



Australian Government

Department of the Environment and Heritage

Assessment of the
Queensland Coral Reef Finfish Fishery

October 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 Parts 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999*. The views expressed do not necessarily reflect those of the Minister for the Environment and Heritage or the Australian Government.

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Assessment of the ecological sustainability of management arrangements for the Queensland Coral Reef Finfish Fishery

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	1
Background.....	1
Overall assessment.....	4
Recommendations.....	6
PART I - MANAGEMENT ARRANGEMENTS	7
Conclusion	10
PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES. 12	
STOCK STATUS AND RECOVERY.....	12
<i>Maintain ecologically viable stocks</i>	<i>12</i>
Information requirements	12
Assessment	14
Management response.....	16
Conclusion	17
<i>Promote recovery to ecologically viable stock levels.....</i>	<i>17</i>
Conclusion	18
ECOSYSTEM IMPACTS	18
<i>Bycatch protection.....</i>	<i>18</i>
Information requirements	18
Assessment	19
Management response.....	20
Conclusion	21
<i>Protected species and threatened ecological community protection</i>	<i>21</i>
Information requirements	21
Assessment	22
Management response.....	23
Conclusion	23
<i>Minimising ecological impacts of fishing operations</i>	<i>24</i>
Information requirements	24
Assessment	24
Management response.....	25
Conclusion	25
REFERENCES	26
LIST OF ACRONYMS.....	27

EXECUTIVE SUMMARY

Background

The Queensland Department of Primary Industries and Fisheries (DPI&F) has submitted a document for assessment under Parts 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The draft document *Ecological Assessment of the Queensland Coral Reef Fin Fish Fishery* (the submission) was received by the Department of the Environment and Heritage (DEH) in June 2005. The submission was released for a thirty-day public comment period that expired on 18 July 2005. No public comments were received.

The submission reports on the Coral Reef Finfish Fishery (CRFF) against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission and associated documents.

Table 1: Summary of the CRFF

Area	The fishery relates to the take of CRFF species taken in Queensland and Commonwealth waters off the eastern coast of Queensland, coinciding with the Queensland line fishing endorsement areas L1, L2, L3, L6, L7 and L8.
Fishery status	Considered fully exploited at 1996 levels.
Target Species	<p>The main target species¹ are Coral trout (<i>Plectropomus leopardus</i>) and Red-throat emperor (<i>Lethrinus miniatus</i>). Other target species are Stripey sea perch (<i>Lutjanus carponotatus</i>), Blue-spotted rockcod (<i>Cephalopholis cyanostigma</i>), Trevally species (Family Carangidae), Yellow-tailed emperor (<i>Lethrinus atkinsoni</i>), Grass sweetlip (<i>L. laticaudis</i>), Hussar (<i>L. adetii</i>), Black-tipped rockcod (<i>Epinephelus fasciatus</i>) and Flowery cod (<i>E. fuscoguttatus</i>).</p> <p>Other target species in fishing operations for the live fish market are Cods (<i>Epinephelus</i> spp.), Variegated emperor (<i>Lethrinus variegatus</i>), Dwarf spotted rockcod (<i>Epinephelus merra</i>) and Fusilier (<i>Caesio teres</i>).</p> <p>Other target species in operations for the processed fish market are Spangled emperor (<i>Lethrinus nebulosus</i>) and Speckled-fin rockcod (<i>Epinephelus ongus</i>).</p>
Byproduct species	More than 100 species are taken as byproduct but they comprise only 10% of the catch. Species include Red emperor (<i>Lutjanus sebae</i>), Nannygai (<i>L. malabaricus</i> and <i>L. erythropterus</i>), other emperors (<i>Lethrinus</i> spp.) and cods (<i>Cephalopholis</i> spp.).
Gear	Hand line, rod and reel (recreational and commercial) and spearfishing (recreational only).
Season	Year round but includes three, nine-day spawning closures.
Commercial harvest 2003/04	Nearly 3000 tonnes (t).
Value of commercial harvest	\$35 to \$50 million annually.
Recreational and Indigenous harvest	Recreational catch is estimated at 2300-3200 t annually (Williams 2002; Henry and Lyle, 2003). Indigenous catch has been estimated at 4.5% of recreational catch.
Commercial licences issued	412 reef quota (RQ) licences.

¹ The DPI&F submission defines target species as those comprising more than 1% of the total retained catch. Those species listed here comprise, in aggregate, 90% of the total retained catch.

Management arrangements	The CRFF is managed under the <i>Fisheries (Coral Reef Fin Fish) Management Plan 2003</i> (CRFF Management Plan). The main management measures are: <ul style="list-style-type: none"> • Total Allowable Catch (TAC) (Aggregate TAC of 3061) and Individual Transferable Quotas (ITQs); • limited entry; • access limited by area endorsements; • designated CRFF species; • minimum and, in some cases, maximum size limits; • gear and boat restrictions; • ‘no take’ of some species; • temporal spawning closures; and • possession limits for recreational fishers.
Export	Live export primarily to Hong Kong and China.
Bycatch	Primarily undersized target/byproduct species.
Interaction with threatened species	Potential for interaction with endangered, threatened and protected species of turtles, seabirds, dugongs, marine mammals and sharks but interactions thought to be low.

The commercial CRFF has been operating since before the 1940s and has been subject to input controls since 1984. Prior to 1993 the fishery operated principally by landing dead fish. However, markets for live Australian coral reef finfish grew rapidly in the 1990s as reef fisheries elsewhere in the world became overfished. Since 1993 the fishery has been based increasingly on the catch of live fish for lucrative markets in China and Hong Kong in particular. Williams (2002) estimates that prices paid for live fish may be up to eight times that paid for the whole fish equivalent either as frozen fillet or iced, gilled and gutted fish. Live coral trout species², predominantly *Plectropomus leopardus*, comprise 90% of the total live coral reef species exported from the CRFF. Fish for the ‘processed’ market are sold domestically.

The CRFF comprises demersal (bottom dwelling) finfish of coral trout species (*Plectropomus* spp.), cods (*Epinephelus* spp.), emperors (*Lethrinus* spp.), tropical snappers (*Lutjanus* spp.), wrasse (*Cheilinus* spp.) and sweetlips (*Plectorhinchus* spp. and *Diagramma* spp.). In the ten years to 2003, Coral trout regularly comprised over 50% of the catch and Red-throat emperor (*Lethrinus miniatus*) around 20%. The majority of the species in the CRFF are not restricted to Queensland waters and are commonly found in northern Australian waters and across the Indo-West Pacific where they form a significant component of many local fisheries.

Coral trout is widely distributed throughout the Indo-Pacific. It grows rapidly, reaching the minimum legal size of 38 cm in its first three years and a maximum size of around 70-80 cm fork length. It can live to approximately 15 years of age, although only about 5% of the population are older than 10 years (Williams, 2002). It is a protogynous hermaphrodite, changing from female to male as their size increases and reaches sexual maturity between 25 and 35 cm fork length. It aggregates to undergo a series of nocturnal, sequential spawning events each year between August and December. This spatial and temporal predictability of spawning aggregations makes it vulnerable to overfishing, but also amenable to specialised management through seasonal and/or spatial closures (Samoilys, 1997).

Red-throat emperor is found throughout the tropical and subtropical region of the Indian and western Pacific Oceans and is most abundant in Australia along the Great Barrier Reef between

² A range of coral trout species (*Plectropomus* spp.) are taken in the CRFF, but *P. leopardus* is the most common. In this assessment ‘Coral trout’ refers to *P. leopardus* and ‘coral trout species’ refers to the group of *Plectropomus* spp.

18°30'S and 24°30'S (Leigh *et al.*, in prep.). The populations on the Great Barrier Reef constitute a single homogeneous stock (van Herwerden *et al.*, 2003), however significant regional patterns in growth and survival are apparent across the CRFF. Red-throat emperor reaches a maximum size of approximately 60 cm and a maximum weight of around 3kg at approximately six years of age. Estimates of the age and size at which it reaches sexual maturity vary from 28 cm fork length and 1-2 years of age to 40 cm and 6 years of age. Red-throat emperor is also a protogynous hermaphrodite. It is likely that the species is a batch spawner and that it forms large aggregations during spawning but this has not been confirmed. The habitat of juveniles is poorly known but they may inhabit deeper rubble areas adjacent to reefs (Williams and Russ, 1994). Adults are found in depths greater than 100m and are thought to be capable of inter-reef migration. Crabs and sea urchins form the majority of the diet and other common prey items include crustaceans, echinoderms, molluscs and fish.

Most managers, stakeholders and researchers agree that the CRFF was fully exploited at 1996 effort levels and, consequently, an investment warning was issued in 1997. Despite this, the price premium for live fish fuelled ongoing expansion. Commercial landings of coral reef finfish increased by 45% and effort by 35% between 1996 and 2001. Total production for the CRFF was approximately 4500t in 2002 with a total effort of 37,000 primary boat days, an increase of 7000 days and almost 1000 tonnes over the 2000 catch. Live fish represented more than 50% of the landed product for 2000 and 2001.

In response to this rapid expansion, the CRFF Management Plan was gazetted in September 2003. Provisions reducing the number of operators authorised to fish in the CRFF (those now allocated RQ licences) took effect in December 2003 and TACs and ITQs took effect from 1 July 2004. The CRFF Management Plan sets a TAC of 3061t based on catch levels in the years leading up to the 1997 investment warning, and allocates ITQs in the form of line units to holders of RQ licences. At present, one RQ line unit is equivalent to one kilogram of whole fish and each line unit is identified as representing either coral trout, red throat emperor or other coral reef fin fish. Separate TACs and ITQ's are specified for Coral trout, Red-throat emperor and 'other' coral reef finfish species. The current TACs are 1350t for Coral trout, 700t for Red-throat emperor and 1011t for 'other species'. The CRFF Management Plan also designates coral reef finfish that may be taken by authorised operators, sets minimum (and in some cases maximum) size limits for these species, and establishes spawning closures. Other measures, including gear restrictions and area restrictions by endorsement, continue to apply under the CRFF Management Plan.

Fishers in the CRFF harvest reef fish using rod and reel (both commercial and recreational) or handline (primarily commercial fishers). Commercial and recreational fishers are restricted to using a maximum of three fishing lines and six hooks in total. Recreational anglers can also spear fish for CRFF species when diving without the use of Self Contained Underwater Breathing Apparatus (SCUBA).

The line fishing methods used in the CRFF are regarded as relatively benign methods of fishing that are likely to have a relatively low impact on bycatch, threatened species and the environment generally (Australian Marine Conservation Society (AMCS), 2004; Morgan and Chuenpagdee, 2003). However, limited information has been collected to quantify bycatch rates in the commercial fishery. Results from a two-year research project in the late 1990s, (the Cooperative Research Centre for the Great Barrier Reef World Heritage Area's (CRC Reef's) Effects of Line Fishing (ELF) program), has provided observer data from the commercial fishery. The results suggest that bycatch in 'live' fish operations represented around 43% of the catch (in numbers of fish) and 25% in 'processed' fish operation. Results also suggest that a high proportion of bycatch consists of target species discarded mainly because they are under legal size limits. More than 50% of bycatch was comprised of Coral trout. The post-release survival of CRFF species is yet to be established. A

current project being funded by the Fisheries Research and Development Corporation (FRDC), *Investigating the Survival of Fish Released in Australia's Tropical and Subtropical Line Fisheries*, will provide further data to quantify discard and survival rates. It is due to be completed by the end of 2007.

Some species that may be affected by this fishery are currently listed protected species under the EPBC Act. Possible protected species interactions in this fishery include marine turtles, sharks, seabirds, marine mammals and cetaceans. Limited evidence to date suggests that interaction with any protected species group is very low and this conclusion has been supported by the results of a preliminary risk assessment. These interactions are assessed under Principle Two of this report.

CRFF species are also taken in other Queensland fisheries, notably the Queensland Deepwater Finfish Fishery. Operators in this fishery are subject to the TAC and ITQ provisions of the CRFF Management Plan in recognition that there is overlap between the species taken in the two fisheries.

Recreational, charter and Indigenous fishers also take CRFF species. Annual estimates of recreational and charter catch vary from around 2500 t (Williams, 2002) to around 3200 t (Henry and Lyle, 2003). The harvest of coral reef species is an important part of the tradition and custom of Indigenous peoples and DPI&F estimate the catch by this sector to be around 4.5% of the recreational catch.

The CRFF is managed under the CRFF Management Plan and the Queensland *Fisheries Regulation 1995* which obtain their authority from the Queensland *Fisheries Act 1994*.

Overall assessment

The material submitted by DPI&F demonstrates that the management arrangements for the CRFF meet the requirements of the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*.

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

- absence of stock and risk assessments for target, byproduct and bycatch species;
- lack of information on total mortalities of target, byproduct and bycatch species;
- lack of validation of target and byproduct catch logbook data;
- lack of performance measures for byproduct of non-coral reef finfish, protected species and the ecosystem generally;
- lack of a risk-based compliance program;
- lack of robust estimates of recreational catch; and
- lack of consideration of recreational catch in the estimate of the sustainable level for a TAC.

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 introduction of the CRFF Management Plan was a significant step toward developing sound management arrangements for the fishery. 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. Given the controls on catch implemented under the CRFF Management Plan, 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. However, given that a number of changes to the management arrangements for the CRFF have only recently come into force as a result of the CRFF Management Plan, DEH recommends that the fishery be declared an approved Wildlife Trade Operation (WTO) with the actions specified in the recommendations to be undertaken by DPI&F to contain the environmental risks in the long term. DEH considers that the fishery, as managed in accordance with the CRFF Management Plan is not likely to cause serious or irreversible ecological damage over the period of the export decision. Specifically, the WTO declaration would allow the export of product from the fishery for a period of three years. The WTO declaration will require annual reporting on the progress of implementing the recommendations of this report and other managerial commitments. The implementation of the recommendations will be monitored and reviewed as part of the next DEH review of the fishery in three years time.

As the official fishery area encompasses Commonwealth as well as State waters, consideration under Part 13 of the EPBC Act is required regarding the impact of the fishery on listed threatened species, listed migratory species, cetaceans and listed marine species.

Protected species occurring in the fishery area include marine turtles, dugong, cetaceans, sharks and seabirds. The available evidence from fishery-dependent and fishery-independent studies suggests that there are limited interactions with protected species and DEH concurs with DPI&F's assessment that line fishing gear is likely to have negligible impacts on protected species. There are no listed threatened ecological communities in the fishery area.

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

The assessment also considers the possible impacts on the World Heritage Values of the Great Barrier Reef Marine Park (GBRMP) since approximately 95% of the catch of the CRFF is taken in the GBRMP. DPI&F notes that it is committed to protecting the values of the Park and that line fishing gear has negligible impacts on benthic communities. DEH believes that the CRFF Management Plan, together with increased area closures in the Park under the Representative Areas Programme, and the implementation of recommendations made in this assessment, will provide adequate protection for the World Heritage Values of the GBRMP.

The implementation of recommendations and other commitments made by DPI&F in the submission will be monitored and reviewed as part of the next DEH review of the fishery in three years time.

Recommendations

1. DPI&F to inform DEH of any intended amendments to the management arrangements that may affect sustainability of the target species or negatively impact on bycatch, protected species or the ecosystem.
2. From 2006, DPI&F to report publicly on the status of the CRFF on an annual basis including explicitly reporting against each performance measure.
3. DPI&F to reassess the review events in the CRFF Management Plan to ensure their appropriateness, that they are quantitative where possible and they are consistent with the application of operational objectives for the fishery. By December 2006, DPI&F is to establish revised objectives, performance measures and indicators for bycatch, protected species and impacts on the ecosystem.
4. DPI&F to monitor the status of the fishery in relation to the review events and performance measures. Within three months of becoming aware that a review event has been triggered, DPI&F to finalise a clear timetable for the implementation of appropriate management responses.
5. DPI&F to complete a compliance risk assessment for the CRFF by mid 2006 and implement a risk-based compliance strategy by December 2006 taking into account risks associated with non-compliance with:
 - catch, possession, size and gear limits;
 - reporting of protected species interactions;
 - area and fishery closures; and
 - quota limits.
6. DPI&F to implement a program to validate logbook data by June 2006. DPI&F to ensure that the program enables collection of information on the composition of ‘other coral reef finfish’ sufficient for DPI&F to monitor and respond to changes in the composition of this group.
7. By end 2006, DPI&F to develop a robust and regular fishery assessment process, that provides a basis for management decisions which are precautionary and recognise the uncertainty and level of risk. The assessment process will examine the ecological sustainability of the take of Coral trout (*Plectropomus leopardus*) and Red-throat emperor (*Lethrinus miniatus*) using robust stock assessments.
8. Within 18 months, DPI&F to undertake a risk assessment to identify “other coral reef finfish” most at risk from the fishery. Actions seeking to reduce risk to be implemented as appropriate within a further 12 months.
9. DPI&F to develop a process to improve estimates of recreational take and factor this into stock assessments and management controls to ensure overall catch levels are sustainable.
10. DPI&F to reassess the appropriateness of the total allowable commercial catches for the main target species and ‘other coral reef finfish’, taking into account the outcomes of the stock and risk assessments for CRFF species by end 2007.
11. DPI&F to review current management arrangements and ensure that adequate protection is being given to spawning stocks of the main target species.
12. DPI&F to use the results of stock and risk assessments, and research projects, to review the need for specific bycatch management measures and introduce effective and appropriate methods to reduce bycatch, or increase survivability, as needed.
13. DPI&F to continue to work with industry and other management agencies to reduce the impact of the CRFF on the broader ecosystem, including impacts relating to anchoring.

PART I - MANAGEMENT ARRANGEMENTS

The CRFF is managed by DPI&F. The management regime is described in the following documents, all of which are publicly available:

- the Queensland *Fisheries Act 1994*;
- the CRFF Management Plan; and
- the Queensland *Fisheries Regulation 1995*.

The *Great Barrier Reef Marine Park Act 1975* also has significant bearing on the operations of the CRFF. A number of other documents, including research reports, scientific literature and discussion papers are integral to the management of the fishery.

DEH considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Because of the importance of the CRFF Management Plan and documents referred to above to DEH's assessment of the fishery, an amendment could change the outcomes of our assessment and decisions stemming from it. 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: *DPI&F to inform DEH of any intended amendments to the management arrangements that may affect sustainability of the target species or negatively impact on bycatch, protected species or the ecosystem.*

DPI&F receives management advice on the CRFF from the Reef Fisheries Management Advisory Committee (ReefMAC), which is the consultative stakeholder forum for the fishery. ReefMAC includes representatives from all the major stakeholder sectors including commercial, recreational and charter tour fishers, scientific advisers, government managers (DPI&F and the Great Barrier Reef Marine Park Authority (GBRMPPA)) and representatives from the conservation and seafood marketing sectors. ReefMAC receives scientific advice from its Scientific Advisory Group (SAG). DEH considers the level of consultation to be adequate and is confident that the management agency will continue to ensure interested parties are consulted appropriately.

The latest publicly available information on the CRFF appears to be that contained in *Queensland's Fisheries Resources: current condition and recent trends 1988-2000* (Williams, 2002). DEH believes that public reporting of performance on a fishery-by-fishery basis would be beneficial and suggests that DPI&F publicly report against each fishery performance measure on an annual basis.

Recommendation 2: *From 2006, DPI&F to report publicly on the status of the CRFF on an annual basis including explicitly reporting against each performance measure.*

The Queensland *Fisheries Act 1994* has broad objectives for the management of Queensland fisheries. The objectives of the CRFF Management Plan are also specified broadly, providing for the 'use, conservation and enhancement of the community's coral reef finfish resources by managing ...in a way that seeks to apply and balance the principles of ecologically sustainable development; and promote ecologically sustainable development.' This objective provides only an indirect link, through the reference to ecologically sustainable development, to management of broader ecosystem impacts of fishing and interactions with protected species.

The CRFF Management Plan specifies a series of review events that trigger a review of achievement of the Plan's objectives. The review events require that there is an annual assessment of 'reliable' data relating to trends in catch, abundance, size and age distribution of Coral trout, Red-throat emperor and 'other' coral reef finfish and bycatch of coral reef finfish. In effect these comprise performance measures. However, the review events fail to recognise impacts on bycatch species (other than coral reef finfish), protected species or broader ecosystem impacts as triggers for review.

In addition, the review events assume that the current levels of catch, bycatch, abundance, size and age distribution are sustainable and establish changes from those levels as the performance measures. Further, the use of the term 'reliable' data is of concern to DEH since the absence of certainty should not be used to delay management action, and arguments about the reliability of data could be used to defer reviews and hence management action. DEH notes that ReefMAC has asked the SAG to reassess the appropriateness and measurability of the review events in the CRFF Management Plan with the aim of making them more quantitative where possible.

Recommendation 3: *DPI&F to reassess the review events in the CRFF Management Plan to ensure their appropriateness, that they are quantitative where possible and they are consistent with the application of operational objectives for the fishery. By December 2006, DPI&F is to establish revised objectives, performance measures and indicators for bycatch, protected species and impacts on the ecosystem.*

Recommendation 4: *DPI&F to monitor the status of the fishery in relation to the review events and performance measures. Within three months of becoming aware that a review event has been triggered, DPI&F to finalise a clear timetable for the implementation of appropriate management responses.*

The CRFF Management Plan was introduced in 2003 and has resulted in a major reduction in latent effort. It has also introduced catch limits in the form of separate TACs for the two primary species, Coral trout and Red-throat emperor, and other coral reef finfish species in aggregate. Management of the fishery is based on a mixture of input and output controls including:

- limited entry in the commercial fishery;
- TACs and ITQs;
- designated CRFF species;
- access limited by area endorsements;
- minimum and, in some cases, maximum size limits;
- spawning closures (three annual nine-day closures of the fishery);
- gear restrictions for recreational and commercial fishers;
- 'no-take' of some species; and
- possession limits for recreational fishers.

DEH is satisfied that this combination of input and output measures is capable of controlling the level of harvest in the fishery in the short to mid term while stock assessments and risk assessments are conducted.

The Queensland Boating and Fisheries Patrol (QBFP) is responsible for ensuring compliance with relevant fishery and GBRMP legislation in the CRFF. The QBFP conducts at-sea surveillance of inshore, reef and offshore areas. The introduction of quotas under the CRFF Management Plan has resulted in additional compliance activities to ensure the integrity of the TAC, including monitoring whole of chain documentation, the removal of a pectoral fin by recreational anglers (to differentiate recreational catch from commercial catch) and prior notice before landing commercial catch. The

submission provides no indication of the extent of compliance/enforcement activity or effectiveness. However, DPI&F have indicated that a compliance risk assessment is being undertaken and that a compliance strategy will be developed to address the risks identified. DEH has some concerns about the potential for the existing compliance arrangements to ensure that commercial catch limits, gear limits, size limits, recreational possession limits and reporting of interactions with protected species are enforced, and considers that these issues should be considered carefully in DPI&F's compliance risk assessment and development of a compliance strategy for the CRFF.

In addition to the compliance risk assessment, DPI&F retained an independent firm to develop a methodology to evaluate the reef line fishery quota monitoring system. The outcomes of such an evaluation would relate to a review of the operation of the quota system as it relates to the commercial sector and would identify improvements which could be made to the system.

Recommendation 5: *DPI&F to complete a compliance risk assessment for the CRFF by mid 2006 and implement a risk-based compliance strategy by December 2006 taking into account risks associated with non-compliance with:*

- *catch, possession, size and gear limits;*
- *reporting of protected species interactions;*
- *area and fishery closures; and*
- *quota limits.*

The CRFF Management Plan requires that a general review of the Plan be undertaken between five and nine years following implementation. In addition, the Plan must be reviewed within at least four years to determine whether the annual catch is sustainable and whether there has been any consistent localised depletion near population centres. The commercial TAC must be reviewed biennially. Figures relating to size and age distribution and catch composition will be reviewed across three consecutive years to determine changes. DEH believe that these requirements constitute a suitable basis for review of the management arrangements.

Fishery-dependent data relating to target/byproduct species³ are collected on a regular basis in the fishery and a range of fishery independent data has been collected through research projects. One of the most significant ongoing collection of fishery-independent data is that from the DPI&F Long Term Monitoring program (LTMP) which was initiated in 1999. Bycatch data are not collected on a regular basis. Discussion of the information collection system can be found in Part II of this report.

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

Management arrangements in the CRFF take into account the impact of the Queensland Deepwater Finfish Fishery, the East Coast Spanish Mackerel Fishery and the Rocky Reef Finfish Fishery, all of which overlap to some extent with the fishery area of the CRFF. Further discussion of interactions with other fisheries is contained 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 DPI&F will also ensure compliance with any future plans or policies as they are developed.

³ The DPI&F submission defines target species as those comprising more than 1% of the total retained catch. In practice there is no distinction between target and byproduct species in the CRFF.

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. The management regime essentially complies with this. Other international regimes are applicable to fisheries management but do not explicitly involve this fishery, for example the 1992 Convention on Biological Diversity and, in particular, the 1995 Jakarta Mandate requiring that, in relation to the sustainable use of marine and coastal biological diversity, the precautionary principle should apply in efforts to address threats to biodiversity. While these agreements are not specifically addressed in the submission, the fishery's compliance with their requirements can be assessed by examination of Part II of this report. The application of the International Convention for the Prevention of Pollution from Ships (MARPOL) to vessels operating in the fishery is addressed under Principle 2, Objective 3.

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

The CRFF operates within the GBRMP. Under the EPBC Act, a person may not take an action that has, will have or is likely to have a significant impact on the World Heritage Values of a declared World Heritage property. People that are taking actions that are a lawful continuation of a use of land, sea or seabed that was occurring immediately before the commencement of the EPBC Act, may continue to take those actions. An enlargement, expansion or intensification of a use is not a continuation of a use. In recent years the area of the GBRMP protected through closed green zones has increased to 33% of the GBRMP area and a minimum of 20% of each of the 70 bioregions identified in the GBRMP are protected. As the reef and inner reef habitats and coral reef finfish communities fished in the CRFF are included in the designated bioregions, they have been protected to at least the minimum 20% level within the GBRMP.

DEH considers that the changes to zoning in the GBRMP introduced in 2004, together with outcomes of the assessment as listed throughout Part II of this assessment report, mean that fishing activities as currently practiced in this fishery are unlikely to have a significant impact on the World Heritage Values of the GBRMP. Any change to existing practices, which is likely to significantly impact on the GBRMP's World Heritage Values, may require approval by the Australian Government Minister for the Environment and Heritage.

Conclusion

DEH considers that the CRFF management regime is documented, publicly available and transparent, and is developed through a consultative process. The management arrangements are adaptable and underpinned by appropriate objectives for target/byproduct species. However, more specific objectives and performance measures need to be developed for bycatch, protected species and the ecosystem. Performance criteria also require further development to ensure that the effectiveness of management arrangements can be measured and reviewed.

The management arrangements are capable of controlling the harvest through a combination of input and output controls appropriate to the size of the fishery. Periodic review of the fishery is provided for, as are the means of enforcing critical aspects of the management arrangements.

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

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

PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES

Stock Status and Recovery

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

Maintain ecologically viable stocks

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

Information requirements

Data collection systems in the CRFF include the Commercial Fisheries Information System (CFISH) Daily Fisher Logbook Program, the Recreational Fishing Information System (RFISH) Recreational Fishing Surveys and Fishing Diaries, DPI&F’s LTMP and the Australian Institute of Marine Science (AIMS) LTMP. Other research projects such as the CRC Reef Effects of Line Fishing (ELF) project and the National Recreational and Indigenous Fishing Survey (NRIFS) also provide data of relevance to the CRFF. Research organisations including GBRMPA and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) also conduct research on CRFF species or the reef habitat.

Fishery Dependent Information

Fishery dependent data from the commercial sector of the fishery is collected via CFISH. Since 1988, the logbook program has required compulsory daily recording and monthly reporting. A revised logbook was introduced in July 2004 to coincide with the introduction of quota management, and it requires reporting of fishing activity by date, code (non fishing or fishing), method, location (six nautical mile grids or latitude/longitude), number of dories, number of fishing lines, weight and number of species retained, product type, effort (fishing days) and interactions with species of conservation interest (SOCl) (see Principle 2).

Data verification undertaken on a number of occasions suggests that logbook data is not substantially different to independent estimates of total catch. There is, however, no ongoing validation of the logbook information. The introduction of whole of chain documentation under the quota system is likely to increase the integrity of the logbook reporting system and DEH notes that DPI&F has also begun an observer program in the CRFF as a means of validating catch (quantity, species, size and fate of retained catch and bycatch) and collecting more refined estimates of effort, such as hours fished. DEH commends DPI&F on this commitment and considers that a data validation program, including the observer program, should be implemented as a priority, particularly since the SAG has recently identified the need for improved, validated catch and effort data across all sectors of the fishery as a research priority. DEH also considers that, as part of a data validation program, information should be collected on the abundance and composition of ‘other coral reef finfish’, of bycatch, and of shark species (see Principle 2).

Recommendation 6: *DPI&F to implement a program to validate logbook data by June 2006. DPI&F to ensure that the program enables collection of information on the composition of 'other coral reef finfish' sufficient for DPI&F to monitor and respond to changes in the composition of this group.*

Information on recreational fishing is derived from the RFISH surveys. DPI&F conducted surveys in 1996/7, 1998/9 and 2001/2, which provided recreational catch estimates on a state-wide and regional basis. RFISH is based on a two-stage survey using a state-wide telephone survey and a 12-month diary program. DEH notes that RFISH data are collected in numbers of fish and that combination of CFISH and RFISH catch estimates is achieved by converting numbers of fish to weight of fish using average weights from charter logbooks, recreational club data or length/weight relationships. In light of the relatively high estimates of recreational catch, DEH recommends that DPI&F develop a process to improve estimates of recreational take, and to factor this take into any stock assessments (**Recommendation 9**).

A voluntary logbook was initiated in the charter boat fishery in 1992 and a compulsory logbook in 1996. Information must be reported on location(s) fished; number of fishers, method (e.g. linefishing, speargun), species landed, number of fish kept and the number of fish released. The logbook is being revised to facilitate improved reporting.

The NRIFS, conducted in 2000/1 (Henry and Lyle, 2003), provides a separate independent estimate of recreational catch in Queensland. The NRIFS also collected information on indigenous fisher's catch and effort. DEH notes that a comprehensive 'Indigenous Subsistence Fishing Survey Kit' has been developed for indigenous community management agencies to develop and conduct community based fishing surveys that are specific to their own community. DEH supports wider implementation of this kit to underpin an ongoing collection of information on Indigenous fishing for CRFF species.

Fishery Independent Information

DPI&F and several other research organisations (e.g. GBRMPA, AIMS, CRC Reef and CSIRO) have collected an extensive body of research on the life history, biology and ecology of the species and habitats of the CRFF, and on the dynamics of the fishery and its various sectors.⁴ In addition, ongoing research programs focus specifically on the species harvested in the CRFF and provide current information on the fishery. These are discussed below.

The focus of the Reef Fish component of the DPI&F LTMP, initiated in 1999, is to monitor trends in populations of coral trout species (*Plectropomus* spp.), which make up around 60% of the commercial catch and 20% of the recreational catch, and to monitor populations of other species important to the CRFF, primarily Red-throat emperor (*Lethrinus miniatus*), Stripey seaperch (*Lutjanus carponotatus*), Barramundi cod (*Cromileptes altivelis*) and Maori wrasse (*Cheilinus undulates*)⁵. Opportunistic information is also collected for a range of other species, such as Spangled emperor (*Lethrinus nebulosus*) and Moses perch (*Lutjanus russelli*), which are taken by recreational, commercial and indigenous fishers. The LTMP focuses on annual surveys of the fish populations of 20 reefs using underwater visual census (UVC) methods. DEH notes that alternatives to the UVC method will need to be developed for species and populations which occur beyond SCUBA diving depths such as sweetlips (*Plectorhinchus* spp. and *Diagramma* spp.) and emperors (*Lethrinus* spp.) and some coral trout populations/species. With only five years of data available

⁴ See Appendix 2 of the DPI&F submission for a comprehensive list of research conducted.

⁵ Barramundi cod and Maori wrasse are now no-take species for all fishery sectors under the CRFF Management Plan

definitive trends in abundance have not yet been established. In the long term, the data collected will provide a fishery-independent database for stock assessment.

DPI&F has informed DEH that the monitoring program's sampling design has been adjusted to ensure that it meets the data needs of the new CRFF Management Plan. The LTMP now uses structured line catch surveys to obtain annual regional estimates of abundance of Coral trout, Red-throat emperor and other species (Small and Large mouthed nannygai, Red emperor and Striped seaperch) and population age and size structure of these and other species. The catch surveys will be complemented by catch sampling (otoliths, gonads) from the recreational, commercial and charter fishery. The use of observers on commercial vessels will also complement the LTMP by monitoring bycatch in the CRFF.

The AIMS LTMP, initiated in 1992, has been designed to detect spatial and temporal changes in reef communities. The AIMS LTMP is focused on benthic organisms and reef fish species that are not considered target species within the CRFF. The coverage across the Great Barrier Reef (GBR) includes three positions across the shelf (inner, mid and outer) as well as six latitudinal sectors. Forty-eight reefs are surveyed annually with reef fish counted and video transects of corals recorded at each of five 50 metre transects and the entire perimeter of the reef surveyed by manta tow⁶ to survey crown of thorns starfish and reef-wide coral cover. An additional 35 reefs are surveyed, using manta tow only, on an annual or triennial basis.

The CRC Reef ELF Project focuses on evaluating various management strategies for the CRFF. A major element of the ELF Project is the ELF Experiment, a manipulative fishing experiment designed specifically to identify changes to the fish populations in response to manipulated fishing effort in each of four treatment areas along the GBR. The ELF Experiment will run until 2006. It is envisaged that the results will show how fish stocks and the reef ecosystem respond to fishing pressure; which fish are most vulnerable to fishing and why; and to what extent closing reefs to fishing results in greater resource protection (Goggin *et al.*, 2002).

The current Fisheries Research and Development Corporation (FRDC) project '*Investigating the Survival of Fish Released in Australia's Tropical and Subtropical Line Fisheries*' will also provide useful information to assist in quantifying bycatch mortality rates for some key species in the CRFF.

Overall, given the range of fishery dependent and independent data gathered by, and available to, DPI&F, DEH considers that the information collection system in place is appropriate to the scale of the fishery. Continuation of existing data collections and research programs, combined with the proposed extension and refinement of such activities will be important for the future management of the fishery. There is a particular need for validation of catch and SOCI data collected under the logbook program. Further discussion of bycatch data is contained under Principle 2 of this report.

Assessment

There are no stock assessments for coral reef finfish species taken in the CRFF. The submission highlights the difficulties in developing assessment methodologies for these species, which tend to:

- have a two stage (pelagic and benthic) life cycle;
- be long-lived, slow growing and late to mature;
- undergo sex inversion; and

⁶ Manta towing involves towing a snorkel diver behind a boat with a board that enables the diver to reach and sustain depths while travelling at speed, enabling rapid surveys of large areas to be covered in a relatively short period.

- form spawning aggregations.

The current management arrangements have, instead, been based on an assessment of trends in data arising from the short and long-term research and monitoring programs underway in the fishery. Based on information available up to 2000, that assessment identified:

- a substantial decline in Coral trout abundance as measured by catch-per-unit-effort (CPUE);
- concerns about serial depletion of Coral trout on reefs;
- substantial declines in Red-throat emperor catch and CPUE since 1995;
- possible growth overfishing of Coral trout in at least part of the GBR and downward trends in densities of Coral trout; and
- populations of Coral trout on fished reefs were smaller and lighter in weight than those on closed reefs and the average size of Coral trout on fished reefs was relatively close to the minimum legal size.

Ayling *et al.* (2000) suggested that the expansion of fishing effort and catch by the commercial fishery was the most likely cause of the decline in abundance of Coral trout populations.

DPI&F has acknowledged the need for formal stock assessments for the key CRFF species, Coral trout and Red-throat emperor, and indicates that these will coincide with the completion of the CRC Reef ELF project which is due to finish in 2006. The DPI&F submission indicates that a preliminary assessment of Red-throat emperor is currently underway, and should be completed by early 2006. In addition DPI&F has committed to carrying out risk assessments for those secondary species that may be vulnerable to fishing pressure as a result of their biology or life cycle. DEH notes that the SAG has recently identified the need for a risk assessment of ‘other coral reef finfish’ and protected species as a research priority. It is unclear what risk assessment methodology will be used or when these assessments will be completed.

Recommendation 7: *By end 2006, DPI&F to develop a robust and regular fishery assessment process, that provides a basis for management decisions which are precautionary and recognise the uncertainty and level of risk. The assessment process will examine the ecological sustainability of the take of Coral trout (Plectropomus leopardus) and Red-throat emperor (Lethrinus miniatus) using robust stock assessments.*

Recommendation 8: *Within 18 months, DPI&F to undertake a risk assessment to identify “other coral reef finfish” most at risk from the fishery. Actions seeking to reduce risk to be implemented, as appropriate, within a further 12 months.*

The estimated level of the recreational catch is significant, with Williams estimating the weight at around 2400 t per annum and the NRIFS estimating it at around 3200 t per annum (including Wrasse, Sea perch/Snapper, Emperors, Cods, Coral trout species and Red emperor). DPI&F has reduced or introduced per species possession limits for the majority of coral reef fin fish species via the Plan and has also reduced the overall recreational possession limit for coral reef finfish by one-third (from 30 to 20) since those estimates were made. DEH commends DPI&F for these initiatives, but notes that the level of recreational take is still significant and considers it imperative that the upcoming stock and risk assessments include estimates of recreational catches. The submission identifies that there is considerable variation in the estimates of recreational catch numbers arising from its own survey in 2000 and that from the NRIFS. DEH believes that there is a need to resolve which of the surveys is likely to provide the best estimate and for estimates of the weight of recreational catches to be used in the stock assessments.

Recommendation 9: *DPI&F to develop a process to improve estimates of recreational take and factor this into stock assessments and management controls to ensure overall catch levels are sustainable.*

Management response

The current CRFF management regime aims to maintain ecologically viable stock levels through a range of input and output controls. These measures were outlined in Table 1 and Part I of this report. The CRFF Management Plan establishes a series of review events based on triggers defined by trends in catch, size and age structure or abundance. However these do not act as target or limit reference points. This is of concern given the apparent trends in CPUE for both Coral trout and Red-throat emperor. DEH is aware that DPI&F have started a process to reassess the review events in the CRFF Management Plan to ensure their appropriateness, that they are quantitative where possible and they are consistent with the application of operational objectives for the fishery (**Recommendation 3**). DEH has also recommended that DPI&F monitor the status of the fishery in relation to the review events and respond within three months of a review event being triggered (**Recommendation 4**).

DEH considers that the CRFF Management Plan, which combines both output and input controls, provides a sound platform for the protection of the target and byproduct stocks. However, the current TACs, totalling 3061 t in aggregate, are based on catch levels representative of the fishery catch in the years preceding the May 1997 CRFF investment warning, and does not take into consideration the recreational take. Given the absence of stock assessments it is not possible to know whether this represents a sustainable level of catch.

Stock assessments for the two principal species (Coral trout and Red-throat emperor) and risk assessments of 'other' coral reef finfish have been recommended (**Recommendations 7 and 8**) and DEH considers that DPI&F should use these assessments to review the TACs and set them at a level that reflects estimates of sustainable levels of catch. DPI&F report that catch by all sectors was taken into account in developing the current management arrangements. DEH therefore expects that, using the improved estimates of recreational take arising from **Recommendation 9**, take by other sectors will be taken into account when reviewing the TACs.

Recommendation 10: *DPI&F to reassess the appropriateness of the total allowable commercial catches for the main target species and 'other coral reef finfish', taking into account the outcomes of the stock and risk assessments for CRFF species by end 2007.*

The DPI&F submission notes that the management arrangements for the CRFF explicitly consider the biological and ecological characteristics, including distribution of coral reef finfish. For many species of coral reef finfish, reproductively mature individuals aggregate to spawn on reefs during the new moon phase. This behaviour during the spawning period makes these species more vulnerable to fishing through fishers targeting spawning aggregations and increased catchability of the fish during these periods. Under the CRFF Management Plan three nine-day closures apply fishery-wide annually to protect spawning aggregations of fish. DPI&F believes this is a conservative approach to ensure fish have the opportunity to spawn in the absence of fishing pressure regardless of their location. While the exact timing of these closures varies from year to year (with the lunar cycle) they occur between late September and late December. The submission indicates that, while not all the major species groups in the CRFF are known to form spawning aggregations, they tend to spawn through Spring and Summer. It is likely therefore that these closures do increase the chances of spawning success for a number of the target species. However, given the wide range of species taken in the fishery, it is likely that the timing of spawning and spawning behaviour varies widely. DEH believes that it is an important management consideration

to protect target species when they are most vulnerable during their respective spawning times and considers that the outcomes of the risk assessments should be used to review the adequacy of existing spawning closures and, in particular, to ensure that adequate protection is provided to species that spawn outside these closure times, such as winter spawning species.

Recommendation 11: *DPI&F to review current management arrangements and ensure that adequate protection is being given to spawning stocks of the main target species.*

The CRFF Management Plan acknowledges the potential for localised depletion of some of the target species, such as Coral trout. The Plan includes review events that refer to changes in catch, effort and size and age distribution of fish in a 'region'. Further, the general review provision of the Plan (Chapter 5, Part 1) requires an assessment of catch in an 'area' during the preceding four-year period. While 'region' is defined in the CRFF Management Plan, 'area' is simply defined as 'an area located near a populated area' and there is no definition on which the latter assessment would be made. DPI&F have informed DEH that the definition of 'area' was left open in terms of its definition to allow for flexibility. It was intended to be a review event that could take into account localised depletion around population centres or ports, which in themselves are difficult to define. DEH notes that the review events are being reviewed and expects that the new review events will have explanations of how they should be interpreted to avoid any confusion. This will help to ensure that adequate provision is given for the detection of potential localised depletion.

Conclusion

DEH considers that the management regime in the CRFF is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to overfishing. The introduction of the CRFF Management Plan, resulting in the removal of over 1300 licences and the introduction of output controls is a significant step towards ensuring a sustainable fishery. DEH considers that the information collection system and management arrangements generally are sufficient to ensure that the fishery is conducted at catch levels that maintain ecologically viable stock levels with acceptable levels of probability.

DEH considers that there is scope to further refine some of the existing information collection, assessment and management responses and has provided a number of recommendations for improvements in the longer term to address these concerns.

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'*

No clearly defined reference points are in place for stocks in the CRFF. Concern for the status of stocks of Coral trout and Red-throat emperor prompted the introduction of the current management arrangements. However, in the absence of stock assessments it is not possible to conclude that these species are overfished. DEH notes that DPI&F are reassessing the review events in the CRFF Management Plan to ensure their appropriateness, that they are quantitative where possible and that they are consistent with the objectives for the fishery (**Recommendation 3**). DEH has also recommended that stock assessments for the two principal species (Coral trout and Red-throat emperor) and risk assessments of 'other' coral reef finfish be conducted (**Recommendations 7 and 8**).

Conclusion

DEH considers that if the proposed stock assessments suggest that stocks are overfished DPI&F will ensure that the fishery is conducted such that there is a high degree of probability the stock would recover to ecologically viable stock levels within nominated timeframes.

Ecosystem impacts

Principle 2: *'Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem'*

Bycatch protection

Objective 1: *'The fishery is conducted in a manner that does not threaten bycatch species'*

Information requirements

There is no ongoing collection of bycatch data in the CRFF. The most comprehensive existing information on bycatch comes from the CRC Reef's ELF Program. Over a two-year period, from 1996-98, CRC Reef carried out an observer program on the 'live' and 'processed' sectors of the commercial fishery as part of an FRDC-funded project (Mapstone *et al.* 2001). The ELF project provides a valuable snapshot of bycatch composition and abundance in the CRFF.

Despite the high level of discards identified by the ELF project (see Assessment section below) and the requirement of the CRFF Management Plan for 'reliable' information on bycatch, the revised CRFF logbooks introduced in July 2004 failed to include provision for the recording of bycatch. Data from the ELF project suggest that around 8% of catch is comprised of species that are not on the designated CRFF species list in the CRFF Management Plan, including species of sharks such as reef sharks (*Carcharhinus amblyrhynchos*), black tip reef sharks (*C. melanopterus*) and bronze whalers (*C. brachyurus*). Australia's National Plan of Action for the Conservation and Management of Sharks (SAG and Lack, 2004) requires that all catch of sharks be recorded by species. DPI&F should take this requirement into account in reviewing its bycatch data collection requirements.

DPI&F has indicated that it will be adjusting the sampling program of the LTMP in order to provide data to support the requirements of the review events. Given the fishery independent nature of the LTMP, DEH has some concern as to whether this program will deliver robust data on the nature, extent and life status of bycatch in the commercial fishery. DEH believes that the lack of an ongoing bycatch data collection system is a problem in the management arrangements for the CRFF, but notes that DPI&F has committed to an observer program to monitor bycatch, with a number of observer trips already being conducted on commercial line fishing boats. DEH supports the continuation of this program as part of the requirements of **Recommendation 6**.

Information on bycatch from the recreational sector has been collected as part of the RFISH diary program and the NRIFS. Bycatch from the charter sector is also collected through logbooks. Bycatch from the Indigenous sector is unknown.

Assessment

Results of the ELF Project showed that around 80 species or groups were taken as bycatch in 'processed' operations, while in 'live' operations around 60 species were taken as bycatch.

In the commercial sector, bycatch accounts for around 43% of the total individuals caught by fishing operations landing live product and around 25% for the operations processing product. Coral trout accounts for greater than 50% of the bycatch taken in both 'processed' and 'live' fishing operations. Including Coral trout, the six most abundant bycatch species comprise more than 75% of the total bycatch for both sectors. The dominant bycatch species, common to both live and processed fishing operations are: Coral trout, Red-throat emperor, Grass sweetlip (*L. laticaudis*), Stripey seaperch and Hussar (*L. adetii*). Trevally species (Family Carangidae) and Blacktip rockcod (*Epinephelus fasciatus*) are also common bycatch species for both 'processed' and 'live' fishing operations.

The submission claims that the high levels of discards of target species are of undersized fish. A key component of the management arrangements for the CRFF is the minimum, and in some cases maximum, size limits. Given the high levels of discards, the contribution of these limits to sustaining fish populations will depend in large part on the survival rate of discarded species. The submission provides no information on the life status of discards but acknowledges that species taken in the fishery that come from deeper waters are likely to have poor post-release survival rates and that a cautious approach to harvesting these fish is required to ensure sustainability.

The 1997 and 1999 RFISH diary programs indicate that around 54% of the catch of CRFF species is released. Release rates ranged from 35% for Hussar to 47% for Coral trout and up to 70% for cods (*Epinephelus* spp.) and red emperor (*Lutjanus sebae*). Where comparison is possible these estimates are corroborated by the NRIFS, which found that sixteen species/groups comprised 90% of released fish by recreational anglers. Henry and Lyle (2003) found that CRFF species are generally released by recreational anglers because they are below minimum size restrictions, they are in excess of possession limits or because the angler is practicing 'catch and release'. In the charter sector logbook data indicate that release rates of CRFF species are less than 20%.

Line fishing is generally regarded as relatively benign in terms of bycatch (AMCS, 2004; Morgan and Chuenpagdee, 2003). McLeay *et al.* (2002) has concluded that the risk to bycatch in the CRFF is largely a function of the susceptibility of the individual species to post release mortality. DEH notes that the SAG has recently identified the need to estimate the survival of released/discarded line-caught fish, especially pelagic species and sharks, as a research priority.

The *National Strategy for the Survival of Released Line Caught Fish* aims to quantify and increase the post-capture survival of released line-caught fish. As part of the Strategy, Mcleay *et al.* (2002) conducted a preliminary risk assessment of the major line-caught species in each State. Of the species taken in Queensland, that assessment identified Nannygai (*Lutjanus malabaricus* and *L. erythropterus*), Jobfish (*Prisipomoides* spp.) and tropical snapper and seaperch (*Lutjanus* spp). as having a relatively high risk of post-release mortality. Coral trout and Red-throat emperor and sweetlips, emperors, tuskfish (*Choerodon* spp.) and cods were rated as having a medium susceptibility to post-release mortality. All of these species/families are discarded in the CRFF.

In response to these findings an FRDC-funded project '*National strategy for the survival of released line caught fish: investigating survival of fish release in Australia's tropical and subtropical line fisheries*' (FRDC Project 2003/019) was initiated in 2003 and will be completed by the end of 2007.

The submission claims that it is unlikely that rates of post capture mortality of Coral trout will be 'unacceptably high' in live fishing operations since operators have an incentive to catch and handle the fish so as to maximise its chances of survival. Practices such as fishing relatively shallow water to minimise barotrauma, good handling techniques and the use of modern de-hooking apparatus are noted as likely to increase the survival rates of fish taken in 'live' operations, including those ultimately discarded.

Management response

There are no legislated bycatch mitigation measures in place in the CRFF. It is DPI&F's intention to await the completion of FRDC project 2003/019 at the end of 2007 before considering any formal action to reduce bycatch. DPI&F expect that the project will enhance the survival of released fish by identifying changes to line fishing techniques such as hook design and barotrauma relief procedures and that it will improve stock assessments through better estimates of mortality. DPI&F has indicated that changes to fishery regulations may be necessary to reduce the impact of line fishing on populations of juveniles and undersized fish. Management responses may include:

- seasonal/spatial closures (eg nursery or spawning areas);
- incentive schemes to reduce discard rates;
- gear restrictions (eg hook size); and
- education schemes.

In the meantime DPI&F is developing a code of practice for commercial line fishers on discarding fish. RecFish Australia's member associations, including those in Queensland, have agreed to promote and support the National Code of Practice which addresses the humane treatment of fish, and the Australian National Sportfishing Association has adopted a Code of Practice on Releasing Fish. DPI&F has also been active in distributing educational material to anglers to improve the survivability of bycatch. This is complemented by further education undertaken as part of the *National Strategy for the Survival of Line Caught Fish*.

Since there is significant overlap between target, byproduct and bycatch species in the CRFF, the monitoring and research programs in place for the target species also apply to bycatch species. The CRFF Management Plan requires that it be reviewed if 'the level of by-catch of coral reef finfish regulated by species has increased by more than 10% in a four-year period.' While this suggests that DPI&F does not have to take action to manage bycatch in less than a four-year period, DPI&F have advised that they would respond to any information that came to hand from research that is currently being conducted on post release mortality as well as any information that comes from the observer program, logbooks or any other source regarding levels of bycatch. In addition, the SAG has specifically requested that they be advised of any information that comes to hand regarding species at risk. DEH notes that the SAG is assessing the review events in the CRFF Management Plan and encourages DPI&F to ensure that any amended review event for bycatch better reflects DPI&F's intentions by including provision for response to new information as it comes to hand.

DEH considers that bycatch management measures should specifically be developed for shark species such as grey reef sharks (*Carcharhinus amblyrhynchos*), black tip reef sharks (*C. melanopterus*), white tip reef sharks (*Triaenodon obesus*) and bronze whalers (*C. brachyurus*), which contribute to the bycatch taken in the CRFF. The development of such bycatch mitigation measures would be consistent with Australia's National Plan of Action for the Conservation and Management of Sharks. Concerns have recently been raised by James Cook University researchers regarding the catch rates and unsustainable population declines in reef sharks on the GBR. Publication of these data is expected to occur in 2005. Given that it is not known what level of fishing pressure these species can sustain, or what level of mortality of these species occurs once

they have been caught as bycatch, DEH considers that DPI&F should take into account results of such research on sharks in reviewing the need for specific bycatch mitigation measures.

Recommendation 12: *DPI&F to use the results of stock and risk assessments, and research projects, to review the need for specific bycatch management measures and introduce effective and appropriate methods to reduce bycatch, or increase survivability, as needed.*

Conclusion

DEH recognises that the ELF program has provided some information on bycatch in the CRFF, but considers that the lack of estimates of post-release mortality, the absence of stock assessments for these species and the concern for the status of the two principal species represents a situation of high uncertainty.

DEH notes that stock assessments and risk assessments are underway or planned and that current research will provide advice on mortality rates and measures to mitigate mortality of bycatch. DPI&F has begun an observer program to collect bycatch data although it will be some time before meaningful bycatch data are available. Results of stock assessments will not be available until end 2006 and the FRDC study on post-release mortality will not be completed until 2007.

Given that the bycatch in the CRFF is primarily comprised of discarded target species, DEH has recommended that DPI&F use the results of stock and risk assessments, and research projects, to review the need for specific bycatch management measures to reduce bycatch, or increase survivability (**Recommendation 12**). DEH considers that this recommendation will help to ensure that the risk of unacceptable impact on bycatch species is detected and minimised in the longer term.

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

A number of species present in the waters of the CRFF are protected under the EPBC Act, the *Great Barrier Reef Marine Park Regulations 1983*, the *Nature Conservation Act 1992* and the *Fisheries Regulation 1995*. There are no threatened ecological communities within the area of operation of the CRFF.

The LTMP, CRC Reef ELF project and the AIMS LTMP have recorded few interactions with endangered, threatened or protected species. However, to date there has been no ongoing collection of fishery-dependent data on such interactions. In order to rectify this deficiency, the commercial logbook has, since July 2004, required Queensland line fishers to record on a daily basis, any interaction with SOCI. If an interaction has occurred the fisher must complete a separate SOCI logbook sheet detailing date, time and location of interaction, fishing gear, species (using species codes), release condition, and tag or band details.

Fishers involved in the RFISH statewide diary program have voluntarily provided some estimates of recreational fishers' interactions with endangered, threatened and protected species. Fisher diary returns from the 1997 and 1999 RFISH surveys, which each included over 3000 fishers, reported 7 and 2 sea snakes, and 10 and 12 marine turtles respectively. At this stage DPI&F considers the RFISH information relating to interactions with endangered, threatened and protected species to be preliminary and indicative only. Future RFISH surveys will be expanded with a specific reference acting as a prompt for participants to report interactions with SOCI ensuring that similar fishery-dependent information is gathered for both recreational and commercial fishers. Charter fishing logbooks make no provision for the reporting of interactions with endangered, threatened and protected species although DEH notes that the charter logbook is being revised and encourages DPI&F to provide for reporting of interactions with these species in the revised logbook.

DEH notes that one of the biggest barriers to successful commercial reporting of protected species interactions is the capacity of the fishers to identify the species involved. In addition, many operators may not be aware of the importance of this reporting. To address this issue, DPI&F has developed and implemented a protected species education program for recreational and commercial fishers.

DEH believes that there is a need for validation of all logbook data, and has recommended that a data validation program, which could also be used to validate SOCI data collected in logbooks, be implemented in the CRFF (**Recommendation 6**).

Assessment

The submission identifies the potential for interaction of the CRFF with endangered, threatened and protected species of finfish, shark, turtles, marine mammals and seabirds.

There has been no formal assessment of the impact of the CRFF on protected species and the submission acknowledges that a detailed risk assessment of the actual and potential impacts on endangered, threatened and protected species is still some time off. However, the submission provides a summary of a preliminary assessment on the likelihood and severity of interactions with protected species in the CRFF.

That assessment shows that there is likely to be some interaction of the CRFF with critical habitats of the Grey nurse shark (*Carcharias taurus*). The submission indicates that Grey Nurse Shark Protection Areas (closures to fishing and collecting) were introduced in December 2003 to reduce the risk of harm or disturbance to sharks in key aggregation sites. Further, the submission indicates that, should an interaction occur, hooked sharks would invariably break the line or be cut loose by the operator to ensure the safety of the fishing operation. The assessment considered that any likelihood of interactions with Great white sharks (*Carcharodon carcharias*) were remote in the CRFF.

Dobbs (2001) identified line fisheries as likely to have a minimal impact on marine turtles due to the relatively low rates of hooking turtles on line fishing gear and the short release time involved if a turtle is hooked. However there remains a risk of infection or injury following capture and release. The preliminary risk assessment compiled by DPI&F indicated that it was possible that the fishery might interact with Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*) and Hawksbill (*Eretmochelys imbricata*) turtles but that these interactions were neither common nor likely. The likelihood of interactions with Olive Ridley/Pacific Ridley (*Lepidochelys olivacea*) or Leatherback turtles (*Dermochelys coriacea*) was rated as remote and with Flatback turtles (*Natator depressus*) as rare.

Haines and Limpus (2000) identified the ingestion of discarded fishing lines as a cause of mortality of turtles. The submission makes no reference to any initiatives to reduce the loss of gear at sea in order to minimise the potential impact on turtle populations.

The preliminary risk assessment compiled by DPI&F indicates that interactions with dugong are likely to be rare. The submission notes that Dugong Protection Areas were established in 1998 in the GBRMP and Hervey Bay Regions and that the recreational sector's Code of Practice also advises fishers on measures to minimise fishing impacts such as boat strikes and habitat disturbance.

GBRMPA's Whale and Dolphin Conservation Policy (GBRMPA, 2000a) identifies direct impacts of fishing on cetaceans as including accidental entanglement in fishing gear, behavioural modification and vessel strikes/interaction and indirect effects as habitat degradation and broader ecosystem impacts such as depletion of cetacean prey species. DPI&F's preliminary risk assessment indicates that the likelihood of CRFF interactions with cetaceans is remote.

The CRFF potentially has both direct and indirect impacts on endangered, threatened and protected seabird species. The preliminary risk assessment compiled by DPI&F indicates that protected species of Albatrosses, Giant Petrels, Frigatebirds and Terns and the Brown booby were likely to take bait from CRFF operations. The submission notes that this potential is minimised by the speed with which fishers sink their baits (Dave Milton, CSIRO, pers. comm., 2003). The DPI&F LTMP and the CRC Reef ELF project report very few interactions. Stakeholders involved in ReefMAC processes also generally consider the CRFF to have only limited potential to cause fatality or injuries to endangered, threatened or protected seabird species due to the relatively benign fishing methods employed in the fishery.

Management response

The submission advises that no formal trigger points relating to protected species have been incorporated into the CRFF Management Plan since the fishing methods employed are relatively benign in terms of both the potential for interaction and the likelihood of a successful release should an interaction occur. DEH has recommended that DPI&F develop objectives, performance measures and indicators for protected species by December 2006 (**Recommendation 3**).

The reduction in latent effort and catch limits imposed on target species under the CRFF Management Plan, along with the extensive area closures in the GBRMP, will afford some indirect protection to protected species in the area of the fishery. In addition, education campaigns undertaken by GBRMPA, the Endangered Species Awareness Course for commercial fishers in Queensland and the voluntary codes of practice in the commercial and recreational sectors contribute to reducing interactions with protected species. DEH supports the development of a code of practice for the commercial sector of the CRFF, but believes adoption and implementation of the code needs to be monitored and complemented by mandatory management measures.

Conclusion

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

The major potential sources of information that may be used in assessing any ecosystem impacts arising from the CRFF are the DPI&F's LTMP and the AIMS LTMP. The DPI&F LTMP provides information on how reef fish populations change over time and helps to link changes in fish populations to changes in reef habitat. The AIMS LTMP aims to assist in monitoring the status and changes in distribution and abundance of reef biota and to assess impacts of human activities. DPI&F has undertaken that information from this program will be included in examination of annual changes in reef fish abundance data.

DEH notes the lack of information collection and research covering the fisheries impact on the ecosystem and environment generally. However, DEH understands that this lack of information is the case across a range of Australian and international fisheries and, until appropriate research techniques and programs are developed and implemented, this will continue to be the case. DEH strongly supports research in the areas of ecological indicators regarding the impacts of fishing and the assessment of impacts of predator removal on the ecosystem.

Assessment

No specific studies have been conducted to determine the impacts of the CRFF on the ecosystem generally. The main sources of impact are likely to be the fishing gear, the removal of target/byproduct species and the setting and retrieval of anchors.

There is a general consensus among fishers, researchers and other stakeholders, supported by the GBRMPA (2000b), AMCS (2004) and Morgan and Chuenpagdee (2003) that line fishing gear is relatively benign in terms of impacts on the environment.

Current knowledge of direct and indirect trophic effects on the structure of coral reef fish communities by the removal of predators is limited. Research to date has proved inconclusive in regard to the impacts of fishing for predatory coral reef finfish on prey populations. The difficulty in ascertaining any impact is confounded by differences in habitat complexity, larval dispersal and recruitment rates.

The submission claims that the large variability in recruitment in reef fish generally, and the high natural levels of environmental stochasticity and species diversity in coral reef ecosystems means that coral reef environments are relatively robust and can adapt to environmental changes and changes in the abundance of key species. Further, the submission claims that there remains limited evidence to indicate that the removal of fish in lower trophic levels of coral reef ecosystems results in significant effects on individual species or levels of biomass in other trophic levels (Russ, 1991).

DEH notes that more recent research on coral reefs indicates that 'reductions in the abundance and intensity of multispecies interactions in a community of high biodiversity allow greater population fluctuations, perhaps destabilising local community structure and increasing the likelihood of both local and regional extinctions.' (Carr *et al.*, 2002)

While no specific studies have been conducted to determine the impacts of the CRFF on the ecosystem generally, the setting and retrieving of anchors is likely to be one of the main potential

sources of impact to the ecosystem in which the CRFF operates. This impact has the potential to be significant given that up to 1000 dories may up-anchor several times each day. While there is limited evidence to suggest that anchor damage in the CRFF is of major ecological significance, the submission acknowledges that there is some evidence of localised impacts from boating activity in general in heavily used areas such as the Whitsunday Islands and reefs offshore from Cairns and Port Douglas. DEH also notes that the SAG has recently identified the need for a risk assessment of the impact of anchor damage as a research priority.

Recommendation 13: *DPI&F to continue to work with industry and other management agencies to reduce the impact of the CRFF on the broader ecosystem, including impacts relating to anchoring.*

Management response

DPI&F has implemented a range of management measures that minimise the risk of significant impact of fishing on ecosystems and their components. Most management measures were established to protect target species and their habitats. However the introduction of the Representative Areas Program in the GBRMP will provide significant additional protection to the ecological communities within the CRFF.

DEH notes that the CRFF Management Plan does not include any review events specifically relating to broader marine ecosystem impacts. The submission claims that this is because any broader ecosystem impacts in the CRFF would most likely be a flow-on effect from direct and indirect impacts to the target species. DEH does not believe that this provides adequate protection to the ecosystem. Impacts on the ecosystem may occur well before the current review events in relation to target species are triggered. DEH has consequently recommended that objectives, performance measures and indicators relating to ecosystem impacts be developed and implemented (**Recommendation 3**).

Impacts on water quality through the discharge of plastic wastes and pollution from vessels are controlled under MARPOL legislation. Operators are required to comply with the legislation and must retain any plastic waste and dispose of it only when the vessel returns to port.

Conclusion

DEH considers that the fishery is conducted in a sufficiently precautionary manner to minimise the impact of fishing operations on the ecosystem generally. A recommendation has 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

AIMS	Australian Institute of Marine Science
AMCS	Australian Marine Conservation Society
CFISH	Commercial Fishing Information System
CPUE	Catch-per-unit-effort
CRC Reef	Cooperative Research Centre for the Great Barrier Reef World Heritage Area
CRFF	Coral Reef Finfish Fishery
CRFF Management Plan	<i>Fisheries (Coral Reef Fin Fish) Management Plan 2003</i>
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEH	Department of the Environment and Heritage
DPI&F	Department of Primary Industries and Fisheries
ELF	Effects of Line Fishing
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FRDC	Fisheries Research and Development Corporation
GBR	Great Barrier Reef
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
ITQ	Individual Transferable Quota
LTMP	Long Term Monitoring Program
MARPOL	International Convention for the Prevention of Pollution from Ships
NRIFS	National Recreational and Indigenous Fishing Survey
QBFP	Queensland Boating and Fisheries Patrol
ReefMAC	Reef Management Advisory Committee
RFISH	Recreational Fishing Information System
RQ	Reef Quota
SAG	Stock Advisory Group
SCUBA	Self Contained Underwater Breathing Apparatus
SOCI	Species of Conservation Interest
t	Tonnes
TAC	Total Allowable Catch
UVC	Underwater Visual Census
WTO	Wildlife Trade Operation