



Australian Government

Department of the Environment and Heritage

Assessment of the
South Australian Sea Urchin Fishery

December 2005

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This document is an assessment carried out by the Department of the Environment and Heritage of a commercial fishery against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. It forms part of the advice provided to the Minister for the Environment and Heritage on the fishery in relation to decisions under Part 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 South Australian Sea Urchin Fishery

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EXECUTIVE SUMMARY

Background

The Department of Primary Industries and Resources South Australia (PIRSA) has submitted a document for assessment under Part 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The draft document *Ecological Assessment of the South Australian Sea Urchin Fishery* (the submission) was received by the Department of Environment and Heritage (DEH) in September 2004. The submission was released for a thirty-day public comment period that expired on 29 October 2004. Two public comments were received. PIRSA 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 South Australian Sea Urchin Fishery against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission, associated documents, public comments and PIRSA response to the comments.

Table 1: Summary of the South Australian Sea Urchin Fishery

Area	Waters adjacent to the State of South Australia (State waters only). The areas surrounding Streaky Bay and Coffin Bay are the main harvesting locations.
Fishery status	Little information is available however the stock is considered under-fished.
Target Species	Purple sea urchin (<i>Heliocidaris erythrogramma</i>).
By-product Species	None.
Gear	Taken by hand using hookah or Self Contained Underwater Breathing Apparatus (SCUBA).
Season	Unrestricted. Fishing mainly undertaken between May and December when roe is of the highest quality and market demand is greatest.
Commercial harvest 2003/04	7660 kilograms (whole weight).
Value of commercial harvest 2003/04	Estimated at \$215,000
Recreational harvest	Considered low, National Recreational and Indigenous Fishing Survey (NRIFS) estimate of 147 individuals annual catch with only 45% of urchins retained.
Commercial licences issued	Two licences have been issued that allow the harvesting of sea urchins. Five scallop divers also have licence conditions that provide access to sea urchin stocks but have not reported harvesting sea urchins in the last two years.
Management arrangements	Input controlled through: <ul style="list-style-type: none"> • limited entry (7 licences); • limited effort (currently 1 boat per licence with 2 agents); and • gear restrictions (hand harvest only).
Export	Exported after processing to Asian markets (primarily Japan).
Bycatch	None.
Interaction with Threatened Species	Negligible.

The area of the fishery includes all State waters off the coast of South Australia. There are no restrictions on the depth to which sea urchins can be harvested, however the harvesting methods limit access to certain areas and rely on good weather to access offshore islands and reefs. The majority of harvesting occurs along the western coast of the Eyre Peninsula, with the main locations being the Streaky Bay and Coffin Bay areas.

Three species are commercially harvested in Australia including *Heliocidaris erythrogramma* in Tasmania, Victoria and South Australia, *Centrostephanus rodgersii* and *Heliocidaris tuberculata* in New South Wales and eastern Victoria (Worthington and Blount, 2003).

In South Australia, the only species currently commercially exploited is *H. erythrogramma*, commonly known as the purple sea urchin. No byproduct species are permitted to be taken in the fishery (apart from the five scallop licence holders who are also permitted to take scallops, however this assessment does not address scallop harvest).

H. erythrogramma is the most common sea urchin found in southern Australian waters. The species is endemic to Australia and inhabits intertidal rocky reefs down to depths of 35 metres along southern Australian coasts. In South Australia they are commonly found amongst rocks, boulders or crevices of shallow subtidal limestone and granite reefs. *H. erythrogramma* is usually 60 to 90 millimetres in diameter but has been known to reach 125 millimetres.

Sea urchins are free spawners, with both males and females releasing their gametes into the water column, triggered by environmental cues. Previous studies on *H. erythrogramma* have shown that fertilisation success is density dependent, therefore significantly higher when male and female urchins are located within a couple of metres of one another (Lawrence 2001). Generally, spawning occurs during early summer to late autumn. *H. erythrogramma* mature at a diameter of 23 millimetres, however may not spawn until they reach a diameter of 40-50 millimetres.

H. erythrogramma mainly moves at night and feed by grazing on filamentous algae and encrusting algae found on the substrate, or by capturing drift algae, and are considered a dominant herbivore in the southern Australian region (Lawrence 2001).

Sea urchin stocks are generally at risk of localised and serial depletion due to their limited dispersal abilities, patchy distribution, ease of collection, slow recovery from overfishing and limited information on biological and spatial distribution available for management. There is a history of “boom-bust” cycles in a number of sea urchin fisheries internationally. The species therefore requires strict management controls to ensure the sustainability of harvests.

In 2003/04, 7660 kilograms (whole weight) of sea urchins were harvested in South Australia. Assuming a 7% yield (amount of roe per whole sea urchin) and a price of \$400 per kilogram for roe, the fishery has been valued at approximately \$215,000.

Harvesting of sea urchins has been sporadic for many decades in South Australia. The development of the commercial fishery began in 1999, when five exemptions were granted for harvesting in five zones across the state. The exemptions were initially issued for the purpose of market research and development, to identify potential markets for sea urchin products and to determine if the industry could be viable. The fishery has shown a small amount of growth since 2000, after a very large year in 1999/2000 (12770 in 1999/2000, 1219 in 2000/01). The greatest growth has occurred in the last year as markets have been established (an increase of approximately 6200 kg live weight from 2002/03 to 2003/04).

Between 1999 and 2005, the number of exemptions reduced to two. These two exemption holders were the only two persons actively exploiting sea urchins and developing markets overseas. A decision was therefore made to issue licences to these two fishers. This allows for more direct management of the fishery, and for the collection of licence fees to meet the costs of future research. The licences held by commercial scallop divers also have conditions allowing the take of sea urchin. This access was granted when the scallop arrangements were established, to encourage exploration of the resource. The scallop fishers have not harvested any sea urchins in the last two years.

The trial period for the fishery ended in March 2002, however due to low harvest levels and limited understanding of the biological characteristics of the species, the fishery continues to be managed as a limited entry developmental fishery.

Development of sea urchin fisheries in Australia is believed to be currently limited by economical viability due to low recovery rates (percentage of roe per urchin). The PIRSA submission identifies that without the development of innovative solutions to increase recovery rates, such as supplementary feeding for short periods, the fishery will not fully progress beyond the developmental phase.

The main market for Australian sea urchin roe is thought to be the well-established overseas markets due to limited demand for sea urchin roe in local domestic markets. Until 1999 there has been limited success from numerous attempts to develop an export industry of Australian sea urchin roe (Blount et al 2001). Traditionally, sea urchin roe has been popular in sushi restaurants with most retailers/consumers preferring locally sourced roe to imported product. Sea urchin roe is now also found in Japanese local supermarkets, opening a market for lower grade imported roe. The colour, size and texture of the roe is generally used to determine the value of the product on the Japanese market.

Sea urchins are hand harvested by divers operating on hookah (compressed air). Divers can also use SCUBA although hookah allows a greater searching and harvesting time underwater. There are no restrictions on the amount of sea urchins that can be harvested, however divers are currently limited by the number that can be carried in their small vessels. The fishery is currently limited to seven licences, however only two are active. The licences are reviewed annually with no guarantee of renewal and are also non-transferable. Each fisher is allowed only one vessel in the fishery, with two additional divers assisting with the harvest.

The fishery is target-specific (i.e. hand selected harvesting) and therefore has no bycatch. Currently, there is little to no information on the interaction between commercial sea urchin fishing and its effects on endangered, threatened or protected species. Interaction with threatened, endangered and protected species is however considered low due to the fishing methods employed and the low amount of effort currently in the fishery.

The recreational and indigenous take of sea urchins for human consumption in South Australia is not currently studied and there is no size, bag or boat limits set for any species of sea urchin. PIRSA consider the level of take by these sectors to be low due to the low demand for sea urchin products on the local domestic market. In the NRIFS it was estimated that the total annual catch of sea urchins was 147 individuals across South Australia, with only 45% retained. In addition, the South Australian Museum and the Malacological Society are permitted to take sea urchins for scientific purposes. There is no record of any harvest of sea urchins under these exemptions in the last six months.

The licences permitting the take of sea urchins in South Australia are issued under the *Fisheries Act 1982*. A formal fishery management plan has not yet been developed for the fishery. The regulations that govern the management of the fishery are established in the *Fisheries (Scheme of Management - Miscellaneous Fisheries) Regulations 2000* and through licence conditions.

Overall assessment

The material submitted by PIRSA demonstrates that the management arrangements for the South Australian Sea Urchin Fishery meet most of the requirements of the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*.

DEH has identified a number of risks that must be managed to ensure that their impacts are minimised:

- limited management measures for ensuring that harvest is limited to sustainable levels;
- potential for localised and serial depletion, given a lack of controls on the level of take in the fishery;
- limited information on take from the recreational sector, and a lack of precautionary management controls for this sector;
- no research basis to determine ecologically sustainable harvest levels; and
- little information on the effects of harvesting sea urchins on the wider ecological community.

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

The South Australian Sea Urchin Fishery is in a developmental stage and has made considerable progress in developing sound management arrangements. The management regime aims to ensure that fishing is conducted in a manner that does not lead to over-fishing and for fishing operations to be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. On balance, the fishery is being managed in an ecologically sustainable manner and is working to address existing problems and minimise environmental risks.

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

Recommendations

1. PIRSA to advise DEH of any material change to the fishery's management arrangements that could affect the criteria on which EPBC decisions are based, within 3 months of that change being made.
2. Within 18 months PIRSA to develop precautionary fishery specific objectives linked to performance indicators and performance measures for the target species and impacts on the ecosystem.
3. PIRSA to develop and implement a robust system to validate commercial logbook reporting of catch and effort in the fishery within two years.
4. PIRSA to develop and implement management strategies to address key gaps in the knowledge of sea urchin biology and ecology.
5. Within 18 months, PIRSA to develop a process to improve estimates of recreational and Indigenous take and factor these into management arrangements.
6. Within 2 years PIRSA to develop and implement finer scale data collection and reporting and management measures to mitigate the risk of localised and serial depletion of sea urchins in the fishery.

PART I - MANAGEMENT ARRANGEMENTS

The South Australian Sea Urchin Fishery is managed by PIRSA.

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

- South Australian *Fisheries Act 1982*;
- South Australian *Scheme of Management (Miscellaneous Fisheries) Regulations 1991*; and
- Relevant gazetted notices and permit/licence conditions.

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

Recommendation 1: *PIRSA to advise DEH of any material change to the South Australian Sea Urchin Fishery's management arrangements that could affect the criteria on which EPBC decisions are based, within 3 months of that change being made.*

There is currently no formal consultative mechanism in place for the discussion of issues relating to the management of the South Australian Sea Urchin Fishery. PIRSA consults with the two active fishers on issues affecting the development of the fishery. Should the fishery progress beyond the developmental phase, PIRSA has committed to undertake a formal process to develop appropriate consultative arrangements. This process will include extensive public and stakeholder consultation. DEH considers that PIRSA will ensure that all interested parties are consulted appropriately at this time. PIRSA is currently developing a policy for the management of 'Developmental Fisheries', which will outline the process for moving the developmental fishery to a full commercial fishery.

There are no fishery specific objectives, performance indicators and performance measures in place for the fishery. DEH considers that fishery specific objectives and indicators need to be developed to ensure that the performance of the fishery can be monitored and management action taken as required, particularly given the limited knowledge on biological characteristics of the species and the vulnerability of the species to localised and serial depletion. Performance measures (which may include review events and reference points) should be capable of detecting and responding to changes in the status of the fishery.

Recommendation 2: *Within 18 months PIRSA to develop precautionary fishery specific objectives linked to performance indicators and performance measures for the target species and impacts on the ecosystem.*

Once developed, the objectives, performance indicators and performance measures should be regularly reviewed and made publicly available.

The fishery is currently restricted to two harvesters targeting urchins and five scallop licence holders who are also allowed to take sea urchins. All management controls for the fishery are input controls. A maximum limit of 21 fishing days was a management measure when exemptions were first issued for the fishery, however it is not a restriction that is placed on current licence conditions. There are no limits on the number of sea urchins that can be harvested by either the commercial or recreational sector.

Given the absence of a reliable stock assessment process, and the potential for localised depletion of sea urchin species, DEH is concerned that the number of sea urchins harvested is not limited. DEH considers that the implementation of **Recommendation 2** should ensure the precautionary management of the fishery in the short term, until more reliable information is available on which to base long term management.

The Sea urchin exemption holders and the scallop harvesters operating in the fishery are required to submit harvest information to PIRSA. There is no ongoing independent monitoring of the South Australian Sea Urchin Fishery. Discussion of the information collection system for the fishery can be found in Part II of this report.

An analysis of the fishery's capacity for assessing, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which the target species lives and the fishery operates is contained under Principle Two.

It is unlikely that the impact of harvesting sea urchins in South Australia would have a significant impact on sea urchin populations in other jurisdictions due to their limited dispersal ability. There is very limited information about the distribution of stocks in South Australia, however the biology of the target species is relatively well known as a result of studies undertaken elsewhere in Australia. The spatial management of sea urchin stocks is discussed further in Part II of this report.

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

No regional or international management regimes, to which Australia is a party, are of direct relevance to the fishery. The prime international regime affecting the fishery is the United Nations Convention on the Law of the Sea (UNCLOS). The management regime essentially complies with this. Other international regimes are applicable to fisheries management but do not explicitly involve this fishery, for example the 1992 Convention on Biological Diversity and in particular the 1995 Jakarta Mandate requiring that, in relation to the sustainable use of marine and coastal biological diversity, the precautionary principle should apply in efforts to address threats to biodiversity. While these agreements are not specifically addressed in the Submission, the fishery's compliance with their requirements can be assessed by examination of Part II of this report.

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 considers that the South Australian Sea Urchin Fishery management regime is documented and is developed through a process suitable to the current developmental status of the fishery. The management regime adheres to arrangements established under Australian laws and international agreements. DEH considers that there is scope to further refine the management arrangements and has provided a number of recommendations for improvements in the longer term.

PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES

Stock Status and Recovery

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

Maintain ecologically viable stocks

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

Information requirements

Sea urchin fishers and scallop divers with access to the fishery are required to submit monthly logbook data to PIRSA on the number of specimens harvested, the date and area fished, the port of landing, species targeted (scallop divers only), name of each species taken (scallop divers only), processing method and the use made of the resource. There is currently no validation of catch information.

Little fishery independent research has been conducted on the ecology and status of South Australian sea urchin stocks. The South Australian Research and Development Institute (SARDI) has completed a major project on the post harvest enhancement of sea urchin roe. The project explored the potential of controlling the quality and consistency of roe by holding and feeding post harvest and may enhance the sustainability of the fishery by reducing the number of sea urchins discarded due to the poor quality of roe. DEH supports research in this area and encourages PIRSA to implement an information collection system that accounts for the number of sea urchins being discarded at processing to enhance knowledge in this area and improve future management of this problem.

Fishery dependent data for the fishery are currently the best source of fishery information, due to the lack of fishery independent data available. As management of the fishery heavily relies on accurate fishery dependent data there is a need for the data to be validated. DEH therefore recommends that PIRSA develop and implement a system to validate commercial logbook data.

Recommendation 3: *PIRSA to develop and implement a system to validate commercial logbook reporting of catch and effort in the fishery within two years.*

Assessment

No formal stock assessment has been undertaken and there have been no other studies to quantify the amount of sea urchins available for harvest in South Australia. DEH encourages PIRSA to pursue methods to obtain more reliable estimates of stock abundance in the near future.

There is very little information available on the spatial distribution and population dynamics of South Australian *H. erythrogramma* stocks, apart from data collected through monthly logbooks. In NSW and Victoria a number of studies have been completed, which have contributed to the management of the South Australian population. Studies have shown that *H. erythrogramma* larvae have a limited ability to disperse, with fertilisation success relying on males and females being in close proximity of one another. This trait limits recruitment and replenishment of depleted stocks from another location.

Public comment suggested that further research is required to ensure the ongoing sustainability of the fishery. Particular knowledge gaps that need to be addressed include; reproductive biology, relationships between site, season and roe yield, investigation of closed seasons to allow recovery and development of the stock, extent of self seeding and vulnerability to localised depletion.

DEH is concerned that no formal management strategies are in place to address the key gaps in the knowledge of sea urchin biology and ecology or to ensure that the current level of take is sustainable. DEH considers that management of the fishery would be improved by research strategies to address these knowledge gaps. Strategies could include the development of a research program to establish stock estimates for sea urchins or to improve knowledge of sea urchin biology and ecology.

Recommendation 4: *PIRSA to develop and implement research strategies to address key gaps in the knowledge of sea urchin biology and ecology.*

The level of harvest in the fishery is currently contained by limiting the numbers of entitlements and restricting the level of take through input controls. No controls on the number of sea urchins taken are currently in place, although PIRSA advise that fishers only take 40% of available sea urchins in a given area before voluntarily moving on to a new harvest site.

No harvest has occurred by the scallop licence holders in the last two years, however a large increase in effort has been evident from the active fishers, from 1490 kg in 2002/03 to 7660 kg in 2003/04.

Potential removals from the fishery include direct harvest by exemption holders and scallop divers, as well as scientific, recreational and indigenous take.

The recreational and indigenous take of sea urchins in South Australia is currently unknown and there are no size, bag or boat limits set for any species of sea urchin. Harvest by the recreational and indigenous sectors are considered to be low due to the low demand for sea urchins on the domestic market and the difficulty in harvesting significant numbers of sea urchins without appropriate gear. Although the National Recreational and Indigenous Fishery Survey indicated that sea urchin harvest was low throughout the State, there is evidence elsewhere in Australia that the recreational harvest of sea urchins is becoming increasingly popular. DEH is concerned that this take is not currently being taken into account in management of the fishery and considers that take from all sectors should be considered in relevant aspects of the management of the fishery.

Recommendation 5: *Within 18 months, PIRSA to develop a process to improve estimates of recreational and Indigenous take and factor these into management arrangements.*

Management response

The current management regime of the fishery aims to maintain ecologically viable stock levels through the input controls outlined in Part I.

In the submission PIRSA have proposed a number of additional management measures for consideration as the fishery develops. These include regular sampling of urchin stocks to determine adequate recovery periods before fishing re-occurs and the translocation of urchins to areas of lower density. DEH does not support translocation or restocking as a substitute for poor management of localised depletion and expects that PIRSA would evaluate the environmental risks of translocation and will inform DEH during the consideration of translocation or restocking, particularly given the lack of knowledge of the impact of urchins on ecological communities.

As outlined above the low dispersal capabilities of sea urchin populations may lead to localised depletion. DEH considers that the risk of localised and serial depletion of the target stock and on the wider ecosystem has not been adequately addressed in management arrangements or by the voluntary take of approximately 40% of urchins present at any one site by harvesters. A number of public comments also raised concerns regarding localised and serial depletion and the lack of fine spatial scale reporting to provide a more accurate picture of stock status, abundance and effort in the fishery.

Recommendation 6: *Within 2 years PIRSA to develop and implement finer scale data collection and reporting and management measures to mitigate the risk of localised and serial depletion of sea urchins in the fishery.*

No byproduct is permitted to be taken in the South Australian Sea Urchin Fishery, therefore no information, assessment or management response regarding byproduct is needed for this fishery. DEH considers that the fishery does not directly threaten stocks of species inhabiting the same area.

Conclusion

DEH considers that the management regime in the South Australian Sea Urchin Fishery is appropriately precautionary at the current scale of fishing and provides for the fishery to be conducted in a manner that does not lead to overfishing. 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. The fishery is currently in a developmental phase with a low level of operators and a relatively low level of harvest in recent years. Through the implementation of the recommendations within this report, DEH believes that PIRSA will be adequately prepared to implement a recovery strategy should sea urchin stocks fall below reference points (once developed).

Conclusion

DEH considers that the South Australian sea urchin stock is not below a defined reference point but should that occur in the future, PIRSA would manage the fishery 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

No formal bycatch risk assessment has been completed for this fishery and is not required due to the highly selective fishing techniques employed by fishers. The limited scale of the fishery within a large area and the small number of operators also helps to avoid bycatch. For these reasons, there are no threat abatement plans, recovery plans or bycatch reduction strategies relevant to the fishery. DEH does not consider that specific bycatch minimisation measures are necessary for the fishery.

Conclusion

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

Protected species and threatened ecological community protection

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

Information requirements

Currently, there is little to no information collected on the interaction between commercial sea urchin fishing and endangered, threatened and protected species. DEH considers that the current small number of fishing vessels, restricted number of divers and target specific harvesting methods are likely to have a low impact on endangered, threatened and protected species. As fishing effort to date has been minimal, benthic damage and interaction is considered to have been at a minimum. No threatened ecological communities have been identified as occurring in the area of the fishery.

Conclusion

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

Minimising ecological impacts of fishing operations

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

Information requirements

Fishery independent information on possible ecosystem impacts arising from this fishery has not been collected for the fishery and fishery dependent information is low. PIRSA advises that a Management Plan will be developed to manage the fishery through its developmental phase and that a management plan will include research requirements for the fishery. The development of a Management Plan for the fishery is in progress.

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.

Assessment

H. erythrogramma can play an important role in the ecology of reefs. Increases and decreases in sea urchin populations may have enormous consequences for the types and number of algae, fish and other organisms found on reefs (Andrew 1999). In NSW, Victoria and Tasmania high densities of sea urchins have caused devastating impacts on important ecological communities by creating sea urchin barrens. Large areas of kelp and seagrass meadows have been destroyed in short periods of time when sea urchins have formed high density feeding fronts.

There is evidence that the removal of sea urchins can impact on the ecology of the surrounding area. DEH considers that at current levels of effort this impact is likely to be low, however is concerned at the lack of appropriate measures to monitor localised disturbance and the potential for expansion of current harvesters given there are no limits on the level of take in the fishery. Implementation of **Recommendation 4** to take into account effects of sea urchin harvesting on the wider marine ecosystem will assist in addressing this issue.

Due to the fishing methods employed in the fishery, current direct impacts are considered to be minimal. However, evidence from studies undertaken in other locations suggests the removal of key species such as sea urchins may significantly alter the structure of localised ecological communities. As is evidenced by the occurrence of urchin barrens, the species can play a major role in determining the structure of benthic communities. If large numbers of urchins are removed there is likely to be an increase in the amount of algal cover, which could increase the abundance of other species, but reduce space for benthic organisms (Lawrence 2001). In the long term, a reduction in habitat space may reduce the ability for sea urchin numbers to re-establish in an area due to a reduction in space to settle and a possible increase in predators of young urchins.

DEH considers it important to gain more information on the long term effects of removing large numbers of sea urchins. Incorporation of research into the role that sea urchins play on local ecological communities into the research plan developed as part of the implementation of **Recommendation 4** will assist in addressing this issue.

The PIRSA submission recognises the important role that sea urchins play in the ecology of reefs. As stated in the submission, changes in the abundance of sea urchins may have significant consequences for the types and numbers of algae, fish and other organisms found on reefs. Increases in urchin numbers can impact significantly on algal abundance in an area whereas decreases in numbers may effect predatory species and cause an increase in algal cover. Purple sea urchins are vulnerable to predation by fish, octopus, and predatory fish (Andrew 1999).

The method of fishing undertaken is believed to have minimal impact on the physical habitat. As fishing effort increases impact from anchor damage in popular areas will need to be taken into consideration.

Management response

Due to the current level of effort in the fishery, impacts to the wider marine ecosystem are expected to be low. DEH is concerned about the potential impact of localised and serial depletion on the ecosystem given there is currently no limit on the number of urchins harvested and there is no

monitoring of sea urchin abundance and changes to the ecosystem. DEH considers that the implementation of **Recommendation 6** will mitigate this risk.

Conclusion

DEH considers that the fishery is conducted in a sufficiently precautionary manner to minimise the impact of fishing operations on the ecosystem generally. Recommendations have been developed to ensure that the risk of significant impact by the fishery on the marine environment generally is minimised in the longer term.

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LIST OF ACRONYMS

DEH	Department of Environment and Heritage
EPBC Act	Environment Protection and Biodiversity Conservation Act
NRIFS	National Recreational and Indigenous Fishing Survey
PIRSA	Department of Primary Industries and Resources South Australia
SARDI	South Australian Research and Development Institute
SCUBA	Self Contained Underwater Breathing Apparatus
UNCLOS	United Nations Convention on the Law of the Sea
WTO	Wildlife Trade Operation

