



Australian Government

Department of the Environment and Heritage

Assessment of the
West Coast Deep Sea Crab Interim Managed Fishery

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This document is an assessment carried out by the Department of 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 West Coast Deep Sea Crab Interim Managed 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 - *Application to Environment Australia on the West Coast Deep Sea Crab Interim Managed Fishery* (the Submission) was received by the Department of Environment and Heritage (DEH)¹ in August 2003 after a period of discussion between DFWA and DEH, during which preliminary drafts were refined. The Submission was released for a thirty-day public comment period that expired on 12 September 2003. One public submission was received and DFWA provided a response to the issues raised. No changes were made to the Submission as a result of public comment.

The Submission reports on Western Australia's (WA's) West Coast Deep Sea Crab Interim Managed Fishery (WCDSCIM Fishery) against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the Submission and associated documents, public comments and DFWA's response to the comments.

Summary of the West Coast Deep Sea Crab Fishery

Area	Commonwealth waters from WA/Northern Territory (NT) border to Cape Leeuwin, in waters deeper than 150 m.
Fishery status	Developing, interim-managed. Status of stocks not assessed.
Target Species	Snow (or crystal) crab <i>Chaceon bicolor</i> Champagne crab <i>Hypothalassia acerba</i> Giant crab <i>Pseudocarcinus gigas</i>
By-product Species	No by-product is taken. Rock lobsters may not be retained; no other restrictions.
Gear	Standard plastic pot – restrictions on design and use apply. Experimental pots require authorisation.
Season	No closed season
Commercial harvest 2001	230 tonnes
Value of commercial harvest 2001	\$2.8 million
Recreational harvest	No recreational fishery
Commercial licences issued	7 permits (5 full time and 2 part time)
Management arrangements	Limited entry; zonal management; legal minimum sizes; boat and gear restrictions; spatial and temporal restrictions; protection of egg-bearing female crabs; and daily take limit on commercial rock lobster fishers.
Export	Most of harvest is exported live to Asia
Bycatch	Deep sea crabs, spider crabs, sea lice, fin fish and molluscs
Interaction with Threatened Species	Potentially, several whale and dolphin species, manta rays and leatherback turtles. There is no evidence of interactions although dolphins may feed on discarded bait.

¹ The Department of the Environment and Heritage was formerly named Environment Australia

The area of the fishery lies in Commonwealth waters at depths of 150-1200 m, from the NT border to Cape Leeuwin. Currently most fishing activity occurs in the southern half of this region with landings of live crabs at ports between Canarvon and Fremantle. The outer continental shelf substrate comprises old limestone reefs interspersed with extensive areas of sand. On the continental slope sediments are mainly fine mud. While mainly conducted in Commonwealth waters the entire fishery is managed by WA under an Offshore Constitutional Settlement (OCS) agreement between the Australian and WA governments. The Leeuwin Current is a major environmental influence on the region, flowing strongly during winter and sweeping warm tropical water southward along the coast.

The fishery targets champagne (or spiny) crabs *Hypothalassia acerba*, giant (or king) crabs *Pseudocarcinus gigas* and snow (or crystal) crabs *Chaceon bicolor*. The fishery has shifted from focusing on champagne crabs as an offshoot of deepwater fishing for western rock lobsters *Panulirus cygnus* to a specialised fishery focusing on the higher valued snow crabs and small numbers of giant crabs. There is no by-product and rock lobsters may not be retained.

Very little is known about the biology of deep sea crab species. Champagne crabs occur mainly around depths of 200 m at latitudes 17-18° south. In the main fishing area to the south the mean carapace lengths of males and females caught in 2000 were 97 and 94 mm, respectively. Snow crabs are widely distributed at depths of 300-1600 m on the continental slope off northern and western Australia and New Zealand. In WA they occur from Exmouth to the border with SA, at depths of 450-1220 m (Melville-Smith *et al.* - submitted). As most females mature at 92-94 mm carapace width, the voluntary minimum size (120 mm) is estimated to protect over 95% of mature females. Males mature at a smaller size but grow to larger sizes and, hence, predominate in the commercial landings (Melville-Smith *et al.* - submitted).

Giant crabs are endemic to the waters of southern Australia from Cape Naturaliste around to the mid-NSW coast. While they typically occur on the slope at depths of 120-370 m, they also occur on the shelf at depths as shallow as 30 m off south eastern Australia where they support a small commercial fishery and where some aspects of their biology have been studied (Levings *et al.*, 1995 and 2001). They move up into warmer waters to feed and into deeper waters to moult and spawn. The warm Leeuwin Current is said to be a barrier to giant crabs at WA's lower west coast as they prefer temperatures of 7-11 °C. They are believed to be long lived and slow growing and may require strict management controls to ensure sustainability of harvest (Yearsley *et al.* 1999). Males grow faster and reach larger sizes than females. Off WA, females average 114 mm carapace length at first maturity. Allozyme and DNA analyses have indicated a genetically homogenous stock structure (Levings *et al.* 2001).

The total commercial harvest from this fishery in 2001 was 300 tonnes with a landed value of \$2.8 million. The mean landed prices were \$9.50/kg for champagne crabs, \$25/kg for giant crabs and \$13/kg for snow crabs. These crabs are consigned live to local and overseas markets. Champagne crabs were first taken as by-product of the western rock lobster fishery during the early 1970s. In 1990, seven fishers were authorised to fish for deep sea crabs during the closed season for rock lobsters. The fishery concentrated on champagne crabs and the small numbers of giant crabs available off the southern west coast until 1997-98 when commercial quantities of snow crabs were discovered in deeper waters. Higher prices for this species and low prices and demand for champagne crabs resulted in a shift in the fishery which is now concentrated on snow crabs. The snow crab component of the South Coast Crustacean Fishery (SCCF) was closed in September 2002 and will remain so until 14 November 2004. This arose from the likelihood that several of the 26 licences would increase their level of effort while others would be transferred to new operators, activating latent effort and leading to fears of rapid stock

depletion and over-capitalisation in the fishery (Melville-Smith *et al.* - submitted). As part of a recently-funded program, three commercial fishers will conduct research fishing throughout the South Coast region at depths of 300 to 1500 m. The main implication of this development for the WCDSCIM Fishery is that, when the South Coast fishery resumes after November 2004, it is expected to do so under an improved management regime based on information from this exploratory fishing project and designed to ensure productive, sustainable and economically viable fishing. The implications for the WCDSCIM Fishery are discussed further under Principle One of this report.

The WCDSCIM Fishery is currently managed under an interim management plan underpinned by the *WA Fish Resources Management Act 1994*. These arrangements are administered by the DFWA. The interim plan was implemented in January 2003 and will end in December 2004. A comprehensive review of the fishery, currently scheduled for December 2004, will determine whether and if so under what arrangements, it may continue beyond then. The Submission states that the Act, the *Fish Resources Management Regulations 1995* and the interim management plan comply with Australian laws with regard to international agreements. An Ecologically Sustainable Development (ESD) report has been prepared for the fishery, including formal assessment of the risks it poses to target, by-product, bycatch, protected species, marine communities and the environment. The management structure is discussed under Part I of this report. Specific management arrangements for the fishery are described and discussed under Part II.

The primary management objectives are to maintain the champagne crab and snow crab spawning stocks above levels which might risk recruitment overfishing, and to introduce a comprehensive management regime that will enable deep sea crabs to be harvested on a sustainable basis. The conservative legal minimum size, small catches (relative to the species range) and reduced targeting provide confidence in the condition of champagne crab stock and the management arrangements of this component of the fishery. For snow crabs, while catches and targeting have increased substantially, the combination of current input controls and small fishery area (relative to the species range) provide confidence in the stock condition and management arrangements. Performance measurement data needs are either in hand or being addressed. While the appropriateness of the voluntary minimum size will be assessed as part of a current research program, DFWA is already moving to introduce a State-wide minimum size of 120 mm carapace width. In keeping with the interim nature of the current management regime, some objectives, indicators and performance measures are yet to be developed along with the data collection necessary for determining the effectiveness of some components of the regime.

Deep sea crabs are only harvested in WA by the commercial fishing sector. There is no record of deep sea crabs being taken by the indigenous and recreational sectors. Western rock lobster fishers fishing in deeper waters once retained champagne crabs as by-product but now release them as bycatch because of their low market value. Deep sea crab pots may only be used by WCDSCIM Fishery licensees. Giant crab is also harvested in managed commercial fisheries in Tasmania, South Australia and Victoria and is a by-product in the Southern and Eastern Shark and Scalefish Fishery. Deep sea crab species may be taken in the Western Trawl Fisheries although harvest is thought to be very small.

Assessments outlined in the Submission indicate that the fishery has very little impact on and poses no threat to bycatch, protected species and benthic communities. Because of the small number of active boats and the nature of the pots and the depths and manner in which they are used, the numbers of bycatch species and of individual organisms caught are both small. Sea

lice, spider crabs and molluscs are caught in small numbers on a regular basis but are all released with what are believed to be high survival rates. Western rock lobsters, octopus and finfish are said to be caught infrequently and in very small numbers. Sponges and corals are occasionally brought to the surface with pots. The large diameter ropes and practice of setting numbers of pots on a main line pose slight risks of entanglement to marine mammals, turtles and manta rays in surface waters. While there is limited information about ecosystem impacts, in particular the role of deep sea crabs in the ecosystem, given the small quantities harvested in this fishery, DEH is satisfied that the fishery also poses limited risk to the general ecosystem. Bycatch, protected species interactions and ecosystem impacts are discussed under Part Two, Principle Two of this report.

Overall assessment

The material submitted by DFWA demonstrates that the management arrangements for the fishery meet most of the requirements of the Australian Government *Guidelines for the ecologically sustainable management of fisheries*.

The fishery is in a developmental stage and has made considerable progress in developing sound management arrangements. Of particular note is the current move to replace the voluntary minimum size for snow crabs with a legal minimum size – which is around 30 mm larger than the sizes at sexual maturity of males and females. The combination of expanded mandatory monitoring and reporting arrangements, improved assessment tools and the proposed review of the fishery in late 2004 will improve the level of understanding and confidence in the state of the fishery and its environmental impacts. As the focus has switched first from giant crabs to champagne crabs, then to snow crabs during the past decade, the key management strategy of setting minimum sizes to ensure protection of spawning stocks and, hence, recruitment to all three stocks has been particularly appropriate.

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

- Inadequate information on critical elements of deep sea crab (especially snow crab) biology, including stock recruitment relationships and potential productivity of the resource;
- the absence of a robust assessment model and robust indicators of stock status;
- lack of data validation and fishery independent information to inform management that is reliant on catch per unit effort data;
- the pending review of the appropriateness of minimum size limits; and
- the major review of the management regime at the end of 2004, which may significantly change management of the fishery and snow crab resource.

Recommendations to address these issues have been developed to ensure that the risk of impact is minimized in the longer term. Noting that DFWA's review of the fishery and interim management arrangements, currently scheduled for December 2004, will determine how the fishery will be managed in the post-development phase, this would seem the appropriate time to address some key concerns with the fishery. DEH welcomes DFWA's commitment to review the sustainability and management arrangements of the fishery and has made a number of recommendations to be implemented as part of that review. 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 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. On balance, the fishery is being managed in an ecologically sustainable manner and has identified areas for future work to address existing knowledge gaps/areas for improvement and minimise environmental risks. Management of this fishery during its recent development phase has featured appropriate avoidance of potential threats to sustainability and DEH is confident that DFWA will continue to provide this high quality management.

The operation of the fishery is consistent with the objects of Part 13A of the EPBC Act. DEH is satisfied 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 is satisfied 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 three 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 three 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.

A number of protected wildlife species occur in the fishery area, including marine turtles, cetaceans and seabirds, however the fishery has minimal interaction with these species. DEH considers that the fishery is unlikely to have an unacceptable impact on protected species. DEH recommends that the *West Coast Deep Sea Crab Fishery (Interim) Management Plan 2003* 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 plan 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, cetaceans or listed marine species or a population of any of those species. DEH also considers that the interim management plan 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 is satisfied that an action taken by an individual fisher, acting in accordance with the management plan, would not be expected to have a significant impact on a listed threatened species or listed migratory species protected by the EPBC Act.

Recommendations

1. DFWA to immediately inform DEH of any action taken to address threats to the sustainability of the West Coast Deep Sea Crab Fishery.
2. DFWA to ensure that the ESD report, including all performance measures, responses and information requirements, is formally incorporated into the management regime and decision making process.
3. WADF to ensure, where appropriate, that any relevant conservation interests in the fishery are considered throughout consultative mechanisms. In particular, in conducting the review of the fishery and in developing any new management arrangements for the fishery, DFWA to ensure that participation by conservation interests is specifically sought.
4. DFWA to conduct, within 12 months, 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. Within two years, DFWA to develop and implement a compliance strategy for the fishery that includes clear management actions and the means of measuring the performance of the strategy on a defined and regular basis.
5. As part of the review of the fishery, DFWA to review catch and effort reporting requirements, and amend these requirements as necessary, to ensure that the completeness and reliability of fishery dependent information is maximised. DFWA to also ensure that catch and effort data collected is validated on an ongoing basis.
6. As part of the review of the fishery, DFWA to review the research information needs and priorities to meet the management information, decision making and performance measurement needs of the fishery. DFWA to develop a research strategy to address identified priority areas, which includes clear and achievable timeframes for implementation within the context of available research funds.
7. DFWA to determine estimates of the potential productivity and sustainable yield of the snow crab resources and develop robust and biologically meaningful performance measures and reference points, linked to defined management actions for the snow crab resource within three years. As an interim measure, by June 2004, DFWA to incorporate catch rates (i.e. Catch-Per-Unit-Effort) into the monitoring, assessment and performance measures for the snow crab component of the fishery.
8. DFWA to ensure that management arrangements to control the take of joint deep sea crab stocks in the West Coast Deep Sea Crab Fishery and South Coast Crustacean Fishery are consistent and stock assessments ensure that all removals from both fisheries are taken into account. In addition, DFWA to ensure that removals of deep sea crabs by trawling operations are considered in stock assessment and management.
9. As part of the review of the fishery, DFWA to review effort levels in the fishery and develop a strategy to ensure that fishery effort is maintained at precautionary levels appropriate to the size of the deep sea crab resources and the species' vulnerability to overfishing.

10. DFWA to continue to pursue identification of all non-commercial bycatch species and seek advice from the WA Museum on the biological risks of these species. Findings are to be incorporated into future risk assessments and management responses.
11. As part of the review of the fishery, DFWA to assess the adequacy of monitoring and assessment arrangements for detecting change and trends in bycatch composition and quantity and species interactions.

PART I - MANAGEMENT ARRANGEMENTS

The West Coast Deep Sea Crab Interim Managed Fishery (WCDSCIM Fishery) is managed by the Department of Fisheries of Western Australia (DFWA).

The fishery is currently being managed as a developmental and interim managed fishery. Its interim management arrangements are described in the following documents, which are publicly available:

- *Fish Resources Management Act 1994*;
- *Fish Resources Management Regulations 1995*;
- *West Coast Deep Sea Crab Fishery (Interim) Management Plan 2003*;
- State of the Fisheries Report 2001/2002; and
- relevant Gazetted notices and licence conditions.

There are a number of other published documents, including research reports and scientific literature, which are integral to the management of the fishery. The Submission states that any proposals to vary the management arrangements are distributed to stakeholder groups and made publicly available in document form and on the DFWA website. When complete the ESD report for this fishery will be published in similar forms, stating the objectives, indicators, performance measures, management arrangements and an assessment of how the fishery is performing. Ministerial guidelines will also be published, stating the objectives and performance measures for the fishery.

DEH considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Due to the importance of the ESD Report, interim management plan and documents referred to above to DEH's assessment of the fishery, an amendment could change the outcomes of our assessment and decisions stemming from it. DEH understands that DFWA will include in its Annual Report and State of the Fisheries Reports a list of all changes made to management arrangements in this and other fisheries. From time to time, significant management action is taken by DFWA to address threats to the sustainability of individual fisheries. DEH requests that DFWA immediately inform DEH of changes made to the WCDSCIM Fishery under these circumstances.

Recommendation 1: *DFWA to immediately inform DEH of any action taken to address threats to the sustainability of the West Coast Deep Sea Crab Fishery.*

The Submission is largely based on the ESD report for the WCDSCIM Fishery. It describes how that report was developed through a process involving workshops, risk assessment and response planning flowing from an examination of the costs and benefits of the fishery in terms of the major components of the national ESD reporting framework.

While management objectives, performance measures and responses are outlined in the Submission text, and the *Fish Resources Management Act 1994* contains objects that apply to all management plans, there appears to be no succinct formal statement of the specific objectives, performance measurement and management responses for the WCDSCIM Fishery. The ESD report contains these elements but is currently only a guiding document that has no legislative basis. The management commitments specified in this report have been fundamental in DEH's assessment and consequent recommendations. 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, within one year, with a clear timeframe for implementation.

Recommendation 2: *DFWA to ensure that the ESD report, including all performance measures, responses and information requirements, is formally incorporated into the management regime and decision making process.*

As required under the Act, the fishery management arrangements have been developed through formal consultation with industry, other stakeholders and the public. The stakeholder groups consulted include the WA Fishing Industry Council, the recreational fishers' peak body Recfishwest, and the Conservation Council of WA. As a developing fishery exploited only by a small number of commercial licensees there is no formal fisheries management committee, nor have there been stock assessments for any of the target species. Instead the DFWA meets regularly with commercial fishers to discuss management, research and compliance issues. In addition, workshops on the West Coast Rock Lobster Managed Fishery involving wider participation (including conservation interests) have provided information on the WCDSCIM Fishery used in preparing the Submission.

The Submission gives no clear indication of how the WCDSCF interim management arrangements will progress in a way that will ensure that a range of expertise and community interests are involved in fishery management committees, stock assessment and research planning processes. Currently, consultation by management occurs only with industry. There is no apparent direct involvement of general community and conservation interests in current or proposed management structures. Stakeholder involvement appears to be limited to industry, peak bodies, and research and management interests. DEH believes that there should be demonstrated involvement of general community and conservation interests in any management committees and in stock assessment processes. Noting that the establishment of a management advisory committee may not be pursued by DFWA due to cost, other mechanisms to ensure adequate consultation should be sought. In particular, these groups should be consulted in the review of the fishery, currently scheduled for December 2004, and the establishment of new management arrangements for the fishery. DFWA should also provide opportunity for ongoing involvement.

Recommendation 3: *WADF to ensure, where appropriate, that any relevant conservation interests in the fishery are considered throughout consultative mechanisms. In particular, in conducting the review of the fishery and in developing any new management arrangements for the fishery, DFWA to ensure that participation by conservation interests is specifically sought.*

Section 5 of the Submission details the objectives, indicators and performance measures by which the effectiveness of the management arrangements are measured. The primary objectives are to maintain the champagne crab and snow crab spawning stocks above levels which might risk recruitment overfishing, and to introduce a comprehensive management regime that will enable deep sea crabs to be harvested on an ecologically sustainable and economically viable basis. Key features of the management regime will be published as Ministerial guidelines. Performance measurement is already possible for some objectives where data are already available while for others data collection has begun only recently. Because of the small and highly variable nature of annual giant crab landings (<1 tonne), no performance measures are specified for this species. DEH believes that the performance measures, triggers and responses outlined are sufficiently comprehensive and appropriate to the nature and scale of this fishery at this stage of its development. An assessment of the effectiveness of these measures is included in Part Two of this report. Their long term strategic value and practicality will be tested during the review of the fishery in 2004, before the termination of the interim management plan.

The fishery is divided into five fishing areas for licensing and access purposes. Underpinned by the *Fish Resources Management Act 1994* and the interim management plan, the management of the fishery is based on input controls. These controls, which are discussed in detail under Part Two, Principle 1 of this report, include:

- limited entry with 7 permits (5 full time, 2 part time);
- access limits on permit holders;
- fishing gear and vessel restrictions;
- legal minimum sizes for champagne crabs and giant crabs;
- an agreed (ie voluntary) minimum size for snow crabs;
- protection of female crabs carrying fertilised eggs; and
- spatial and temporal restrictions.

Legal minimum carapace lengths are specified for champagne crabs (92 mm) and giant crabs (140 mm) and a voluntary size limit of 120 mm carapace width (CW) for snow crab. DEH notes that DFWA is moving to replace the voluntary minimum CW for snow crabs with a legislated minimum size of 120 mm CW. DFWA is also consulting with interest groups on the introduction of a daily take limit on deep sea crabs by rock lobster fishers and a prohibition on the take of egg-bearing females of all deep sea crab species (ie including species other than champagne, giant and snow crabs). DFWA intends that the 5 full time and 2 part time permits will continue until the end of the interim management plan (December 2004) when all licensees will be granted equal access. At that time, measures will be introduced to prevent any increase in fishing effort. These may include output controls (Individual Transferable Quotas), satellite tracking and time-access restrictions.

Deep sea crabs are taken only in pots (traps) set at depths of 150-1200 m. Fishing is restricted to waters deeper than 150 m to minimise rock lobster catches, gear conflicts with rock lobster fishers and associated compliance problems. Each licensee may use up to 700 standard plastic pots measuring 782 x 565 x 470 mm³ each with one top entrance and a 504 x 54 mm² escape gap. Special permission is required to use other pots experimentally. Lines of 50-100 baited pots are set with buoy lines at each end. The pots are hauled after 1-4 days and the retained catch is held in live storage tanks. Bycatch and ghost fishing are not management issues in this fishery largely as a result of the combination of the standard pot design, compulsory escape gaps and the area and method of fishing. The long soak times result from a combination of the distances from ports to the offshore fishing grounds and the impracticality of hauling more than 400-500 pots per day.

The five full time licensees may fish up to 12 months annually and the two part time licensees may not fish more than three months annually. One full time licensee has been permitted to operate in each of the five areas of the fishery. One part time licensee has been permitted to operate in each of two areas. These are interim restrictions that are intended to constrain effort and to provide essential fishery data from all areas during the development phase of the fishery. They will apply until December 2004 when all licensees will be granted equal access under a new post-development regime designed to ensure that the fishery performs on a sustainable and productive basis. These licensing arrangements have resulted in the collection of information essential for the management of the fishery while avoiding the substantial latent effort and related problems facing the South Coast Crustacean Fishery (Melville-Smith *et al.* - submitted).

The critical aspects of the management arrangements are underpinned by limited compliance activities, which largely comprise at-sea and port enforcement. As the WCDSCIM Fishery operates offshore from the western rock lobster fishery, for much of the year the high level of at-

sea enforcement deployed to the latter enables some activity to ensure compliance with critical aspects of the WCDSCIM Fishery management regime, in particular licensing and gear restrictions. During the rock lobster closed season, at-sea inspections of crab fishing operators are minimal because of the high cost involved, however, landings are inspected regularly. Apart from enforcement activities, industry liaison and education does not appear to be part of the sea or port based compliance program. Instead DFWA meets with operators several times per year to discuss compliance and other issues.

Intelligence gathering on suspect activities is undertaken from sources including the small number of active crab fishers and the licensed rock lobster fishers. While the means of enforcing critical aspects of management arrangements exist and no offences have been detected, the Submission concedes that the level of compliance cannot be adequately determined under the current level of enforcement effort. The high prices and demand for snow crabs provide incentives for illegal fishing for this species. Overfishing in similar fisheries overseas has increased the demand for deep sea crabs, adding to this incentive and suggesting that WA's fishery may face similar risks. DEH recognises that DFWA proposes to conduct a compliance risk assessment to identify more effective use of compliance resources and believes this assessment should proceed as a matter of urgency. A compliance strategy, drawing on the outcomes of the risk assessment would need to be developed to guide further work in compliance activities.

Recommendation 4: *DFWA to conduct, within 12 months, 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. Within two years, DFWA to develop and implement a compliance strategy for the fishery that includes clear management actions and the means of measuring the performance of the strategy on a defined and regular basis.*

The performance of major aspects of the fishery is reviewed and published in Annual State of the Fisheries reports following review by the WA Office of the Auditor General. The performance of the fishery under the current interim management regime will be reviewed thoroughly during 2004, leading to the introduction of comprehensive performance measurement arrangements from December 2004. A comprehensive review of the performance of the fishery, including the adequacy of the objectives, indicators and measures will be conducted every five years. These reviews will include status reports on non-retained species and the environmental impacts of the fishery. DEH is satisfied that the current and proposed performance reviews and assessment arrangements are commensurate with the nature and size of the fishery and its environmental impacts. Progress towards annual assessments of the target species is described in Part Two of this report.

Fishery-dependent data relating to the target species is collected on a regular basis in the fishery. Discussion of the information collection system and future work, both proposed and required, can be found in Part Two of this report. DFWA has adapted the outcomes of workshops on the western rock lobster and south coast crab fisheries to identify, assess, prioritise and mitigate adverse impacts of the WCDSCIM Fishery on the wider marine ecosystem. This process concluded that, based on the similarities of these fisheries and as no issue was found to pose more than a minor risk, no specific monitoring is needed for the WCDSCIM Fishery. A full 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 also contained Part Two of this report.

The management arrangements take into account arrangements in other jurisdictions. Specifically, management arrangements for other giant crab fisheries around Australia were

taken into account in the development of size limits for giant crab harvested in the WCDSCIM Fishery. Ongoing research concerning giant crab by other jurisdictions is of relevance to this fishery and DEH is confident that any new information obtained will be incorporated into this fishery where relevant.

DEH is satisfied that the current management arrangements are consistent with all relevant threat abatement plans, recovery plans, the National Policy on Fisheries Bycatch, and bycatch action strategies developed under that policy. The *Fish Resources Management Act 1994* contains mechanisms that allow for amendments to management practices so that they comply with any future plans of these types.

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 Two 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.

Conclusion

DEH is satisfied that the WCDSCIM Fishery management regime is documented, publicly available and transparent, and is developed through a consultative process. The management arrangements are adaptable and 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 also 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 refine the management arrangements in some of these areas 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 through compulsory monthly catch and effort returns and logbooks which all operators complete on a daily basis and submit to DFWA. Together, these records provide information on catch, effort, catch rate, bycatch (including discarded crabs), protected species interactions, fishing locality and depth. According to the Submission, the reliability of effort information is only moderate because of limitations on the way that effort can be recorded on returns. In view of the high degree of reliance placed on fishery dependent – particular catch and effort - data in routine monitoring, performance measurement, modelling and assessments, DEH considers that this is a matter that should be rectified as a priority. The review of the fishery schedule for December 2004 would be an appropriate time to amend existing reporting requirements. Validation of commercial fishers’ landings data should also be undertaken, including the use of the detailed records relating to all deep sea crab landings that the interim management plan requires processors to collect, maintain and submit on a monthly basis. The Submission refers to planned validation “between the compulsory catch and effort forms and the logbook forms” but gives no indication of when this may proceed.

Recommendation 5: *As part of the review of the fishery, DFWA to review catch and effort reporting requirements, and amend these requirements as necessary, to ensure that the completeness and reliability of fishery dependent information is maximised. DFWA to also ensure that catch and effort data collected is validated on an ongoing basis.*

Because of the remoteness, scale and nature of this fishery and the fact that deep sea crabs can only be effectively caught in pots, the collection of fishery independent information relies on specific periodic research programs and ad hoc observations by enforcement and research officers. Previous studies have determined some important aspects of the population biology and characteristic of giant crabs (Levings *et al.* 1995 and 2001). Murdoch University and DFWA are currently conducting Fisheries Research and Development Corporation (FRDC) funded studies to determine:

- a yield-per-recruit and egg-per-recruit model for the champagne crab (to assess the appropriateness of the current legal minimum size);
- the catch and distribution of the snow crab fishery and the abundance, size and sex composition by depth of snow crabs.

Melville-Smith *et al.* (submitted) also refer to the tagging of thousands of deep sea crabs to determine information on movement and growth.

DEH encourages the timely completion of research currently underway in the fishery but notes that the Submission gives no indication of a strategic research plan or proposed research plan to address remaining research needs in the fishery. DEH notes that information on critical elements of deep sea crab (in particular snow crab) biology is inadequate and may impede further development of the fishery, especially in relation to the development of a robust stock assessment model. Recognising that existing work on snow crabs and the review of management scheduled for the end of 2004 is likely to highlight some information gaps, DEH considers there is a need for a clear set of research priorities and a research strategy for the fishery. In particular, analysis of research needs in areas including, but not limited to, recruitment to the fishery, appropriateness of existing size limits, fishing mortality, habitat characterisation and ecosystem impacts should be considered. DEH considers that the appropriate time to plan and prioritise future research and monitoring needs will be during the review of the fishery scheduled for December 2004.

Recommendation 6: *As part of the review of the fishery, DFWA to review the research information needs and priorities to meet the management information, decision making and performance measurement needs of the fishery. DFWA to develop a research strategy to address identified priority areas, which includes clear and achievable timeframes for implementation within the context of available research funds.*

DEH is satisfied that the current information system is sufficiently reliable and appropriate to the scale of the fishery at this stage of its development. It is based on fishery dependent research and monitoring to meet management information needs in the short term. In the longer term, the recommended improvements to address research needs and the reliability of effort reporting are essential given the high degree of reliance on fishery dependent data for monitoring and assessment purposes.

Assessment

The status and trends in the fishery are reviewed annually and reported in DFWA's annual state of the fishery reports. Pending completion of the FRDC study of champagne crabs and snow crabs, assessments of the status of the fishery and stocks continue to be based on annual catch and, for snow crabs, effort data and trends.

Off WA, giant crab and champagne crab are taken in small quantities considering the vast extent of their habitat there. For each species, DFWA has assessed the risk of fishing impacting on breeding stocks - to the extent of affecting recruitment - as negligible.

Champagne crab landings have been highly variable, declining as a result of changed fisher behaviour and markets during recent years. The legal minimum size is well above the size at maturity and will be reviewed on completion of a current study which will provide a yield-per-recruit and egg-per-recruit model. Giant crabs could be considered as a by-product species as landings are extremely small (<1t pa since 1996). Effort targeted at this species cannot be distinguished; hence this component of the fishery can only be assessed in terms of annual landings. The legal minimum size maintains 40% of the virgin stock egg production (Levings 2001) thus ensuring that fishing remains sustainable. Given the comprehensive and reliable nature of landings data, DEH accepts the performance measurements and assessments for these two species as outlined in the Submission at this stage of development of the fishery.

Commercial landings of snow crabs in the WCDSCIM Fishery began in 1998 and quickly reached 200 tonnes as the focus switched from the lower-value champagne crabs. Crabs of the genus *Chaceon* are slow growing and long lived making them vulnerable to overfishing (Hastie

1995). Based on these factors, DFWA has assessed the risk of the fishery reducing the snow crab stock to the point where recruitment is impaired as moderate, hence the objective to maintain the spawning stock by means of an appropriate legal minimum size.

The Submission indicates that there are currently no estimates of the potential productivity of any of the deep sea crab stocks off WA. The emphasis of current monitoring and research is to:

- provide assessments needed to ensure that legal minimum sizes are set to minimise the risk of recruitment overfishing for each species;
- estimate natural mortality, growth and fecundity of champagne crabs; and
- determine the distribution and related population biology features of snow crabs.

Reflecting the shift in emphasis of the fishery from champagne crabs to snow crabs, the two combined FRDC funded research projects have increased their emphasis on the latter species, with results scheduled for reporting in mid-2005. Melville-Smith *et al* (submitted) indicate that research on snow crabs is focused on improving catch and effort data, providing information on growth and movement and assessing the fishery's "robustness to fishing pressure". In view of the poor state of knowledge of the biology and populations of champagne crabs and snow crabs, and the high dependence on minimum sizes to ensure sustainability, DEH strongly encourages the completion of this research and the application of the results to the management of the fishery at the earliest possible opportunity. The need for both thoroughness in these investigations and precautionary interim management approaches is outlined below.

The Submission acknowledges that further studies will be needed to determine growth and other population characteristics for snow crabs. However, there is nothing in the Submission to indicate that determining the potential productivity of the main target species (snow crab) and the proportion that may be harvested sustainably is a research priority for this fishery. Given the high value and scope for further growth of the snow crab fishery, the uncertain state of the stock off WA and the vulnerability of the species to overfishing, DEH believes this to be a matter that requires urgent attention. DEH considers that the estimation of the potential productivity and sustainable yield from the snow crab stock should be among the priority issues addressed in the research plan proposed in **Recommendation 6**. Melville-Smith *et al.* (submitted) indicate that some preliminary estimates of maximum sustainable yield are possible, using fishery information, related research and reasonable assumptions drawn from similar fisheries elsewhere. They suggest that, while it is too soon to attempt to define a TAC for snow crabs, 30 tonnes per year is a useful "preliminary reference benchmark" for future maximum sustainable yield estimates which seem likely to fall within the 15-60 tonne range.

Biologically based performance measures linked to management action are absent in the fishery due to a lack of understanding of deep sea crab biology and ecology. The current reference points are based on catch levels. DEH considers that existing reference points could be strengthened if catch rates were included. The Submission states that performance measures/trigger limits based on catch rates are possible but have not been developed. DEH's view is that, given the influence of operators' targeting preferences, the likelihood of increasing snow crab catches, the uncertain status of the snow crab stock and the reliance on fishery dependent data, additional and more robust indicators are urgently needed for this species. DEH expects that with the completion of key research underway on snow crabs, the development of biologically based performance measures and reference points should be possible in the next few years but as an interim measure catch rates should be incorporated into existing reference points and performance measures.

Recommendation 7: *DFWA to determine estimates of the potential productivity and sustainable yield of the snow crab resources and develop robust and biologically meaningful performance measures and reference points, linked to defined management actions for the snow crab resource within three years. As an interim measure, by June 2004, DFWA to incorporate catch rates (i.e. Catch-Per-Unit-Effort) into the monitoring, assessment and performance measures for the snow crab component of the fishery.*

The importance and urgency of these improvements is under-scored by recent developments in the WA South Coast Crustacean Fishery (SCCF). The snow crab component of that fishery was closed in September 2002 and is to stay closed until September 2004 to prevent the activation of many of the 26 licences. This closure is based on concerns that increased harvesting of the species was highly likely to occur and, without strong management measures, may result in rapid depletion, threatening the economic viability of the fishery and leading to over-capitalisation (Melville-Smith *et al.* - submitted). While confident that biological sustainability of the fishery is assured, DFWA is investigating the management arrangements needed to ensure economic viability of the SCCF. Provided the potential excess fishing capacity within the SCCF is effectively dealt with in the long term, the main implication of these developments for the WCDSCIM Fishery centre on the state and productivity of the snow crab stock component on the south coast.

Snow crabs occur on the continental slope off western and northern Australia. As they are not targeted in fisheries outside WA and have only been targeted in the WCDSCIM Fishery since 1999 (and the SCCF since 2002), little is known of their distribution, stock structure and biology. Most fishing off WA is conducted at depths of 600-800 m although they occur over a much wider depth range (Jones and Morgan, 2002). More is known about giant crabs which occur across southern Australia and are exploited commercially off South Australia, Victoria and Tasmania. While they occur at depths of 18-400 m the main concentrations occur at depths of 140-270 m. Electrophoretic studies of giant crabs from different localities across southern Australia and indicate genetic homogeneity across the whole species range (Levings *et al.*, 2001). Champagne crabs occur across southern Australia at depths of 30-550 m (Yearsley *et al.* 1999) but have only been targeted off WA. In view of the remoteness of the WCDSCIM Fishery from other Australian deep sea crab fisheries and the fact that only the giant crab is harvested in other states, DEH considers the current level of interaction between DFWA and inter-state management and research bodies to be appropriate.

Potential removals from the deep sea crab populations include direct harvest (including discards) by this fishery and the SCCF, potential direct harvest and mortality from damage caused by trawling operations in the Western Trawl Fisheries and harvest by dedicated giant crab fisheries in other jurisdictions. Due to the offshore, deepwater nature of the fishery, there is no recreational and indigenous take of deep sea crabs.

The WCDSCIM Fishery and the SCCF are based on the same three species and stocks, using similar gear and subject to similar – in some cases identical – regulations. The Submission and other documents indicate that the WCDSCIM Fishery and SCDSF Fishery originated as offshore extensions of the west coast and south coast rock lobster fisheries, respectively. However, in both deep sea crab fisheries the nexus with adjoining rock lobster fisheries has been largely severed with the establishment of separate licensing and related management regimes. With uncertainty surrounding the future management of the SCCF and the upcoming review of management in the WCDSCIM Fishery, there is some risk that significantly different management arrangements could be developed for the same stock. DEH considers that DFWA should ensure that management measures across the fisheries are consistent and for stock

assessment purposes at least, these two deep sea crab fisheries should be treated as one. As pointed out in the public submission, this would enable the total removals of each deep sea crab species within WA's jurisdiction to be assessed and incorporated in yield estimates, performance measurement and management arrangements effectively on a whole-of-stock basis.

Recommendation 8: *DFWA to ensure that management arrangements to control the take of joint deep sea crab stocks in the West Coast Deep Sea Crab Fishery and South Coast Crustacean Fishery are consistent and stock assessments ensure that all removals from both fisheries are taken into account. In addition, DFWA to ensure that removals of deep sea crabs by trawling operations are considered in stock assessment and management.*

Catch and effort information from the fishery is factored into management and stock assessment and takes account of all deep sea crab landings in the fishery. A review of catch and effort reporting requirements has been recommended to ensure reliability of data can be maximised in the future (see **Recommendation 5**). Deep sea crab harvest in the SCCF is not factored into stock assessments however DEH has recommended that this be conducted in the future (see **Recommendation 8**).

Similarly, removals of deep sea crabs by the Western Trawl Fisheries are not considered in the management of the WCDSCIF. DEH strongly encourages DFWA, in collaboration with the Australian Fisheries Management Authority (AFMA), to ensure that the size and species composition of trawl catches (and the ecological impacts of trawling on crab grounds) are considered in future stock and risk assessments of the deep sea crabs and in research planning (see **Recommendation 8**).

Management response

The current WCDSCIM Fishery management regime aims to maintain ecologically viable stock levels through a range of input controls. These measures were outlined in Table 1 and Part One of this report.

The primary management tool for the fishery is the use of minimum size limits, designed to maintain sufficient biomass of the deep sea crab populations. The Submission and related documents make several references along the lines "the current size limits ensure maintenance of breeding stock and biological sustainability" (Melville-Smith *et al.* - submitted). DEH regards this as a crucial point for all three species, particularly in relation to the sustainability of the snow crab stock which appears likely to continue as the main target of the fishery in the medium term. Assuming that they have been set at appropriate sizes, confidence in these size limits as key conservation measures hinges on industry compliance, survival of released crabs and minimising catches of undersized crabs through the use of appropriate escape gaps. The Submission describes existing compliance measures and Recommendation 4 is designed to identify further improvements required. DEH understands that the adequacy of the current minimum size will be reviewed as part of the current FRDC study. Accordingly DEH encourages DFWA to ensure that confidence in minimum sizes is based on sound knowledge and that any identified shortcomings are factored into future research needs and priorities.

Noting the absence of estimates of the potential productivity of deep sea crab stocks, use of appropriate size limits and ensuring that effort in the fishery is appropriate to the size of the resource are key considerations in the overall management of the fishery. The Submission makes reference to the possibility of restricting effort in the fishery following the review of management at the end of 2004. DEH considers that such a review will be necessary once

existing work on the snow crab resource is completed and a better understanding of potential productivity and sustainability is obtained. For example, Melville-Smith et al. (submitted) indicate that some preliminary estimates of maximum sustainable yield are possible, using fishery information, related research and reasonable assumptions drawn from similar fisheries elsewhere. They suggest that, while it is too soon to attempt to define a TAC for snow crabs, 30 tonnes per year is a useful “preliminary reference benchmark” for future maximum sustainable yield estimates which seem likely to fall within the 15-60 tonne range. Information such as this may have implications for what is considered an appropriate level of effort in the fishery. This future total catch will not support seven full time operations, presenting a challenge in terms of how access or catch entitlements will be assigned under the management plan. DEH therefore recommends that a review of effort be undertaken as part of the review of the fishery.

Recommendation 9: *As part of the review of the fishery, DFWA to review effort levels in the fishery and develop a strategy to ensure that fishery effort is maintained at precautionary levels appropriate to the size of the deep sea crab resources and the species’ vulnerability to overfishing.*

The Submission states that the review of the fishery scheduled for December 2004 is likely to result in significant changes to the WCDSCIM Fishery management regime. Among the management measures that may be considered are time-access (i.e. days fished) restrictions and Individual Transferable Quotas (ITQ) both of which enable the level of take to be controlled. In addition, WA legislation and the interim management plan provide options for DFWA to introduce amended or additional controls on a fishery wide or area specific basis if needed. DEH is confident that DFWA has the management tools in place or readily available to control the level of take, either directly (e.g. by the introduction of ITQs) or indirectly (e.g. by effort and access controls) and that the review to be conducted in 2004 will lead to the introduction of appropriate management strategies.

Based on the limited historic catch data, limit reference points have been set in terms of annual catch for snow crabs (lower limit 100 t, upper limit 200 t), champagne crabs (upper limit 50 t) and giant crab (upper limit 2 t). DEH is concerned that preliminary estimates in Melville-Smith et al. (submitted) suggest that these limits are significantly higher than the estimated sustainable yield and recommends that they be reviewed as part of the implementation of **Recommendation 7**.

The ESD report specifies review and response requirements should limit reference points be breached but does not prescribe specific management responses. Given the recent market driven switch in target species and the safeguards already in place (minimum sizes in particular), DEH accepts that the proposal to review the causes of catch changes as the initial management response as being justified rather than implementing prescribed management responses. The Submission indicates DFWA’s capacity to take actions to increase protection of stocks if necessary. Such actions could include reductions in fishing gear and effort, a review of minimum sizes and spatial and/or temporal closures. DEH accepts the current suite of reference points, triggers and management responses as adequate measures during this period of interim management of the developing fishery. However, performance measures and reference points based on catch rates are currently possible for snow crabs but are not used. DEH believes that this is a deficiency which should be addressed as part of the review of the interim management plan in 2004 and has addressed this in **Recommendation 7**. In the longer term, as the fishery moves beyond the development phase and time series of catch and effort data and assessment models improve, DEH also expects that DFWA will develop more robust and biologically meaningful performance measures and responses (see **Recommendation 7**).

No by-product species are taken in this fishery. The shift in deep sea crab targeting by the fishery through the 1990s has seen annual landings of giant crabs decrease to below 1 tonne, reducing the species to by-product status. DEH is satisfied that this shift has been market driven and that the legal minimum size for giant crabs and other management measures ensure that there is no threat to the stock.

Conclusion

DEH is satisfied that the management regime in the VGC Fishery is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to over-fishing. DEH is satisfied 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 fishery at present. Trigger points and management responses are in place to avoid the risk of overfishing the deep sea crab stocks off WA. DEH is satisfied that the deep sea crab stocks are 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 stocks 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

While it is not stated explicitly, the Submission suggests that the main bycatch component of the fishery comprises deep sea crabs that are returned to the water alive because they are carrying eggs, out of season, damaged or undersized. Such discards of commercial species must be recorded daily in mandatory commercial logbooks. These records must distinguish between small and berried (ie egg-bearing) crabs.

DEH notes that bycatch is currently recorded in logbooks by fishers on a monthly basis, although identification of species is difficult. The Submission reports that most of the fish and mollusc bycatch species are caught infrequently and are yet to be identified by the WA

Museum. While noting the probability that fishing may pose no threat to these species, DEH is concerned that this may not be the case if the fishery is repeatedly taking species that occur in low numbers and are vulnerable to fishing. This concern was reflected in the public submission and applies particularly to finfish, which may suffer high mortalities on release due to barotrauma effects. If bycatch data is to be useful and reliable for ongoing monitoring of bycatch composition and abundance, identification of species being captured is important. DEH recommends that DFWA continue to seek identification of these species from the WA Museum and identify those species vulnerable to fishing. DEH recognises that this may not be simple task but encourages DFWA to pursue this matter and incorporate any findings into future risk assessments. If possible, identification guides should be provided to fishers to increase reporting accuracy.

Recommendation 10: *DFWA to continue to pursue identification of all non-commercial bycatch species and seek advice from the WA Museum on the biological risks of these species. Findings are to be incorporated into future risk assessments and management responses.*

With the exception of discarded target species crabs, the numbers and variety of bycatch in this fishery appear to be extremely small. DFWA requires that operators record the species and approximate numbers of all non-commercial bycatch at the bottom of commercial logbook sheets. However, these details are not required to be recorded on a daily basis (they are monthly estimates) for these species and the Submission gives no summary of the reported bycatch or any indication of compliance and how this is verified. The other source of fishery dependent information on bycatch is personal communication with commercial operators. Most of the fishery independent information is either extrapolated from monitoring of similar WA pot fisheries. Collectively, this information indicates that (apart from discarded deep sea crabs) the bycatch comprises five species or groups: western rock lobsters *Panulirus cygnus*, sealice *Bathynomous* spp and spider crab, finfish and octopus species. DEH considers that – if completely and accurately recorded – operators’ logbook information should be sufficient to enable changes in the overall volume and other details of western rock lobster and deep sea crab bycatch to be detected. Stock assessments for these species should identify and remedy any deficiencies in reporting. However, DEH has reservations about whether the way in which details of non-commercial bycatch species are reported in practice provides a confident basis for assessment or trend monitoring (see Recommendation 14, below). At DFWA’s review of the fishery during 2004, these matters should be examined as part of the requirement to improve the information base and confidence level for future assessments as the fishery develops. In particular, reporting arrangements should, as a minimum, be able to detect gross changes in bycatch quantity and composition.

Recommendation 11: *As part of the review of the fishery, DFWA to assess the adequacy of monitoring and assessment arrangements for detecting change and trends in bycatch composition and quantity and species interactions.*

Assessment

The internal ESD risk assessment workshop for this fishery analysed the risk to bycatch species. This analysis concluded that the fishery was of negligible risk to each of the invertebrates and fish species. Much of the low overall incidence of bycatch can be attributed to the small number of vessels, the highly species specific nature of crab pots, the use of mandatory escape gaps and the depths and manner in which pots are used along the vast length of WA’s coast.

Western rock lobsters are very rarely caught at the depths of this fishery, particularly since targeting shifted to snow crabs at depths of 600-1200 m. All rock lobsters must be released

alive immediately. Large numbers of sea lice may enter pots to feed on bait, but as pots are hauled after periods of up to four days – by which time the bait is gone - most lice (and other bycatch) have escaped through the various openings in the pots. Remaining lice may escape while pots are being hauled. Those which reach the surface are quickly returned to the water. A variety of finfish and mollusc species, along with spider crabs and octopus are caught in very small numbers and are returned to the water alive. High survival rates have been shown for discarded rock lobsters and some crabs.

Survival rate of released deep sea crabs and other invertebrates is believed to be high. However, while the numbers of scalefish released may be small, most could suffer lethal barotrauma resulting from ascent from great depths. Difficulties in bycatch species identification and the small numbers caught make it difficult to confirm assumptions that risks to individual species and species groups are acceptable. Accordingly, DEH believes identification of bycatch species and review to ensure that reporting and monitoring requirements are adequate to detect changes in bycatch composition and abundance is required (see **Recommendations 10 and 11**). Once species can be identified, DFWA may have additional information on which to base future risk assessments.

Management response

Some management measures are in place that serve to minimise bycatch in the fishery. The management regime requires that escape gaps of a prescribed size are fitted to all pots. Mandatory escape gaps in crab pots are intended to reduce, if not minimise, some or all forms of bycatch. The Submission makes no reference to the basis for the dimensions of the mandatory escape gaps in crab pots (54 mm high by 504 mm wide). The height dimension appears to have been adopted arbitrarily from the western rock lobster fishery, possibly dating back to when crab fishing began as an extension of that fishery by rock lobster fishers. If so, the development of escape gaps specifically designed to minimise the retention of undersized crabs should be feasible and may have the added benefit of further reducing bycatch of other species. DEH believes that investigation of this matter is highly desirable and should be considered as part of DFWA's 2004 review of the fishery.

In addition to escape gaps, the physical separation of the rock lobster and deep sea crab fisheries is effective in reducing the incidence of rock lobsters and other shallow water bycatch species caught in crab pots set in depths greater than 150 m. Furthermore, the small number of boats operating in this remote offshore fishery over a vast length of coast would serve to minimise impacts on bycatch species.

In the absence of any apparent significant bycatch there is no indicator species group, nor are there decision rules relating to bycatch numbers. DFWA proposes to review this position as part of the next major review of this fishery in five years time. However, it is DEH's view that the comprehensive review of the fishery during 2004 is the appropriate time to review the adequacy of current bycatch reporting, monitoring and assessment arrangements and to examine the scope for further reducing bycatch. These arrangements should be incorporated in a formal performance measurement and response framework. **Recommendation 11** addresses these concerns.

Conclusion

DEH is satisfied 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 this fishery does not threaten bycatch species.

DEH considers that a review of the existing information collection, assessment, performance measurement and management responses is required and has made a recommendation regarding this.

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

DFWA requires that all interactions between crab fishing gear and marine mammals, turtles and birds be noted at the bottom of commercial logbook sheets. However, the Submission gives no indication of compliance with this requirement or of efforts to ensure that operators understand its importance. The other source of fishery dependent information on threatened species interactions is personal communication with commercial operators. Fishery independent information has been obtained from unpublished DCLM data. In addition, the internal DFWA risk assessment workshop for this fishery drew upon information and risk assessments generated at formal workshops held for the West Coast Rock Lobster Managed Fishery and the South Coast Crustacean Fishery.

Given the small size of this fishery and the extremely low exposure of threatened species and communities to risk of harm, DEH believes that the information collection system is capable of providing adequate data. However, to ensure that the system does so, DEH urges DFWA to impress on operators the importance of reporting all interactions and to provide them with aids to identification of the species that are likely to be encountered. Furthermore, as part of the review of the fishery scheduled for December 2004, DEH recommends that DFWA assess the adequacy of existing reporting arrangements in monitoring protected species interactions in the fishery (see **Recommendation 11**).

Assessment

The risks of the fishery to protected species were assessed during the internal ESD workshop for this fishery. This analysis concluded that:

- the species most at risk from this fishery are whales, dolphins and leatherback turtles;
- there have been no reports of deaths, entanglements or boat strikes from this fishery in relation to these species;
- the only interactions reported are dolphins feeding on discarded bait;
- risks of fishery impacts are negligible (except for leatherback turtles for which the risks are assessed as low).

The risk assessment will be reviewed within five years. This fishery has not been found to be associated with or to impact on any threatened ecological communities. DEH accepts the high likelihood that, under existing management arrangements and effort levels, the fishery poses no risk to any protected species or threatened community.

Management response

The small number of boats operating in this remote offshore fishery over a vast length of coast, together with the use of longlines, make the likelihood of interactions with marine mammals, turtles and seabirds most unlikely. The thick buoy lines used at either end of longlines are much less likely to entangle these species than the smaller diameter lines used in the rock lobster fishery. Hence, the lack of reports of interactions between crab fishing gear and marine wildlife is not surprising and no specific measures have been imposed to reduce the likelihood of interactions.

Accepting the low likelihood of interactions, DEH proposes that, as part of the review of the fishery during 2004, operators' understanding of the importance of incident reporting and their compliance with reporting requirements should be examined and remedial actions (eg education and liaison) implemented if necessary.

Conclusion

DEH notes that there are minimal interactions with protected species in this fishery and is satisfied 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 the risk assessment process indicate otherwise, DEH suggests that appropriate actions be undertaken to ensure the fishery avoids mortality, injury to these species and avoids or minimises impacts on threatened ecological communities.

A recommendation has been developed to ensure that the risk of unacceptable impact on protected species is minimised in the longer term.

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

DFWA's internal workshop has drawn on information on the size, nature and operational area of the WCDSCIM Fishery to identify potential threats and to assess risks posed to the ecosystem. The main sources of information are fishery dependent reports of catch, effort, bycatch and wildlife interactions, plus extrapolations from other similar WA pot fisheries. The Submission proposes that, given the small size of the fishery and lack of interactions, large amounts of data are not needed to assess its wider impacts on the ecosystem. The Submission also refers to research into this and similar fisheries continuing to provide information on which future management actions will be based where necessary. However, the nature of such research – both current and future - is not described.

DEH notes that there is no real data collected on the impact of the fishery on the marine environment generally. The only information on the impact of deep sea crab fishing on this ecosystem is scant and anecdotal. DEH is concerned at 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.

The Submission acknowledges the need for increased knowledge of the communities and interactions between deep sea crabs and other species and the impacts of fishing on the ecosystem but notes that the cost and logistical issues may make collection of relevant information difficult. **Recommendation 6** should enable ecosystem impact related research to be identified and included in the research strategy.

Assessment

The ESD workshop identified potential threats to the general ecosystem systematically and comprehensively. The impacts of the fishery on trophic interactions, soft mud substrates and associated benthic biota were all assessed as negligible as was the impact of ghost fishing. The dispersed nature of this small fishery, the small number of potlifts, small bycatch and sustainable take of target species and the manner in which pots are set and hauled all mitigate against significant interactions with the benthic ecosystem. Operators' observations and studies of similar fisheries indicate that fish and invertebrates vacate pots once the bait is exhausted. DEH concurs with this assessment, which DFWA proposes to review every five years.

DEH agrees with DFWA that in cases such as the WCDSCIM Fishery where it is impossible to obtain comprehensive information on which to base a decision, a risk assessment implemented in a precautionary way can provide a suitable basis for decision making. DEH has made several recommendations in this report aimed at improving the information base used when conducting future risk assessments.

Management response

Management measures which restrict the number of boats and their access to this wide-ranging offshore fishery and the way that pots are used contribute to the assessed low impacts of this fishery. The low incidence of bait and bycatch discarding, the position of crabs in the food chain and the current measures in place to maintain healthy crab stocks (eg minimum sizes) are important factors which mitigate against impacts on higher or lower trophic levels.

The Submission does not refer explicitly to the application of the International Convention for the Prevention of Pollution from Ships (MARPOL) to vessels operating in the fishery in relation to the disposal of wastes. The Submission does however explain that there is a high level of industry awareness on the need to minimise waste disposal at sea and a code of practice requiring operators to dispose of all packaging and other waste material in bins provided at all landing points. DEH believes that DFWA, as a standard applied across all its fisheries, that all vessels operating in the fishery must employ appropriate controls on waste disposal meet standards of seaworthiness.

Taken together, these factors suggest that there is no need for further specific management measures to ensure against damage to the general ecosystem. DEH is satisfied that the risk assessment process used has been robust enough to ensure that short to mid-term risks have been identified and that appropriate management measures are in place. Accepting the low likelihood of harmful ecosystem impacts, DEH proposes that, as part of the review of the fishery during 2004, the adequacy of current knowledge of environmental impacts should be examined. Information needs should be identified and prioritised. Impact assessments should be incorporated in a formal performance measurement and response framework, where possible.

Conclusion

DEH is satisfied that the fishery is conducted in a manner that minimises the impact of fishing operations on the ecosystem generally. DEH notes that should circumstances alter significantly in the fishery appropriate assessments and additional actions will be developed by DFWA.

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LIST OF ACRONYMS

AFMA	Australian Fisheries Management Authority
CW	Carapace width
DEH	Department of Environment and Heritage (formerly Environment Australia)
DFWA	Department of Fisheries, Western Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ESD	Ecologically Sustainable Development
FRDC	Fisheries Research and Development Corporation
ITQ	Individual Transferable Quota
MARPOL	International Convention on Marine Pollution
NT	Northern Territory
OCS	Offshore Constitutional Settlement
SCCF	South Coast Crustacean Fishery
UNCLOS	United Nations Convention on the Law of the Sea
WA	Western Australia
WCDSCIM	West Coast Deep Sea Crab Interim Managed (Fishery)
WTO	Wildlife Trade Operation