Australian Government

Department of the Environment and Heritage

Assessment of the

Northern Developmental Blue Swimmer Crab Fishery

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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 Northern Developmental Blue Swimmer 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 *Draft Application to the Australian Government Department of Environment and Heritage on the Northern Developmental Blue Swimmer Crab Fishery* (the submission) was received by the Department of the Environment and Heritage (DEH) in November 2005. The submission was released for a thirty-day public comment period that expired on 23 December 2005. No public comments were received. A final submission for assessment was received in December 2005.

The submission reports on the Northern Developmental Blue Swimmer Crab Fishery (NDBSCF) against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission, associated documents, public comments and DFWA's response to the comments.

Table 1: Summary of the NDBSCF

Area	Waters to the 200 m isobath between 115°E latitude and 120°E latitude, from approximately Onslow to Port Hedland on the northwest Western Australia coast in the Pilbara region.
Fishery status	Unknown.
Target Species	Blue swimmer crab (*Portunus pelagicus*).
Byproduct Species	Coral crab (*Charybdis cruciata*) and sand crab (*Ovalipes australiensis*). No recorded catch of sand crab in the NDBSCF to date.
Gear	Crab traps – design must be approved by DFWA.
Season	No closed season, although less fishing is undertaken in summer due to unfavourable weather conditions.
Commercial harvest 2004	49.1 tonnes of blue swimmer crab (reduction of 24% from 64.2 tonnes taken in 2003).
Value of commercial harvest	Approximately $6.50/kg, or around $325 000 in total.
Recreational harvest	20 tonnes estimated to have been taken in the region in 1999-2000.
Commercial licences issued	Two commercial fishers are authorised to operate in the NDBSCF.
Management arrangements	Commercial sector: compulsory logbook reporting requirement, limited entry, species restriction, gear restrictions (design and number of traps), 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	Most exported product is sent to Singapore.
Bycatch	Considered low, but unquantified.
Interaction with Threatened Species	Considered low. Possible interactions with marine turtles.

The NDBSCF occupies waters out to the 200 m isobath between 115°E latitude and 120°E latitude, from approximately Onslow to Port Hedland on the northwest Western Australia coast in the Pilbara region. Each exemption holder has slightly different fishing area boundaries, with exemption holder one being permitted to fish within the zone 115°6'60 E to 120°E, and exemption holder two being permitted to fish within the zones 115°E to 116°45'E and 117°E to 120°E. The fishery area extends into Commonwealth waters however the entire fishery is managed by Western Australia under an Offshore Constitutional Settlement between the Australian Government and the Government of Western Australia.

The fishery targets blue swimmer crab (*P. pelagicus*). Operators in the NDBSCF are also permitted to retain coral crabs (*C. cruciata*) and sand crabs (*O. australiensis*) as byproduct. However, only very low levels of coral crab have been landed as byproduct in the NDBSCF and there have been no recorded catches of sand crab.

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 Western Australia (WA) coast, although the commercially fished stocks are found in the area between Bunbury and Mandurah, the Peel/Harvey Estuary, Comet Bay (near Mandurah), Warnbro Sound, Cockburn Sound, the Swan/Canning Estuary, Shark Bay, Exmouth and Nickol Bay.

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 crabs are a fast growing, early maturing and highly fecund species that exploit a broad ecological niche. Female crabs spawn up to 2 million eggs per batch, with larger crabs producing more eggs than smaller crabs. In the subtropical waters of the NDBSCF, ovigerous females can be found year round, although a peak in spawning is evident in the spring months. The size at which maturity occurs varies with latitude and within individuals at any location (Kailola *et al*., 1993). In a WA study, the 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. While no specific research on size at maturity has been conducted in the NDBSCF, the geographical characteristics of the region, crab distribution and water temperature are similar to Shark Bay. It is therefore believed that size at sexual maturity of blue swimmer crabs in the area of the NDBSCF is similar to that of crabs in Shark Bay, at approximately 100 mm CW.

Approximately 49.1 tonnes of blue swimmer crab were harvested in the NDBSCF in 2004, at an estimated value of AU$325 000. Catch in the NDBSCF constitutes less than 6% of the state's total annual catch of blue swimmer crab in 2004. The NDBSCF is an experimental fishery that has been in operation since 2001. Catch and effort in the fishery both rose from 2001 until 2003, before declining in 2004. In 2001 9.9 tonnes of blue swimmer crab were harvested from 19 200 trap lifts. These figures rose to 64.2 tonnes from 68 500 trap lifts in 2003, before declining to 49.1 tonnes from 30 660 trap lifts in 2004. Most of the exported product from the NDBSCF is sent to Singapore.

The NDBSCF uses purpose-designed crab traps. As the NDBSCF is in the experimental phase, specifications on trap design have not been formalised, however all trap designs must be approved by DFWA prior to use within the fishery. Traps 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 traps used in the NDBSCF.

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

- regulation of the number of licenses (currently limited to two exemptions);
- 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 WA).

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 traps 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 NDBSCF 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 considered significant. A survey of recreational crabbing in the region of the NDBSCF estimated a blue swimmer catch of 20 tonnes in 1999-2000, most of which was caught from Nickol Bay. Blue swimmer crabs are also targeted in a number of commercial fisheries within WA, although the populations targeted are likely to exhibit limited movement between bays and estuaries along the coastline. The extent to which DFWA accounts for the removal of blue swimmer crabs by other fisheries in the management of the NDBSCF is discussed in Part I.

The *Fish Resources Management Act 1994* provides the legislative framework to implement the management arrangements for the NDBSCF, which is currently managed through a combination of exemptions and conditions on Fishing Boat Licences.

Overall assessment

The material submitted by DFWA demonstrates that the management arrangements for the NDBSCF meet most of the requirements of the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*.

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

- the fishery is in the developmental stage with no formal management arrangements and is likely to expand in the future as the fishery develops;

- 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 fishery specific objectives, performance measures and performance indicators for byproduct, bycatch and protected species and for ecosystem impacts; and
- lack of an established sustainable yield for blue swimmer crab stocks targeted in the NDBSCF.

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.

The NDBSCF is in a developmental stage and has made considerable progress in developing sound management arrangements. 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 seabirds, marine turtles and cetaceans. However, the small scale of the NDBSCF 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 NDBSCF 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 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 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 NDBSCF'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 Ecologically Sustainable Development (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, 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. DFWA, in its Annual State of the Fisheries Report, to report on the performance of the NDBSCF against performance measures that relate to the sustainability of the fishery, once developed.

7. 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.

8. Noting the potential for fishing efficiency to increase and for the fishery to continue to evolve, DFWA, by the end of 2007, to review the management arrangements of the fishery to ensure that blue swimmer crab stocks continue to be fished within ecologically sustainable levels.

9. 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 NDBSCF is managed by the 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*;
- exemption conditions;
- ESD Report; and
- the DFWA submission *Draft Application to the Australian Government Department of the Environment and Heritage on the Northern Developmental Blue Swimmer Crab Fishery*.

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

DEH considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Because of 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: *DFWA to advise DEH of any material change to the NDBSCF's legislated management regime that could affect the criteria on which EPBC decisions are based, within three months of that change being made*.

An 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 concern for 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*.

As the NDBSCF is currently in a developing phase, appropriate groups to be consulted on matters regarding the fishery have not been defined within a management plan. However, DFWA does

consult with industry, recreational fishers and the wider community to ensure the management process is kept somewhat transparent. Before amending or introducing any legislation or policy, DFWA consults with representatives of the recreational sector, the WA Fishing Industry Council and any other interested party, depending on the issue. The DFWA Research Division provides technical and research expertise on management of the NDBSCF while the Commercial Fisheries Program oversees the strategic management and policy aspects of the fishery. DEH is confident that adequate expertise is involved in management of this small-scale fishery, but considers that consultation with relevant groups is vital in ensuring stakeholder participation and transparency in management decision-making processes and consequently has some concern that consultation is currently limited to industry representatives and only conducted on an ad hoc basis.

Recommendation 3: *DFWA to ensure, where appropriate, that any relevant indigenous, conservation, 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 arrangements for the various blue swimmer crab fisheries. These objectives are complementary to those stated in the *Fish Resources Management Act 1994*. While an objective and indicator have been developed for the target species of the NDBSCF, 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 the lack of information regarding the blue swimmer crab stocks in the area of the NDBSCF reinforces the importance of establishing precautionary performance measures.

In addition, a management objective based on the portion of stocks that can be sustainably harvested has not been established for byproduct species, nor have performance indicators or measures for these species. While the amount of byproduct taken in the NDBSCF is generally low (there has been no recorded catch of sand crab from the NDBSCF), DEH considers that fluctuations in the abundance of coral crabs at certain times of the year can mean they are landed in increased quantities. Performance measures for byproduct species therefore need to be established to ensure that significant changes in catch levels can be detected and acted upon, thus decreasing the risk to byproduct species.

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 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 byproduct, 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 traps that can be used, spatial restrictions for each exemption holder, prohibition on the take of berried females, and minimum size limits. Differential size limits are in place throughout WA, 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 for blue swimmer crabs in northern waters of WA is approximately 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 currently limited to two.

Few compliance resources are directed at the NDBSCF given the small size of the fishery. However, the Karratha District Office currently services the fishery by delivering a range of at-sea and on-land inspections with the majority of checks being conducted at the point of landing and at processing establishments. These inspections typically focus on ensuring compliance with minimum legal size limits, ensuring that berried females are not retained, checking that no bycatch is being retained, and ensuring gear compliance and that operators hold a current authorisation. DFWA also considers that the close proximity of the fishery to the Karratha township generates a degree of community interest that is likely to further assist in ensuring compliance with management arrangements.

A number of incidents of non-compliance have been reported for the NDBSCF. These have related to fishing outside the permitted area of operation and failure to hold a commercial fishing license. DEH notes that the first of these offences resulted in prosecution and conviction, while the second was dealt with by infringement notices. While DEH has some concerns that the remote locality of the fishery may pose an increased compliance risk, DEH is satisfied that monitoring and enforcement of management arrangements is being provided by the Karratha District Office at a level appropriate for the scale of the fishery.

DFWA plans to conduct an annual review of the performance of major aspects of the fishery 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 WA management. However, blue swimmer crab fisheries have, in the past, been reported on collectively, rather than as individual fisheries. 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 recommended, in its assessment of the Shark Bay Experimental Crab Fishery, that DFWA publicly report against each fishery performance measure for the fishery on an annual basis, and considers

that the same arrangement would be beneficial for the NDBSCF (note that a requirement for the development of performance measures for the fishery is expressed in **Recommendations 4 and 5**).

Recommendation 6: *DFWA, in its Annual State of the Fisheries Report, to report on the performance of the NDBSCF against performance measures that relate to the sustainability of the fishery, once developed.*

Fishery-dependent data relating to the target species is 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 with fisheries targeting the species 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 addressed 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.

Conclusion

DEH has made a number of recommendations to ensure that the NDBSCF management regime is documented, publicly available and transparent (**Recommendation 6**), 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 NDBSCF to monitor catch, effort and catch rates for the fishery. Fishers are required to record:

- licence number, vessel name and date;
- any non-fishing periods;
- names of collectors and collection methods used;
- names of species collected;
- number of traps, fishing location, trap depth and soak time;
- number of baskets of crabs and weight of retained catch;
- bycatch; and
- general remarks (ie., weather, gear failure).

Each operator in the NDBSCF is also required to provide a written report to DFWA at the beginning of each year in relation to fishing activities undertaken in the previous year. Details that are required include:

- the quantity of crabs taken, the number of days spent fishing for crabs, the type and quantity of gear used and the areas fished for crabs during each month of operation;
- any bycatch;
- the markets to which crabs were sold;
- progress towards achieving business plan objectives; and
- goals and targets for the following 12 months.

Data is 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 DFWA review existing information collection systems to ensure they provide comprehensive information.

Information on take by the recreational sector is not collected on a regular basis, although a specific survey of recreational take was conducted during 1999-2000. No subsequent surveys have been conducted since. Additional information on recreational harvest can be derived from the National Recreational and Indigenous Fishing Survey (NRIFS).

Information relevant to the NDBSCF 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 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) was completed in 2000/01.

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. 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 NDBSCF, there are also likely to be a number of knowledge gaps that need to be addressed in relation to blue swimmer crab stocks in the area of the fishery specifically. Given that the NDBSCF 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 in 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 completed for other blue swimmer crab fisheries may result in savings in DFWA resources. In particular, DFWA committed to the development of a research strategy for the Shark Bay Experimental Crab Fishery as part of the recommendations arising from the assessment of that fishery under the EPBC Act. DEH considers that the research strategy for that fishery and the NDBSCF could be developed in an integrated fashion.

Recommendation 7: *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 7** is also likely to ensure that knowledge gaps in relation to NDBSCF 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, and the stock-recruitment relationship for the target species is currently unknown. However, the life history characteristics of blue swimmer crab, such as rapid growth, high fecundity and a relatively short life cycle, along with the management measures implemented in the NDBSCF make blue swimmer crabs relatively robust to overfishing. DEH also notes that the catch-per-unit-effort of blue swimmer crabs has continued to rise since the development of the NDBSCF, indicating that the stocks are not being overfished. DFWA is currently completing an FRDC project (2001/068) that is examining the stock-recruitment relationship of the species. DEH considers that the results of this project will be highly relevant to determining the ecologically sustainable catch levels for this fishery, and encourages DFWA to use these results to guide future management of the NDBSCF.

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 it important that blue swimmer crab stocks targeted in the NDBSCF, and fisher effort, are managed in such a way as to prevent localised depletion of the stock. This issue is addressed under the ‘Management Response’ section (see **Recommendation 8**).

Removals from the blue swimmer crab population include direct harvest by the NDBSCF, recreational and indigenous harvest, 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 was conducted in 1999-2000. This survey estimated that the recreational harvest (20 tonnes) is currently equivalent to around 50% of the NDBSCF commercial harvest. According to the submission, this result is consistent with the

high popularity of the area with recreational crab fishers. While the proportion of recreational harvest is high compared to the commercial take, it is clear that the level of harvest by both sectors is currently low and unlikely to result in overfishing of the stock. A range of measures have been incorporated into the NDBSCF to ensure that harvest by the recreational sector is factored into management of the commercial fishery. These are discussed in the 'Management response' section below. Indigenous take is considered to be non-applicable, according to the submission, although no surveys on the indigenous take of blue swimmer crabs have been conducted.

Management response

The NDBSCF 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. However, DEH notes that the fishery is currently managed by Exemptions, and not under a formal management plan. DEH considers that the development of such a management plan would help to ensure the long term sustainability of the fishery and encourages DFWA to pursue the development of a formal management plan for the NDBSCF.

Currently, the blue swimmer crab stock in the NDBSCF 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 northern waters are thought to be 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. Research investigating the recruitment dynamics of blue swimmer crab stocks in Cockburn Sound (FRDC Project 98/121) found that high levels of fishing had minimal effect on the fecundity of mature crabs. The researchers suggested that a reduction in the legal minimum size limit would still ensure adequate protection to brood stocks, although DFWA has not made any such changes to the legal size limit, indicating that the current minimum size limit is highly precautionary. The spawning stock is further protected through the prohibition on the take of berried females. DEH considers that the management arrangements in place limit the proportion of the total stock that is available to the fishery currently. However, DEH has some concerns about the ability of current management measures to adequately control future effort in the fishery as it expands. These concerns stem mainly from the large increase in fishing effort that has occurred in the NDBSCF. In 2001, dedicated crab trap fishers made 19 200 trap lifts, while in 2003 this figure rose to 68 500. While effort in the fishery is restricted by the number of participants and the number of pots that can be employed, DFWA acknowledge that catch is likely to increase as the fishery develops and there is also potential for catches 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.

Recommendation 8: *Noting the potential for fishing efficiency to increase and for the fishery to continue to evolve, DFWA, by the end of 2007, to review the management arrangements of the fishery to ensure that blue swimmer crab stocks continue to be fished within ecologically sustainable levels.*

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 NDBSCF. 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 a management plan for this fishery would provide DFWA with an opportunity to develop appropriate performance measures within which the fishery must operate and DEH has encouraged DFWA to pursue this option. Such performance measures would be beneficial to the fishery, particularly given that DFWA has identified a number of management responses, including a reduction in pot numbers and the 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 byproduct in the NDBSCF – the coral crab (*C. cruciata*) and the sand crab (*O. 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 NDBSCF, but their abundance at certain times of the year means they are sometimes landed. Only very small amounts of coral crab have been reported from the NDBSCF. 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 NDBSCF on the coral crab is considered to be negligible. Similarly, while fishers are permitted to retain sand crabs landed as byproduct, there has been no recorded catch of sand crab from the NDBSCF. Statewide, commercial catches of this species have remained below 700 kg over the last five years. Consequently, the impact from the NDBSCF on the sand crab population was also considered low. DEH concurs that the current level of harvest of these species from the NDBSCF is unlikely to significantly impact the stock status of these species, and notes that byproduct is currently required to be recorded in commercial fisher's logbooks in the NDBSCF. While this provides a good mechanism for monitoring the catch of byproduct species, DEH considers that performance measures for byproduct species should be established, particularly given the seasonal abundance of coral crabs in northern WA waters. 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 byproduct species was made previously (see **Recommendation 4**).

Conclusion

DEH considers that the management regime in the NDBSCF 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 stock assessment 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 NDBSCF 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 for the NDBSCF. 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 NDBSCF are required to record bycatch in their logbooks. Information on the composition and abundance of bycatch has also been obtained through liaison with the fishers in the NDBSCF and in other similar fisheries such as the Shark Bay Experimental Crab Fishery. In addition, DFWA has performed at-sea monitoring of catch and bycatch in the NDBSCF whilst undertaking compliance and targeted research activities.

While no dedicated studies relating to bycatch associated with the NDBSCF have been conducted, it is likely that an indication of the likelihood and impact of bycatch from the NDBSCF can be gained by comparing it with fisheries that use similar gear such as the Shark Bay Experimental Crab Fishery.

An internal workshop was conducted by DFWA to complete the ESD report for the NDBSCF. This process identified nine groups as potential bycatch from the NDBSCF – other crabs, finfish, octopus, starfish, dolphins, dugongs, sea birds, turtles and whales. 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*), Butterfish (pentapod spp.), leather jackets, box fish, octopus, other crabs and starfish. 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 indicate that there is likely to be a high rate of survival of released bycatch and discarded blue swimmer crabs, providing their time out of water is kept to a minimum.

DEH concurs with the conclusion by DFWA that the NDBSCF is currently unlikely to have a significant impact on bycatch species. This conclusion has been verified at sea by DFWA researchers and compliance staff. In September 2005, a DFWA Fisheries and Marine Officer accompanied one of the operators in the NDBSCF for a day while the fisher performed routine activities. From 270 crab trap retrievals, bycatch consisted of 9 finfish, marine gastropods, several hermit crabs and 15 starfish. On this occasion, the bycatch constituted less than 0.7% of the landed catch. All specimens were reportedly in a healthy condition and were discarded immediately.

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. In most crab 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. In the NDBSCF it is a requirement that fishers return all unwanted bycatch to the ocean within five minutes. This practice is likely to greatly increase post-release survival of bycatch taken in the NDBSCF.

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 NDBSCF.

The submission indicates that DFWA does not consider additional bycatch reduction measures or monitoring of bycatch species to be 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 NDBSCF 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 likely to result in protected species interactions, the nature of such interactions and the levels of mortality of protected species. DEH therefore considers that the NDBSCF 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 9: *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 NDBSCF and each of the listed species likely to occur in the area of the fishery has been undertaken internally by DFWA with input from experts. The assessment concluded that the NDBSCF did not capture any protected species. For species that fell under the 'direct interaction but no capture' category (whales, dolphins, turtles, sea birds and dugongs), 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 there have been no reports of whales becoming entangled in fishing gear associated with the NDBSCF specifically. DEH consider that interactions with whale species by the NDBSCF are likely to be minimal given 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 NDBSCF is minimal.

Five species of sea turtle occur on the west coast: the Flatback turtle (*Natator depressus*), Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochylys imbricata*), Leatherback turtle (*Dermochelys coriacea*) and the Loggerhead turtle (*Caretta caretta*). 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 NDBSCF. While other blue swimmer crab fisheries in Australia have shown evidence of interaction with marine turtles, the potential for entanglement in NDBSCF pots is low, given the specialised design that prohibits turtles from entering the pots.

Dugongs are relatively common in the inshore protected waters of the Pilbara, however reports from the whole of WA did not record a single incidence where crab trap fishing gear interacted with dugongs. Similarly, various seabirds are regularly seen following or lingering near fishing boats, particularly Pied cormorants (*Phalacrocorax varius*), which dive for fish and have been known to poach from lobster and crab traps. Interactions with Pied cormorants have been reported in other trap based fisheries, although no such interactions have been reported for the NDBSCF.

While DEH accepts that the potential for protected species interaction in the NDBSCF is low as a result of the small number of operators and limits on the number of pots that can be set, DEH will be monitoring any future interactions with protected species and whether there are any areas where protected species are particularly at risk of interacting with the fishery. **Recommendation 9** 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 developed or implemented.

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 NDBSCF 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 9**, 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 NDBSCF 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. In completing the ERA for this fishery, DFWA also sought input from the Department of Conservation and Land Management, the Conservation Council of WA, Recfishwest, the West Australian Fishing Industry Council and the WA Department of Environment.

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 NDBSCF. These were ghost fishing, trophic level impacts, 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 NDBSCF develops, particularly if it develops in environmentally sensitive habitats.

The main potential threat to the ecosystem generally is likely to be the annual take of legal size blue swimmer crabs. DFWA considers that the commercial take of crabs represents a relatively small

portion of the biomass of crabs since the fishery area represents only a small proportion of the distribution of the species. 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 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 NDBSCF 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 NDBSCF, 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 impact on the marine environment.

Water and air quality are not considered at significant risk from the NDBSCF. Since pots are set on the benthos and hauled to the surface quickly for checking, impacts to water column communities are considered negligible. 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 NDBSCF, this is facilitated through the protection of berried females and through a precautionary minimum size limit that enables crabs 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 lacks information on specific actions and requirements in the fishery which relate to the prevention of marine pollution from vessels. Given the nature and scale of the fishery DEH is satisfied that the fishery would not be in breach of MARPOL obligations.

DEH considers that 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**.

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 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.

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LIST OF ACRONYMS

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
NDBSCF	Northern Developmental Blue Swimmer Crab Fishery
NRIFS	National Recreational and Indigenous Fishing Survey
NW	Northwest
UNCLOS	United Nations Convention on the Law of the Seas
WA	Western Australia
WTO	Wildlife Trade Operation