



**Australian Government**

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**Department of the Environment and Heritage**

Assessment of the  
**Cocos (Keeling) Islands Marine Aquarium Fish Fishery**

October 2005

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Assistant Secretary  
Marine Environment Branch  
Department of the Environment and Heritage  
GPO Box 787  
Canberra ACT 2601

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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 the management arrangements for the  
Cocos (Keeling) Islands Marine Aquarium Fish Fishery**

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## EXECUTIVE SUMMARY

### Background

The Department of Fisheries, Western Australia (DFWA) has submitted a document for assessment under Parts 13 and 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The document *Draft Application to the Australian Government Department of the Environment and Heritage on the Cocos (Keeling) Islands Marine Aquarium Fish Fishery* (the submission) was received by the Department of the Environment and Heritage (DEH) in July 2005. The submission was released for a thirty-day public comment period that expired on 12 August 2005. No public comments were received.

The submission reports on the Cocos (Keeling) Islands Marine Aquarium Fish Fishery (CKIMAFF) 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 CKIMAFF**

<b>Area</b>	Waters of the Australian Fishing Zone within the 12 nautical mile territorial waters of Cocos (Keeling) Islands, excluding the waters of North Keeling National Park.
<b>Fishery status</b>	The target species is considered underfished.
<b>Target Species</b>	Yellowheaded Angelfish ( <i>Centropyge jocularis</i> ).
<b>By-product Species</b>	The operator is permitted to take any fish within the families: <ul style="list-style-type: none"> <li>• Toxotidae (Archerfishes);</li> <li>• Ephippididae (Batfishes);</li> <li>• Chaetodontidae (Butterflyfishes);</li> <li>• Pomacanthidae (Angelfishes); and</li> <li>• Pomacentridae (Damsel-fishes).</li> </ul>
<b>Gear</b>	Hand or scoop net, or seine net of specific dimensions. Self Contained Underwater Breathing Apparatus (SCUBA) equipment is permitted.
<b>Season</b>	No closed season, although fishing activity is dependent on weather conditions.
<b>Commercial harvest</b>	Consistently less than 400 individual Yellowheaded Angelfish collected per year. 245 collected in 2004.
<b>Value of commercial harvest</b>	Unknown.
<b>Recreational harvest</b>	Unknown – considered to be negligible.
<b>Commercial licences issued</b>	1 licence issued.
<b>Management arrangements</b>	Output controlled through: <ul style="list-style-type: none"> <li>• limit on species permitted to be harvested;</li> <li>• limit on the total number of individuals of all species combined that can be harvested in a year (4000); and</li> <li>• limit of the number of individuals within a Family that can be harvested within a year (2000).</li> </ul> Input controlled through: <ul style="list-style-type: none"> <li>• limited number of permits (1);</li> <li>• gear restrictions; and</li> <li>• area restrictions.</li> </ul>
<b>Export</b>	Mainly exported to Japan, with Taiwan, Hong Kong, Europe and the United States all placing orders in the past two years.

<b>Bycatch</b>	Potential for some bycatch to be taken with seine nets, but most likely limited to commensal organisms living on the harvested individuals.
<b>Interaction with Threatened Species</b>	No interactions have been reported to date.

The area of the fishery includes waters of the Australian Fishing Zone within the 12 nautical mile territorial waters of the Cocos (Keeling) Islands. The Cocos (Keeling) Islands are located in the eastern Indian Ocean, approximately 2700 km north west of Perth at latitude 12°10' south and longitude 96°50' east.

One licensed operator is currently permitted to take limited numbers of any fish belonging to the families Toxotidae (Archerfishes), Ehippididae (Batfishes), Chaetodontidae (Butterflyfishes), Pomacanthidae (Angelfishes) and Pomacentridae (Damsel-fishes). However, the only species that has been exported to date is the Yellowheaded Angelfish (*Centropyge jocularis*). Other species have also been harvested as part of the fishery, but only in small numbers (less than 50 fish across all species annually).

The target species (*C. jocularis*) is endemic to the Cocos and Christmas Islands (Parks Australia, Cocos Islands, 2005) and inhabits fringing reefs from 12 m to 40 m. The species is territorial, living in colonies of 2-5, although juvenile aggregations can number as high as 20 in suitable environments. They are expected to live to around three to five years of age and are believed to be highly resilient to fishing pressure, with populations having the ability to double in less than 15 months (Froese and Pauly, 2005).

The CKIMAFF is part of a global multi-million dollar industry that is estimated to be worth US\$200-330 million annually. The value of the CKIMAFF is unknown, although *C. jocularis* commands a high price on the international market. Less than 400 individuals of this species have been collected each year from 1996-2005 and fishing is undertaken on a demand, rather than supply basis. DFWA reports that there is little incentive for the operator to increase catch or effort since he is able to maintain valuable markets and high prices by only having small numbers of fish available for sale.

The CKIMAFF officially began in 1993 when a Commonwealth developmental licence was issued by the Australian Fisheries Management Authority (AFMA) under the *Fisheries Management Act 1991*. In December 2002, the territorial waters around both the Cocos (Keeling) and Christmas Islands were declared as 'excepted waters' under the *Fisheries Management Act 1991*. As a result, all fishing activity undertaken within a 12 nautical mile radius of each territory is now managed by Western Australia under the applied *Fish Resources Management Act 1994 (WA) (CI) (CKI)*. At the time of this hand over, all existing AFMA permit holders were reissued appropriate authorities under the applied legislation. The Australian Government Department of Transport and Regional Services (DOTARS) is technically responsible for the management of the CKIMAFF, but DFWA has entered into a Service Delivery Agreement with DOTARS and is responsible for day-to-day management of the fishery, while all Ministerial decisions are referred to the Australian Government Minister for Territories.

As part of the hand over of management of the fishery, the existing permit holder was able to continue to fish under the conditions that existed on the previous permit. While the expiry date of the old permit has now passed and a new permit has been issued, the same conditions are still attached to the current permit. DFWA intends to review the licence conditions by the end of June 2006, and it is expected that the review will reduce the catch limits and narrow the list of species

permitted to be targeted in order to make the conditions more complementary to actual fishing practices. DEH has made a recommendation that this review be conducted as a priority and that resultant changes to management arrangements be implemented in a timely manner (**Recommendation 5**).

The operator is only permitted to harvest fish using a hand or scoop net, or a seine net, the dimensions of which are specified as part of the permit conditions. SCUBA diving equipment is also permitted. Apart from gear restrictions, fishery management arrangements also include limits on the species allowed to be targeted and on the number of individuals that can be taken and area closures. There is also limited participation in this fishery with only one permit issued currently.

While seine nets have the potential to take bycatch, the actual bycatch taken in the CKIMAFF is thought to be limited to minor amounts of commensal organisms living on or within the targeted fish. This is mainly due to the use of hand harvesting techniques and the limited number of operators in the fishery. Species listed under the EPBC Act that may be affected by this fishery include turtles, sharks, seasnakes, syngnathids and cetaceans. Possible protected species interactions in the fishery include vessel interactions with turtles and cetaceans. However, there have been no interactions reported to date, and such interactions are considered unlikely given the very low number of vessels operating in the fishery. Possible interactions are assessed under Principle Two of this report.

There is no documented evidence of a recreational fishery for ornamental species, however members of the public are permitted to collect specimens for their private aquariums. There are no indigenous fishing interests on the Cocos (Keeling) Islands.

The fishery is managed according to conditions associated with permits issued under the applied *Fish Resources Management Act 1994 (WA) (CI) (CKI)*.

## **Overall assessment**

The material submitted by DFWA indicates that the CKIMAFF operates in accordance with the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. DEH considers that the CKIMAFF is a well-managed fishery that is unlikely to have an unacceptable or unsustainable impact on the environment in the short to mid term. Recommendations have been developed to ensure that the risk of impact is minimised in the longer term. Overall, the management regime of species limits, catch limits and gear restrictions suggests that the fishery is being managed in an ecologically sustainable way.

In making its assessment, DEH considers that the current management arrangements are sufficient to ensure that the fishery is conducted in a manner that does not lead to over-fishing and that stocks are not currently overfished. Considering the research and monitoring programs that are in place, the small size of the fishery and the commitment of DFWA to review the license conditions to further control the level of harvest in the fishery, DEH considers that fishing operations are managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem.

The assessment finds that the fishery is managed in an ecologically sustainable way and its operation is consistent with the objects of Part 13A of the EPBC Act. DEH recommends that the export of species taken in the fishery should be exempt from the export requirements of Part 13A of the EPBC Act, with that exemption to be reviewed in 5 years. DEH considers that the fishery, as

managed in accordance with the management regime, is not likely to cause serious or irreversible ecological damage over this period.

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

Protected species potentially occurring in the fishery area include syngnathids, marine turtles, sharks, sea snakes and cetaceans. No interactions with these species have been reported to date, and it is considered that such interactions are unlikely given the low level of effort in the fishery and the benign harvesting methods employed. There are no listed threatened ecological communities in the fishery area.

DEH recommends that the CKIMAFF management regime 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 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 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, 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 considered the possible impacts on the ecological character of the Pulu Keeling National Park (North Keeling Island) Ramsar site. The permit conditions applied to the operator in the CKIMAFF prohibit fishing in waters of the North Keeling National Park. This, combined with the extremely low level of effort in the fishery indicates that the management regime in place for the CKIMAFF is consistent with the values for which the Pulu Keeling National Park (North Keeling Island) Ramsar site was listed. On this basis DEH considers that an action taken by an individual fisher, acting in accordance with the management regime, would not be expected to have a significant impact on a Ramsar wetland protected under the EPBC Act.

To further strengthen the effectiveness of the management arrangements for the CKIMAFF, and to contain the environmental risks in the medium to long term, DEH has developed a series of recommendations. The implementation of these and other commitments made by DFWA in the submission will be monitored and reviewed as part of the next DEH review of the fishery in 5 years time.

## **Recommendations**

1. DFWA to advise DEH of any material change to the CKIMAFF's legislated management regime that could affect the criteria on which EPBC Act decisions are based, within three months of that change being made.
2. As part of the review of current management arrangements, DFWA to develop precautionary performance indicators and performance measures for the main target species taken in the CKIMAFF, linked to existing objectives.
3. DFWA, in its annual report to the Australian Government Department of Transport and Regional Services, to report on the performance of the CKIMAFF against performance

measures that relate to the sustainability of the fishery, once developed, and to forward the information to DEH.

0. As part of the review of current management arrangements, DFWA to implement the recording of fishing activity location, to an appropriate scale, in compulsory logbooks.
0. By the end of June 2006, DFWA to conduct a review of the current management arrangements for the CKIMAFF and develop a timeline for the implementation of proposed changes to the permit conditions for the fishery.

## PART I - MANAGEMENT ARRANGEMENTS

The CKIMAFF is managed by DFWA.

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

- conditions on authorisations issued under the applied *Fish Resources Management Act 1994 (WA) (CI) (CKI)*; and
- the applied *Fish Resources Management Act 1994 (WA) (CI) (CKI)* itself.

A number of other documents, including research reports and scientific literature are also relevant 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 management regime and documents referred to above to DEH's assessment of the fishery, an amendment could change the outcomes of the assessment and decisions stemming from it. Decisions resulting from this assessment relate to the arrangements in force at the time of the decision. In order to ensure that these decisions remain valid, DEH needs to be advised of any changes that are made to the management regime and make an assessment that the new arrangements are equivalent or better, in terms of ecological sustainability, than those in place at the time of the original decision.

**Recommendation 1:** *DFWA to advise DEH of any material change to the CKIMAFF's legislated management regime that could affect the criteria on which EPBC Act decisions are based, within three months of that change being made.*

It is not known what level of consultation occurred prior to AFMA issuing a fishing permit within the Cocos (Keeling) Islands. DFWA understands that AFMA officers visited the islands on an annual basis to discuss fishing levels and effort, however no formal reports of these meetings are available. Since taking over management of the fishery, DFWA has not implemented any formal consultative mechanisms, but the local community, Shire and the local Parks Australia office are aware of the fishery and the extent to which the operator is permitted to fish. While expert advice is not routinely sought as part of management of the CKIMAFF, experts from the Western Australia Museum and DFWA scientists are available to provide advice on species abundance and distribution, handling techniques and survivability.

DFWA report that, in managing the CKIMAFF, local group representatives such as divers, recreational fisheries managers and other non-extractive users of Territorial waters are consulted as necessary. They also report that any changes to the management arrangements for the CKIMAFF would be developed in consultation with the industry participant, the local Parks Australia office and any other relevant stakeholders. DEH considers that such an arrangement is appropriate to the size of the CKIMAFF and considers the fact that the current management arrangements and permit conditions are readily available will enable interested parties to be aware of, and involved in, any changes to management arrangements. DEH strongly encourages DFWA to ensure the parties identified in the submission, and any other stakeholders, are consulted during the proposed review of the management arrangements for the fishery mid next year.

In general, the CKIMAFF is managed according to the precautionary principle to ensure that the fishery does not over-exploit a particular species or cause any habitat destruction. Specifically, a number of objectives are applied to the management of the fishery. These are complementary to the objectives contained in the applied *Fish Resources Management Act 1994 (WA) (CI) (CKI)* and relate to harvest of the target species as well as to the impact of the fishery on the wider ecosystem

and on bycatch species. Each objective has a number of management strategies. No performance measures or indicators have been developed for the fishery yet, because of the small size of the fishery and the low level of take. DEH recognises these factors but has some concern that, while the catch levels of *C. jocularis* have been low to date, the operator had already harvested 257 individuals of this species by June 2005, with the potential to harvest many more than in previous years in the second half of this year. Also, while permit conditions limit the catch to a maximum of 2000 specimens from one Family of fish in a 12-month period, and a maximum of 4000 fish in total within the same period, DEH is concerned that these limits appear to be arbitrary and not based on any understanding of sustainable yield limits for the target species. While the current level of take is not of concern to DEH, DEH is concerned that effort in the fishery may only be limited currently by a lack of interest in the fishery. If market demand for the species targeted in the fishery increases and additional operators wish to enter the fishery, DEH is concerned that there is no mechanism, apart from catch limits enforced for each permit to limit harvest in the fishery. DEH therefore considers that a precautionary performance measure and indicator should be developed for the fishery to ensure that, if catch or effort significantly increases, performance indicators will be triggered and management responses implemented as necessary.

**Recommendation 2:** *As part of the review of current management arrangements, DFWA to develop precautionary performance indicators and performance measures for the main target species taken in the CKIMAFF, linked to existing objectives.*

DFWA have committed to reviewing the current permit conditions and further limiting the number of fish permitted to be harvested, to better reflect actual fishing activity. DEH is highly supportive of this commitment and considers that DFWA could develop more specific performance measures as a result of this review.

DEH suggests that the performance measure and indicator, once developed, should be capable of detecting and responding to changes in the fishery. This would require ongoing monitoring of the fishery against such performance measures and a clear process for responding to breaches of performance measures. DFWA has advised that if there is a breach in a performance measure, this will be reported in the annual report to DOTARS. If a breach materially affects the sustainability of the target species or negatively impacts on by-product, bycatch, protected species or the ecosystem, the breach will be reported to the Minister for Fisheries within 3 months for subsequent management review and action with timeframes for implementation.

Management of the fishery is based on a mixture of input and output controls. Such controls include a limit on the species permitted to be harvested, limit on the total number of individuals that can be harvested in a year and on the number of individuals from each family that can be taken within a year, gear restrictions and area restrictions. DFWA intends to review the management arrangements of the fishery by the end of June 2006 and this review is likely to result in further restrictions on the species and number of individuals permitted to be taken. DEH has recommended that the results of this review be implemented in a timely manner (**Recommendation 5**).

Due to the small size and remote location of the CKIMAFF, there is currently limited enforcement effort available for this fishery. DEH notes that with a single operator in the fishery, it is likely that compliance would be high, particularly given that the current catch limits and species range are far in excess of what the operator actually targets. However, DEH considers that the remote locality of the fishery also means that it is important that some means of ensuring compliance with the management regime is available to DFWA. This may become more important once the management arrangements are reviewed and the species range and catch limits are tightened. DFWA note that it would not be feasible to station a fisheries officer on Cocos (Keeling) Island full

time, but that they are working with DOTARS and local community representatives to identify alternative compliance options. DEH commends DFWA's commitment to developing a compliance program for the fishery and notes DFWA's expectation that an enforcement system will be in place on Cocos (Keeling) Island by the end of June 2006.

The management arrangements for the CKIMAFF are not currently reported as part of DFWA's Annual State of the Fisheries Report for two reasons. Firstly, just one operator participates in the fishery, and catch data cannot be made available for public scrutiny unless it is released by the permit holder. DEH recognises this constraint but considers that, to ensure transparency and public accountability, the management arrangements for the CKIMAFF should be reported on as an individual fishery. Secondly, the CKIMAFF is not a Western Australian fishery, so reporting in the Western Australian Annual State of the Fisheries Report is not done. Instead, DFWA reports on the fishery to the Commonwealth Department of Transport and Regional Services. DEH would consider it sufficient for DFWA to report on the performance of the fishery against performance measures, rather than supplying specific catch data, in its annual report to DOTARS and to send the information to DEH.

**Recommendation 3:** *DFWA, in its annual report to the Australian Government Department of Transport and Regional Services, to report on the performance of the CKIMAFF against performance measures that relate to the sustainability of the fishery, once developed, and to forward the information to DEH.*

Fishery-dependent data relating to the target species is collected in the fishery. Some fishery independent information is also collected. Discussion of the information collection system can be found in Part II of this report.

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

An additional aquarium fishery is established in Western Australia and managed by DFWA. However, this fishery operates in waters adjacent to the state of Western Australia and does not extend towards the Cocos (Keeling) Islands. Consequently, it is unlikely that the stocks targeted in the CKIMAFF and in the Western Australia Marine Aquarium Fishery are shared. Given the geographical isolation of the CKIMAFF, DEH considers it unnecessary for DFWA to ensure that management arrangements in the CKIMAFF take into account management arrangements in other fisheries and other jurisdictions.

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 DFWA will also ensure compliance with any future plans or policies as they are developed.

No regional or international management regimes, to which Australia is a party, are of direct relevance to the fishery. The prime international regime affecting the fishery is the United Nations Convention on the Law of the Sea. 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 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.

## **Conclusion**

DEH considers that the CKIMAFF management regime is documented and will become more publicly available and transparent through the implementation of **Recommendation 3**. The fishery is developed through a consultative process suitable to the size of the fishery. The management arrangements are adaptable and underpinned by appropriate objectives and the development of a performance indicator and measure according to **Recommendation 2** will provide a means by which the effectiveness of the management arrangements can be measured, enforced and reviewed.

The management arrangements are capable of controlling the harvest through a combination of input and output controls appropriate to the size of the fishery and DFWA is committed to ensuring that a means of enforcing critical aspects of the management arrangements is developed and implemented on the Cocos (Keeling) Islands. DEH has recommended that periodic review of the fishery be provided for by reporting on the fishery specifically in DFWA's annual report to DOTARS (**Recommendation 3**).

The management 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**

Between 1993 and 2002, while the CKIMAFF was being managed by AFMA, the operator was required to complete a logbook issued by that agency. Until recently, this logbook was still being used by the operator, but a Western Australia logbook has now been sent to the licensee to provide fishery dependent data. The information required in this logbook includes:

- licence number, vessel name and date;
- any non-fishing periods;
- number of hours spent diving;
- names of collectors and collection methods used;
- names of species collected (common and scientific);
- numbers of each species collected; and
- gear details (ie. type and length of any net used).

DEH considers that the introduction of this new, Western Australian, logbook is likely to provide more useful data on the fishing activities than the previous logbook did. In particular, DEH notes that, while the fisher has harvested other species besides the main target species, they do not appear to have been recorded in the logbook since no catch data is available for those species. In contrast, the new logbook will require the fisher to record each species harvested and the number of each species taken. In addition, DFWA will require the fisher to complete the logbook on a monthly basis and to return the catch logbook to DFWA within 5 days of the end of the month. DEH considers that this arrangement will allow DFWA to monitor the catch and effort by the CKIMAFF and to ensure the operator is not breaching the total catch limits described in license conditions.

DEH does note, however, that the new logbook does not require the fisher to record the location of fishing activity. DEH considers that this information should be gathered, as it would allow DFWA to monitor the distribution of fishing effort and ensure that effort is not too localised. This is important in a fishery that targets only a small number of species that are likely to be limited in movement and associated with particular reefs or habitat areas.

**Recommendation 4:** *As part of the review of current management arrangements, DFWA to implement the recording of fishing activity location, to an appropriate scale, in compulsory logbooks.*

DFWA report that there is no simple means of validating the data recorded in commercial logbooks since the fishery is located in a remote area, and aquarium species are not processed so catches cannot be validated against processor returns. DFWA also consider that the penalties associated with breaching licence conditions, such as not completing logbooks, is a significant deterrent to

overfishing or under declaring catch. DEH accepts these arguments, but considers validation of catch data in the CKIMAFF is important given that, while the number of licences is limited to one currently, the number of collectors is not limited. DFWA report that the licence holder usually fishes with one other diver, however, the fact that collectors are not limited enhances the risk that catches will not be recorded accurately. DEH therefore strongly encourages DFWA to explore options for validating catch data collected from the CKIMAFF.

No fishery-independent data is currently collected specifically for the CKIMAFF due to the small size of the fishery, the limited number of participants and the low catch returns to date. However, a variety of research on the biology and ecology of several species that occur on the Cocos reef systems has been conducted. Most notably, the Parks Australia *Reefcheck* program, which includes data from 1997 to 2005, has produced several status reports for the Cocos Atoll. The *Reefcheck* program involves the collection of field data on an annual basis at 11 representative sites around the Cocos Atoll. Internationally recognised underwater visual survey methods are used to census the marine environment according to *Reefcheck* protocol, which enables spatial and temporal trends in reef health to be detected and compared with the status of coral reefs around the world (Parks Australia, Cocos Islands, 2005). Habitat information for some areas is also available from the local Parks Australia office.

Overall, DEH considers that there is a reliable information collection system in place appropriate to the scale of the fishery. DEH considers that the new logbook requirements that have been introduced by DFWA will provide a sound mechanism for regularly reviewing the performance of the CKIMAFF, noting that a recommendation has been made to further enhance the logbook recording requirements (**Recommendation 4**). While there is currently limited fishery independent information collected, DEH considers that the small size of the CKIMAFF and likely low impact to the environment, means that the current programs that are run by Parks Australia will be sufficient to monitor the environment in which the fishery operates and identify any risks.

## Assessment

No stock assessment has been conducted for the CKIMAFF due to the current small size and low amount of effort in the fishery. Consequently, there is also no estimate of the potential productivity of the target stocks available. However, the amount of target species that can be taken in the CKIMAFF is highly regulated and limited and is likely to become more limited as a result of the review of management arrangements that DFWA intends to undertake. In addition, the ongoing *Reefcheck* monitoring program run by Parks Australia provides DFWA with a means of monitoring the impact of fishing activity in the CKIMAFF on the target species and on the wider ecosystem. The latest report from this program indicates that overall, fish and invertebrate species were found to have similar abundances throughout the survey period at all sites, and the overall abundance of reef species was comparable to other surveys at Cocos and similar coral reef locations (Parks Australia, Cocos Islands, 2005).

The main target species (*C. jocularis*), while endemic to the Cocos (Keeling) Islands and Christmas Island, is believed to be highly resilient to fishing pressure, with populations having the ability to double in less than 15 months (Froese and Pauly, 2005). This assumption has been confirmed to a large degree by both the fisher and local Parks Australia reports, which have concluded that collection activities in the CKIMAFF has resulted in no discernable changes in the environment. DEH considers that the lack of evidence of localised depletion and other environmental impacts can likely be attributed to the current low level of effort in the fishery, but notes that the risk of such an impact has the potential to increase if effort increases in the fishery since the target species would exhibit limited movement and is likely to be associated with particular reefs or habitats. However,

DEH has made a recommendation that the compulsory logbook used in this fishery contain a field for recording the location of fishing activities (**Recommendation 4**), which will allow DFWA to monitor catch spatially and respond to any risks in the fishery if they arise. In addition, the development of a precautionary performance indicator and measure (**Recommendation 2**) will ensure that appropriate management responses are implemented in the event that catch or effort in the fishery significantly increases.

There is no indigenous fishing at Cocos and no known recreational fishing for aquarium fish. While individuals may collect fish for private aquariums, this practice is likely to be limited and insignificant. Therefore, the only potential removal from the aquarium species populations of importance is from the single operator in the CKIMAFF. The take by this sector has been recorded in the past, and DEH considers that these records will become more reliable in the future since new logbooks for the fishery have now been issued.

### **Management response**

The current CKIMAFF management regime aims to maintain ecologically viable stock levels through a range of input and output controls. These measures are outlined in Table 1 and Part I of this report.

DEH considers that the combination of the management measures should ensure adequate protection of the target stocks, but has some concern that, while entry to the fishery is currently limited to one operator, there is no limit in place on the number of fishers that can assist the permit holder in collection activities. While DEH recognises that the fishing activities usually only involve the permit holder and one other diver, DEH considers that DFWA should consider this issue as part of the review of permit conditions and limit the amount of fishers able to harvest aquarium species under each permit.

No reference points have been developed for the CKIMAFF due to the small size of the fishery. However, the submission notes that there are a number of informal indicators that may prompt a management response including significant changes in density, indications of poor recruitment or high rates of natural mortality. DFWA would have the ability to implement such changes quickly by varying permit conditions as provided for under the applied Act. In addition, a range of management responses are available to DFWA if effort in the fishery escalates, such as removing a species from the list of species permitted to be targeted, further restricting catch limits, or introducing area or seasonal closures. DEH consider that these management responses are sound and that the indicators would be appropriate for the CKIMAFF. DEH is unsure how measurable the indicators would be given that no research specific to the CKIMAFF is undertaken, and casual observations by the fisher, local community or visiting scientific researchers may not be regular or highly reliable. DEH has previously made a recommendation that DFWA develop a precautionary performance measure for the main target species (**Recommendation 2**) and considers that this will ensure that the CKIMAFF remains sustainable into the future in the event that effort increases as a result of increased market demand or interest in the fishery.

DEH notes that DFWA has committed to undertake a review of the current management arrangements, and hopes to have completed this by the end of June 2006. Given that DEH has encouraged DFWA to consider a range of issues in reviewing the management arrangements as part of this assessment, it is considered that this review should be conducted and implemented as a priority and that the resulting new management arrangements should be implemented in a timely manner. In particular, DEH considers that the review should consider the development of specific performance measures based on sustainable yield limits.

**Recommendation 5:** *By the end of June 2006, DFWA to conduct a review of the current management arrangements for the CKIMAFF and develop a timeline for the implementation of proposed changes to the permit conditions for the fishery.*

No byproduct has been taken in the CKIMAFF to date.

## **Conclusion**

DEH considers that the management regime in the CKIMAFF is appropriately precautionary and provides for the fishery to be conducted in a manner that does not lead to over-fishing. 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.

## **Promote recovery to ecologically viable stock levels**

Objective 2: *'Where the fished stock(s) are below a defined reference point, the fishery will be managed to promote recovery to ecologically viable stock levels within nominated timeframes'*

This objective is not applicable to the fishery at present. While trigger points have not been developed for the fishery, they will be as part of **Recommendation 2**. A number of management responses are available to DFWA in the event that permit conditions are breached, and DEH is confident that the current management arrangements are effective in meeting the objectives for the fishery and likely to avoid the risk of overfishing the aquarium fish stocks in the Cocos (Keeling) Islands. DEH considers that the management arrangements will become even more precautionary as a result of the review of the permit conditions that DFWA has committed to undertake.

## **Conclusion**

DEH considers that the aquarium fish stocks are not below a defined reference point but should that occur in the future, the fishery is conducted such that there is a high degree of probability the 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**

The operator in the CKIMAFF is not required to record bycatch in logbooks, as such a requirement is considered unnecessary due to the highly selective nature of the harvesting technique employed (hand-harvesting) that minimises the potential for bycatch. DEH notes that the operator is also permitted to use seine nets in the CKIMAFF and considers that this gear type does have potential to result in bycatch being taken as part of the fishery operation. However, given that there is just one permit issued for the fishery, the amount of bycatch taken is likely to be limited and would only become a problem if the use of seine nets increases. DEH does not consider that studies to gather information on the potential for the CKIMAFF to impact on bycatch species are necessary currently, but notes that the logbook used in the CKIMAFF require the operator to record the gear type used. DEH encourages DFWA to monitor these records and respond appropriately if it becomes apparent that bycatch may be a problem in the CKIMAFF.

## **Assessment**

As noted above, significant bycatch is unlikely in the CKIMAFF primarily due to the harvesting technique employed. DEH considers that discards of target species are also unlikely in this fishery since the requirement for aquarium species to be healthy and undamaged means that the commercial harvester would only select appropriate specimens, and that these would be handled extremely carefully to avoid damage or mortality. Because of the limited ability of the fishery to result in bycatch, no formal bycatch risk assessment has been completed. DEH does not consider that such a risk assessment is necessary for this fishery.

## **Management response**

Impacts to bycatch species are primarily avoided through the use of hand harvesting. In addition, the limited scale of the fishery and the small number of operators helps to avoid bycatch in the CKIMAFF. For these reasons, there are no threat abatement plans, recovery plans or bycatch reduction strategies relevant to the fishery. As noted above, DEH does not consider that specific bycatch minimisation measures are necessary for the fishery at this time, but expects that DFWA would respond appropriately if bycatch were to become a significant issue in the future.

## **Conclusion**

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

## **Protected species and threatened ecological community protection**

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

## **Information requirements**

Information on protected species interaction is not recorded in the logbooks used in the CKIMAFF. As with bycatch, this is due to the limited opportunity for the fishery to impact on non-target species. DEH recognises that interactions with protected species are unlikely to occur in the fishery,

and as such, does not consider that a formal recommendation regarding reporting of protected species interaction is necessary.

### **Assessment and Management response**

Protected species likely to occur in the range of the CKIMAFF include marine turtles, sharks, syngnathids, sea snakes and cetaceans. Interactions with protected species in the CKIMAFF are considered unlikely because of the low level of fishing (ie. only one participant in the fishery currently) and the harvesting method (mostly hand harvesting), although interactions with protected species could occur through boat strikes. While recognising that interactions of this nature are possible, DEH considers that since only a limited number of vessels operate in the fishery the likelihood that such interactions would be significant is minimal. No threatened ecological communities have been identified as occurring in the area of the CKIMAFF. For these reasons, no assessment has been, or is planned to be, undertaken.

DEH considers that the need for a formal risk assessment with regard to protected species is not necessary for the CKIMAFF, given the low likelihood of interaction with such species. DEH is confident that, if this situation were to change, DFWA would respond appropriately to mitigate such impacts.

### **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 expects that appropriate actions will be undertaken to ensure the fishery avoids mortality or injury to these species and avoids or minimises impacts on threatened ecological communities.

### **Minimising ecological impacts of fishing operations**

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

### **Information requirements**

Due to the small scale of the CKIMAFF, specific information on the impact of the fishery on the general ecosystem is not routinely collected, with the exception of the Parks Australia *Reefcheck* program which monitors the general health of some of the reefs where fishing activity occurs. While aware of the lack of information collection and research covering the fisheries impact on the ecosystem and environment generally, DEH considers that the amount of information available currently is appropriate to the size and scale of the fishery.

### **Assessment**

Despite the lack of information collected from the CKIMAFF regarding ecosystem impacts, the fishery is generally thought to have minimal impacts on the ecosystem due to the benign collection method and the low level of harvest. This assumption is supported by the results of the latest *Reefcheck* report, which showed that overall, fish and invertebrate species were found to have similar abundances throughout the survey period at all sites, and the overall abundance of reef species was comparable to other surveys at Cocos and similar coral reef locations. There were also

very low levels of ecological disturbance such as coral damage, presence of rubbish, bleaching, introduced marine pests and disease (Parks Australia, Cocos Islands, 2005). Consequently, no risk assessment of impacts on the ecosystem has been conducted. DFWA considers that effort in the fishery would be unlikely to significantly increase because it is in the operator's best interest to have only a limited number of specimens available for sale at any one time, as he is then able to fetch a higher price. For this reason, it is unlikely that such risk assessments would be required in the future.

The most likely impact on the natural ecosystem would arise from the exploitation of the target species and its impact on the size of the spawning biomass of the species. However, the harvest from the CKIMAFF is extremely low, with only 245 individuals taken in 2004. While there is potential for this harvest to be localised and to cause localised depletion of the main target species, DEH has recommended that DFWA review the logbook reporting requirements for this fishery, and include a requirement for location of fishing activity to be recorded (**Recommendation 4**). DEH considers that the low number of specimens harvested, along with the implementation of **Recommendation 4**, that will enable DFWA to better monitor the spatial impacts of harvest in the fishery, means it is highly unlikely that the spawning biomass of target species in the CKIMAFF would be significantly impacted.

The removal of the target species could also potentially have an impact on marine food chains, given that a number of species would be likely to prey on small, reef species such as those targeted in the fishery. However, as noted above, only a small number of specimens are taken in this fishery and the species targeted in the fishery are unlikely to represent specific prey species for any other species in the Cocos (Keeling) Islands area. The management arrangements currently in place, such as limited entry and bag limits, are likely to ensure that impacts to food chains remain low.

Physical habitat, such as reefs, could potentially be damaged through anchoring or through diving activity, while water quality could be impacted by spillage of fuel and oil from vessels. However, DEH considers that such impacts are likely to be isolated and negligible since there is only one permit holder and a small number of vessels in this fishery

### **Management response**

No evidence has emerged to suggest that collection in the CKIMAFF has a significant impact on the ecosystem. The lack of observed impact is likely to be due to the low level of harvest in the fishery, the low number of participants and the benign nature of the harvesting method.

DFWA have described a number of management responses they are able to implement in the event that the CKIMAFF adversely impacts the ecosystem. While there are no reference points in place for the fishery specific to ecosystem effects, a number of management objectives for the fishery are described. DEH considers that, in keeping with these objectives, DFWA would be likely to respond appropriately to any ecosystem impacts caused by the fishery, and that such impacts would be detected by the ongoing *Reefcheck* program administered by Parks Australia.

### **Conclusion**

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

## REFERENCES

Froese, R. and Pauly, D. Editors (2005) *FishBase*. World Wide Web electronic publication [www.fishbase.org](http://www.fishbase.org), version (05/2005) accessed July 2005.

Parks Australia, Cocos Islands (2005) *Reefcheck: the status of the coral reef community at the Cocos (Keeling) Islands, Eastern Indian Ocean, 1997-2005*. Internal report for Parks Australia.

## LIST OF ACRONYMS

AFMA	Australian Fisheries Management Authority
CI	Christmas Island
CKI	Cocos (Keeling) Islands
CKIMAFF	Cocos (Keeling) Islands Marine Aquarium Fish Fishery
DEH	Department of the Environment and Heritage
DFWA	Department of Fisheries, Western Australia
DOTARS	Department of Transport and Regional Services
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
SCUBA	Self Contained Underwater Breathing Apparatus
WA	Western Australia