inefficient means of catching non-target species, and most species would be able to leave the pots through the entrance gaps in the side of the pots either while it is soaking or while it is being hauled to the surface. In addition, the pots/traps themselves do not inflict damage to caught species since the rigid size and structure of the pots effectively eliminates the potential for bycatch to be crushed or damaged through the weight or body structure of other bycatch species. These factors, combined with the fact that the waters of Shark Bay are relatively shallow (therefore minimising the risk of barotrauma in fish), indicate that there is likely to be a high rate of survival of released bycatch and discarded blue swimmer crabs, providing fishers ensure time out of water is kept at a minimum.

DEH concurs with the conclusion by DFWA that the SBECF is currently unlikely to have a significant impact on bycatch species. While fishers are required to record bycatch in their logbooks, it is also important that fishers are made aware of the importance of handling undersize crabs correctly to minimise bycatch mortality. As with most fisheries, the practices employed by fishers varies from sorting each pot immediately after it is lifted to sorting the entire catch at the end of the day. The latter practice results in unnecessary mortalities of discarded crabs since few would survive being kept out of the water for up to 5 hours. DEH strongly urges DFWA to make fishers aware of handling techniques for bycatch, especially juvenile crabs, to maximise survivability of bycatch.

Management response

The management regime requires that blue swimmer crab pots include escape gaps. DEH considers that this management measure is likely to reduce the incidence of bycatch in the SBECF.

The submission indicates that DFWA does not consider additional bycatch reduction measures and monitoring of bycatch species are necessary based on the results of the risk assessment performed. Further, no indicator species has been identified in the submission. The risks associated with the groups of species identified as potentially comprising bycatch in the SBECF will be reassessed at the next major review of the fishery, which will occur within five years as a requirement of the WA ESD policy.

DEH concurs that, under current effort levels and using current gear, the fishery is unlikely to threaten bycatch. In addition, the requirement for fishers to record bycatch in logbooks is likely to ensure that any significant changes in bycatch abundance or composition are detected. Similarly, the development of an objective to minimise or maintain at sustainable levels the take of non-retained species (as required under **Recommendation 5**) is likely to minimise impacts to bycatch species.

Conclusion

DEH considers that there is a high likelihood the fishery is conducted in a manner that does not threaten bycatch species. Should this situation change, or a risk assessment process indicate otherwise, DEH expects that DFWA would undertake appropriate actions to ensure that bycatch species are not threatened by this fishery.

Protected species and threatened ecological community protection

Objective 2: *'The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities'*

Information requirements

As part of DFWA's logbook requirements, fishers must record all interactions with protected species and report all interactions to DFWA and to the Department of Conservation and Land Management. Information is also available from unpublished data from the Department of Conservation and Land Management.

DEH considers that it is important that information collected on protected species interactions is accurate and validated, so that DFWA can confidently identify practices that are causing interactions, areas that are more likely to result in protected species interactions, the nature of such interactions and also whether or not it led to the mortality of protected species. DEH therefore considers that the SBECF may benefit from an education program that enables accurate reporting, promotes appropriate handling techniques and highlights the importance of minimising interactions with protected species.

Recommendation 10: *DFWA to implement an education program to ensure that industry has the capacity to make protected species reports at an appropriate level of accuracy*.

Assessment

A risk assessment of the likelihood of interaction between fishers in the SBECF and each of the listed species likely to occur in the area of the fishery has been undertaken internally by DFWA. The assessment concluded that the SBECF did not capture any protected species. For species that fell under the 'direct interaction but no capture' category (whales, dolphins and turtles), the assessment concluded that the fishery was of negligible risk.

A number of species of conservation interest are known to occur near the area of the fishery. Two species of whale are regularly observed migrating along the coast of WA, the Humpback whale (*Megaptera novaengliae*) and the southern Right Whale (*Eubalaena australis*). According to the submission, unpublished data from the Department of Conservation and Land Management report a total of 20 incidences of migrating whales becoming entangled in rope associated with various fishing operations between 1985 and 2003. None of these incidences resulted in the death of a whale. There have been no reports of whales becoming entangled in fishing gear associated with the SBECF specifically. DEH consider that interactions with whale species by the SBECF are likely to be minimal given the relatively shallow water of Shark Bay and the low number of incidences reported to date.

Two species of dolphins have been reported following crab boats, the Bottlenose dolphin (*Tursiops truncates*) and the common dolphin (*Delphinus delphis*). There have been no reports of negative interactions with dolphins from any of the WA blue swimmer crab fisheries. DEH therefore considers that the risk of interaction with dolphins by the SBECF is minimal.

The Leatherback turtle (*Dermochelys coriacea*) and the Loggerhead turtle (*Caretta caretta*) are both found on the west coast of WA. The submission suggests that the main risk of interactions between fishing operations and these species is from boat strikes and entanglement in ropes and lines, not from capture within the pots. The submission notes that the incidence of turtles becoming entangled in pot lines is less than one per year and that there have been no reports of boat strikes or entanglements of turtles in the SBECF. While other blue swimmer crab fisheries in Australia have shown evidence of interaction with marine turtles, the potential for entanglement in SBECF pots is low, given the specialised design that prohibits turtles from entering the pots. While DEH accepts that the potential for protected species interaction in the SBECF is low, as a result of the small number of operators and the limits on number of pots that can be set, DEH will be paying particular attention to any future interactions with protected species and whether there are any areas where protected species are particularly at risk of interacting with the fishery. The monitoring of these issues is important since Shark Bay represents the southern limit for a number of marine turtle species. **Recommendation 10** should ensure that fishers are aware of the importance of reporting such interactions and ensure the reliability of reports of protected species interactions.

As there are no threatened ecological communities in the fishery areas, no fishery-specific assessments into impacts on threatened ecological communities are being done or are planned.

Management response

Management of protected species interactions in the fishery relies upon the specialised design of pots used in the fishery, the limited number of commercial fishers and pots, and the relative frequency with which pots are checked. DEH concurs that this may be an appropriate approach to managing protected species interactions, although the frequency of interactions may increase as the SBECF develops, and DFWA needs to be able to respond to such changes. The submission notes that, should any interactions occur, management arrangements would be reviewed and measures implemented as required.

DEH believes that the education program required under **Recommendation 10**, should improve knowledge and data reliability over the coming years. In addition, the development of an objective to minimise protected species interactions, as required in **Recommendation 5**, should ensure that the risk of interactions between the SBECF and protected species remains low.

There are no declared threatened ecological communities in the blue swimmer crab fishery area, and therefore these provisions in the Guidelines are not applicable.

Conclusion

DEH notes that there are minimal interactions with protected species in this fishery and considers that the fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities. Should this situation change, or a risk assessment process indicate otherwise, DEH expects that appropriate actions will be undertaken to ensure the fishery avoids mortality or injury to these species and avoids or minimises impacts on threatened ecological communities.

Minimising ecological impacts of fishing operations

Objective 3: *'The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally'*

Information requirements

According to the submission, the impact of the fishery on the environment generally is likely to be low. Sources of data include anecdotal evidence, research in this fishery and other similar fisheries, and commercial fishery logbooks including protected species reporting.

DEH notes the lack of information collection and research covering the fisheries impact on the ecosystem and environment generally. However, DEH understands that this lack of information is the case across a range of Australian and international fisheries and until appropriate research techniques and programs are developed and implemented this will continue to be the case. DEH strongly supports research in this area.

Assessment

DEH recognises that, as in most pot fisheries, the potential for the blue swimmer crab fishery to impact unacceptably and unsustainably on the environment is generally considered to be low. Regardless, a risk assessment was performed by DFWA for each of the general ecosystem issues identified as being relevant to the SBECF. These were ghost fishing, impacts to benthic biota (sand and seagrass), discarding/provisioning and debris.

Physical impacts are assumed to be minimal because blue swimmer crab pots are relatively lightweight and stable, and only minimal dragging on the benthos occurs as pots are retrieved. The mesh used on pots is also sufficiently large to enable sand dwelling macrobenthos to escape. Clearly, some macrobenthos may be directly impacted upon when pots are placed on the benthos, but since pots are moved around this impact is likely to be minimal. In addition, seagrasses are occasionally directly impacted upon when brought to the surface with the pot, although this only occurs infrequently and is not expected to have a significant impact. DEH notes that the potential to

impact on the benthic environment may become more significant as the SBECF develops, particularly if it develops in environmentally sensitive habitats.

Because pots are set on the benthos and hauled to the surface quickly for checking, impacts to water column communities are considered negligible.

The main potential threat to the ecosystem generally is likely to be the annual take of legal size blue swimmer crabs. The submission argues that the commercial take of crabs represents a relatively small portion of the biomass of crabs in Shark Bay and that the stock is effectively renewed annually. There are also strengths in the blue swimmer crab lifecycle that give them resilience to fishing pressure including high fecundity, a protracted spawning period, rapid growth and early sexual maturation. The results of the study on the spawning/recruitment relationship of blue swimmer crabs in Shark Bay are likely to provide more information on ecosystem impacts caused by the take of blue swimmer crab.

The impact of the fishery on ecological communities, related species and the structure and productivity of food webs is unknown and little work has been done on the trophic role of blue swimmer crabs. The larval stage of the blue swimmer crab is planktonic and as such may be a source of food for plankton-eating organisms such as fish and jellyfish. Post-larvae and juveniles are presumed to be eaten by a wide variety of fish species and other crustaceans. Blue swimmer crabs are likely to form only one of many prey for these species and, given current management practices that ensure there is an abundance of size classes under the legal size limit of 135 mm CW, associated predator species are not considered to be significantly affected by the fishery. Adult blue swimmer crabs are prey to large fish, turtles, sharks and rays. DFWA claim that secondary food chain effects from the SBECF are likely to be minimal, however, this claim has not been validated through research in this area. DEH suggests that, as more detailed biological data becomes available, a more formal risk assessment would provide greater certainty of the sustainability of ecosystem impacts. DEH suggests that DFWA undertake work to assess the risk of removing blue swimmer crabs from the ecosystem. Particular attention should be given to identifying the impacts on ecologically dependent and related species.

Ghost fishing generally is not considered an issue, mainly because the gear used in the SBECF generates minimal non-retained species and the design of the pots (side entry, escape gaps and mesh size) is such that they do not ‘ghost fish’ if lost. The number of pots lost each year is unknown but, according to the submission, is likely to be low. Anecdotal evidence and observations by DFWA staff demonstrate that blue swimmer crabs and other large animals are rarely seen in any pot without bait, showing that animals are able to escape from the pot if given enough time. Given the specialised design of pots used in the SBECF, DEH concurs with this assessment.

DFWA recognise that some non-retained species in this fishery may be considered to provide a food source to species following the vessels (sharks, dolphins) or on the bottom (sharks, finfish and invertebrates) when discarded. However, the amount of finfish and invertebrates discarded by this fishery is small and since traps are usually left soaking for several days between hauls, little bait remains when the pots are brought to the surface. It is therefore considered that the small quantities of discarded catch and bait would be unlikely to have a significant on the marine environment.

Water quality and air quality are not considered at significant risk from the SBECF. There is a general code of practice among crab fishers to return packaging and garbage back to the wharf. Waste disposal bins are located at all points where commercial boats dock and, given the relatively closed area of the fishery, and therefore exposure to other commercial fishers, it is considered that impacts to water quality through littering is likely to be low.

Management response

The submission indicates that no management actions or strategies are in place specifically to address the effect of the fishery on the marine environment generally. While the impact of removing large quantities of blue swimmer crab on the ecosystem is unknown, the nature and scale of the fishery is likely to cause little impact to the physical environment.

The submission notes that the most important management measures required to ensure that there is minimal impact on the general ecosystem include maintaining sufficient stock/biomass levels of the target species. In the SBECF, this is facilitated through the protection of berried females and through a precautionary minimum size limit that ensures crabs are able to spawn at least once before becoming vulnerable to fishing. The protection of the spawning stock ensures that the biomass of the target species can be renewed annually, thereby minimising the potential for any trophic interactions. Other management measures in place that are likely to minimise ecosystem impacts include limited entry and gear restrictions.

As the fishery area contains Commonwealth waters, operators are required to comply with the MARPOL. The submission is silent on specific actions and requirements in the fishery related to prevention of marine pollution from vessels. Given the nature and scale of the fishery DEH is satisfied that the fishery may not be in breach of MARPOL obligations.

DEH considers that the future management of the fishery would be enhanced if a specific system based management objective relating to ecosystem impacts were to be developed. Such an objective could form the basis of the development of indicators and measures as management of the fishery develops. The need for an ecosystem based objective has been addressed through **Recommendation 5**.

Because the area of the fishery includes the Shark Bay World Heritage Area, consideration needs to be given to potential impacts on this matter of national environmental significance by the SBECF. However, due to areas of Shark Bay being closed to fishing, the small scale of the fishery and the relatively benign nature of the fishing methods employed, DEH considers that the fishery, if operated consistently with the current management regime, is unlikely to have a significant impact on the World Heritage values of Shark Bay.

Conclusion

DEH considers that the fishery is conducted in a sufficiently precautionary manner to minimise the impact of fishing operations on the ecosystem generally. A number of suggestions have been made to ensure that the risk of significant impact by the fishery on the marine environment generally is minimised in the longer term. In addition, all of these issues will be reassessed by DFWA within five years and if there is an increase at that time in the risk of these issues, DFWA will investigate ways to mitigate the impacts.

The area of the SBECF encompasses the Shark Bay World Heritage Area, and as such, impacts to this matter of national environmental significance have been considered. However, it is considered that the management regime in place is consistent with the values for which the Shark Bay World Heritage Area was listed. On this basis, DEH considers that an action taken by an individual fisher, acting in accordance with the fishery management regime, would not be expected to have a significant impact on the World Heritage Area protected under the EPBC Act.

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LIST OF ACRONYMS

CPUE	Catch Per Unit Effort
CW	Carapace Width
DEH	Department of the Environment and Heritage
DFWA	Department of Fisheries, Western Australia
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Ecologically Sustainable Development
FRDC	Fisheries Research and Development Corporation
MARPOL	International Convention for the Prevention of Pollution from Ships
NRIFS	National Recreational and Indigenous Fishing Survey
NW	Northwest
SBECF	Shark Bay Experimental Crab Fishery
UNCLOS	United Nations Convention on the Law of the Seas
WA	Western Australia
WTO	Wildlife Trade Operation