



Australian Government

Department of the Environment and Heritage

Assessment of the
Torres Strait Bêche-de-mer Fishery

June 2005

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**Assessment of the ecological sustainability of management arrangements for the Torres Strait
Bêche-de-mer Fishery**

TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
Background.....	4
Overall assessment.....	9
Recommendations.....	10
PART I - MANAGEMENT ARRANGEMENTS	12
Conclusion	16
PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES.	17
STOCK STATUS AND RECOVERY	17
Maintain ecologically viable stocks	17
Information requirements	17
Assessment	20
Management response.....	21
Conclusion	23
Promote recovery to ecologically viable stock levels	23
Conclusion	24
ECOSYSTEM IMPACTS	24
Bycatch protection	24
Information requirements	24
Assessment	24
Management Response	25
Conclusion	25
Protected species and threatened ecological community protection	25
Information requirements	25
Conclusion	25
Minimising ecological impacts of fishing operations.....	26
Information requirements	26
Assessment	27
Management response.....	27
Conclusion	27
LIST OF ACRONYMS.....	28
LIST OF ATTACHMENTS	28
REFERENCES	29

EXECUTIVE SUMMARY

Background

The Australian Fisheries Management Authority (AFMA) has submitted documents for assessment of the Torres Strait Bêche-de-mer Fishery under Parts 10, 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act).

The Minister for the Environment and Heritage (the Minister) signed an Agreement with the Minister for Fisheries, Forestry and Conservation to initiate strategic assessment of the Torres Strait Bêche-de-mer Fishery in November 2002. After public consultation required under the EPBC Act, *Terms of Reference for the Torres Strait Bêche-de-mer Fishery* were adopted. The document *Draft Assessment Report: Torres Strait Bêche-de-mer Fishery* (the submission) was received by the Department of the Environment and Heritage (DEH) in September 2004. The document was released for a public comment period that expired on 15 October 2004. One public comment was received. AFMA has provided a response to the issues raised and amended the submission where necessary. The document *Draft Assessment Report: Torres Strait Bêche-de-mer Fishery: February 2005* (the submission) was submitted for assessment on 11 May 2005.

The submission reports on the Torres Strait Bêche-de-mer Fishery against the *Terms of Reference for the Torres Strait Bêche-de-mer Fishery*, which include the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission, associated documents, the public comment and the response from AFMA to the comments.

The Torres Strait Bêche-de-mer Fishery management area incorporates Australian jurisdictional waters under the Torres Strait Treaty¹ and the *Torres Strait Fisheries Act 1984* (TSFA). The area is approximately 41,000 km², however fishing is only conducted in the relatively restricted areas of suitable habitat. The Torres Strait Bêche-de-mer Fishery is managed by the Torres Strait Protected Zone Joint Authority (PZJA), established under the TSFA, and AFMA is responsible for the day-to-day management. Table 1 provides a summary of the main characteristics of the fishery and current management arrangements.

The fishery is based on collection by hand in shallow water and areas of suitable habitat exposed intertidally and by free diving from dinghies crewed by 2-3 fishers. The use of compressed air (hookah or Self Contained Underwater Breathing Apparatus (SCUBA)) is not permitted. As a selective hand collection and free-dive fishery, there is no bycatch other than symbiotic animals, including pearl fish and a range of internal and external parasitic and commensal invertebrates that are discarded with offal.

¹ The Treaty between Australia and the Independent State of Papua New Guinea concerning matters of sovereignty and maritime boundaries in the area known as the Torres Strait and related matters was negotiated between 1972 and its signature in 1978. It came into force on 15 February 1985.

Table 1: Summary of the Torres Strait Bêche-de-mer Fishery

Area	Australian jurisdictional waters to which the TSFA applies.
Target Species	Market-driven – all holothurian species of commercial value. A total of 18 species. Seven species taken preferentially, eight others commonly, several other more abundant species currently of lower commercial value taken opportunistically.
Fishery status	Overexploited species: sandfish, Pacific black teatfish and surf redfish. Species of concern or possibly overexploited: Prickly redfish. All other species are considered under exploited, or status unknown.
Gear	Intertidal and shallow-water reef-top collection and free-dive fishery. Hookah and SCUBA are not permitted.
By-product Species	None, due to selective harvest method.
Season	Not limited although fishing effort is seasonal due to weather conditions and participation in other commercial and traditional fisheries.
Commercial harvest	In 2001/2002 harvest was estimated to be 128.7 t
Value of commercial harvest	Landed value estimated at \$250,000 on average 1998-2002. Estimated export market value of product 2001-2002 \$AUD 1-1.5 m.
Recreational and traditional harvest	Recreational harvest considered to be at low levels in areas adjacent to islands of main population centre, possession limits apply. No history of traditional fishing for local consumption.
Commercial licences issued	Approximately 130 Traditional Inhabitant Boating (TIB) licences. One non-TIB licence issued (reportedly no longer active).
Management arrangements	Input controlled through licence and gear restrictions. Output controlled through size limits and Total Allowable Catches (TACs). For more details see Table 2.
Export	All processed product (i.e. bêche-de-mer) is for export (primarily to Asia) in dried, frozen, pickled whole or other processed forms.
Bycatch	As direct hand fishery, target species only are selected. Incidental take of commensal organisms unavoidable.
Interaction with Threatened Species	Negligible.

The fishery for bêche-de-mer or trepang is regarded as having been the first commercial fishery established in Australia, and is of considerable importance in the early post-contact history of the Torres Strait and the north and north-east coasts of Australia. Use of bêche-de-mer for a range of traditional medicinal purposes has a very long recorded history. Trepang fisheries in northern waters possibly predate Chinese exploratory voyages which may have passed through the Torres Strait area in the 1400s², and the voyages of Willem Janszoon and de Torres in 1606. Although, MacKnight³ considered it unlikely that there was a major fishery in northern Australian waters before what he considers to be the initial expansion of the trepang trade with China in the late 1600s-1700s. Those early operations, which were seasonal and relied on shore-based processing camps, may not have extended routinely beyond Arnhem land and the eastern Gulf, but the development of the industry in the Torres Strait has its most direct roots in the Maccassan visits to the northern Australia coast from at least the mid 1600s. That phase of activity, which became progressively more organised and extensive as trade links through Maccassar and Singapore to the

² Menzies, 2002

³ MacKnight, 1976

Chinese mainland developed, effectively ceased in the early 1900s, although praus and crews from Eastern Indonesia have continued to fish in Northern Australia.

The decline in Maccassan operations was a direct consequence of the development of competing operations by European traders and processors, using Torres Strait and aboriginal labour in the trepang and pearl shell fisheries in the Torres Strait, waters of the Great Barrier Reef and to the west. In Torres Strait, a bêche-de-mer station was established on Erub (Darnley) as early as 1865 and by 1871 the island was regarded as the centre of the industry in the Strait⁴. The industry in the Strait peaked from the late 1890s-1910, declining rapidly after 1922. There was a total cessation of activity during WWII, in part as a result of evacuation of islands after bombing raids and the compulsory acquisition of fishing vessels in wartime operations. Despite proposals to re-establish the fishery in Torres Strait as part of post-war reconstruction of northern Australia⁵, there were only sporadic commercial catches over the next 40 years.

The increased market price for bêche-de-mer driven again by rapid growth in markets in mainland China in the early 1980s resulted in increased interest in Australia and Papua New Guinea. Identification of the potential for a renewal of the industry in Torres Strait in the mid 1980s (for example, Shelley 1986, complete with recommendations for conservative size limits)⁶, a developing industry in Papua New Guinea (PNG) and infrastructure available in the adjacent Queensland east coast fishery, resulted in resurgence of the Torres Strait fishery over a relatively short period. Rapid expansion of effort in the sandfish fishery on the Warrior reef complex in 1993-95 resulted in a peak harvest estimated at 1200-1400 tonnes wet weight in 1994/1995, with an estimated export market value of \$1-1.8m in 1994. The sandfish stocks then went into decline and a 0 t TAC was implemented for the species. Since then progressive depletion of other higher value species has resulted in the implementation of additional zero catch limits for other species and increased importance in the catch of previously unexploited medium and lower value species. Reported catches in 2000-01 were 21.7 t and in 2001-2002 128.7 t. The decline in high-value species was reported in 2003 to have reached the point where catches were no longer sufficient to support permanent buyers in the Torres Strait⁷.

The Torres Strait Bêche-de-mer Fishery is important in the local communities, although the annual value of unprocessed landings is modest in comparison to other major fisheries in the region such as rock lobster and prawn. Torres Strait Islanders have been directly involved in each of the successive phases of the fishery, but there is no tradition of harvesting bêche-de-mer for local consumption. The contemporary fishery, carried out by Torres Strait Islanders and some other operators and processors, is wholly for export product. There are, however, very strong traditional links between the communities associated with the inhabited islands and home reefs, and with traditional access and use of more distant shallow-water marine resources.

For survey and management purposes, a series of 21 bioregions are recognised in the Torres Strait Protected Zone (TSPZ)⁸ and adjacent waters, reflecting the diversity of habitat types and oceanographic regimes present in the area. In the central Warrior Reef complex and the more extensive shallow systems of the eastern reefs for which estimates are available, the area of fishable suitable habitat (reef top and reef edge/slope in waters less than 15 m deep) ranges from 3-20% across the eastern bioregions and is about 7% overall (an estimated 158,000 ha).

⁴ Mulrennan 1999, citing Singe 1979 and Ganter 1994

⁵ Fisheries Division Dept. of Commerce and Agriculture 1946

⁶ Shelley 1986

⁷ Williams 2003

⁸ CSIRO (Skewes et al 2004) identified slightly different areas in the most recent stock assessment, but the management agency and CSIRO have identified the need to ensure that the two are harmonised and a single series used for stock assessment and management and catch recording purposes

There are over 1400 species of holothurians recognised, 34 of which have been recorded in shallow water surveys in Torres Strait⁹. At least eighteen of the species in the two families Holothuriidae and Stichopodidae present in the range of habitats in the management area are taken commercially. There has been a premium value placed on the larger species with thick body walls that process, transport, and keep well and which have commanded the highest prices on the international market. Changes in processing technology, the emergence of demand for new products, including fresh frozen and biopharmaceutical products and shifts in market access and availability all influence the relative value of harvested species. Thin walled apodid holothurians such as *Synapta* which are abundant on coral reefs are not harvested in this fishery.

There are marked differences in the distribution of habitat types across the bioregions in the areas, and in the patterns of distribution and abundance of the commercially-important and other holothurian species¹⁰. While some species occur in a range of habitats, no species is abundant in all the bioregions of the Strait or across habitats within those regions. Their distributions in the area now reflect at a broad scale past dispersal¹¹, and more locally, the habitat preferences and requirements of adults and settling larvae, and the outcomes of high variability in spawning success, larval settlement, and juvenile survival. They will also reflect, to varying degrees, past patterns of exploitation. The northern and western reefs do not appear to support significant numbers of commercially-important bêche-de-mer and are not currently fished. Coupled with the continued failure of recovery of sandfish on the Warrior Reef complex, the focus of the fishery is increasingly shifting toward the eastern reefs.

While there is information emerging on significant fine-scale metapopulation structure in some species, none of the harvested species are endemic to the Torres Strait, and all have relatively broad distributions in the Indo-West Pacific region. Components of stocks of most species taken in the Torres Strait fishery are likely to be common to adjacent fisheries in PNG waters, the Gulf of Carpentaria, the Queensland east coast, Ashmore and Boot reefs, and the Coral Sea. The relationships between these fisheries is not understood, and the precautionary approach to management would be to assume that populations are dependent on localised recruitment.

There is, however, considerable sub-specific differentiation, with evidence of distance-limited genetic exchange at several scales across the species for which genetic information is available. There are species complexes that are as yet poorly understood and unresolved issues in the taxonomy of even some of the commonly-targeted high-value species. Accurate identification and consistent differentiation between similar species is problematic in the field, in recording landed catches, in identifying processed product and in enforcement and trade-related forensics. It was raised in public comment as an important issue, and is one that will need to be addressed by this and other bêche-de-mer fisheries.

Some smaller reef top holothurians have been known to reproduce by asexual budding, however the main reproduction method used by holothurians is sexual fertilisation in the water column. Successful fertilisation is increasingly unlikely with increasing distance between individuals and therefore bêche-de-mer populations are particularly vulnerable to fishing practices which reduce the local abundance and density of mature individuals, leading to compensatory or Allee effects¹². For sandfish, there is compelling genetic evidence that recruitment is normally relatively localised, probably on scales of less than 100km¹³.

⁹ Williams, 2000

¹⁰ Stutterd and Williams, 2003. Skewes et al., 2004

¹¹ Benzie, 1999

¹² Petersen and Levitan, 2001

¹³ Uthicke and Benzie, 2001

The holothurian species taken in the Torres Strait fishery illustrate the paradox of all the multi-species tropical bêche-de-mer fisheries. All the species taken commercially share a number of important general biological and life history characteristics which make them particularly vulnerable to localised depletion. Despite those similarities, the differences between the species in body form, growth, maturity and other life history characteristics are such that reliance on generic management controls, such as multi-species TACs or generic size limits, are demonstrably risky.

The high-value species taken in the Torres Strait Bêche-de-mer Fishery are relatively large, obvious and easily collected from the depth to which fishing occurs using small boats and simple equipment. They are slow moving, slow growing and relatively slow to mature. Replenishment of local populations is dependent on larval dispersal and recruitment, which may be episodic and highly variable. Predation on eggs, larvae and juveniles is assumed to be very high. While a range of invertebrates and fish have been recorded feeding on holothurians¹⁴, the growth form, toxicity¹⁵ and other defences are such that natural mortality rates of larger adults are considered to be low. Average life spans may be in the order of 5-10 years. In some of the larger species maximum age may be several decades, with recent estimates for black teatfish of over 100 years.

The bêche-de-mer species harvested in the Torres Strait Bêche-de-mer Fishery also have major characteristic differences in patterns of distribution and abundance, feeding, size, growth and maturation, reproductive mode, larval dispersal and patterns of settlement and habitat selection. The species occurring in sandy areas and seagrass beds, reef flat and reef edge and gutter rubble are bottom feeding detritivores, ingesting large amounts of surface sediment and detritus, performing a range of ecosystem services. Other species, such as surf redfish, have much more restricted occurrences and habitat requirements, and are specialised feeders on the algal film on consolidated coralline and other hard surfaces in reef edge surf zones. Some species are locally abundant and occur in high densities, but the majority are relatively rare even in areas of suitable habitat. The wider impacts of removal of a high proportion of the populations are unknown.

Fishing practices in many small-scale commercial and artisanal bêche-de-mer fisheries may exacerbate the impacts on vulnerable populations. Operators may focus on areas of higher density and may harvest all marketable individuals encountered in an area. Sequential harvesting of lower value species may also support continued searching for higher value species at population levels that would otherwise be uneconomic.

Bêche-de-mer fisheries world wide have been characterised as boom-and-bust fisheries¹⁶, and there is increasing evidence that recovery of some longer-lived and very slow growing species may take several decades. Populations of some other species, including surf redfish, have been reported on isolated islands as showing little sign of recovery over nearly 50 years¹⁷. Bêche-de-mer are currently being considered for listing under the Convention on the International Trade in Endangered Species (CITES) to afford the species further protection through trade restriction and regulation.

In the six year period from mid 1996 to mid 2002, the total reported landings in the fishery were just over 430 tonnes wet weight. There are currently (2003/2004) approximately 130 TIB licences issued for the fishery, each of which may operate with 3 crew in vessels of less than 7m. Most would hold endorsements for operation in other Torres Strait fisheries. Activity in the bêche-de-mer

¹⁴ Francour, 1997

¹⁵ Bakus, 1974

¹⁶ Conand, 2004

¹⁷ Trianni and Bryan, 2004

fishery may be dependent on commitments in other higher value fisheries such as rock lobster, and on seasonal weather patterns and other factors, including the availability of fuel. Current recreational take of bêche-de-mer in the Torres Strait Bêche-de-mer Fishery area is considered to be negligible.

The fishery has been managed in accordance with the provisions of the Torres Strait Treaty and the *Torres Strait Treaty Fisheries Act 1984*. Until 1 April 1999 the fishery was managed under the *Queensland Fisheries Act 1994* and the *Queensland Fisheries Regulations 1995* by the Queensland Fisheries Management Authority (QFMA), later the Queensland Fisheries Service (QFS). In April 1999, responsibility for management of the fishery was transferred from QFMA to the PZJA, with day to day management by AFMA and Queensland Department of Primary Industry and Fisheries (DPI&F) staff. The fishery currently has no formal management plan.

Overall assessment

Management of the fishery faces two major tasks. The immediate requirement is to ensure conservative management of the remaining medium and lower value species, some of which are considered to be only lightly exploited at present. The second is a focussed effort on the development of effective recovery strategies for the higher value species for which zero TACs are in now in place.

The development of a series of fisheries independent surveys, undertaken in 1995/96, 1998, 2000, 2002 and in early 2004 and the development of spatially-structured estimates of standing crop and species-based estimates of yield and TAC have provided an improved basis for development and implementation of management measures capable of reducing the risks of overfishing.

The continued refinement of management measures, the implementation of reporting systems intended to improve fisheries-dependent catch and effort information and spatially-structured standing stock and yield assessments will provide a much more robust basis on which to base management recommendations to manage the fishery. It will be important, however, to ensure that there is a timetable established for consideration of such recommendations to ensure a timely management response.

The submission sets out a series of significant commitments intended to address some of the identified risks. These include continued investment in fishery-independent stock information and refinement of assessment of potential yield, estimation and implementation of species-based TACs and spatial allocation, review of the basis and implementation of minimum legal size limits, improved catch reporting and monitoring and the development and implementation of a community-based co-management regime for the fishery.

The material submitted by AFMA on the current and proposed management arrangements for the Torres Strait Bêche-de-mer Fishery can be expected to meet most of the requirements of the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries* and should provide a sound basis for adaptive and sustainable management of the fishery. This report identifies a number of areas that must be managed to ensure that the risk from the fishery of impacts on target species and their environment are minimised. 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 establishing ecologically sustainable fishing levels and controlling, monitoring and enforcing the level of take from the fishery.

The operation of the fishery is consistent with the objects of Part 13A of the EPBC Act. Given the current management arrangements and AFMA's commitment to rebuilding depleted stocks, 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 the PZJA for immediate action and to contain the environmental risks in the long term. DEH considers that the fishery, as managed in accordance with the proposed management arrangements, 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 commitments in management of the fishery.

As the fishery management area for the Torres Strait Bêche-de-mer Fishery encompasses both Commonwealth and State waters; consideration under Part 13 of the EPBC Act is required relating to the impact of the fishery on listed threatened species, listed migratory species, cetaceans and listed marine species.

Protected species occurring in the fishery area include marine turtles, seabirds, dugong and sea snakes. The Torres Strait Bêche-de-mer Fishery is a selective hand fishery, and there is no recorded interaction with these species groups. The actual and potential impact on Part 13 species under the management arrangements is considered low. There are no listed threatened ecological communities in the fishery area.

DEH recommends that the Torres Strait Bêche-de-mer Fishery be declared an accredited management regime under Sections 208A, 222A, 245 and 265 of the EPBC Act. In making this judgement, DEH considers that the fishery to which the management regime relates does not, or is not likely to, adversely affect the survival in nature of listed threatened species or a population of that species, or the conservation status of a listed migratory species, cetacean species or listed marine species or a population of any of those species. DEH also considers that the management regime for the Torres Strait Bêche-de-mer Fishery requires that all reasonable steps are taken to avoid the killing or injuring of protected species, and the level of interaction under current fishing operations is low. On this basis, DEH considers that an action taken by an individual fisher, acting in accordance with the management regime for the Torres Strait Bêche-de-mer Fishery would not be expected to have a significant impact on a listed threatened species or listed migratory species protected by the EPBC Act.

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

Recommendations

1. PZJA to inform DEH of any proposed amendment to the management regime for the Torres Strait Bêche-de-mer Fishery to enable DEH to evaluate any impact on the ecological sustainability of the fishery.
2. Consultative processes to continue to be conducted in a manner that promotes the timely implementation of management responses essential for the sustainability of the fishery.

3. PZJA to develop fishery specific objectives, performance measures and performance indicators for the fishery relating to target species and ecosystem impacts within 2 years. The performance of the fishery to be reviewed annually against these measures and the outcomes published.
4. PZJA to develop and progressively implement, over the next 3 years, strategies to address risks in the Torres Strait Bêche-de-mer Fishery, identified in the compliance risk assessment undertaken for the Torres Strait fisheries.
5. PZJA to continue to work with Torres Strait communities, fishers and processors to ensure that the docket book recording system provides comprehensive and robust data on the Torres Strait Bêche-de-mer Fishery.
6. PZJA to continue to cooperate with other management agencies, research institutions, Torres Strait communities and the industry in efforts to identify and undertake research projects to address key gaps in the understanding of bêche-de-mer biology and ecology.
7. PZJA to review stock assessment process to ensure that methods used to estimate potential yield and sustainable TACs are sufficiently precautionary, with risk included within 2 years.
8. PZJA to implement more precautionary species-based TACs for white teatfish and prickly redfish within 1 year, and all other species taken in the fishery within 2 years.
9. PZJA to investigate and progressively implement measures to minimise localised depletion in the fishery.
10. PZJA, within 18 months, to review the minimum size limits to ensure that the measures provide a precautionary level of protection to the breeding stock.
11. PZJA to develop and implement, within 3 years, a precautionary recovery strategy for overfished species that specifies reference points, management actions and timeframes for implementation.

12. PART I - MANAGEMENT ARRANGEMENTS

The Torres Strait Bêche-de-mer Fishery is managed by the Protected Zone Joint Authority (PZJA) considering advice from its consultative bodies. This Authority consists of the Australian Government (represented by the Minister for Fisheries, Forestry and Conservation), the Queensland Government (represented by the Minister for Primary Industries and Fisheries) and the Torres Strait Regional Authority (represented by the Chair). The Australian Fisheries Management Authority (AFMA) coordinates and delivers fisheries management and surveillance/enforcement programs in the Torres Strait (TS) in conjunction with DPI&F on behalf of the PZJA and in accordance with the *Torres Strait Fisheries Act 1984* (TSFA). Recreational fishing, including charter fishing, is managed under Queensland law.

Since 1999, when management of the fishery was transferred from the Queensland Government to the PZJA, the fishery has been managed under the TSFA. The management regime is legislated through Fisheries Management Notices (FMN) under the TSFA and conditions on fishing permits. FMNs are publicly available. AFMA is preparing Statements of Management Arrangements for all fisheries that do not have statutory management plans, and such a Statement of Management Arrangements has been prepared for the Torres Strait Bêche-de-mer Fishery. While not a statutory instrument, a Statement of Management Arrangements describes the arrangements in place for the fishery, including relevant FMNs, permit/licence conditions and arrangements that have been agreed to at a policy level.

The public documents setting out and implementing the management arrangements for the fishery include policy documents issued by the PZJA, issue and endorsement of fishing and vessel licences, FMNs, including Gazettal Notices of Total Allowable Catch (TAC) limits and other management arrangements, and catch and buyer/processor reporting documents. A summary of management arrangements for the fishery was also made public as part of the process of public comment on an application for authorities under Section 303GB of the EPBC Act in June 2004 and was referred to in the authorities approved. The Annual Reports of the PZJA include a review of all of the fisheries under its management; the most recent is the 2001/2002 Report.

DEH considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Due to the importance of the documents discussed above to DEH's assessment of the fishery, an amendment could change the outcomes of our assessment and decisions stemming from it.

Recommendation 1: *PZJA to inform DEH of any proposed amendments to the management regime for the Torres Strait Bêche-de-mer Fishery to enable DEH to evaluate any impact on the ecological sustainability of the fishery.*

The current management regime has been developed through the consultative processes under the new arrangements for management of Torres Strait Fisheries implemented by the PZJA in 2002-2003. Consultation and communication across the scattered islands of Torres Strait is difficult and time consuming, but are important elements in the effective management of the region's fisheries. The Torres Strait Regional Authority consultative committees are complemented by meetings between fisheries officers and fishers in communities around the Torres Strait and other extension activities.¹⁸ Inclusion of the Chair of the Torres Strait Regional Authority in its membership provides direct representation for the 17 Island and two mainland community councils. The primary advisory body to the PZJA for the Torres Strait Bêche-de-mer Fishery is the Torres Strait Fisheries

¹⁸ PZJA, 2003

Management Advisory Committee (TSFMAC), whose membership includes representatives of the Torres Strait communities, Islander fishers, AFMA, DPI&F and the Queensland Commercial Fishermen's Organisation (QCFO). A bêche-de-mer working group existed in the past to provide advice on the management of the Torres Strait Bêche-de-mer Fishery, however this role was subsumed into the TSFMAC in 2003. Public comment raised the issue of the need to have a group with responsibility for providing management advice on the bêche-de-mer fishery and recommended that the Beche De Mer Working Group be reconstituted and be expanded to include holothurian biologists. AFMA has stated that the working group was disbanded because it was not meeting frequently enough. Due to the status of the fishery and the recognition for the implementation of further management measures to ensure the sustainability of bêche-de-mer in the Torres Strait, there is likely to be an increase in the amount and complexity of management advice to be provided to the PZJA, in competition with the other priorities and workloads facing the TSFMAC. DEH encourages AFMA to consider re-establishing a dedicated working group charged with those tasks and provided with the resources to meet regularly.

The consultative structure is inclusive and provides a sound framework for wide input from the island communities and other interested parties in the region. The development and implementation of additional species-based TACs, spatial allocation of catches, biologically-based size limits, and the development of the framework for community-based management and the consultation and scientific advice needed will require significant effort and resources. It will be dependent on the allocation of resources for development and consultation with the communities and wider public, to ensure that timely advice can be provided to the PZJA for its consideration. The PZJA has allocated considerable resources to the fisheries consultative structure recognising that it is the backbone of decision-making. A process is underway to up-skill the members of the consultative bodies and this will continue to take more resources.

Recommendation 2: *Consultative processes to continue to be conducted in a manner that promotes the timely implementation of management responses essential for the sustainability of the fishery.*

There is a strong commitment to greater participation by Islander representatives at all levels of the consultative process, with a major shift in the overall framework for management of the commercial fisheries in the region and of the aspirations of the local communities for a greater say in management. The changes have been welcomed by the local communities, and are seen both as a new opportunity for direct participation, and as a necessary step in building the capacity of indigenous fishers for effective participation in management of the region's marine resources. Management agencies should ensure that the advice on management and the basis for decisions made on management arrangements are documented, available and accessible to the wider public. AFMA have made a commitment to develop a framework for community-based management that provides a strong science-based process for stock assessment and TAC recommendation and a community-based allocation process for the TACs. It may also include quota allocation and monitoring, and a compliance process at an appropriate scale. DEH supports the shift in management to a community-based scheme, however the implementation is likely to be some time off and such management arrangements are therefore not explicitly considered in this assessment.

The fishery is managed in accordance with the Torres Strait Treaty and the TSFA. Management objectives developed by the PZJA include ensuring the sustainable use of all bêche-de-mer stocks in the Torres Strait and that utilisation of the bêche-de-mer resources is for the direct benefit of the Australian traditional inhabitants of the Torres Strait. In addition the TSRA has identified its desired outcomes for Torres Strait fisheries as: for Traditional Inhabitants to be totally and effectively involved in the consultative and management processes of Torres Strait fisheries; and for Torres

Strait fisheries to be managed in an ecologically and economically sustainable manner. There are currently no performance measures formalised for this fishery.

Recent stock assessment and suggested yield-based recommendations for species TACs and proposed density-based stop-catch rules are a significant advance. They require refinement and the development of more explicitly system-based management objectives and risk-based reference, limit and trigger points to ensure long-term ecological sustainability and to provide the basis for development of objective performance-measures.

The gaps in knowledge of the basic biology and ecology of bêche-de-mer continue to be such that a precautionary and strategic approach to harvests in the fishery is essential. The strategic management of a fishery is contingent on articulating the objectives for management of the fishery, and developing performance indicators and measures against which performance of the fishery can be assessed. DEH recommends that AFMA refine the fishery specific management objectives, and develop performance indicators and performance measures. In addition, in order to ensure transparency in the evaluation of the performance of the fishery, DEH recommends that AFMA annually review the fishery against these measures and publish the outcomes.

Recommendation 3: *PZJA to develop fishery specific objectives, performance measures and performance indicators for the fishery relating to target species and ecosystem impacts within 2 years. The performance of the fishery to be reviewed annually against these measures and the outcomes published.*

Management of the fishery is based on a mixture of input and output controls as detailed in Table 2.

Table 2: Current input and output controls in the Torres Strait Bêche-de-mer Fishery in 2002/03

Input controls	Output controls
<ul style="list-style-type: none"> • Entry to the fishery is limited to Traditional Inhabitants of the Torres Strait (apart from one non-TIB licence holder); • TIB licences restricted to vessels of less than 7m; • Gear limited to either hand or hand held non-mechanical implement; and • Use of hookah gear or SCUBA prohibited. 	<ul style="list-style-type: none"> • Zero catch limits for pacific black teatfish, sandfish and surf redfish; • A competitive TAC of 600 tonnes, split into 260 tonnes each for white teatfish and prickly redfish and an aggregated limit of 80 tonnes for all other species taken in the fishery. • Minimum size limits for ten of the 18 commercial species.

An assessment of the effectiveness of these measures is included in Part Two of the report.

While the management provisions provide the framework for implementing key provisions relating to catch and size limits, the current capacity for compliance and enforcement is limited. AFMA reports that the current allocation of resources permits two days of activity, which is invested in extension and training.

Poaching by crews of vessels travelling from PNG waters was considered significant in the central reef area (Southern Warrior Reef complex), particularly in the early period of the resurgence of the sand-fish fishery. Illegal catches continue as a serious issue in some components of the fishery, although no current estimates are available. Unreported catches and poaching may be a significant contributor to the scarcity of commercial species in the Western Islands and in the northern sector of the Warrior reef complex. Some foreign fishing vessels apprehended during incursions into the Australian Fishing Zone (AFZ) in the Gulf of Carpentaria have had processed bêche-de-mer on board; the incidence and locations of harvest are not known.

The submission and Skewes *et al* (2004) identify that in some areas, particularly the northern part of Warrior Reef under Australian jurisdiction, there is a possibility that continued illegal harvesting may be affecting the sandfish population. Numbers of cross-border movements reported grew from 24,000 in 1996/97 to more than 45,000 in 1999/2000 (DFAT 2002), and the issue is likely to remain significant. The proposed development of improved cooperative arrangements with PNG may assist in addressing the issue. National border surveillance measures provide a means of detecting cross-border poaching and incursions by foreign fishing vessels which may take bêche-de-mer. However, the capacity for on-ground enforcement, and the resources allocated to the activity in this fishery are very limited.

DEH is concerned that despite significant compliance risks in the fishery, compliance efforts are limited to two days which are primarily spent on education. The illegal fishing of bêche-de-mer is possibly inhibiting the recovery of the overfished Warrior Reef sandfish fishery and hence threatening the sustainability of the fishery. DEH considers that particular attention should be paid to this issue. Non-compliance with other measures including 0 t TACS and size limits could also have a significant impact on the sustainability of bêche-de-mer stocks in the Torres Strait. AFMA has recently undertaken a compliance risk assessment for the Torres Strait fisheries. In order to ensure that the limited resources are directed toward the greatest identified risks in the Torres Strait Bêche-de-mer Fishery, DEH recommends that strategies to address identified risks be developed and progressively implemented in the fishery.

Recommendation 4: *PZJA to develop and progressively implement, over the next 3 years, strategies to address risks in the Torres Strait Bêche-de-mer Fishery, identified in the compliance risk assessment undertaken for the Torres Strait fisheries.*

The PZJA, AFMA and DPI&F require a level of annual reporting on the performance of the fishery and its management arrangements. Bureau of Rural Sciences (BRS), as part of its preparation of Fisheries Status Reports, provide a review of this fishery. Report and stock analyses from commissioned fishery independent surveys may be externally peer reviewed and provide periodic review of aspects of the management of the fishery. Annual reports on performance of the fishery have also been required under previous EPBC Act export approvals.

Stock assessments and surveys are undertaken in the Torres Strait Bêche-de-mer Fishery every two years. Where those have confirmed indications of overfishing or other management issues, they have provided the basis for a review of specific management provisions and the implementation of corrective measures.

Fishery dependent and independent data on the fishery is collected on a regular basis. Discussion of the information collection systems in place can be found in Part II of this report, as can 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.

The spatial extent of the stocks, and the possibility that the Torres Strait area may act as a source of larvae which disperse and recruit to other fisheries, and that some recruits to populations fished in the area may derive from populations elsewhere, are dealt with in more detail under Principle 1.

Regular consultation with PNG occurs under Treaty arrangements. There are also a number of formal and informal consultative mechanisms between the State and Territory management agencies responsible for these fisheries including discussion at the annual Northern Fisheries Management Workshop.

Management arrangements for the fishery have been developed specifically to meet the requirements of the *Torres Strait Fisheries Act 1984*, which implements the provisions of the Torres Strait Treaty. The United Nations Convention on the Law of the Sea (UNCLOS) is also applicable to the management of the Torres Strait Bêche-de-mer Fishery. The management regime essentially complies with this. Other international regimes are applicable to fisheries management but do not explicitly involve this fishery, for example the 1992 Convention on Biological Diversity and in particular the 1995 Jakarta Mandate requiring that, in relation to the sustainable use of marine and coastal biological diversity, the precautionary principle should apply in efforts to address threats to biodiversity. While these agreements are not specifically addressed in the Submission, the fishery's compliance with their requirements can be assessed by examination of Part II of this report. The application of the International Convention for the Prevention of Pollution from Ships (MARPOL) to vessels operating in the fishery is explicitly discussed under Principle 2, Objective 3.

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

The south-eastern management zone of the Torres Strait fishery, which includes the eastern outside-but-near extent of the Torres Strait Fishing Zone, abuts the waters of the Great Barrier Reef (GBR) World Heritage Area, but there are no direct impacts on that area.

Conclusion

The Torres Strait Bêche-de-mer Fishery, while important in the community and regional economy, is relatively small by comparison to some of the other commercial fisheries in the region. As a result, resources available for management, compliance and research are necessarily limited.

The key elements of the Torres Strait Bêche-de-mer Fishery management regime are documented, publicly available and transparent. Management provisions are developed through a consultative process established under the procedures of the PZJA and the requirements of the Torres Strait Fisheries Management Act. The management arrangements are adaptable and underpinned by objectives consistent with the requirements of the Torres Strait Treaty relating to sustainability and ensuring a flow of benefits to the traditional inhabitants of the Torres Strait. The management regime would benefit from the development of performance criteria by which the effectiveness of the management arrangements can be measured, enforced and reviewed.

The management arrangements provide a framework for control of the harvest through a combination of input and output controls appropriate to the size of the fishery. Annual review and reporting on the fishery is required under the standard processes of the PZJA. There are limited means of enforcing critical aspects of the management arrangements, although a risk assessment has been undertaken and compliance risks identified.

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

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

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

Under the management regime implemented for the fishery from the mid-1990s, there was no legal requirement for catch records to be provided by traditional inhabitants fishing under the community fishing licensing system then in operation.

Fishery dependent data for the fishery have been gathered since 1996 by Queensland Fisheries Management Authority (QFMA) using commercial processor and buyer logbook records. The submission states that the records are not reliable and do not provide a basis for stock assessments. They remain, however, the main basis for assessing catch levels through the fishery, and information derived from them is used providing estimates of changes in catch rates and effort in the fishery.

Council operated freezers in some communities have maintained records of catch¹⁹ which contain limited information on bêche-de-mer landings, and commercial records may also provide a source of historic catch data for the area. The initial processing and preparation of the catch before transport to buyers or freezers may vary, depending on the distance from freezers or buyers. Continuing concerns about the quality of the logbook data resulted in the implementation of a new Torres Strait Seafood Buyers and Processors Docket Book (TDBO1). The new system will allow all buyer/processors to record catch and effort data, including that for catches by the traditional inhabitant sector. The system is intended to record the location of catches that can be used in spatially structured stock assessments, using some 20 “bioregions” or subunits within the fishing management area defined on the basis of benthic habitat surveys carried out by Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The boundaries of the subunit employed in the most recent stock assessment by CSIRO for the eastern fishery²⁰ are sufficiently different to make direct comparison with historical area-specific catch and effort data difficult. AFMA has recognised the issue and is taking steps to ensure that there is a single set of bioregions used for assessment and catch recording purposes. It is important that the basis for the identification and delineation of the areas used is documented. In the longer term, measures of species abundance and density are likely to be needed at the finer scale of individual reefs that is increasingly being applied operationally by some sectors of the industry in other areas.

¹⁹ Begg and Murchie, 2003

²⁰ Skewes *et al*, 2004

As more species are taken in the fishery, consistent identification of species by fishers, processors and buyers is important. It is understood that the management agency is distributing species identification material to fishers active in the Torres Strait, but as identified in the public comment, there continue to be unresolved taxonomic issues with some species of holothurians.

The current TDB01 data collection program for bêche-de-mer buyers provides information on the species, weight and form (frozen, salted etc) of animals taken, but not the size or number of pieces. Where there is initial selective harvesting for larger animals, one of the first indicators of potential adverse impacts on the stocks is a decline in the mean size of animals taken. Included in the recommendations from the 2003 FAO ASCAM Conference²¹ is a series of recommendations on the sorts of information needed for management. It includes routine collection of information on the size, rather than aggregate weight, of animals taken. DEH encourages AFMA to incorporate a mechanism in the data collection program to obtain a measure of the average size of harvested specimens if refining the data collection system in the future.

Fishery independent data in the fishery has been collected on a regular basis since 1998, through surveys and stock assessments conducted by CSIRO. Details and results of the surveys are provided in Skewes *et al* (2004) and in the AFMA submission. The surveys have been designed to provide statistically robust estimates of the abundance, standing biomass and density of holothurians in the Torres Strait Bêche-de-mer Fishery for use in spatially structured stock assessments and yield estimates.

Fishery-independent resource surveys and stock assessments have been critical in assessing the available resource and potential yields and catches and in developing and implementing a series of management measures to prevent further declines in stocks identified as overfished. In the absence of a reliable series of catch data, the fishery independent information has been critical in ensuring that corrective measures could be identified and implemented. The information is also critical in monitoring the status of stocks where zero catch limits have been imposed and in assessing recovery.

The fishery dependent data collected in the fishery is considered to be of low value due to concerns regarding quality and reliability of the data and the limited returns. As a result, management relies heavily on the collection of fishery independent information through the stock surveys undertaken every two years. DEH commends the commitment of AFMA to regularly survey the stocks and conduct stock assessments. However, while the surveys collect useful information, they are unable to monitor aspects of the fishery including levels of catch and effort, spatial distribution of catch, or fisher behaviour. The collection of this data is critical to the ecologically sustainable management of the fishery and in addition, combined with the survey data, would provide valuable information on the biological and ecological impacts of beche-de-mer fishing. In recognition of this need, AFMA has implemented a docket book system to collect fishery dependent information on catch, effort and spatial characteristics of the fishery. Since the introduction of this system, AFMA has achieved 100% coverage of all buyers/processors in Torres Strait and on the mainland. DEH commends AFMA on their efforts to ensure that reliable information is obtained for the fishery and recommends that AFMA continue to work with Torres Strait communities, fishers and processors to ensure that the data being obtained from the docket book system is robust and comprehensive.

Recommendation 5: *PZJA to continue to work with Torres Strait communities, fishers and processors to ensure that the docket book recording system provides comprehensive and robust data on the Torres Strait Bêche-de-mer Fishery.*

²¹ Lovatelli, 2004

There is a growing body of research on the biology and population dynamics of a number of east coast holothurian species, including population genetics, which is directly relevant in the development of sustainable management in the Torres Strait Bêche-de-mer Fishery. However there are still significant gaps in the understanding of biology and ecology traits. Skewes *et al* (2004) have identified a number of key areas for further research and data needs relevant to the management of the fishery, including:

- improvements in the fishery dependent data collection and verification and catch sampling;
- population dynamics modelling and the development of biological reference and trigger points; and
- refinement and local application of life history parameters, including growth, mortality and seasonality in breeding.

An additional area that has not been specifically identified, however, is the development of harvesting strategies and decision rules for sessile species such as holothurians where synchronisation of reproductive activity and breeding success may be critically dependent on maintaining the local density of mature adults above the threshold at which there is a risk of depensatory effects in fecundity and fertilisation.

The PZJA and its associated management advisory committee and groups review data requirements and research projects and proposals for the fishery as part of the development of the PZJA Fisheries Research program.

The bêche-de-mer fisheries of the tropical waters of northern Australia harvest many of the same species and face many of the same issues in the development of an adequate base of biological information for management of the resources. While there will be variation in local characteristics that require specific studies, there is clearly much to be gained from fostering cooperative projects across bêche-de-mer jurisdictions to examine issues such as stock identity and structure across the fisheries, growth, production and natural mortality, robust survey methods and population responses to fishing pressure.

Recommendation 6: *PZJA to continue to cooperate with other management agencies, research institutions, Torres Strait communities and the industry in efforts to identify and undertake research projects to address key gaps in the understanding of beche-de-mer biology and ecology.*

Removals from the holothurian populations in the area include harvesting under the management arrangements of the fishery, possible recreational take in some areas, and illegal and unreported cross-border fishing. Unrecorded discards and high grading before transfer to buyer/processors was also raised by Skewes *et al* (2004) as a possible concern, as it may result in significant removals of undersized individuals that are not reflected in catch statistics, but there is no assessment of its occurrence. As noted, there is no history of traditional take of bêche-de-mer for local consumption by the indigenous inhabitants of the Torres Strait. While recreational fishing may occur, it is considered likely to be restricted to the area around Thursday Island, where there is the greatest non-Islander population. There is currently no reported commercial take from that area.

Overall, given the current restructuring of the fishery-dependent data collection for the fishery the series of independent estimates available from repeated surveys and the mechanisms for regularly reviewing the stock status and data requirements, the fisheries-independent information collection system in place is appropriate to the scale of the fishery. As noted, 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.

As a selective hand collection fishery, there is no by-product, in terms of retained non-target species.

Assessment

Stock assessments have been carried out by CSIRO and the Beche De Mer Fishery Advisory Group (BDM FAG) based on the results of surveys structured to provide robust estimates of population abundance, and standing biomass for a range of commercially important species. The survey design provides a statistically robust estimator of the abundance of the species and a basis for the estimation of TACs.

Skewes *et al* (2004) have identified some of the issues in assessing the level of precaution that is built into the approach, and that further work is required to ensure that the approach is sufficiently precautionary. Issues include the basis for reference and trigger levels, and the sensitivity of the estimates of sustainable yield to the values of natural mortality /survival rate and other biological parameters used in the estimates.

There are some additional concerns about the use of TACs based on yields estimated from the whole population where size limits apply, and use of annual yield estimates for populations with irregular and very variable recruitment, where a sequence of annual catches may be taken from stocks with little or no recruitment (ie. a stock with episodic recruitment once every four years fished at 10% has an effective exploitation rate, in crude terms, of 40% of standing biomass over the recruitment period). DEH commends the work being undertaken by AFMA and CSIRO in assessing the bêche-de-mer stocks in the Torres Strait, however considers that the process should continue to be reviewed and refined to ensure sufficiently precautionary recommendations for management.

Recommendation 7: *PZJA to review stock assessment process to ensure that methods used to estimate potential yield and sustainable TACs are sufficiently precautionary, with risk included, within 2 years.*

The TACs recommended assume that all of the surveyed areas for which abundance estimates are developed are potentially open to the fishery. There would thus be no areas that can provide information on unfished stocks in the future as a baseline. DEH encourages AFMA to consider the implementation of closed areas to fishing in the longer term for a number of purposes, including potential comparison of fished and unfished reference areas. AFMA has noted that there may be some merit in designing a network of closed areas through the community-based management structure, and DEH concurs.

As a result of the general Torres Strait marine resources survey undertaken in 1995/96 and the later more constrained surveys of the Warrior Reef and Eastern area components of the fishery, there is a good understanding of the general patterns of occurrence and abundance of the holothurian species taken commonly in the fishery. In addition, there is a reasonable understanding of habitat preferences of Torres Strait Bêche-de-mer Fishery species and the extent of suitable habitat in the fishery area.

The relationship of the populations exploited in the Torres Strait fishery with those in surrounding areas is less clear. For commercially important species harvested in the Torres Strait the documented spatial scale of genetic differentiation of populations varies markedly. It ranges from the relatively fine scale evident in sandfish, to much coarser differentiation where genetic differences are only evident in populations many thousands of miles apart. Even in such species,

however, overfishing and localised depletion has resulted in prolonged periods before resettlement and very slow recovery, with recruitment events sporadic and largely unpredictable with current knowledge.

Skewes *et al* (2004) note that more work is required to understand the areas that are important as sources of larvae, and those in which they settle within and adjacent to the fishing area. In the absence of compelling evidence to the contrary, however, the conservative approach is to assume that the stocks within the Torres Strait fishing area are effectively self-recruiting at least at the level of the zones identified, and probably at finer scales yet. Even if the stock-recruitment relationship remains unclear, management should be geared to reduce as far as possible the risk of localised reductions in density to levels at which recruitment failure is likely to occur. Recent analysis of the catch in the Queensland East Coast fishery indicates that aggregation of catch and effort into cells of 30nm may mask localised declines, and that while the use of 6nm cells for data provides improved definition, reef-scale data capture may be required. DEH encourages AFMA to consider refining spatial data collection in any future review of the fishery dependent data collection system.

Management response

The current management regime for the Torres Strait bêche-de-mer Fishery aims to ensure the sustainability of takes through the implementation of a range of input and output controls. Input controls include limitations on the size of fishing vessels, restriction of access to traditional inhabitants and a ban on the use of hookah and SCUBA.

The major output controls are through the establishment of catch limits for commercial species. Size limits are also in place for some species, intended to ensure that harvested species are not taken before they are sexually mature. Zero catch limits have been established for species considered overfished. Catches will not be permitted again until they have recovered to a level that is yet to be determined.

The most recent stock assessment²² provided estimates of yield and recommended TACs for 20 species, including continuation of a zero catch limit for sandfish on the Warrior Reef complex zero catch limits for pacific black teatfish and surf redfish, the implementation of a series of species-based TAC and an overall TAC of 490 tonnes. The assessment and estimated yields were based on a series of surveys carried out in April 2002. Preliminary results and the major recommendations were discussed at the BDM workshop only a month later in May that year.

The PZJA acted on the recommended closure for black teatfish and surf redfish and implemented some additional minimum size limits, but maintained the overall competitive TAC of 600 tonnes which had applied since 1998/99 (split into 260 t each for white teatfish and prickly redfish and an aggregate of 80 t for all other species). The AFMA submission lodged in February 2005 notes that the PZJA is still to consider the remaining recommendations at its next meeting. A second series of surveys has now been carried out (January 2005), but no results are yet available.

Serial depletion of high value species (the fishing down of higher value species and subsequent shift of harvest to lower value species) has occurred in a number of beche-de-mer fisheries internationally and is evident to a lesser degree in the Torres Strait Bêche-de-mer Fishery. In order to ensure that serial depletion of species does not continue to occur in this fishery DEH considers species specific TACs should be developed and implemented in the fishery. DEH acknowledges that implementing aggregated TACs for broad groups or even value groups (as suggested in the CSIRO report) may be a first step in management at a lower taxonomic level, however DEH is concerned that aggregated TACs may contain species with very different habitat requirements, rates

²² Skewes et al, 2004

of growth and maturity and other life characteristics. These measures may carry an unacceptably high risk of serial depletion and therefore DEH considers that they do not go far enough to prevent the serial depletion and overfishing of vulnerable species and thus recommends that precautionary species specific TACs for all species taken in the fishery be implemented within 2 years.

Having reviewed the data on estimated biomass levels and TACs (see Table 3) for the two high value species still open to fishing, white teatfish and prickly redfish, DEH considers that precautionary catch limits should be implemented for these species as a matter of urgency. At present levels a high proportion of the stock can potentially be harvested, which is a particular concern for holothurians where low levels of harvest (6-8%) have been recommended by CSIRO. DEH therefore recommends that a more precautionary species specific TAC for white teatfish and prickly redfish be implemented within 12 months.

Table 3: Estimated biomass, lower bound estimate, recommended TAC from February 2002 surveys, and current TAC for white teatfish and prickly redfish.

species	Estimated biomass tonnes landed weight	Lower 90% bound for biomass	Recommended TAC (as % of current PZJA TAC)	Current PZJA TAC (as % of biomass lower bound)
White teatfish	431.2	251	15 (5.7%)	260 (103%)
Prickly redfish	568.9	296.1	20 (7.7%)	260 (89%)

Recommendation 8: *PZJA to implement more precautionary species-based TACs for white teatfish and prickly redfish within 1 year, and all other species taken in the fishery within 2 years.*

Depletion of commercially viable species in particular areas has already occurred in the Torres Strait Bêche-de-mer Fishery and due to the nature of fisher behaviour continued depletion of areas is possible. Localised depletion to levels at which breeding success may be impaired is a major risk unless effort can be distributed and measures are in place that provide effective protection for a proportion of the breeding stock. DEH recommend that AFMA investigate and progressively implement measures to mitigate the risk of localised depletion and that monitoring of the spatial characteristics of fishing be undertaken. Measures that may be considered include, but should not be limited to, closed areas, local stop catch and move on rules, and rotational zoning.

Recommendation 9: *PZJA to investigate and progressively implement measures to minimise localised depletion in the fishery.*

Minimum size limits should protect immature animals and ensure that specimens have the opportunity to breed for more than one season. Limits should therefore be set above sound estimates of L50% to provide protection for a proportion of the population required to ensure unacceptable risks of depletion are avoided to levels at which recruitment is compromised. **Attachment A** provides a comparative table of the current minimum size limits in bêche-de-mer fisheries in adjacent jurisdictions.

Precautionary minimum size limits were raised in public comment as currently, minimum size limits do not all allow a buffer for error or differences in growth and maturity between the specimens studied in available research and the Torres Strait stocks. DEH therefore recommends that PZJA review the current size limits of target species to ensure that they are set in a precautionary manner, consistent with available research on the size of first maturity of beche-de-mer species and management in other beche-de-mer fisheries.

Recommendation 10: *PZJA, within 18 months, to review the minimum size limits to ensure that the measures provide a precautionary level of protection to the breeding stock.*

Conclusion

The fishery has an unfortunate history in the early part of the resurgence in the 1990s, in which TACs have chased catch levels down as species have been progressively overfished, and zero catch limits were implemented some time after the event. Unreliability and unknown biases in catch estimates based on processor returns has meant that earlier detection of stock declines through signals from declines in catch per unit effort, size or grade have also hampered early management responses. Improvement of the catch reporting system and development of more robust estimates of stock abundance and status has provided the basis for current proposals for more precautionary species-specific TACs that can be structured across a series of management zones within the fishery management area.

Development and implementation of refined biological reference and trigger levels aimed at ecological sustainability should provide a regime in which the risk of recurrent unsustainable catches is very much reduced and should be sufficient to provide a framework within which the fishery can be conducted at catch levels that maintain ecologically viable stock levels with acceptable levels of probability.

There is a need to further refine some of the existing information collection, assessment and management responses and a number of recommendations for improvements in the longer term are provided.

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’*

The Warrior Reef fishery commenced in the early 1990s, with undocumented levels of catch in 1992-94 and a peak catch in 1995 of well over 1200 tonnes wet weight. Concerns over the status of sandfish stocks in the Warrior Reef complex lead to fishery independent surveys in 1995/96 and the implementation of zero catch limits in 1997/98 after a second survey confirmed that stocks were at low levels and were overexploited. Surveys were repeated in 2000, 2002 and early 2004. Estimates of abundance in 2002 indicate some recovery, but abundance levels are still less than half those of the estimates for 1995/96. The surveys have also shown some major changes in the patterns of abundance on the reef, which may be due to changes in the density of seagrass, and possible illegal fishing in the northern part of the reef. The 2002 survey indicated that there had been poor recruitment. At the time of writing, results from the 2004 surveys were not available.

Some consideration appears to have been given to reopening fishing when the density approaches that of the 1995/96 survey. It is clear, however, that at that stage the reef had already been subjected to very intense fishing pressure, and that abundances must have been very much reduced. In the absence of information on catches immediately before the peak, it must be assumed that the 1995/96 stock represents a population that was already significantly reduced in abundance.

The assessments carried out for the eastern Torres Strait component of the fishery in 2002 showed that two additional high value species were overexploited and zero TACs were subsequently implemented. There is no information available on the levels at which catches might be resumed, or the factors that would lead to a decision to allow resumption of catches of those species.

There is no defined point at which stocks are considered depleted and/or are closed. Although closures are currently in place for overexploited species (sandfish, black teatfish and surf redfish), there is no defined strategy for recovery, for example when is the species no longer considered overexploited and at what point can fishing recommence? DEH considers that PZJA should have in place a strategic recovery strategy that contains reference points linked to management measures and timeframes for implementation. It would be expected that such a strategy would incorporate decision rules for the reopening of overfished species to fishing once recovered.

Recommendation 11: *PZJA to develop and implement, within 3 years, a precautionary recovery strategy for overfished species that specifies reference points, management actions and timeframes for implementation.*

There have been proposals (see for example Williams, 2000) that the recovery of sandfish on the Warrior reef complex could be assisted through re-seeding hatchery reared juveniles, allowing earlier resumption of fishing for that species than would otherwise be the case. DEH has concerns with the use of reseeded programs to compensate for past unsustainable fishing practices. There is also a risk to the genetic diversity and integrity of wild stock populations. DEH therefore considers that priority should be given to other measures that enhance the natural regeneration of sandfish stocks before resorting to reseeded programs.

Conclusion

PZJA has since closed fishing of those species considered overfished in Torres Strait. Although it may take decades for overfished sea cucumber species to recover to sustainably exploitable levels, DEH considers that with the implementation of a strategic recovery strategy, it is likely that the stocks will recover.

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 fishery is based entirely on selective collection of individual animals by hand on reefs or free diving in relatively shallow water. There is no reported directed or incidental harvesting of species other than holothurians.

Assessment

Given the highly selective nature of the fishery, no bycatch assessment has been conducted. A range of internal and external inquilines, symbionts and parasites, including crustaceans, polychaete worms and pearl fishes and other attached micro-organisms and pathogens, will necessarily be removed when animals are harvested. While the impact from removal with the harvested hosts on the dynamics of those populations is unknown, the management measures put in place to ensure

ecological sustainability of the target species should provide the same level of protection to the associated organisms.

Management Response

Authorities issued in the Torres Strait Bêche-de-mer Fishery limit harvest to direct hand collection of bêche-de-mer species. Harvesting is highly selective and incidental take of any other species is considered to be negligible. The monitoring of an indicator group of bycatch is considered to be inappropriate in this fishery. While the risk to bycatch species appears negligible, DEH encourages the collection of information through observations and anecdotal information in order to inform future management of the fishery.

Conclusion

DEH considers that as a selective hand-collection fishery, the harvest operation is conducted in a manner in which there is little or no take of bycatch species, other than a range of commensal organisms and symbionts and that the activity carried out in accordance with the management arrangements does not threaten bycatch species. Should this situation change or a risk assessment process indicate otherwise, DEH expects that PZJA would undertake actions to address the issue.

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

No information is provided in the Submission on potential interactions with protected species. The fishery is currently conducted primarily, although not entirely, by indigenous inhabitants of the Torres Strait region, a number of whom may hunt both dugong and turtle. Those actions are undertaken under the provisions of management arrangements for traditional hunting and do not arise as a consequence of actions taken in the course of bêche-de-mer fishing.

No other interaction between the fishery and any endangered, threatened, or protected species has been reported in the fishery. DEH considers that the harvesting activities in this fishery are unlikely to have a significant impact on any protected species.

There are no listed ecological communities in the fishery area.

Conclusion

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

Due to the selective fishing method and the spread of effort across the fishery area the overall impact on the reef and associated systems in the Torres Strait from the Torres Strait Bêche-de-mer Fishery is likely to be low. Information collection is therefore limited to fishery independent research projects and other information provided by fishers.

The primary direct impacts of the bêche-de-mer fishery operation on the environment in which the fishery is conducted is the removal of the target species, with potential effects from a significant decrease in the biomass and abundance of part of a suite of benthic detritivores, which may be locally abundant and occur in relatively high densities. The animals are responsible for ingestion and processing of considerable amounts of bottom sediment and particulate matter and may be locally important in nutrient cycling and localised enrichment, bioturbation and mechanical impacts on surface sediments. On hard coral areas and coralline pavements, they may also play a role in removal of accumulated particulate detritus.

In one other fishery, a severe reduction in abundance of a dominant holothurian from overfishing (Galapagos fishery) has been implicated in subsequent overgrowth of algal beds by anemones normally removed by feeding holothurians, and a reduction in food available for other algal grazing herbivores, including marine iguanas. With the diverse suite of holothurian species present in the reefal and shallow water habitats of the Torres Strait, impacts are likely to be diffuse and less immediately apparent. There is anecdotal information that experienced bêche-de-mer fishers are able to differentiate from some distance reef areas that have been heavily fished, but this claim is unsubstantiated.

Larvae and juveniles may be periodically important in energy transfer and food web dynamics in the benthic, epibenthic and pelagic systems in which they occur. Quantifying such effects and the potential impacts of severe reductions in host densities on a range of internal and external parasites and symbionts may not be feasible. One of the simplest approaches to addressing such impacts is based on the assessment that the greater the departure from the usual abundance and age and size distribution in undisturbed populations, the greater the likelihood of adverse impacts on the environment in which they perform ecosystem services. In the absence of specific alternative information, management measures which serve to maintain populations at or above levels at which production is maximised (MSY levels) are far less likely to have a major adverse environmental impact than those that are predicated on maintaining populations at a much lower proportion of unfished biomass.

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 common 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 and considers that it would benefit from a cooperative approach from all fisheries management agencies that manage bêche-de-mer and has made recommendations accordingly.

Assessment

The major environmental risk from the fishery is that populations will be reduced to such an extent that the environmental services provided by the animals, and interactions with associated and dependent organisms will be severely compromised. Additional impacts include distortion of normal selective pressure, reduction in genetic diversity and long-term changes in growth rates and other population parameters as a result of fishing pressure.

Management response

As indicated, management of the fishery is intended to ensure that catches are sustainable and do not exceed levels at which populations continue to function in the ecosystem in which they occur. The BDM FAG workshop in 2002 discussed the possibility of using a discounted MSY as the basis for reference points in the fishery - in essence a reference point that would be set at some percentage above the best estimate of yield in setting catches, with the discount intended to be a buffer related to maintaining the ecosystem services provided by the target organism. The Submission indicates that there is an acknowledgement of the ecological role of bêche-de-mer in their environment and that a “buffer accounting margin” is being considered during the review for setting TACs.

The adoption of such measures, while they may be seen as likely to provide reduced catch limits in the short term, are likely to provide more stable and higher catch levels in the longer term. They are likely to significantly reduce the risk of recruitment overfishing and stock collapse and prolonged adverse wider impacts on associated and dependent organisms. The process of developing system-based biological reference points is addressed earlier.

The National Oceans Office is currently leading a regional marine planning process in the Northern Region, which encompasses the area of the Torres Strait Bêche-de-mer Fishery. The planning process aims to ensure the ecologically sustainable use of the resources in the planning area and will help to integrate management across jurisdictions and sectors. It may also identify potential candidate areas for the National Representative System of Marine Protected Areas (NRSMPA). The regional marine planning process is a potential vehicle for pursuing sustainable fisheries objectives, particularly where cross-sectoral or cross-jurisdictional approaches are required. Due to significant ecological and institutional differences in the Torres Strait, regional marine planning in that area is being progressed through a separate, but concurrent, process to the overall Northern Region marine planning process. AFMA/PZJA should continue to engage in the process as far as practical. More information is available at www.oceans.gov.au.

Conclusion

The fishery is a selective hand collection and dive fishery and uses equipment and methods that have minimal impact on the environment generally beyond the direct impact of the removal of target species. Recommendations that have been developed earlier in this report should contribute to minimising the risk of significant impact by the fishery on the marine environment generally in the longer term.

LIST OF ACRONYMS

AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
BDM FAG	Beche-de-mer Fishery Advisory Group
BRS	Bureau of Rural Sciences
CITES	Convention on the International Trade in Endangered Species
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEH	Australian Department of Environment and Heritage
EPBC Act	The Australian Government <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FMN	Fisheries Management Notices
GBR	Great Barrier Reef
GIS	Geographic Information System
ICC	Island Coordinating Council
MARPOL	International Convention for the Prevention of Pollution from Ships
MSY	Maximum Sustainable Yield
NRSMPA	National Representative System of Marine Protected Areas
PNG	Papua New Guinea
PZJA	(Torres Strait) Protected Zone Joint Authority
QB&FP	Queensland Boating and Fisheries Patrol
QCFO	Queensland Commercial Fishermen's Organisation
QDPI&F	Queensland Department of Primary Industries and Fisheries
QFMA	Queensland Fisheries Management Authority
QFS	Queensland Fisheries Service
SCUBA	Self contained underwater breathing apparatus
TAC	Total Allowable Catch
TDB01	Torres Strait Seafood Buyers and Processors Docket Book
TSFA	<i>Torres Strait Fisheries Act 1984</i>
TSFIICC	Torres Strait Fishing Industry and Islanders' Consultative Committee
TSFMC	Torres Strait Fisheries Management Committee
TSFMAC	Torres Strait Fisheries Management Advisory Committee
TSFSAC	Torres Strait Fisheries Scientific Advisory Committee
TSPZ	Torres Strait Protected Zone
TSRA	Torres Strait Regional Authority
UNCLOS	United Nations Convention on the Law of the Sea
WTO	Wildlife Trade Operation

LIST OF ATTACHMENTS

ATTACHMENT A	Comparison of minimum size limits in place in bêche-de-mer fisheries in adjacent jurisdictions
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Appendix A – Comparison of size limits in place in the Torres Strait Bêche-de-mer Fishery and adjacent fisheries.

Table Comparison of current and proposed size limits in the Torres Strait beche-de-mer and adjacent fisheries

Common name	Species	Value category	Av length	wt (kg)	large animals	body thickness (mm)	estimated size at first maturity	Queensland E Coast			Torres Strait	Coral Sea *	PNG	
								pre-2003	proposed 2003	proposed 2004			live	dried
Holothuriidae		\$\$	mm	kg	kg	mm	mm	mm		mm	mm	mm	mm	
Black teatfish	<i>Holothuria whitmaei (nobilis)</i>	High	370	1.7	3.2	12	260	closed		300	Closed 250	250	220	100
White teatfish	<i>Holothuria nobilis (fuscogilva)</i>	High	420	2.4	4.10	12	324	(150)	320	400	320	320	350	150
Sandfish	<i>Holothuria scabra</i>	High	220	0.3		6	150	(150)	180	200	Closed 180?	160	220	100
Golden sandfish	<i>Holothuria s. versicolor</i>	High						(150)	180	(150)?				
Prickly redfish	<i>Thelenota ananas</i>	Medium	450	2.5	5.00	15	345	(150)	300	500	300	300	250	150
Surf redfish	<i>Actinopyga mauritiana</i>	Medium	220	0.3	1.00	6	220	(150)	200	250	Closed 220		200	80
redfish (deepwater)	<i>Actinopyga echinites</i>	Medium	300	1	1.70	7	120	(150)	200	200	120		250	150
Stonefish	<i>Actinopyga lecanora</i>	Medium	250	0.4	0.80	6		(150)		(150)			150	100
Blackfish	<i>Actinopyga miliaris</i>	Medium	250	0.4	2.70	6	120	(150)		200	220		150	100
Burrowing blackfish	<i>Actinopyga? sp?</i>	Medium	?	?	?	?		(150)						
Tigerfish / Leopardfish	<i>Bohadschia. argus</i>	Medium	360	2	3.00	12	300	(150)		350				
Brown sandfish	<i>Bohadschia marmorata</i>	Medium	320	1.2		7	150	(150)		250			200	100
Flowerfish	<i>Bohadschia graeffei</i>	Low	350	0.7	1.20	4		(150)		(150)				
Pinkfish	<i>Holothuria edulis</i>	Low	200	0.2	0.40	3		(150)		(150)				
Lollyfish	<i>Holothuria atra</i>	Low	200	0.3	2.60	3	120	(150)	150	200	150	150	300	150
Elephant trunkfish	<i>Holothura fuscipunctata</i>	Low	360	1.5	4.20	10	350	(150)	320	400	240		450	150
Amberfish	<i>Thelenota anax</i>	Low	550	3.5	7.00	15	350	(150)		500			200	100
Snakefish	<i>Holothuria coluber</i>	Low	400	0.3	0.70	4		(150)		(150)				
Stichopodiidae														
Greenfish	<i>Stichopus chloronotus</i>	Medium	180	0.1	0.80	2	140	(150)		200	-		20	100
Curryfish	<i>Stichopus hermanni</i>	Medium	350	1	3.50	8	270	(150)	250	350	240		250	100
Curryfish	<i>Stichopus vastus</i>	Medium						(150)		(150)				
remaining species								(150)		(150)		(150)		

sources 1,2 1,2,3 1,3,6 1 4 4 5 8 1 1

- 1 Desurmont, SPC generic size limits (150)
- 2 Skewes et al 2003 *size limits as guide only, in Coral Sea Fishery
- 3 QDPIF 2004
- 4 QDPIF 2004, table p 31
- 5 AFMA 2005 TSBDM Report
- 6 Benzie & Uthicke 2003
- 7 QDPIF December 2003