Assessment of the
Western Australia Pearl Oyster Fishery

Environment Australia

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Disclaimer

This document is an assessment carried out by Environment Australia of a commercial fishery against the Commonwealth 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 EPBC Act. The views expressed do not necessarily reflect those of the Minister for the Environment and Heritage or the Commonwealth Government.

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Assessment of the ecological sustainability of management arrangements for the Western Australia Pearl Oyster 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 for the Pearl Oyster Fishery* (the submission) was received by Environment Australia (EA) in October 2002 after a period of discussion between DFWA and EA, during which preliminary drafts were refined. The submission was released for a thirty-day public comment period that expired on 3 December 2002. Two public comments were 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 the Western Australia (WA) Pearl Oyster Fishery (POF) against the Commonwealth *Guidelines for the Ecologically Sustainable Management of Fisheries.* The EA assessment considers the submission and associated documents, public comments and DFWA's response to the comments.

The POF targets *Pinctada maxima* (silver lipped pearl oyster) in WA waters, from Exmouth Gulf to the Northern Territory (NT) border. A summary of the *P. maxima* fishery is provided in Table 1. Parts I and II of this report provide an assessment of the *P. maxima* fishery.

Pearl oyster species are also harvested from WA waters in small quantities for aquaculture purposes. These species include *P. margaritifera, P. albina, P. fucata, Pteria penguin and Pt. fulcata.* An assessment of the wild harvest component of aquacultured species is presented in Part III of this report.

While the fishery includes a hatchery reared component and seeding operations, the EA process assesses only the wild harvest aspect of the *P. maxima* and aquaculture pearl oyster species fishery.

Pinctada maxima is widespread in the Indo–West Pacific. In WA, it has been recorded from Dirk Hartog Island in Shark Bay, but is not fished commercially south of North West Cape. *P. maxima* lives on shallow rocky pavements on the continental shelf where there are small crevices into which the young animals can settle and drop. Genetic studies indicate that, within WA and northern Australia, the WA population is separate from the Northern Territory (NT) and Queensland populations and that there are some clines[1] from the north to the south in WA.

A brief description of the distribution of the aquacultured pearl oyster species is presented in Table 2. Further information on the species is provided in Part III.

P. maxima is a protandrous hermaphrodite. This means the animals mature first as males, around 3-4 years of age, (110-120 mm) after which they undergo a sex change and become female. By 170 mm in length, half of the animals are females and half are males and by 190 mm the whole population is female. In WA, pearl oysters spawn from September to April, with peaks from late October to December and February to March. Growth rates are initially fast with animals reaching 120 mm (legal size of collection) at three years of age. They are collected for some three to four years before they become unsuitable for round pearl culture. Large oysters of 200 mm are 15-20 years of age, and some

[1] gradual but continuous change of form of a species across its range, usually linked with differences in environment.

animals reach a size of 270 mm. Pearl oysters are filter feeders. The aquacultured pearl oyster species have similar life history characteristics to *P. maxima.*

Table 1: **Summary of Western Australia *Pinctada maxima* Pearl Oyster Fishery.**

Area	Licensees can collect pearl oyster from Exmouth Gulf in WA to the Northern Territory border; principal fishing areas occur in Commonwealth waters.
Fishery status or development stage:	Fully exploited.
Stock assessment reliability:	Main focus on fishery-dependent data. Some fishery - independent studies underway/completed. ESD report assigns high robustness.
Target Species	*Pinctada maxima*, silver lipped pearl oyster.
Hatchery reared product	Increasing use of hatchery reared product. 350,000 hatchery reared pearl shells permitted to be seeded annually. Hatchery reared quota options have been operating since 1996.
Byproduct	None.
Gear	Hand collection by hookah[2] divers being towed behind large tender boats up to 35m long.
Season	Fishing can occur all year, however generally occurs between March - July.
Fleet	In any given year, there can be between 6 - 10 vessels fishing for pearl oyster. Currently 9 vessels involved in wild harvest of pearl oysters.
Commercial harvest 2000	Wild harvest TAC in 2000 was 502,500 for Zone 2/3 and 115,000 in Zone 1. Total caught in 2000 was 501,419 in Zone 2/3 and 66,772 in Zone 1.
Value of commercial harvest	Second highest grossing fishery in WA, with an average annual value of around $220 million (2001- $150 mill.)
Recreational harvest	Recreational harvest prohibited.
Commercial licenses issued	16 licensees
Management arrangements Commercial:	Quota system, min and max size limits, data collection, wild shell stock / hatchery quota substitution, subject to regular review process.
Export	Most product (90-95%) exported including pearls and shell. Pearl meat currently used only domestically.
Bycatch	"Piggy back " species i.e. those species that live on the shells of pearl oysters; negligible risk impact.
Interaction with Threatened Species	None identified.

Table 2: **Distribution of aquacultured pearl oyster species in Western Australia (WA).**

Species	Distribution
Pinctada margaritifera	Indo Pacific species. In WA occurs northwards from the Abrolhos.
Pinctada albina	Common in Shark Bay and occurs northwards of the Abrolhos.
Pinctada fucata	Wide distribution. In WA occurs as far south as Albany.
Pteria penguin	Occurs north of the Abrolhos. and more commonly in the warmer northern tropics.
Pteria fulcata	Occurs north of the Abrolhos. and more commonly in the warmer northern tropics.

[2] Underwater diving system; air delivered to the diver via a floating air hose

The *P. maxima* fishery is managed under the WA *Pearling Act 1990*, Regulations and Ministerial Guidelines. These include a number of defined management arrangements, such as a quota system, spatial zonal system, minimum and maximum size limits and the ability to substitute wild harvest quota with hatchery reared quota. In addition, an Ecologically Sustainable Development (ESD) workshop was held for this fishery in 2001 to conduct a risk assessment of the POF. The outcomes from this workshop are contained in a report titled "Environmental Risk and Impact Assessment of the Pearling Industry" (Jernakoff, 2002), and are summarized in the DFWA ESD Application to Environment Australia on the Pearl Oyster Fishery (DFWA ESD Report, 2002). The DFWA ESD Report contains objectives, indicators and performance measures for measuring effectiveness of the management arrangements for the POF.

The *P. maxima* fishery operates in shallow coastal waters along the North West Shelf and comprises four fishing zones (however fishing currently does not occur in Zone 4). Licensees can collect pearl oyster from Exmouth Gulf to the NT border. Harvest of culture shell occurs mostly in Zone 2, around Eighty Mile Beach (88% of total catch taken in 2000) and most of the principal fishing areas occur in Commonwealth waters.

The number of licensees is 16. In any given year there can be between 6 to 10 vessels fishing for pearl oysters. Currently nine vessels are operating. The license issued under the *Pearling Act* allows only for the take of *P. maxima*.

Fishing for live pearl oysters is permitted throughout the year, but generally occurs outside the wet season between March and July when water visibility is best, making for more efficient harvesting. The divers swim about 1.5 m off the seabed and even in murky water when divers swim closer to the bottom, they are still above the bottom substrate.

In 1986, DFWA commissioned the Pearl Industry Review to set out Management Guidelines for the industry, establish a legislative process and move towards the upgrading of the *Pearling Act*. A number of management recommendations for the resource were developed, including annual quotas to be set by annual stock assessments using catches and catch rates, complete phasing out of Mother of Pearl (MOP) collection and zoning of the fishery to achieve more precise management. Further management changes occurred over the last decade or so, such as encouragement for companies to substitute the wild quota allocations with hatchery reared oysters. DFWA considers that the industry is highly organized, geared to maintaining a sustainable production both economically and environmentally, having overcome many of the problems that the fishery faced in its history.

The take of aquaculture pearl oyster species is authorized through an Oyster Fishing Licence (OFL) under the *Fish Resources Management Act 1994*, (Section 135) and Regulations 127 and 128. The interested party is required to fill out an *Application for an Oyster Fishing Licence*. An OFL allows the party to fish for oysters in public waters subject to the conditions set out on the licence. The conditions contained on the OFL include the size limits, method of fishing, number of oysters permitted and the completion of a logbook.

The POF fishery is the second highest grossing fishery in WA, with an annual average value of around $220 million ($150 mill. in 2001). The POF is second in value to the WA Rock Lobster Fishery. Most product (90-95%) is exported, including pearls and shells, with the pearl product by far affording the highest revenue.

There are no byproduct species in the *P. maxima* and aquaculture pearl oyster fishery due to the targeting accuracy of the harvest methodology as pearl shell are collected by hand and because the licences issued only allow for the take of certain species.

Bycatch and protected species interactions have been identified through the risk assessment process as negligible. These interactions, albeit negligible are assessed under Principle Two of this report. There is also no interaction between the POF and threatened ecological communities and no significant impact on the broader marine environment.

Overall assessment

The material submitted by DFWA indicates that the *P. maxima* fishery operates generally in accordance with the Commonwealth *Guidelines for the ecologically sustainable management of fisheries*. EA concurs that the fishery is a well-managed fishery that is unlikely to have an unacceptable or unsustainable impact on the environment in the short to mid term. Recommendations have been developed to ensure that the risk of impact is minimized in the longer term. Overall, the management regime - including detailed analysis of catch data, mid year reviews of various components of the fishery with scope to vary management responses, real time monitoring, development of indicators, performance measures and management actions, and reviews suggests that the fishery is being managed in an ecologically sustainable manner.

In making this assessment, EA is satisfied that the information collection system, risk assessments, management arrangements and overall objectives are sufficient to ensure that the fishery is conducted in a manner that does not lead to over fishing and that stocks are not currently over fished. EA recognizes that further improvements to management may result from a number of DFWA initiatives as highlighted throughout this assessment. EA notes the declining catch rates for the Zone 1 sector of the fishery, but recognizes that DFWA has a number of performance measures in place for this zone and a suite of management responses should these be breached. EA is confident that these measures should prevent these stocks falling below the defined reference points. Considering the research programs and management arrangements in place and the particular selective and benign characteristic of the fishery operations, EA is satisfied that fishing operations are managed to minimize their impact on the structure, productivity, function and biological diversity of the ecosystem. Management of this fishery has a history of reacting appropriately to threats to sustainability and EA is confident that DFWA will continue to provide this high quality management.

EA is also satisfied that the combination of management arrangements, life history characteristics of harvested species and small scale of wild stock collection, provides confidence that existing harvesting operations pose no significant threat to the sustainability of aquacultured pearl oyster species. The limited harvest, combined with the highly selective method of collection ensures that impacts on bycatch and protected species are negligible and there is no significant impact on the structure, productivity, function and biological diversity of the ecosystem. EA notes that the wild stock harvest is subject to controls appropriate to the scale of the fishing operations. In the event that wild stock harvest of these species increases, EA encourages DFWA to ensure that additional management arrangements and data collection systems are implemented.

As the principal fishery area occurs in Commonwealth 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 and threatened communities. A number of protected species occur in the fishery area. The ESD report indicates no interactions with protected species

therefore management responses and triggers are considered unnecessary. EA concurs with this assessment and is satisfied that the operations of the fishery ensure that it is unlikely to have an unacceptable impact on protected species. EA is also satisfied that in the event that interactions are detected DFWA will ensure that all persons engaged in fishing are required to take all reasonable steps to minimize impacts. EA recommends that this fishery be accredited under Part 13 of the EPBC Act.

The assessment concludes that the POF is managed in an ecologically sustainable way. EA recommends that the export of *Pinctada maxima, P. margaritifera, P. albina, P. fucata, Pteria penguin and Pt. fulcata* should be exempt from the export permit requirements of Part 13A of the EPBC Act, with that exemption to be reviewed in five years.

To further strengthen the effectiveness of the management arrangements for the POF, and to contain the environmental risks in the medium to long term, EA has developed a series of recommendations and made a number of suggestions. The implementation of these and other commitments made by DFWA in the submission will be monitored and reviewed as part of the next Commonwealth review of the fishery in five years time.

Recommendations

1. DFWA to include the operational objectives, reference points and performance measures from the DFWA ESD report in the Pearl Oyster Fishery Ministerial Policy Guideline and to review these at least every 5 years. Operational objectives to be developed in relation to minimizing impacts on bycatch and protected species and the broader marine environment.
2. The DFWA ESD report to be amended to incorporate a clear timeframe for the completion of a performance measure breach review. The breach review report should include a clear timeframe for implementation of management response actions.
3. Within one year, the DFWA ESD report to be published, and all performance measures, responses and information requirements formally incorporated into a Ministerial Policy Guideline.
4. DFWA to maintain effective compliance and enforcement mechanisms to ensure that all wild harvested pearl oysters are fully accounted.
5. DFWA to inform EA of any changes to the Pearling Act, Ministerial Policy Guidelines or managerial commitments in the DFWA ESD report.
6. A mechanism to be developed to enable the amendment of management arrangements to respond to new information or future Government plans and policies.
7. DFWA to encourage the Pearl Producers Association while finalizing their Environmental Code of Practice, to consider including actions to address issues relating to the wild harvest of pearl oysters that are highlighted in the ESD Report and EA's assessment report.
8. DFWA to maintain an effective research and monitoring program in the fishery to validate the catch data, enhance understanding of the stocks status and develop biological performance measures.
9. Should fishing commence in Zone 4, DFWA to include Zone 4 in the assessment program for the fishery to ensure a reliable biological assessment of stock status is established, including performance measures, and that fishing is managed in an ecologically sustainable manner.

PART I - MANAGEMENT ARRANGEMENTS

A number of pearl oyster species are harvested in waters off Western Australia (WA). The primary fishery for pearl oysters targets *Pinctada maxima* (silver lipped pearl oyster) and is the focus of the assessment by Environment Australia und the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This part of the report deals only with the *P. maxima* fishery. Pearl oyster species, including *P. margaritifera, P. albina*, *P. fucata*, *Pteria penguin and Pt. Fulcata*, are also harvested from WA waters in small quantities for aquaculture purposes. An assessment of the harvest of these species has also been conducted. An assessment of the management arrangements and impacts of the aquaculture pearl oyster fishery are provided in Part III of this report.

The Department of Fisheries WA (DFWA) manages the WA Pearl Oyster Fishery (POF). The management regime is described in the following documents, all of which are, or will be publicly available:

- provisions of the *Pearling Act 1990*
- Pearling (General) Regulations 1991
- Ministerial Policy Guidelines
    - No. 17, 2001 "Pearl Oyster Fishery" and;
    - No. 8,1998 "Assessment of Applications for Authorizations for Aquaculture and Pearling in Coastal Waters of WA"; and,
- the WA Application to Environment Australia on the Pearl Oyster Fishery (DFWA ESD Report, 2002).

There are a number of other documents, including research reports, scientific literature and discussion papers, which are integral to the management of the fishery.

Copies of the *Pearling Act 1990* can be purchased from the State Law Publisher and is available through the Internet. The Ministerial Policy Guideline for the POF No. 17 is regularly updated through a process, including consultation with industry, such as the Pearl Producers Association (PPA) and the Pearling Industry Advisory Committee (PIAC). These guidelines are distributed to all pearling licensees, the PPA, and PIAC members and copies are available free of charge upon request or on the Internet.

The DFWA ESD Report of the Pearl Oyster Fishery will be amended in light of the recommendations made in this assessment. It will then be made publicly available via publication or electronically. The report will provide transparency to the POF management through explicitly stated objectives, indicators, performance measures and management arrangements for each identified issue and to the performance of the fishery against these measures. Environment Australia (EA) notes that the WA Environmental Protection Authority (WAEPA) is preparing a framework for reporting on all WA fisheries. It is proposed that this framework would be linked to a regular audit cycle involving the WAEPA and the Office of the Auditor General. EA understands that the reporting focus for the pearl oyster fishery is on pearl farming management issues and may not give specific attention to wild harvest issues. EA supports this work and suggests that the tripartite Memorandum of Understanding (MOU) between WAEPA, DFWA and the Office of the Auditor General be developed and include the wild aspects of the pearl oyster fishery.

The *Pearling Act 1990* does not include an explicit statement of objectives and the POF does not have a management plan. The Ministerial Policy Guideline No. 17 outlines the general outcomes to be achieved and contains the basic rules for management of the POF.

Currently the *Pearling Act 1990* and the Ministerial Policy Guidelines are under National Competition Policy review. The Government's response to the outcomes of the review will be incorporated into the revised Act. EA welcomes the Pearling Act review and understands that it will be consulted by DFWA as a part of the review process. EA also notes DFWA intentions to include a set of high order objectives, incorporating ESD principles and a hierarchy of principles in the revised Act. The *Pearling Act 1990* does not include provisions relating to review of the Act, however DFWA has advised that the operational objectives of the DFWA ESD Report will be reviewed on a regular basis and that these objectives are most appropriately placed in the Ministerial Policy Guidelines. EA notes however that there are no operational objectives in the current ESD Report concerning minimizing impacts of the fishery on bycatch and protected species and the broader marine environment. EA believes it is important that future management of the fishery recognizes the need to minimize impacts on bycatch species and the broader environment, despite a current low risk to these elements of the fishery.

Recommendation 1: *DFWA to include the operational objectives, reference points and performance measures from the DFWA ESD report in the Pearl Oyster Fishery Ministerial Policy Guideline and to review these at least every 5 years. Operational objectives to be developed in relation to minimizing impacts on bycatch and protected species and the broader marine environment.*

The *Pearling Act 1990* defines the requirements for procedures that must be undertaken before determining or amending management arrangements. The management arrangements for the POF are developed through formal consultation with industry, PIAC and the PPA.

DFWA holds an annual public meeting in Broome to allow for community input and to provide information to the community on POF management issues, broader fishery policy management issues, and results from POF research and catch data analysis.

The DFWA ESD Report, which includes consultation matters, recognizes that the consultation process is not well understood and that there are low levels of participation by external stakeholders.

DFWA considers that community interest is minimal because there are no resource sharing conflicts (i.e. recreational/ indigenous take of *P. maxima*), low exploitation rates and the method of fishing has little impact on the ecosystem.

EA notes that one of the indicators in the ESD Report is the level to which licensees consider that they are adequately and appropriately consulted. EA considers that this could be broadened to also include other stakeholders to ensure better representation of all interested parties. The need for broader stakeholder representation was also raised in the public comments. EA notes the State government directions in response to the National Competition Policy review as it applies to the *Pearling Act* i.e. "the composition, focus and structure of the Pearling Industry Advisory Committee (PIAC) should be considered in parallel to the review of the Act so that it reflects a more balanced representation of community interests and comes into effect upon the adoption of the new *Pearling Act*". EA strongly supports this direction and suggests that community interests that should be considered for representation in PIAC include conservation, community and recreational and indigenous fishing interests.

The DFWA ESD Report was developed through a consultative process that included a wide range of stakeholders including the pearling industry, recreational sector, representatives of government and non-government conservation agencies. DFWA has indicated that this workshop will be repeated at the five-year review of the ESD report. EA considers that a fishery management regime should be developed through a consultative process providing opportunity to all interested and affected parties. If the stakeholder workshop is not repeated at the five-year review, then DFWA will need to ensure that adequate consultation occurs through other fora.

The ESD Report specifies the objectives, performance indicators, performance measures and actions to address the main components of the fishery. The Report contains some triggers for management action should performance measures not be met, however, EA notes that timeframes for the implementation of these actions are not included.

Recommendation 2: *The DFWA ESD report to be amended to incorporate a clear timeframe for the completion of a performance measure breach review. The breach review report should include a clear timeframe for implementation of management response actions.*

The indicators identified in the DFWA ESD Report are well established and data are available to demonstrate levels of performance over time. EA notes that DFWA is proposing to conduct a review of the indicators / performance measures. An assessment of the effectiveness of these measures is included in Part II of this report.

The DFWA ESD Report is not currently a formal component of the legislative arrangements for the fishery. The Report sets out a number of management commitments, including detailed and explicit management triggers and performance measures that have been fundamental to EA's assessment and recommendations. Although EA is satisfied that the lack of a legislative basis will not cause issues in the fishery in the short term, for certainty in the longer term, the Report needs to be formally incorporated into the management regime.

Recommendation 3: *Within one year, the DFWA ESD Report should be published, and all performance measures, responses and information requirements formally incorporated into a Ministerial Policy Guideline.*

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

- setting maximum and minimum size limits;
- quota limitations or total allowable catch;
- the use of spatial zone management (four zones);
- wild shell stock / hatchery shell quota substitution; and,
- a catch data collection process.

Each licensee is allocated an individual shell quota as part of an overall TAC. Transfer of quota is provided for under sec. 32 of the *Pearling Act 1990* and is permitted with the approval of Executive Director (ED) of DFWA. Permanent and temporary transfers of quota are also permitted under the Pearling (General) Regulations 1991. Closures and quota limitation can be made mid season by DFWA or at the request of the licensees to account for exceptional events such as cyclones and inclement weather.

The Pearling (General) Regulations 1991 support the Western Australian *Pearling Act 1990* and provide the framework for the management of administrative and technical matters for this fishery. The ED may issue licences, leases and permits subject to a number of conditions being satisfied and having regard to any Ministerial Policy Guidelines. The guidelines deal with the elements of fishing and farming and focus on the establishment of zones in the fishery, quota allocation and transfer of shell. In addition the Pearl Oyster Translocation Protocol outlines disease minimisation policies relevant to the movement of pearl oysters into, within and out of the state. The Enzootic Diseases Amendment Regulations 1999 are also relevant in this regard.

Fishery-dependent data relating to *P. maxima* 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.

The equivalent of 4.6 officers implemented compliance and enforcement throughout all zones in the fishery during 1999-2000. Compliance officers based at Broome and Karratha patrol from Exmouth Gulf in Zone 1 to the Kimberley development (Zone 4). These patrols use diving inspections, aircraft, and patrol vessels (DFWA and industry boats). EA understands that in 2000-2001 22 offences (which would have included prior warnings) were issued, of which 7 concerned the wild harvest component of the fishery.

Major compliance activities are diving inspections on wild stock holding sites to monitor quota and minimum and maximum shell sizes, verification of shell numbers and size prior to seeding operations.

Quotas are monitored through a combination of quota tags and a paper audit trail using catch, holding site, transport and seeding operations logbooks submitted by licensees to DFWA. Other activities include officers accompany catcher boats to monitor catch and transport documentation and to ensure compliance with the *Pearling Act*/Regulations.

Since 2000, the use of a Vessel Monitoring System (VMS) was required in Zone 1 to enforce quotas that were established in three sub areas of that zone. EA understands that Zone 1 is no longer divided into sub zones and the zone is managed as a single unit. VMS is not required on vessels operating in Zones 2 and 3, however EA notes that DFWA report that in the future there may be greater use of VMS and placement of trained observers on fishing vessels to verify wild stock catches. EA recognizes the usefulness of VMS in validating logbook data. EA strongly supports the implementation of VMS across all zones in the fishery in the near future (including Zone 4 should fishing commence) with the information collected used to validate logbook data.

The DFWA ESD Report addresses governance and compliance issues, with some aspects still being developed. With the completion of the Fisheries Research and Development Corporation (FRDC) compliance study, compliance activities, indicators and performance measures will be reviewed. The legislative review may also assist in more targeted compliance activities. DFWA have recently advised that it will, in consultation with industry, review the compliance strategy, including a compliance risk assessment process. The completed review is expected mid 2003.

EA also commends the above mentioned compliance review and suggests that the following issues be addressed:

- further development of effective compliance and enforcement mechanisms to ensure full accounting for all wild harvested pearl oysters.

- review of the quota units within the fishery zones, addressing the proportional allocation of hatchery and wild harvest quota units, to ensure that the wild harvest of pearl oysters is sustainable. Particular consideration should be given to reducing the wild harvest quota unit allocation in Zone 1.

A public comment was made about the adequacy of compliance, particularly given the remoteness of much of WA's northern coastline and the value of pearls. The concern was raised about the risk of illegal fishing with the potential to "launder" pearls or pearl oysters through the NT. DFWA advises that the risk of unlawful movement of wild shell is minimal. Any movement between States of shell, hatchery reared or wild harvested stock, requires transport approval from DFWA.

EA consider that there may be scope for improvement in compliance and enforcement activities in order to ensure that all wild pearl oyster harvest removals are fully accounted. EA suggests that an audit of the risks associated with the movement of pearl oyster product from WA to other jurisdictions be undertaken. In response to that audit and as appropriate, arrangements with relevant jurisdictions to prevent the incidence of illegal movement and ensure that these removals are factored into the management of the WA pearl oyster fishery should also be established.

Recommendation 4: *DFWA to maintain effective compliance and enforcement mechanisms to ensure that all wild harvested pearl oysters are fully accounted.*

EA is broadly satisfied that these compliance measures, together with the recommendations, contain the means of enforcing critical aspects of the management arrangements.

Western Australia prepares Annual State of the Fisheries Reports (SFR), which review the performance of the major aspects of WA fisheries, including the POF, and are published following review by the WA Office of the Auditor General. The DFWA ESD Report for the POF provides another review forum for the fishery. The DFWA ESD Report includes, *inter alia*, status reports for those components that are not subject to annual assessment and are generally more detailed than the annual SFR assessment. The DFWA ESD report will be reviewed every five years. EA is satisfied that a five-year review of the entire fishery is appropriate while critical aspects are reviewed annually. These are discussed further in Part II of this report.

EA considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Because of the importance of the *Pearling Act 1990*, the Ministerial Policy Guidelines and the DFWA ESD Report to EA's assessment of the fishery, any amendments to these documents could change the outcomes of the assessment.

Recommendation 5: *DFWA to inform EA of any changes to the Pearling Act, Ministerial Policy Guidelines or managerial commitments in the DFWA ESD report.*

The ESD report has also documented the capabilities for the assessment, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem. This is assessed under Principle Two of Part II of this report.

The fishing method comprises divers hand collecting pearl oysters directly from the seabed and results in very little to no contact with other species. DFWA reports that there are no threatened species affected by the fishery and as a result no threat abatement plans or bycatch action plans are relevant to

this fishery. EA notes, there is no mechanism in the management arrangements that require compliance with any future plans or policies.

Recommendation 6: *A mechanism to be developed to enable the amendment of management arrangements to respond to new information or future Government plans or policies.*

Some of the licensees have environmental guidelines and are in the process of developing Environmental Management Systems for their companies' pearling operations. In addition, the PPA is finalizing an Environmental Code of Practice. EA commends industry for these important initiatives and recommends that they address issues associated with the wild harvest of pearl oysters. EA also supports a suggestion (Jernakoff 2002) to study the environmental implications of fishing vessels discharging treated sewage rather than untreated sewage.

Recommendation 7: *DFWA to encourage the Pearl Producers Association while finalizing their Environmental Code of Practice, to consider including actions to address issues relating to the wild harvest of pearl oysters that are highlighted in the ESD Report or EA's assessment report.*

Conclusion

EA is satisfied that the management regime in the POF is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to over-fishing and for fishing operations to be managed to minimize their impact on the structure, productivity, function and biological diversity of the ecosystem. EA is also satisfied that stocks are not currently over fished, but should that occur in the future, the fishery is conducted such that there is a high degree of probability the stock(s) would recover.

The management regime is developed through a consultative process. The management arrangements are adaptable, are underpinned by adequate objectives and performance criteria by which the effectiveness of the management arrangements are measured, are enforceable and reviewable.

EA has made a number of recommendations to improve long term sustainability of the fishery.

PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES

This part of the report presents an assessment of the *P. maxima* fishery against the Guidelines for the ecologically sustainable managements of fisheries. An assessment of the aquaculture pearl oyster species is presented in Part III of this report.

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 is collected on a regular basis in the fishery. Some fishery-independent information is also collected. DFWA advises that a substantial amount of information is collected to monitor stock abundance within the fished areas. Since the 1980s, fishery dependent data has been obtained through compulsory daily catch logbooks. Fishers are required to record the number of pearl oysters taken, location (10x10 mile blocks which are further divided into 2.5x2.5 sub blocks), total dive time and depth. The DFWA ESD report states that the fishery data collection process is moderately robust.

There has been a heavy reliance on catch data collection through logbooks to determine the status of stocks and quota allocation. This was raised as an issue during public consultation. DFWA considers that catch rates in the pearl oyster fishery are a relatively robust means of indicating the local abundance of pearl oysters. This is because effort is tightly controlled by standardized dive profiles developed specifically for the pearl industry. DFWA continually analyses the catch rates within a year as well as from year to year and adjusts the quotas accordingly. Data on critical environmental conditions, such as visibility, is also collected.

EA notes DFWA advice that it will continue to investigate the feasibility of using more indirect environmental measures, such as water currents or sea temperature, as an indicator of pearl oyster recruitment and incorporate these parameters into assessments and management practices where appropriate. EA suggests that in doing so, DFWA validate assumptions that cyclone activity and other environmental occurrences and subsequent habitat damage / modification are the cause of stock declines / increases.

The range of compliance activities used to validate fishery information is discussed in the Principle 1, Objective 1, 'Management Response' section.

A number of fishery-independent surveys have been or are being undertaken in the POF which complement existing fishery dependent data collection. These include:

- An FRDC funded study is underway to determine the spat abundance index. The project is expected to deliver a more predictive mechanism to set future catch limits.
- Fishery-independent dive surveys have been undertaken in all zones, but most extensively in Zone 1.
- A catch sampling program has been in place since 1998 to determine size frequency ranges in the three fishing zones.
- A Mother of Pearl (MOP) research project that measured pearl oyster stock in fished, and unfished areas, including some deeper fishing grounds. The project covered only Zones 2 and 3. DFWA advised that it has conducted other population surveys of both fished and unfished areas in all zones, with the focus mainly on areas that have been previously fished.

While EA supports the fishery- independent monitoring of stocks in Zone 1, it notes that monitoring is not conducted in all fishing areas of that zone. Furthermore, in a fishery that targets pearl oysters for approximately three years once they reach the legal size, projections based on past catch data may under or over estimate available stock. Given the previous declines in catch landings in this zone, its current status and the changing nature of fishing effort within the zone, sufficient monitoring of stocks across the zone is important. Further refinement of monitoring in Zone 1 through fishery independent data collection could be useful in addressing these issues. In particular, attention should be given to improving monitoring in the northern and middle areas of Zone 1. EA also believes that of the level of fishery-independent data collection in Zones 2 and 3 could be improved.

DFWA has established a long-term research and development strategy for the WA pearling industry and is working in cooperation with industry to identify and develop proposals for future research priorities. EA strongly supports a long-term research strategy for the fishery that provides greater industry ownership and commitment to setting and achieving research priorities.

EA considers that independent dive surveys and ongoing research and monitoring projects are important to validate catch data and stock status trends collected through fishery-dependent means, particularly in Zone 1, and encourages the continuation and future enhancement of these activities. In addition, EA recognizes that the spat collection project[3] currently underway could provide information on population recruitment and inform decisions relating to the potential productivity of the fishery. EA suggests that if this project does not yield the anticipated results, that DFWA pursues alternative methods to further validate / determine the biological productivity of the stocks. The relationship between recruitment and environmental factors could be further evaluated to extend the predictions

Overall, given the range of fishery dependent independent data gathered by DFWA and the mechanisms for regularly reviewing the data requirements, EA is satisfied 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.

[3] FRDC Project 2000/127

Recommendation 8: *DFWA to maintain an effective research and monitoring program in the fishery to validate the catch data, enhance understanding of the stocks status and develop biological performance measures*[4].

Assessment

A review of the performance of the fishery is conducted annually and within the fishing season when required. The DFWA ESD report provides detailed interpretations of fishery data in relation to the distribution of fishing, landings, fishing effort and catch rates. An assessment model, using the Catch Per Unit Effort (CPUE) data and some environmental data forms the basis of the annual stock assessment and quota setting process. However, the submission states that the fishery performance assessments are primarily conducted to gauge the economic performance of the fishery, rather than focusing on the ecological sustainability of the fishery.

As discussed in the previous section, management of the fishery relies significantly on CPUE data. In general, an assessment model based upon CPUE data is not likely to be as robust as one based upon biological data, with the ability to estimate stock biomass and recruitment relationships. The potential for manipulation or misrepresentation of catch and effort recorded by fishers in logbooks, and its implications for setting an annual Total Allowable Catch (TAC), is an inherent concern with all CPUE based models. DFWA advises that the CPUE data obtained in the POF is considered to be of a high quality due to the occupational health and safety (OHS) requirements to log diver's time very accurately and there has been high logbook reporting compliance to date. Robustness of the assessment process in the POF is further strengthened by a Mother of Pearl (MOP) research project, which included independent surveys of the pearl oyster stocks both inside and outside the fished areas that have been factored into assessment of the stock.

EA agrees that the existing assessment process in the POF is reasonable given the robustness of information collected. However, EA suggests that assessments should be conducted with a greater focus on determining the ecological performance of the fishery, incorporating fishery-independent information, and that biological performance measures be incorporated to increase the robustness of the stock assessment. In addition, while pearl oysters are currently not harvested in Zone 4, in the event that fishing is conducted in Zone 4, a reliable assessment of the stocks will be needed to ensure that fishing occurs in an ecologically sustainable manner.

Recommendation 9: *Should fishing commence in Zone 4, DFWA to include Zone 4 in the assessment program for the fishery to ensure a reliable biological assessment is established, including performance measures, and fishing is managed in an ecologically sustainable manner.*

The SFR 2001/2002 states that the pearl oyster stocks are considered fully exploited within the management parameters of diver safety and maximization of values of the pearl crop. Recent data indicates that the recruitment in Zone 1 is lower and less regular compared to Zones 2 and 3.

For Zone 1, recruitment is considered to be more variable and sporadic so greater emphasis is placed on size frequency of catch than on catch. DFWA also conducts direct surveys on broodstock numbers in Zone 1, which also examines if cyclones or other environmental influences have affected overall stock abundance.

[4] Note: The rationale for the development of biological performance measures is discussed in the Principle 1, Objective 1, "Assessment" section.

For Zones 2 and 3, the season's catch rate (number of shells per hour) is monitored against ten and five year averages, respectively. These zones have a long time series data set, starting in 1978, and DFWA considers that for more than thirty years there has been no impact on recruitment level outside of environmentally driven fluctuations. DFWA has advised, in response to public comments, that in these two zones recruitment levels have increased as a result of environmental conditions such as El Nino Southern Oscillation (ENSO) and that the spawning biomass therein is higher now that it has been for a century.

The species distribution is well understood and the species range has been factored into management responses by maintaining at least 40% of the pearl distribution within unfished areas and spreading fishing across a number of management zones.

One genetic study[5] indicates that the WA *P. maxima* pearl population is genetically separate from the NT and Qld population. Another more detailed investigation[6] revealed some clines[7] from the north of the fishery to the southern end of the distribution. It is not apparent in the submission how these specific genetic findings have been factored into the management responses. DFWA has recently advised that it is considering greater use of genetic studies to aid compliance activities. EA strongly supports this initiative.

The commercial harvest of pearl oysters is known and factored into assessment and management practices. The fishery is managed in four zones that allow management arrangements and monitoring to be tailored according to the differences (i.e. environmental conditions, recruitment variability) between each of the zones. The stock status is reviewed each year by DFWA in liaison with pearling licensees and PIAC. Quota is determined for each zone annually and takes into account past performance and future expectations for each zone. EA notes the commercial catch data is analyzed in a detailed manner to determine, among other things, catch levels, as indicators for stock assessments and catch rate trends over time in the various sectors and even, in the past, sub areas of zones in this fishery.

DFWA reports that the fishery management is adaptable, tailored to each fishing zone, taking into account the variability of recruitment and abundance of pearl oysters in each fishing zone, using a number of indicators. The indicators include catch rate (total catch and fishing effort, size class of pearl oyster, in water survey of broodstock*)* to assess the sustainability of the pearl oysters in each zone.

DFWA reports there is no recreational or indigenous take of pearl oysters in WA. DFWA considers that the illegal take of pearl oysters is minimal and focused on the removal of shell from pearl farms (which have been inoculated with pearl nuclei), not from the wild stock.

DFWA states that the long history of the *P. maxima* fishery (more than 30 years in the pearl culture) coupled with the catch and effort data and research data enables very reliable estimates of the sustainable yield to be calculated for the pearl fishery in fished areas. Annual harvest quantities have significantly reduced since the fishery commenced from 1,000-1,500 tonnes (1.5 mill shells) in the early 1930s when targeting MOP shell, to about 250 tonnes (500,000 shells) for culture size shells in

[5] Johnson and Joll, 1993
[6] Benzie and Smith, 2002
[7] gradual but continuous change of form of a species across its range, usually linked with differences in environment

the 1960-70s. This reduction in harvest levels has persisted for approximately thirty years and the catch rate information indicates that the overall abundance of the pearl oysters is increasing.

EA is satisfied that there is an adequate and ongoing assessment of pearl oyster stocks that takes into account the distribution and spatial structure of the stocks and provides reliable estimates of potential stock productivity on which to base sound management decisions.

Management response

The current management regime for the adult fishery 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.

The primary management tool for the fishery is a quota system linked to individual management zones. Four zones have been established to allow management arrangements and monitoring to be tailored to the different environmental conditions and subsequent recruitment levels of areas within the fishery.

EA supports the use of management zones in the fishery as a means of effectively taking into account the spatial distribution of stocks but notes that the POF zones are based on historical fleet fishing behavior, rather than on ecological or spatial information about the stocks. There may be some risk that existing zone boundaries do not adequately take into account the spatial structure of the stocks and may result in localized depletion of stocks over time. For example, catch data indicates highly skewed catch and effort in Zone 2, which accounted for 88% of the total landings in the fishery.

DFWA advises that the assessment process and robust catch and effort data ensure sustainable catches within each zone through the annual setting of quotas for each zone. DFWA considers that localized depletions are not an issue, as the economics of the fishery mean that long term environmental harm would not occur. EA suggests that DFWA consider a review of management boundaries to determine if existing zones remain appropriate.

Maximum and minimum size limits have also been established to protect stocks from over exploitation and maximize recruitment potential. The size limits are considered effective and ensure that sufficient spawning individuals remain in the fishery. In addition, while pearl oysters are harvested, they are not killed and removed from the natural system. Shells are aggregated in ocean farms and are not necessarily removed from the breeding population and may spawn several times while in culture.

DFWA consider the mix of input and output controls an adequate and precautionary management strategy for the fishery. Furthermore, given the area fished and the small size range of suitable shell, the exploitable biomass is only about 5-10% of the total biomass. Therefore, even if all the exploitable biomass were removed, it would have little impact on the spawning stock. EA concurs that the management arrangements are appropriate to the scale of the fishery and provide a sound basis for the ongoing precautionary management of the fishery.

No byproduct species are taken in the POF because the POF harvesting method is highly targeted and because licensees are allowed to only take *P. maxima.* Consequently, management arrangements specific to byproduct have not been developed. EA agrees with this approach and is confident that in the unlikely event that byproduct species are identified that DFWA would develop appropriate management arrangements for those species.

The current WA POF management regime includes a range of indicators / performance measures used throughout the various fishery zones by which to measure fishery impacts on spawning stocks of pearl. The indicators and performance measures are reviewed and refined on a regular basis to maintain their relevance as fishing practices change over time. The indicators and performance measures include:

- relative area where the pearl oyster fishery operates;
- catch rate (total catch and fishing effort);
- size class of pearl oyster fished; and
- in water survey of brood stock.

The area that is fished each year compared to the total area where pearl oysters are located in this region is used as an indicator of stock sustainability in the fishery. The indicator is linked to the performance measure that 40% of the pearl oyster distribution is not harvested. DFWA states that fishing for pearl oyster currently occurs in less than 10% of the species distribution within the fishery region and that the fishery is currently at a substantial distance from triggering even this precautionary limit. DFWA further considers that the measure is appropriate, given bivalve stock recruitment theory and is highly precautionary to protect long-term sustainability of the stock.

The annual catch rate of culture shell is used as an indicator of pearl oyster abundance within the fished areas of each zone. A limit reference point for Zones 2 and 3 is 50% decrease in catch rates from historical averages. If the catch rates decrease or increase by more than 50% from the average a review of the quota and other management measures will be initiated. DFWA advises that the 50% level of change is appropriate because historically, catch levels have changed significantly from year to year due to environmental factors. A change by 50% represents a departure from the range values since 1978 and would indicate a severe economic problem for the industry.

The size class of pearl oysters harvested is another indicator used in the fishery. The performance measure requires that size frequency histograms of catches in Zone 1 should be skewed towards newly recruited oysters (120-145mm). If the performance measure is breached, it taken as an indication of limited new recruitment and a review of management is initiated.

Multiple trigger points are also in place to detect any significant declines of incoming recruitment as a result of environmental effects and are associated with the implementation of appropriate risk management interventions.

EA notes that in the main, the performance measures are mainly related to catch data and consideration should be given to investigating a biological parameter such as pearl oyster spawning / biomass level. EA notes DFWA intentions to develop a funding submission to review the trigger points and recognizes the results could be used to develop robust biological performance measures and refine the stock assessment process. **(See Recommendation 8)**

The ESD report outlines a number of management responses should reference points be triggered. These include reassessment of quota, introducing maximum size limits and closure of areas. EA is confident that appropriate management action would be implemented in a timely manner in the event that a trigger point is breached.

DFWA considers that overall the management is precautionary with a high degree of industry participation, acceptance and support. The management approach has been operational for over thirty

years and has been very effective, resulting in a very high probability of continuing to achieve the main objective of maintaining the spawning stocks of the pearl oysters. EA notes that *P. maxima* is generally harvested in a very small area of its distribution (<10%). There are also inefficiencies in the harvesting method that would further afford protection to the wild populations of pearl oysters or prevent the populations from being over fished including specific diver requirements such as certain depth ranges, visibility requirements, tides and size limit ranges. In addition, the commercial value of the product from the fishery places an economic limit on harvest, as operators are reluctant to harvest significant quantities and risk a decline in market value.

Conclusion

EA is satisfied that the information collection system and stock assessment and management arrangements are sufficient to ensure that the fishery is conducted at catch levels that maintain ecologically viable stock levels with acceptable levels of probability.

EA 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'*

DFWA consider that stocks harvested within this fishery are currently above defined reference points. Although catch rates have declined in Zone 1 over recent years and stocks are of potential concern, EA considers that the management measures in place, such as the performance measures, management responses, scope to further improve data collection and an overall review of trigger points in the fishery, together with other EA recommendations; should work towards preventing the Zone 1 stock from falling below the defined reference points and, moreover, promote recovery of the stocks. Therefore this objective is not applicable to this fishery, at this time. However EA suggests close monitoring of the pearl oysters in Zone 1 to ensure the implementation of timely management responses, to prevent stocks in this zone becoming ecologically unviable.

EA is satisfied that fish stocks are not below a defined reference point and is confident that, should that occur, the fishery would be managed to promote recovery 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

The DFWA ESD risk assessment workshop identified 'piggy-back' species as the only by-catch in this fishery. The risk to this group of species was assessed as negligible. The fishing method is highly selective as experienced divers do all harvesting by hand. Consequently, bycatch of species, other than 'piggy-back' species, is not encountered in the fishery.

'Piggy-back' species are those fouling commensal organisms, including other small invertebrates that encrust the pearl oyster shell and are harvested when the pearl shell is collected. These species are then either scraped off or discarded and most likely do not survive. DFWA consider that data collection is not required given the results of the risk assessment process. EA concurs with this assessment and is confident that should any bycatch species of concern be identified that appropriate monitoring systems would be developed.

Assessment

The risk assessment identified that 'piggy-back' species were of negligible risk from the fishery. The risk was considered negligible, as it is unlikely that 'piggy back' species use pearl oyster shell exclusively as a substratum and that fishing practices ensure that a large proportion of the pearl oyster population is not fished and it therefore remains available to provide habitat for sessile invertebrates. EA concurs with this assessment.

All issues raised in the ESD report will be reassessed within five years and EA is confident that should a subsequent risk assessment demonstrate risk to any bycatch species that appropriate action would be undertaken.

Management response

As the take of 'piggy back' species was identified as a negligible risk, DFWA considers, and EA concurs, that management responses are not required. Given the negligible impact of the fishery on bycatch species it is not applicable for the management of this fishery to monitor an indicator group of bycatch species.

Conclusion

EA is satisfied that the fishery is conducted in a manner that does not threaten bycatch species. In the unlikely event that this situation changed, or future ESD risk assessments process indicated otherwise, EA suggests is confident that appropriate actions would be undertaken to ensure bycatch species are not threatened by the operation of the 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/ Assessment / Management Responses

Due to the selective harvesting fishing method used in the fishery, no interactions with protected, endangered or threatened species or threatened ecological communities were identified in the DFWA ESD risk assessment workshop. DFWA consider therefore that there is no need to have in place information collection processes, further assessment or management responses in relation to these species and communities. EA concurs with this view however notes that in the unlikely event that interactions with protected species occur (such as boat strikes) during the operation of the fishery that there is no mechanism to require the reporting and monitoring of such interactions. EA suggests that the logbooks be amended to enable protected species interactions recording, to further validate the assessment of negligible risk. EA also suggests that this issue could also be addressed in the finalization of the Environmental Code of Practice.

Conclusion

EA 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. However should this situation change, or the risk assessment process indicate otherwise, EA suggests that appropriate actions be undertaken to ensure the fishery avoids interaction with and impacts on protected species.

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 consider that appropriate levels of information have been obtained for most of the ecosystem issues identified in the ESD Report allowing the determination of a defensible assessment on the level of risk. Information sources include direct data on levels of catch and effort, research publications on trophic interactions and ecosystem functions of pearl oysters, nationally and internationally. DFWA state that the application of these information sources has been critical in developing management responses and will continue to be an integral part of future management.

Assessment

The DFWA ESD risk assessment workshop analyzed the risk of impact of the fishery on the general ecosystem. A total of six issues were identified, assessed and rated as a negligible risk. The six issues that were identified were trophic interactions; stock enhancements, in terms of the ranching of shells, discarding of shells; holding sites; diver activities and anchoring.

Jernakoff (2002) identified a number of ecosystem impact issues that could be addressed through small studies. The proposed studies relate to the amount and nature of material cleaned from the pearl

oysters after capture, and the environmental benefits of fishing vessel discharge of untreated sewage compared to sewage treated with chemicals. EA considers it would be beneficial to undertake these studies.

Management response

DFWA reports that none of the activities identified in the risk assessment process were considered as sufficient risk to warrant management attention. Therefore no performance measures have been developed to trigger management responses in relation to ecosystem impacts. EA considers this appropriate given the fishery's relatively benign ecosystem impact.

Discarding was raised as a concern during public consultation. A very small proportion of live pearl oysters harvested are inappropriate for retention. DFWA advise that operators must return discarded pearl oysters to the pearl beds in the vicinity of where they were harvested. The MOP research project[8] has indicated survival of discarded oysters is high. In addition, pearl oysters do not have to attach to a particular substrate and can settle on whatever substrate is available. EA does not believe that discarding in this fishery is likely to have a significant detrimental impact on the ecosystem or species. However, EA has previously noted and supported the suggestion of a study to be undertaken to confirm the view of low discards of pearl oysters and their survivability rates.

Conclusion

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

[8] Hart and Friedman, 2003.

PART III –AQUACULTURE PEARL OYSTER SPECIES MANAGEMENT

Introduction

The Department of Fisheries Western Australia (DFWA) has submitted material for assessment under Part 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) of five aquaculture pearl species, *Pinctada margaritifera, P. albina, P. fucata, Pteria penguin and Pt. fulcata.* This Part assesses the wild harvest component of aquaculture operations for these five species in accordance with the Commonwealth *Guidelines for the ecologically sustainable management of fisheries*. This assessment takes into account only the wild harvest of these species and does not report on the management of the fishery post harvest.

Pearl oyster species collected from the wild for aquaculture purposes are harvested in the same manner as described for *P. maxima* earlier in this report. Consequently, the impact of harvesting aquaculture pearl oyster species from the wild can be expected to be similar (if not lower risk) to that described for *P. maxima* in Part II, Principle 2 of this report. A separate assessment against Principle 2 of the Guidelines is therefore not repeated in this Part.

Species

A total of five pearl oyster species are harvested in Western Australia for the purposes of aquaculture. Each species is managed through individual size and harvest limits that provide for a once off harvest with subsequent collections permissible upon request (see Table 3). In general, industry focus on these species is with hatchery reared stock, with some collection of juvenile/adult stock from the wild.

These species have not attracted significant research attention due to their limited commercial harvest, and as such little is known about the biology and life history characteristics of individual species. It is reasonable to assume however that they would possess similar life history characteristics to *P. maxima*.

Pinctada margaritifera

P. margaritifera is an Indo Pacific species and in WA occurs northwards from the Abrolhos. The species produces black pearls. Hatchery production produces 99.9% of animals used in culture. There are no commercial scale wild seedings of the species and it appears that this operation is basically a closed cycle. Production relies mainly on culture stock.

Pinctada albina

P. albina is common in Shark Bay and occurs in massive beds, but also occurs northwards of the Abrolhos. The pearl oyster industry commenced harvesting this species in the 1860s. Currently product value is low and the species is not widely cultured. Due to the abundance of the species in Shark Bay, a large harvest is permitted while a once only harvest is permitted outside Shark Bay (see Table 3). Discretion is granted to the DFWA Executive Director on the allocation for this species in Shark Bay.

The species is not harvested for broodstock as there is no hatchery production of this species, however, shells are collected for pearling operations. During 2001–02, only 500 shells of this species were collected and used in pearl production and not for broodstock purposes. The remaining *P. albina* in culture were collected as spat on the pearl farm site and grown out from this size.

Pinctada fucata

P. fucata has a wide distribution and in WA occurs as far south as Albany. It is considered a common species and wild spat settles readily on pearl farm gear.

Pteria penguin and Pt. fulcata

Pt. penguin is cultured for the production of half pearls. The species occurs north of the Albrolhos and more commonly in the warmer northern tropics. It is generally found in deeper, fast current zones attached to black coral and is readily found on moorings and ropes. The species is collected on farms as spat or harvested from man-made structures. There is little wild collection of this species due to its limited habitat.

FDWA has recently advised that in the field, the distinction between *Pt. penguin* and *Pt. fulcata* is problematic as it is difficult to clearly observe taxonomic features. In particular, external shell colouration is difficult to identify under heavy biofouling and the internal shell nacre colour and adductor muscle scar shape is impossible to view in a live animal. Consequently, inadvertent collection of *Pt. fulcata* while collecting *Pt. penguin* is inevitable, particularly as the two species occur in a similar habitat in Western Australia. Therefore, the collection limit of *Pteria* on a licence refers to the combined catch, which may include both *Pt. penguin* and *Pt. fulcata*.

Management arrangements

The harvest of aquaculture pearl oyster species is managed by DFWA through licence conditions and regulations under the *Fish Resources Management Act 1994*. Specifically, the management regime is described in the following documents, all of which are publicly available:

- The *Fish Resources Management Act 1994* (Section 135)
- Regulations 127 and 128
- Oyster Fishing Licence (OFL) (containing conditions for operation)
- Relevant Gazetted notices and licence conditions

A number of input and output controls ensure the level of take of individual species is regulated (see Table 3). Each species is subject to controls such as:

- Requirement to hold an OFL;
- Minimum size limits for each species;
- Wild harvest limits for each species

Table 3: Management arrangements for the harvest of aquaculture pearl oyster species

Species	Size limit	Harvest limit	Licences
Pinctada margaritifera	>80mm	Once off harvest of 300 adults	36 (including hatcheries)
Pinctada albina	>50mm	Once off harvest of 1000 adults outside Shark Bay, 50,000 p.a in Shark Bay (500 shells harvested in 2001/02)	23 licences (including hatcheries) 3 active in 2001/02
Pinctada fucata	>50mm	Once off harvest of 1000 adults	1 licence
Pteria penguin	>80mm	Combined limit of once off harvest of 300 adults	29 licences
Pteria fulcata	>80mm		4 licences

An OFL allows the party to fish for oysters in public waters subject to the conditions set out in the licence. The conditions contained on the OFL include size limits, method of fishing to be used, number of oysters permitted and the completion of a compulsory logbook.

Size limits are based on sustainability and economic criteria, namely:

- All pearl oysters are protandrous hermaphrodites i.e. mature as males first and then change to females at a later stage/size. The sizes were selected to allow the males to spawn prior to collection.
- The size limit is set at approximately 20mm below the seedable size (i.e. the size at which the first nuclei can be inserted) to enable the shell to be collected and acclimatize to handling and stress, prior to operation. The shell generally grows approximately 20mm during this acclimatization phase.

DFWA considers that the level of take for all species has been conservatively set by its Research Division, particularly *P. albina* which has supported fishing since the early 1900s. There is a total of 37 licenses, including 6 hatchery licenses.

There are no requirements/controls for spat collection outside the regulations and conditions set out by the OFL. A draft policy was developed but did not progress due to lack of interest by individuals to fish for spat. Industry focus for these species is on the use of hatchery reared stock and spat collection as opposed to collection of juvenile/ adult stock. An aquaculture license allows for spat collection from licensed areas and limited access to wild stock, principally for broodstock for hatchery purposes. Only holders of aquaculture license for the relevant species may be issued with the OFL. For all species, except *P. albina*, the harvest license allows for once off culture trials with subsequent collections permissible upon request with a max of 100 adults for broodstock purposes.

Due to the high abundance of *P. albina* in Shark Bay, significant (50,000 shells p.a) harvest may occur. Outside Shark Bay, a once off harvest of 1000 adults is permitted, due to the lower abundance of the species. While there is potential significant harvest of the species, only 500 shells were harvested in 2001/02. The low market value of the species compared to *P. maxima* provides little incentive for large harvesting and low harvest levels are expected to continue in the short to mid term.

As outlined above, *Pt. penguin and Pt. fulcata* have a combined harvest limit of 300 shells, as they are difficult to differentiate in the wild. 300 shells were permitted in the first collection, to provide pearl farmers an opportunity to conduct wild shell seeding trials at the start of operations on site. Through consultation with the pearl seeders and industry, DFWA determined that 300 shells represented an adequate sized sample (about one day seeding for the technician) to establish the suitability of the site.

Fishery dependent information is collected in the fishery through compulsory logbooks. Compliance with logbooks is considered high due to the occupational health and safety requirements to log diver's time accurately.

No formal stock assessment is conducted for the wild harvest component of aquaculture pearl oyster species. DFWA consider that the small-scale harvest regulated through precautionary harvest and size limits, combined with a reliable data collection system ensures that the fishery operates within sustainable limits.

Given the precautionary harvest limits and small-scale wild harvest of aquaculture pearl oyster species, performance measures and trigger limits have not been developed. EA suggests that DFWA continues to monitor and regulate the wild harvest of these species and, in the event that the scale of harvesting operations increases, develops appropriate performance measures linked to precautionary trigger limits and defined management action.

DFWA is confident that the wild harvest of aquaculture pearl oyster species in WA is conducted at sustainable levels with precautionary management measures in place to ensure that overfishing does not occur.

Further confidence is afforded in that while these animals are 'fished' they are not killed or removed from the natural system. Shells are aggregated on the farm, therefore oysters that are being used for pearling are not necessarily removed from the breeding population, as with most fishing practices. Pearl oysters used for production of pearls may spawn several times while in culture. Given the increased likelihood of spawning success of a broadcast spawning animal in an aggregation (e.g. a pearl farm), holding shell in aquaculture sites may actually increase the number of recruits per spawning, as more eggs will be able to be fertilized.

Conclusion

EA is satisfied that the management arrangements for the harvest of aquaculture pearl oyster species in WA are sufficient to ensure that fishing is conducted at catch levels that maintain ecologically viable stock levels with acceptable levels of probability. EA is confident that the combination of management arrangements, life history characteristics of harvested species and small scale of wild stock collection, ensures that existing harvesting operations pose no significant threat to the sustainability of aquacultured pearl oyster species.

While the potential harvest of *P. albina* in Shark Bay is large, the abundance of the species in that region, combined with a long history of significant harvest and the current low value and harvest of the species, suggests that there is no serious threat to sustainability of the species in the short to mid-term. The harvest of *P. margaritifera, P. fucata, Pt. penguin and Pt. fulcata* is small and populations are likely to withstand regular harvesting at current levels.

EA notes that the wild stock harvest is subject to controls appropriate to the scale of the fishing operations, but encourages DFWA to ensure that in the event that wild stock harvest of these species increases that additional management arrangements and data collection systems are implemented.

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LIST OF ACRONYMS

CPUE	Catch Per Unit Effort
DFWA	Department of Fisheries, Western Australia
EA	Environment Australia
ED	Executive Director
ENSO	El Nino Southern Oscillation
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically Sustainable Development
FRDC	Fisheries Research and Development Corporation
MARPOL	International Convention on Marine Pollution
MOP	Mother of Pearl
NT	Northern Territory
OFL	Oyster Fishing Licence
OHS	Occupational Health and Safety
POF	Pearl Oyster Fishery
PIAC	Pearl Industry Advisory Committee
PPA	Pearl Producers Association
SFR	State Fisheries Reports
TAC	Total Allowable Catch
VMS	Vessel Monitoring System
WA	Western Australia
WAEPA	Western Australia Environmental Protection Authority