

**A SUSTAINABLE FUTURE FOR
RECREATIONAL FISHING
IN THE
COCOS (KEELING) ISLANDS**

Proposals for community discussion

A draft five-year strategy for managing the recreational catch

FISHERIES MANAGEMENT PAPER NO. 192

Department of Fisheries
168 St. Georges Terrace
Perth WA 6000

March 2005

ISSN 0819-4327



A Sustainable Future for
Recreational Fishing
In the
Cocos (Keeling) Islands

March 2005

Fisheries Management Paper No. 192
ISSN 0819-4327



CONTENTS

1.0	INTRODUCTION	5
2.0	SUMMARY OF PROPOSALS	7
3.0	MAKING A SUBMISSION.....	13
3.1	WHERE TO SEND YOUR SUBMISSION	13
4.0	FISHING IN THE COCOS (KEELING) ISLANDS	15
4.1	PROFILE OF FISHING IN THE COCOS ISLANDS	15
4.2	STATUS OF FISH STOCKS	15
5.0	PLANNING FOR THE FUTURE.....	17
5.1	MANAGING FOR THE FUTURE - WHY HAVE A RECREATIONAL FISHING MANAGEMENT STRATEGY?	17
5.2	RECREATIONAL FISHERIES MANAGEMENT IN WESTERN AUSTRALIA.....	17
5.3	IMPACT OF FISHING ON STOCKS	18
5.4	FISHERY MANAGEMENT STRATEGIES - WHAT WORKS AND HOW	19
5.4.1	<i>Daily bag limits.....</i>	<i>19</i>
5.4.2	<i>Boat limits.....</i>	<i>20</i>
5.4.3	<i>Possession and trip limits</i>	<i>20</i>
5.4.4	<i>Legal sizes – minimum and slot limits</i>	<i>20</i>
5.4.5	<i>Closed seasons and closed areas.....</i>	<i>21</i>
5.4.6	<i>Gear and method restrictions</i>	<i>21</i>
5.4.7	<i>Education.....</i>	<i>22</i>
6.0	THE PROPOSED RECREATIONAL AND SUBSISTENCE FISHING STRATEGY	25
6.1	INFORMATION FOR MANAGEMENT – CATCH AND FISHERY PERFORMANCE.....	25
6.1.1	<i>Key issues and proposals.....</i>	<i>25</i>
6.1.2	<i>Species biology.....</i>	<i>26</i>
6.2	PROTECTING VULNERABLE FISH AND MANAGING THE RECREATIONAL CATCH	27
6.2.1	<i>Key issues and proposals.....</i>	<i>27</i>
6.2.3	<i>Key issues - invertebrates</i>	<i>30</i>
6.2.4	<i>Possession limit</i>	<i>32</i>
6.2.5	<i>Line fishing</i>	<i>32</i>
6.2.6	<i>Spear fishing.....</i>	<i>32</i>
6.2.7	<i>Net fishing.....</i>	<i>33</i>
6.2.8	<i>Fish observation areas</i>	<i>34</i>
6.3	IMPROVING COMMUNITY STEWARDSHIP - EDUCATION AND COMPLIANCE.....	34
6.3.1	<i>Key issues and proposals.....</i>	<i>34</i>
6.3.2	<i>Education and compliance strategies.....</i>	<i>35</i>
6.3.2	<i>Fishing competitions.....</i>	<i>36</i>
APPENDIX 1	SPECIES VULNERABILITY TO OVEREXPLOITATION.....	37
REFERENCES	41

1.0 INTRODUCTION

The Cocos (Keeling) Islands offer a range of recreational fishing experiences. The sheltered lagoon, fringing reefs and offshore 'blue water' environments support a range of demersal and pelagic fish species, which are highly sought by fishers for both recreational and subsistence purposes.

Fishing activity on the Cocos is essentially unmanaged at present and there has been some concern by the local community that a number of species, such as coral trout, have declined in numbers over the last decade.

This draft strategy was developed by the Western Australian Department of Fisheries who now has responsibility for managing recreational fishing on behalf of the Commonwealth Department of Transport and Regional Services.

The management of fisheries in Western Australia encompasses a flexible approach that recognises the needs for the effective management of fish stocks based around fishing pressure, stock abundance and the risk of over-exploitation of individual species. The applied *Fish Resource Management Act* (WA)(CKI) provides a legislative framework that allows for management arrangements to be developed specifically for the Cocos (Keeling) Islands.

The purpose of this discussion paper is to seek community feedback on the appropriateness of a range of management strategies, which are designed to help ensure the future sustainability of fish stocks around the Cocos.

Ultimately, the local community will largely determine the future sustainability of fish resources around the Cocos (Keeling) Islands. Anyone who has an interest in the future management of recreational fishing is encouraged to carefully consider these proposals and provide 'input' to help ensure the quality and diversity of the fisheries are protected for future generations of Cocos Islanders.

2.0 SUMMARY OF PROPOSALS

Proposal 1 – Study of existing literature

A detailed desk study of existing literature be undertaken to incorporate all available information into a single source including:

- Identification of species;
- Levels of abundance; and
- Assessment of harvest levels.

Proposal 2 – Catch survey

A catch survey be undertaken periodically to provide detailed information about the level of recreational activity and catches on which to base management decisions.

As a subset of the major survey, information should be collected on indicator species and areas to monitor recreational fishing and catch. These indicators should cover at a minimum the size and abundance of key species. This information could be collected on a voluntary basis through a logbook program or could be run as part of a schools-based project.

The indicator species should encompass those targeted by different types of fishing. For example, sweetlip and mullet are key species targeted by line and net respectively, whereas Maori wrasse is targeted by line and spearfishing, as well as being valued for conservation reasons by recreational divers.

It is proposed that the following species be used as key indicator species:

Indicator species	Environment where species is most often found	
	<i>Lagoon</i>	<i>Outer lagoon</i>
	<ul style="list-style-type: none"> • Diamond scale mullet (Ikan Sayap Hitam) • Mud crabs (Rajungan) • Milk fish (Ikan Bandang Laut) • Gong gong • Sweetlip (Ikan Kapkuning) • Coral trout (Ikan Gelek Burik) • Maori wrasse (Ikan Hiju) 	<ul style="list-style-type: none"> • Wahoo (Ikan Tengiri) • Tuna – yellowfin and dog tooth (Ikan Tuna) • Rosy snapper (Ikan Kakap)

Proposal 3 – Priority species for research

Research be undertaken on the following key recreational species (in order of priority) to provide information on species biology and stock structure. Some research has been done on the priority species which is not quantitative with respect to stock around the Cocos (Keeling) Islands. Predictive fisheries stock assessment models and, where practical, indices of recruitment, should then be developed for these key species:

	Gap analysis of Research			
Species	Biology	Stock assessment	Exploitation status	Breeding stock level
Gong gong	N/A	N/A	Limited	N/A
Tropical snappers (Ikan Kapkuning)	Limited	N/A	N/A	N/A
Maori wrasse (Ikan Hiju)	Limited	N/A	N/A	N/A
Silveries (Ikan Bodas, Ikan Putih)	N/A	N/A	N/A	N/A
Mud crabs (Rajungan)	Limited	N/A	N/A	N/A
Coral trout (Ikan Gelek Burik)	Limited	N/A	N/A	N/A

NOTE: N/A means 'not available'.

Category 1 Fish – total mixed daily bag limit of seven

Category 1 fish are considered to have the highest risk of over exploitation. Many fish in this category have low catch rates and levels of abundance, while others may be highly valued for their fishing and eating qualities. Many Category 1 fish are slow-growing and mature at four years plus. For these reasons, Category 1 fish require a high degree of protection.

Species	Species bag limit	Size limit (mm)	Other controls
Billfish, sailfish, swordfish, marlins (Ikan Layar, Ikan Pendang)	1		
Coral trout and coronation trout (Ikan Gelek Burik dan Ikan Gelek Berekor) -combined	2	450	
Hump-headed maori wrasse - greenfish (Ikan Hiju)	2		
Wahoo (Ikan Tengiri), mahi mahi (Ikan Dolfin), yellowfin tuna, and dogtooth tuna (Ikan Tuna) - combined	4	900 - wahoo	

Proposal 4 – Bag and size limits for fin fish

Category 2 Fish – total mixed daily bag limit of 16

Category 2 fish have a moderate risk of overexploitation. Many fish in this category have moderate catch rates and levels of abundance. Category 2 fish are mostly found in inshore and estuarine areas, are highly sought after by recreational fishers and mature at three to four years.

Species	Species bag limit	Size limit (mm)	Other controls
Bone fish (Ikan bandang)	4		
Bonito and tunas – (other) (Ikan Tuna)	8		
Cod (Gerapu Atau Ikan Gelek) – combined	8		
Dart (Ikan Bawal)	8		
Parrot fish - napoleon fish (Ikan Dongol)	8		
Sweetlip (Ikan Kapkuning), paddletail (Ikan Merah), redthroat (Ikan Raja), moses perch (Ikan Karang) – combined	8	280	

Category 3 Fish – Daily bag limit

Category 3 fish include all fish not listed in other categories except baitfish of the sardine, anchovy and hardyhead families (Clupeidae, Engraulididae and Atherinidae).

Species	Species bag limit	Other controls
Garfish (Ikan Julung-julung)	40	
Mullet, sea (Ikan Belanak)	40	
Mullet, diamond scale (Ikan Sayap Hitam)	30	
Rabbit fish (Ikan Menyerat)	40	
Silveries (Ikan Bodas)	40	
Unlisted species - (all species not specified except baitfish species)	40	

Proposal 5 - Bag limits for crustaceans, molluscs and other reef animals

Crustaceans

Species	Bag limit	Other controls
Mud crab (Rajunan)	5	<ul style="list-style-type: none"> Boat limit of 10 Size limit 150mm Females with eggs protected and must be returned to the water
Rock lobster (Udang Dan Udang Galah)	4	<ul style="list-style-type: none"> Boat limit of 8 Size limit 76mm Females with eggs protected and must be returned to the water
Slipper lobsters (Udang Lepeh)	4	<ul style="list-style-type: none"> Boat limit of 8 Females with eggs protected and must be returned to the water
Other crabs including ghost, hermit and sand crabs (combined)	20	

Molluscs and other reef animals

Species	Bag limit	Other controls
All species of edible mollusc including gong gong and turban shell (Siput Kepala Biola) - combined	9 litres – in whole form (standard plastic bucket)	
Squid (Sotong), and octopus (Gerita) (large reef octopus) (combined)	15	Boat limit of 30
Small octopus caught during the doldrums	9 litres (standard plastic bucket)	

Proposal 6 - Totally protected

Due to very low levels of abundance and vulnerability to overfishing, it is proposed that clams (Kima) be totally protected.

Proposals 7 – line fishing

- 7(a)** That fishers be allowed to use a maximum of three hooks or gangs of hooks on each line.
- 7(b)** That unattended set lines be prohibited.

Proposal 8 – Spearfishing

That spearfishing while using compressed air be prohibited.

Proposal 9 – Options for the future management on netting

- 9 (a)** Limit the allowable length of haul or set net to 60 metres. A number of 60 metre nets cannot be strung together.
- 9 (b)** That the main channels between islands leading in and out of the lagoon be closed to all netting.
- 9 (c)** Prohibit the use of nets which have a mesh size smaller than 63mm or greater than 114mm, (noting a net mesh is measured by stretching it so that the two knots on the left and right hand side of the mesh meet). The size of the mesh is then the distance between the inside of the knots at the top and bottom of the mesh.
- 9 (d)** The northern lagoon on West Island be closed to all netting. The boundary of this zone is proposed to run from Pulu Melintang, on the north side of the entrance to Telok Jambu, to Pokok Poda (Banana Point) on the southern side of the entrance.
- 9 (e)** Nets must be attended at all times.

Proposal 10

That demersal fishing be prohibited within 150 metres of the dive sites (marked by yellow mooring buoys) known as the Aquarium Wall, Cabbage Patch, Two Trees, Trannies, North Point, Cologne Gardens and Rose Wall.

Proposal 11 – Education and compliance

11 (a) Fishing guide

A guide to recreational fishing in the Cocos (Keeling) Islands be produced to inform and educate local and visiting fishers about recreational fishing management controls and promoting stewardship for fish stocks and the environment.

11 (b) Educational resource materials

Adequate quantities of practical educational tools such as fish measuring rulers, measuring gauges for rock lobster and crabs, and adhesive bag limit guides should be produced to support the regional fishing guide. All guides and educational material will need to be available in Malay and English.

11 (c) Compliance

- i. That a member of the Malay community be appointed as a “fish warden” with powers to educate and enforce fisheries controls.
- ii. That Fisheries and Marine Officers visit the island regularly to assist in providing training, education and raise awareness of fisheries rules.
- iii. The Department of Fisheries should hold discussions with on-island authorities such as the Australian Federal Police and Parks Australia over possible involvement in enforcing fisheries legislation.

11 (d) Schools program

That a school education program is established to promote awareness of fishing rules, the need to protect breeding stocks and the best methods for handling fish.

3.0 MAKING A SUBMISSION

The release of this discussion paper for public comment provides an opportunity for you to express an opinion on how the recreational and subsistence fishing on the Cocos (Keeling) Islands should be managed. It is equally important that you respond whether you agree or disagree with the various proposals.

A questionnaire form has been prepared to assist you in making a submission. Alternatively you may choose to write your own submission.

Points to consider for submissions - to ensure your comments are as effective as possible, please:

- Clearly and briefly describe each separate subject you wish to address;
- Refer to the different proposals in the discussion paper;
- Tell us whether you agree/disagree with any or all of the proposals; and
- Suggest alternative ways to resolve the issues raised in this paper or identified by you.

3.1 Where to send your submission

The closing date for submissions is **14 June 2005**. Please send your submission along with your full name and address to:

Recreational Fisheries Program
Department of Fisheries
Locked Bag 39
Cloisters Square Post Office
PERTH WA 6850

Alternatively you can lodge your submission at the Shire Office on Home Island or the Group Training Centre on West Island. The Shire will forward these submissions to the Department of Fisheries.

4.0 FISHING IN THE COCOS (KEELING) ISLANDS

4.1 Profile of fishing in the Cocos Islands

Fish is a very important part of diet for Cocos (Keeling) Islanders. A previous study (Lincoln Smith *et al.* 1993) indicated Home Islanders consume 50 to 70 tonnes of fish and two to three tonnes of gong gong per year. It should be noted that given increasing number of bigger boats and changes in fishing practices, the current annual catch may be higher.

In the Cocos lagoon, fishers target finfish by line and with haul and set nets in the southern part of the lagoon. Key target species in the lagoon are “silveries” (silver biddies), sweetlip (*Lethrinus* sp) and mullet. Invertebrates are also targeted, including gong gong and octopus.

Traditionally, fishing was by line with limited use of nets. Although line fishing continues as one of the primary techniques used today, anecdotal evidence suggests the use of nets is becoming more widespread. This was a major issue of concern to many people in the community.

Within the lagoon, nets are used in a variety of ways including:

- Haul netting, where a school of fish is encircled and the net is hauled back to a boat. This fishing method is popular when targeting species such as mullet.
- Setting a net around coral reef structures and chasing fish into the net. This method is used when targeting species such as parrot fish (napoleon fish).
- Setting nets in channels where fish are likely to move in and out of the lagoon. In some cases, anecdotal evidence suggests up to three nets totalling 120 metres in length have been joined together and set to cover the entire width of the channel between islands. This method is indiscriminate, catches a range of different species and different sizes of fish and poses a significant risk to sustainability.

Outside the lagoon, fishers troll for pelagic species including wahoo, dog tooth tuna, yellowfin tuna and mahi mahi (dolphin fish). Sharks take a large number of fish hooked when trolling and this may be an important consideration in assessing the total mortality of pelagic species.

While sharks are abundant, recreational fishers do not retain them. The local dive operator highlighted the abundance of sharks as an attraction for visiting divers.

Shore-based fishers also line fish for species such as sweetlip and collect rock lobster on the outer reef.

4.2 Status of fish stocks

To date, two studies have been undertaken on fish stocks assessments around the Cocos (Keeling) Islands. The Institute of Marine Ecology, University of Sydney, conducted the first quantitative baseline survey of fish stocks in 1995, and the second survey was conducted in 2001 (J.Hender, C.A. Mc Donald and J.J Gilligan).

These two surveys have provided baseline information on the range of species which are found around the island.

The abundance of fish stocks around the atoll is likely to be influenced by both fishing pressure and environmental conditions. The isolation of the Cocos (Keeling) Islands and limited habitat structure may mean that the abundance of certain species will be linked to larval recruitment from other environments, often hundreds of kilometres away.

Based on knowledge of the finfish species exploited by the island community, reviewing past surveys and discussion with representatives of that community, anecdotal evidence suggests that finfish stocks in the lagoon have been depleted. Species believed to be worst affected include coral trout (*Plectropomus spp.*), sweetlip emperor (Family Lethrinidae), and trevally (Family Carangidae). Some local people have also expressed concern about the lack of coral trout on outer fringing reefs of the island group.

Fishing outside the lagoon appears to be largely weather dependent and thus it is unlikely that, in general terms, fishing pressure generated by the current island community is having any adverse effect. Large pelagics, such as yellowfin tuna, are clearly part of a widely distributed Indian Ocean resource.

Based on evidence elsewhere, other pelagics such as dogtooth tuna, sailfish, and wahoo may be more localised, and therefore capable of localised depletion. In contrast, the demersal resource is likely to be quite localised, and vulnerable to over fishing.

The establishment of any substantial commercial fishing venture based on the exploitation of these species is likely to be unsustainable. This is particularly true of the deep water snappers, which are slow-growing and very long-lived, and, as a consequence, can only sustain very low levels of exploitation.

Fish are also exported off-island, mostly to relations/friends in WA. Earlier studies have estimated this may be 20 - 30 tonnes. Due to concern over increasing amounts of fish being taken off-island, restrictions have been introduced to limit the amount of fish that can be taken onboard aircraft (and hence off-island). The Department of Fisheries understands this control has not been strictly enforced. This is a key issue, as the export of large quantities of fish is likely to not be sustainable.

Based on the limited experiences of Department of Fisheries staff who have visited the region, their initial observations would indicate that the exploitable finfish resource in this area appears to be in relatively low abundance compared to equivalent environments bordering mainland Australia.

5.0 PLANNING FOR THE FUTURE

5.1 Managing for the future - why have a recreational fishing management strategy?

Recreational and subsistence fishing on Cocos (Keeling) Islands is currently unmanaged. Anecdotal evidence from residents on the Cocos indicates that the abundance of some fish species, particularly residential reef species such as coral trout, appear to have declined over a period of time.

This decline may be due to a number of factors including fishing pressure, fishing methods and environmental changes. Many fish species do not breed at the same level each year. A successful breeding season which results in large numbers of fish entering the fishery may be followed by several poor breeding years, where very few fish enter the fishery.

If the availability of fish resources in the Cocos is to be maintained or improved over time, it is important to ensure breeding stocks are protected so that future generations of Cocos Islanders can enjoy catching and eating fish in the future.

A wide range of tools can be used to help protect stocks including - size limits (both minimum and/or maximum), bag limits, possession limits, gear controls (e.g. size and type of nets, lines, pots, etc) closures (both for time periods – to protect groups of fish spawning - and areas – to protect nursery grounds).

Generally, a number of these tools are used in combination to ensure an adequate proportion of breeding stock is protected. The most appropriate combination of tools will vary, depending upon the nature of species and level and type of fishing activity.

The recreational fishing management arrangements for the Cocos Islands need to be developed in consultation with the local community. Community support for management arrangements is essential, as there is a strong need for people to understand the need and benefit of sustainable management in order to promote fishers to voluntarily comply with the rules. A focus of this strategy must be on education rather than enforcement (see section 5.4).

5.2 Recreational fisheries management in Western Australia

In Western Australia, four regional recreational fishing management zones have been established. The development regional management strategies was a proactive approach to management, which has resulted in the development of targeted and flexible responses to key management issues.

The basis for a more regional approach to recreational fisheries management was an acknowledgment of the natural complexity and diversity of WA's marine life and environments, and a clear need to better link management to the biology and distribution of both fish stocks and fishing activity. In other words, building effective management from the biological characteristics of resource upwards, rather than simply imposing human social values on fisheries management.

The WA framework provides the opportunity to develop specific arrangements that properly takes account of the requirements of fish stocks and community needs for Cocos rather than impose WA standards. The Cocos (Keeling) Islands will be identified as a distinct bioregion, and management arrangements will be developed specifically for Cocos.

A key feature of the new regional recreational framework in WA is the ‘risk assessment’ matrix for identifying the vulnerability of fish species to overfishing. This system is based on a three-tiered bag limit structure:

- Category 1 fish are considered to have the highest risk of overexploitation. Many fish in this category have low catch rates and levels of abundance, while others may be highly valued for their fishing and eating qualities. Many Category 1 fish are slow-growing and mature at four years-plus. For these reasons, Category 1 fish require a high degree of protection.
- Category 2 fish have a moderate risk of overexploitation. Many fish in this category have moderate catch rates and levels of abundance. Category 2 fish are mostly found in inshore and sheltered environments, are highly sought after by recreational fishers and mature at three to four years.
- Category 3 fish have a lower risk of over exploitation. Many of the fish in this category mature at one to two years old, are of high abundance, are distributed widely and are generally pelagic.

5.3 Impact of fishing on stocks

To protect future fish stocks, it is important to understand what happens to a stock of fish over time with fishing pressure.

When fishing pressure is exerted on a ‘virgin’ or unfished stock, initially the catches include a number of older or larger fish, which are highly sought after by fishers. At this time, catches are high for a relatively small number of fishers.

As more of the larger fish are removed from the population, faster growing young fish replace the older fish. In this situation, the overall catch can actually increase, with more medium size fish but less bigger fish available to be caught.

As competition between fishers increases, individual catches decline, although the overall catch tends to level off. This can be the start of what is referred to as ‘growth overfishing’. Put simply, this means there are still adequate mature fish in the population to produce sufficient juvenile fish, however the number of older mature fish have been significantly depleted.

If competition for fish stocks among fishers increases further, individual catches begin to crash as fish are taken from the stock more rapidly than they can be replaced. This situation is called ‘recruitment overfishing’, where both mature fish and juvenile fish are being fished down below sustainable levels.

In order to avoid overfishing it is important to protect a sufficient proportion of the breeding stock of each species to ensure the population can be maintained or improved over time.

There are a number of management tools that can be used to achieve this.

5.4 Fishery management strategies - what works and how

There are a limited number of management strategies that can be applied to recreational fisheries. Ultimately, these strategies have one fundamental goal – to ensure that future generations of Cocos Islanders can enjoy catching and eating fish at the same or a better standard than they currently enjoy.

This section provides a brief outline of the major recreational fishery management tools that can be used. It is important to note that these tools are used in combination, and that often there is no single effective solution to any one issue.

5.4.1 Daily bag limits

In WA, bag limits were previously set at social standard for a “fair day’s catch” for an individual angler and reflect the social values when they were set in the late 1980s. These values change over time, in line with community views and expectations.

Bag limits have the capacity to reduce the rate at which an aggregation of fish (a group of fish gathering to breed) or an area is depleted by fishing, and ensure that a larger number of fish are available in the water for a longer period of time.

Bag limits also help to share the available catch among the anglers who wish to catch fish.

However, to be effective, bag limits need to be set at a level which is readily attainable for an angler of reasonable skill and knowledge, while allowing for a reasonable quantity of fish to be caught for a meal.

Under current WA fishing regulations, bag limits can be accumulated over an unlimited number of days and consequently do not, in general, constrain the total recreational catch.

The limitations of bag limits include the unknown mortality factors involved in catch and release fishing – especially for fish caught in deep water or played for long periods of time on light line. They also tend to be seen as unfair by anglers aiming to maximise their catch because they reduce the total quantity of fish they can land on any one occasion.

Depending on the level at which they are set, bag limits may assist in the sustainable management of our fisheries. However, the greater the number of people fishing, changes in gear or fishing efficiency or the number of days spent fishing, the less effective bag limits are in managing either individual or total catches. In this context, they serve mainly to set a social standard and highlight the need for conservation.

An additional weakness is the concern that, if used in isolation, they may simply make more fish available to the commercial sector by reducing the total recreational catch.

5.4.2 Boat limits

Boat limits can be used to provide protection for recreational species by restricting the total number of fish which can be taken from a boat during a specific fishing trip.

Due to the mobility of a boat and its ability to be enhanced as a fishing platform through fish finding technology boat limits have the capacity to reduce the rate at which an aggregation of fish or an area is depleted by fishing, eg, coral trout at certain times of the year.

Boat limits can also help to share the available catch among anglers who wish to catch a fish.

The greater the number of people on a boat the more effective a boat limit becomes in restraining the recreational catch. However, this can also be seen as placing an unfair restriction on recreational fishers.

5.4.3 Possession and trip limits

Possession and trip limits are a strategy to manage the total 'take' of an individual angler on any one fishing trip. Put simply, a possession limit refers to a maximum limit an angler can have in possession at any time in a defined area. A possession limit can be expressed either in total weight or in numbers of fish, or a combination of both. Places of permanent residence and commercial premises may be excluded from possession limits.

Possession limits were originally introduced in areas such as the Ningaloo Marine Park to reduce the ability of anglers to accumulate commercial quantities of fish. Their major application was to eliminate "shamateur" quasi-commercial fishing and the storing and freezing of large quantities of fish in remote locations.

However they have also been used in limited single-species fisheries elsewhere in the world to in effectively establish a total recreational "quota", usually in combination with a limit on the total number of participants.

Their weaknesses include the ability of anglers to transport fish unaccompanied without any effective constraint, and the evidentiary and legal issues inherent in proving possession.

Like bag limits they set a firm social standard for a recreational catch, but become less effective in managing the total catch as numbers of fishers or angler/fishing days increases.

5.4.4 Legal sizes – minimum and slot limits

Minimum size limits are usually based on the breeding biology of a species, and are set to protect fish until they reach maturity and have been able to spawn at least once. They can also be set to help increase the average size of fish available.

The effectiveness of size limits as a management tool is reduced in fishing gear such as set nets where there is a very high mortality. Their effectiveness also depends on voluntary compliance – particularly where filleting is allowed at sea and compliance checks are not possible.

The ability to determine appropriate size limits, and hence their applicability as a management tool, is limited by the level of biological information available for many species. There is also increasing concern over the mortality of fish, particularly demersal species, taken from deep water and the appropriateness of size limits as a management tool for these species is being questioned.

Maximum size or slot limits are theoretically useful for protecting large breeding fish, or reducing the take of highly prized, and often rare, large specimens.

Like minimum sizes and bag limits the issue of mortality of fish returned to the water is of great importance. Minimum sizes may be effective in the lagoon and fringing reefs – but not in deep water.

5.4.5 *Closed seasons and closed areas*

Closed seasons can be used as a means of containing total effort outside the peak fishing season, or to protect fish at crucial stages in their life cycle.

Their advantages are that they affect all fishers equally and effectively limit the opportunity to fish to a given number of days. Closed seasons have been widely accepted in rock lobster, abalone and pink snapper fisheries.

However, they may be difficult to gain acceptance for in multi-species fisheries such as the demersal finfish fishery. Closed seasons may also not be effective if peak fishing seasons and spawning times are not clearly defined or consistent from year-to-year.

Closed areas may also be used to protect fish at crucial stages in their life history (such as during spawning), protect populations of sedentary species, or protect important fish habitats from the impact of human use. They have also been proposed as an alternative means of rebuilding depleted fish stocks. However, they depend for their success on either widespread community support or effective compliance.

Both closed areas and closed seasons may limit all fishing, or only limit some types of fishing. Consequently, they can also be used as a means of resource sharing and reducing community conflict.

5.4.6 *Gear and method restrictions*

Gear restrictions may limit the type of fishing gear that can be used, or limit the area and time in which defined types of gear may be used.

In recreational fisheries, gear restrictions aim to prevent the use of highly destructive fishing methods, such as poisoning reefs and using explosives, the use of highly efficient commercial-

type fishing gear, and reduce conflict in some areas between incompatible fishing activities such as set netting and angling.

Fishing gear may also be designed to assist in the release of undersize fish and reduce the likelihood of injury to the fish involved. Examples include setting a minimum mesh size for haul and set nets.

Gear restrictions in line fisheries are harder to regulate, however angler education in catch and release methods, including substituting plain J-style hooks for jag or treble hooks, and flattening barbs all helps in improving the survival rate of released fish.

Limitations on the quantity of gear an individual fisher can use are also a means of resource sharing and spreading the opportunity to catch with other participants in the fishery.

Different types of gear and fishing methods include spearfishing. In areas that have a high conservation value, such as marine parks, restrictions have been put on spearfishermen by prohibiting the use of compressed air or not allowing spearfishing in any form. These measures are designed to protect vulnerable residential reef fish that can be more effectively targeted by spearfishing.

Netting is generally only permitted in WA to allow targeting of fish that cannot be readily caught by line (eg: mullet).

Spatial closures are also a means of managing social conflict and resource sharing.

5.4.7 Education

Community support for the sustainability of fish resources is a crucial factor in successful recreational fisheries management. Community education is the key process for the development of effective community stewardship.

Community stewardship can be evaluated against four criteria:

- The level of individual knowledge of what is required to ensure healthy fisheries.
- The attitudes and values which individuals hold in relation to fishing.
- The behaviour that people adopt when fishing.
- The level of community support for necessary changes to management.

In promoting a sense of stewardship for fish stocks it is essential that the fishing community needs to be properly informed of management decisions, and given a clear lead on the values and attitudes which will assist in sustaining fish stocks.

Recreational fishers need to be made aware that bag limits are not targets. While some catching of fish may be required to feed extended families, persons not needing this quantity of fish should only 'take enough for their immediate needs'. The ocean is the best freezer! Under no circumstances can the accumulation and dumping of frozen fish be justified.

A wide range of education and awareness strategies can be used to promote a strong fishing conservation ethic and set social standards within the recreational fishing community. These strategies include community-based education programs using elders or volunteers, school education programs, TV and radio advertising, and information publications.

6.0 THE PROPOSED RECREATIONAL AND SUBSISTENCE FISHING STRATEGY

A wide range of issues have been taken into consideration in planning for the future management of recreational fishing in the Cocos (Keeling) Islands.

These issues have been identified through previous reports (J. Hender, CA McDonald, JJ Gilligan. Baseline Survey of Marine Environments and Stock Size Estimates of Marine Resources of the South Cocos Atoll, 2001; Cocos Keeling Islands - Quantitative Baseline Surveys for Core Marine Reserves and Biosphere Reserve in the South Keeling Lagoon, Institute of Marine Ecology University of Sydney, (1995) and recent meetings by Department of Fisheries staff and residents on both Home and West Island.

Following is a summary of the issues identified at those meetings, along with proposed strategies to protect the future sustainability of fishing in the waters around the Cocos (Keeling) Islands.

6.1 Information for management – catch and fishery performance

6.1.1 Key issues and proposals

Good quality time-series data on fishing activity, catches, and fish population structure is important for the sustainable management of fisheries.

This type of information is essential for understanding what is being caught, detecting changes in abundance over time and assisting with the resolution of fishery management and resource sharing issues.

Baseline data is available on the range of species found around the islands, but there is no up-to-date information on the composition and size of the catch, nor quantitative stock assessments of key species.

For example, it is important to determine whether juveniles and adults occur together throughout all waters of the island group, or whether juveniles are more abundantly distributed in the protected lagoonal waters where fishing is most intense. It is also important to understand whether the species in question aggregate at certain times of the year (e.g. to spawn), or certain times of the day (e.g. to feed).

Understanding the biology and lifecycle of the different species is also important, in particular, size/age at maturity, longevity, and source of recruitment. For example, it is important to know the source of recruitment into the exploited stock - does it originate from fish distributed outside the island group, or is the source solely from fish from island waters?

An understanding of stock size estimates in the lagoon is particularly important, given that local fishers are becoming more efficient at targeting and catching a range of species, particularly through the use of nets.

Fisheries research however is expensive and considerable resources are required to provide a quantitative assessment of the status of stocks. It is therefore important to prioritise research on the species deemed to be at highest risk.

Proposal 1 – Study of existing literature

A detailed desk study of existing literature be undertaken to incorporate all available information into a single source including:

- Identification of species;
- Levels of abundance; and
- Assessment of harvest levels.

Proposal 2 – Catch survey

A catch survey be undertaken periodically to provide detailed information about the spatial and temporal distribution of recreational activity and catches on which to base management decisions.

As a subset of the major survey, information should be collected on indicator species and areas to monitor recreational fishing and catch. These indicators should cover at a minimum the size and abundance of key species. This information could be collected on a voluntary basis through a logbook program or could be run as part of a schools-based project.

The indicator species should encompass those targeted by different types of fishing. For example, sweetlip and mullet are key species targeted by line and net respectively; and Maori wrasse are targeted by line and spearfishing, as well as being valued for conservation reasons by recreational divers.

It is proposed that the following species be used as key indicator species.

	Environment where species is most often found	
	Lagoon	Outer lagoon
Indicator species	<ul style="list-style-type: none"> • Diamond scale mullet (Ikan Sayap Hitam) • Mud Crabs (Rajungan) • Milk fish (Ikan Bandang Laut) • Gong gong • Sweetlip (Ikan Kakuning) • Coral trout (Ikan Gelek Burik) • Maori wrasse (Ikan Hiju) 	<ul style="list-style-type: none"> • Wahoo (Ikan Tengiri) • Tuna – yellowfin and dog tooth (Ikan Tuna) • Rosy snapper (Ikan Kakap)

6.1.2 Species biology

Only a limited amount of biological information is available for many of the species targeted by recreational anglers in the Cocos (Keeling) Islands.

It must be acknowledged that to carry out comprehensive biological work on a range of important recreational species would be difficult to obtain without significant funding. It is therefore important to prioritise species which require research.

Research into the biology of gong gong and associated fishing activity has been highlighted as a priority in all recent scientific surveys that have been carried out at the Island Group (Berry, 1989; Lincoln-Smith *et al.* 1993 and Hendler *et al.* 2001). Gong gong is heavily exploited by the Home Island community and little information is known about this species. It was also suggested that increasingly, younger Malays are starting to dive and this may place additional pressure on stocks in deeper areas that were previously unexploited.

Proposal 3 – Priority species for research

Research be undertaken on the following key recreational species (in order of priority) to provide information on species biology and stock structure. Some research has been done on the priority species which is not quantitative with respect to stock around the Cocos (Keeling) Islands. Predictive fisheries stock assessment models and, where practical, indices of recruitment, should then be developed for these key species:

Species	Gap analysis of Research			
	Biology	Stock assessment	Exploitation status	Breeding stock level
Gong gong	N/A	N/A	limited	N/A
Tropical snappers (Ikan Kapkuning)	Limited	N/A	N/A	N/A
Maori Wrasse (Ikan Hiju)	Limited	N/A	N/A	N/A
Silveries (Ikan Bodas, Ikan Putih)	N/A	N/A	N/A	N/A
Mud crabs (Rajungan)	Limited	N/A	N/A	N/A
Coral trout (Ikan Gelek Burik)	Limited	N/A	N/A	N/A

6.2 Protecting vulnerable fish and managing the recreational catch

6.2.1 Key issues and proposals

The following issues relating to the management of finfish have been identified in previous reports, meetings and discussions with individuals and in the results of surveys undertaken in 2003.

- (i) There was a general feeling among people we spoke to that some of the exploited finfish species within the lagoon were depleted relative to their abundance some years ago. Species believed to be worst affected include coral trout (*Plectropomus spp.*), sweetlip emperors (F Lethrinidae), and trevally (F Carangidae). Some also expressed some concern about the lack of coral trout on outer fringing reefs of the island group. This was particularly apparent in the region known as the “cabbage patch” during summer, when the fish are thought to be aggregating to breed. Indeed, some were of the view that the “Chinese footballer” coral trout (*Plectropomus laevis*) has disappeared altogether.

- (ii.) “Silveries” (*Gerres acinaces*) appear to be one of the favoured food-fish species taken in the lagoon and some are caught by line. However, most are harvested by the Home Island community using nets. There was no concern expressed about declining abundance.
- (iii.) “Moses perch” which is most likely to be a similar species called blue striped seaperch (*Lutjanus kasmira*) appeared to still be abundant within the lagoon.
- (iv.) Good fishing opportunities outside the protected waters of the lagoon, i.e. around the fringing reefs, is severely restricted by weather. Indeed, waters extending from the ocean side of West Island (around the southern outer reefs to outer Home Island) were, in the view of those on West Island, fished relatively lightly.
- (v.) Gamefish most commonly taken in these waters include dogtooth tuna (*Gymnosarda unicolor*), yellowfin tuna (*Thunnus albacares*), and wahoo (*Acanthocybium solandri*).
- (vi.) The extensive use of nets and suggestions that smaller mesh sizes are being used was an issue of great concern.
- (vii.) Home Island fishers sometimes catch additional fish over their personal needs to supply extended families or as food for special occasions such as weddings. Fish are also exported to relatives or friends living on mainland Australia.
- (viii.) There have been catastrophic mortality events in the lagoon during past years. The most recent was in 1985, when a major de-oxygenation event allegedly killed all of the coral in the southern half of the lagoon.
- (ix.) Home Island fishers believe the lagoon, particularly the southern area, is becoming shallower.
- (x.) There are a number of other finfish species that are not taken by net but are important to the Home Island community. Those taken in the lagoon include coral trout, sweetlip emperor (Family Lethrinidae), sweetlip (*Plectorhinchus chaetodontoides*), snub-nosed dart, Maori wrasse (*Cheilius undulatus*), “stars and stripes” toadfish (*Arothron hispidus*), and bonefish (by line). Double-headed parrotfish (*Bolboinetopon muricatum*) are taken on the reef platform. Mahi-mahi (*Coryphaena hippurus*), rosy snapper (*Pristipomoides filanemtusus*), ruby snapper (*Etelis carbunculus*), tang snapper (*Lipocheilus carnolabrum*), wahoo, dogtooth tuna, yellowfin tuna and sailfish (*Istiophorus platypterus*) are all reportedly taken outside the lagoon, mostly during the doldrums.

6.2.2 Bag limits

It is proposed that the bag limit framework for the Cocos (Keeling) Islands be based on the three-tiered system. Based on this structure and an assessment of a species risk of overexploitation (see attachment 1) individual species have been placed into one of the following three categories.

- **Category 1 Fish.**

These fish are considered to have the highest risk of overexploitation and require high levels of protection.

- **Category 2 Fish**

These fish are considered to have a moderate risk of overexploitation and require moderate levels of protection.

• **Category 3 Fish**

These fish are considered to have a lower risk of overexploitation and require lower levels of protection.

The proposed bag limits should be seen as part of a total management approach to ensure breeding stocks are maintained at a level which will ensure fishers will continue to enjoy the benefits of healthy fish stocks in the future.

These bag limits apply per person, therefore each person fishing is entitled to this amount, e.g. if there are three fishers in a boat, three limits would be allowed on the boat.

Category 1 Fish – total mixed daily bag limit of 7

Category 1 fish are considered to have the highest risk of overexploitation. Many fish in this category have low catch rates and levels of abundance, while others may be highly valued for their fishing and eating qualities. Many Category 1 fish are slow-growing and mature at four years-plus. For these reasons, Category 1 fish require a high degree of protection.

Species	Species bag limit per person	Minimum size limit (mm)	Other controls
Billfish, sailfish, swordfish, marlins (Ikan Layar, Ikan Pendang)	1		
Coral trout and coronation trout, (Ikan Gelek Burik Dan Gelek Berekor -combined)	2	450	
Hump headed Maori wrasse - greenfish (Ikan Hiju)	2		
Wahoo (Ikan tengiri), mahi mahi (Ikan Dolfin), yellowfin tuna and dogtooth tuna (Ikan Tuna) - combined	4	900 - wahoo only	

Category 2 Fish – total mixed daily bag limit of 16

Category 2 fish have a moderate risk of overexploitation. Many fish in this category have moderate catch rates and levels of abundance. Category 2 fish are mostly found in inshore and estuarine areas, are highly sought after by recreational fishers and mature at three to four years.

Species	Species bag limit per person	Minimum size limit (mm)	Other controls
Bone fish (Ikan Bandang)	4		
Bonito and tunas – (other) (Ikan Tuna)	8		
Cod (Gerapu atau or Ikan Gelek) – combined	8		
Dart (Ikan Bawal)	8		
Parrot fish - napoleon fish (Ikan Katua – Ikan Dongol)	8		
Sweetlip (Ikan Kapkuning), paddletail,(Ikan Merah) redthroat (Ikan Raja), moses perch (Ikan Karang) – combined	8	280	

Category 3 Fish – Daily bag limit

Category 3 fish include all fish not listed in other categories except baitfish of the sardine, anchovy and hardyhead families (Clupeidae, Engraulididae and Atherinidae).

Species	Species bag limit per person	Other controls
Garfish (Ikan Julung-julung)	40	
Mullet, sea (Ikan Belanak)	40	
Mullet, diamond scale (Ikan Sayap Hitam)	30	
Rabbit fish (Ikan Menyerat)	40	
Silveries (Ikan Bodas)	40	
Unlisted species - (all species not specified except baitfish species)	40	

* Size limits for finfish species are based on the total length of fish caught (measured from tip of nose to the tip of tail).

6.2.3 Key issues - invertebrates

The following issues relating to the management of invertebrates have been identified in previous reports, meetings, discussions with individuals and the results of surveys undertaken in 2003.

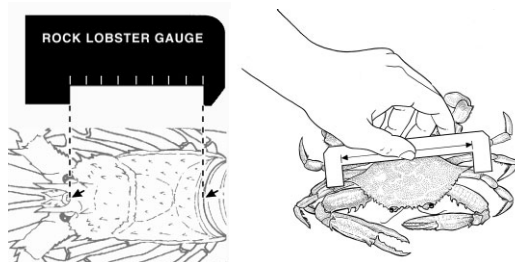
- (i.) The possible depletion of crabs and particularly hermit crabs, which are used for bait by fishers. Alternatively, others did not believe crab numbers had declined and suggested that changes in the flora over the years meant there was considerably more bush/groundcover, making crabs harder to see.
- (ii.) That rock lobsters are abundant in the shallow (often less than a metre) surf zone on the outside of the islands of the southern atoll and are caught by reef walking or by snorkelling. It was alleged many catch their lobsters by spearing them, have no regard for size of lobster taken, nor protection of breeding females. A number of people felt strongly about such a lack of regard for any form of lobster catch regulation. Some West Island residents have also suggested that lobster numbers have become depleted over the last decade.
- (iii.) Mention was made of slipper lobsters (bugs) being taken in certain areas of the Island. Presumably the same issues identified in (ii) could be repeated here.
- (iv.) That in some people's opinion, excessive quantities of gong gong (*Lambis lambis*) are being taken from within the lagoon and turban shell (*Turbo lajonkairii*) outside of the lagoon, and this practice may not be sustainable.
- (v.) That gong gong are harvested on a regular basis for food and bait and an 'informal' size limit is used in that generally only animals larger than the palm of one's hand are retained.
- (vi.) It was noted that mud crabs (*Scylla* spp.) are caught in small numbers and some people appeared to be of the opinion that they have been more plentiful in the past year or two than they had been previously.
- (vii.) That the small octopus caught on the Island are only taken on few days in the year from that part of the lagoon where there is seagrass covered by very shallow water. The octopus are harvested in shallow water on windless hot nights in the early hours of the morning.

(viii.) Clams which are taken by hand from the shallow reefs are in very low abundance.

Proposal 5 - Proposed bag limits for crustaceans, molluscs and other reef animals

Crustaceans		
Species	Bag limit	Other controls
Crab, mud (Rajunan)	5	<ul style="list-style-type: none"> • Boat limitⁱ of 10, size limit 150mm (see diagram below) • Females with eggs are protected
Rock lobster (Udang dan Udang Galah)	4	<ul style="list-style-type: none"> • Boat limit of 8 • Size limit 76mm (see diagram below) • Females with eggs are protected
Slipper lobsters (Udang Lepeh)	4	<ul style="list-style-type: none"> • Boat limit of 8 • Females with eggs are protected
Other crabs including hermit and sand crabs – combined	20	

Diagram 1: How to measure crustaceans



Molluscs and other reef animals		
Species	Bag limit	Other controls
All species of edible mollusc including gong gong and turban shell (Siput Kepala Biola) - combined	9 litres – in whole form (standard plastic bucket full)	
Squid (Sotong), and octopus (Gerita) (large reef octopus) - combined	15	Boat limit of 30
Small octopus caught in the southern part of the lagoon during the doldrums	9 litres (standard plastic bucket)	

Proposal 6 - Totally protected

Due to very low levels of abundance and vulnerability to overfishing it is proposed that clams (Kima) be totally protected.

ⁱ A boat limit applies as an additional ceiling on catch where there are a number of fishers on board a boat, eg. it is proposed that a single fisher can take five mud crabs, however where there are two or more fishers on board a boat, a limit of 10 still applies.

6.2.4 Possession limit

On the Cocos (Keeling) Islands the Australian Quarantine Inspection Service (AQIS) has established a personal possession limit of **5kg** of finfish. This limit was established to prohibit large quantities of fish being sent off the island.

Given the remoteness of the Cocos (Keeling) Islands, the priority for management must be sustainability and to ensure fresh fish are available for local residents. The ability to send fish off the island must be seen as a bonus for well managed stocks. If the sustainability of stocks is threatened the appropriateness of transporting fish off the islands should be one of the first controls reviewed.

6.2.5 Line fishing

Fishing with hand lines and rods and reels is a popular technique for targeting finfish both inside and outside the lagoon.

Based on observations from Department of Fisheries staff and interviews with island residents, fishing with hand lines is popular within the lagoon, especially for targeting sweetlip (*Lethrinidae*) and silveries (*Gerres acinaces*). Outside the lagoon, rods and reels as well as handlines are used to troll for pelagic species such as wahoo (*Acanthocybium solandri*) and dog tooth tuna (*Gymnosarda unicolour*).

Fishing with lines has tended to be an “active” form of fishing with fishers attending their lines and targeting individual fish. To ensure this focus is maintained the following is proposed for line fishing.

Proposal 7 – Line fishing

- 7(a)** Fishers be allowed to use a maximum of three hooks or gangs of hooks on each line.
- 7(b)** The use of unattended set lines be prohibited.

6.2.6 Spear fishing

Historically, only a small number of West Islanders spear fish. The number of people who spear fish from the West Island community depends on the enthusiasm of individuals who may be working on Cocos at any given time. It was also suggested that more recently within the Malay community the popularity of diving has grown among younger members of the community and there may be a propensity for greater spear fishing in the future.

Two species, which can be highly vulnerable to spearfishing are coral trout and Maori wrasse (greenfish). Coral trout tend not to be afraid of divers, while Maori wrasse will often seek refuge under reef ledges. This type of behaviour makes these species particularly vulnerable to spearfishing.

Proposal 8

That spearfishing while using compressed air be prohibited.

6.2.7 Net fishing

The following issues relating to the use of nets have been identified in previous reports, meetings, discussions with individuals and the results of surveys undertaken in 2003:

- (i) Originally the few nets in the community were used by fishers to catch fish for special occasions. Now, almost every household owns a monofilament gill net. Concern has been expressed about the unregulated use of nets. Of particular concern is that some fishers are allegedly now using smaller mesh size of the nets to make it easier to catch fish. The use of small mesh sizes is a dangerous practice as the capture of juvenile fish has capacity to deplete breeding stocks that will affect the number of fish in the long term. Main species targeted by nets are diamond-scale mullet (*Liza vaigiensis*), milkfish (*Chanos chanos*), goatfish (Family Mullidae), rabbitfish or spinefoot (*Siganus argenteus*) and bonefish (*Albula neoguinaica*). Previous reports indicated concerns about the impact of netting and a decline in the abundance of mullet, although on a recent visit by Department of Fisheries staff, mullet stocks appeared relatively abundant.
- (ii) Although bonefish (*Albula neoguinaica*) are present, particularly throughout the shallow seagrass/sand habitats that dominate the southern and western regions of the lagoon, they are difficult to catch recreationally. However, they are taken by the Home Island community as a food source using nets and lines.

Nets are used to catch a variety of species and can be used in a number of ways. Nets can be set and allow fish to become “gilled” or nets can be hauled (kept moving) to encircle a school of fish.

The unregulated use of nets is likely to be having a significant impact on fish stocks in the lagoon. There is thus an urgent need to control netting while the impact of netting effort being expended in the lagoon is assessed.

The potential catch by netting is high due to several reasons. The southern part of the lagoon, including north lagoon on West Island is a nursery area for a range of species that increases the likelihood of catching small juvenile fish. Nets are also indiscriminate and can catch a range of species and large quantities of schooling fish.

Stringing nets across channels or passages between islands can affect the number of fish entering the lagoon and affect the size of the breeding stock of fish.

In WA, netting is permitted in certain areas to allow the targeting of species that can't be caught readily by line. It should be noted that with the exception of mullet and milk fish the majority of species caught in set and haul nets set in the lagoon can be caught by line.

To limit the detrimental impact of netting on breeding stocks the following strategies are recommended:

Proposal 9 – Options for the future management of netting

- 9 (a)** Limit the allowable length of haul or set net to 60 metres. A number of 60 metre nets cannot be strung together.
- 9 (b)** Netting should not be allowed in the main channels between islands leading in and out of the lagoon.
- 9 (c)** Only permit the use of nets which have a mesh size between 63mm and 114mm. Noting a net mesh is measured by stretching it so that the two knots on the left and right hand side of the mesh meet. The size of the mesh is then the distance between the inside of the knots at the top and bottom of the mesh.
- 9 (d)** The northern lagoon on West Island be closed to all netting. The boundary of this zone is proposed to run from Pulu Melintang, on the north side of the entrance to Telok Jambu, to Pokok Poda (Banana Point) on the southern side of the entrance.
- 9 (e)** Nets must be attended at all times.

6.2.8 *Fish observation areas*

Some people visit the Cocos (Keeling) Islands primarily to observe fish in their natural environment. These people who are diving or snorkelling like to see large fish as well as an abundance of different species.

This is important for both locals and as an attraction for visitors. The local dive operator highlighted that the abundance of sharks around the fringing reefs was a drawcard for diving around the Cocos (Keeling) Islands. In many parts of the world the opportunity to dive with sharks is becoming diminished as shark populations are overfished.

To ensure high quality diving experiences are maintained around the Cocos (Keeling) Islands it is proposed that a prohibition on fishing for demersal species is established around key dive sites on the outer edge of the lagoon.

Proposal 10

That demersal fishing be prohibited within 150m of the dive sites (marked by yellow mooring buoys) known as the Aquarium Wall, Cabbage Patch, Two Trees, Trannies, North Point, Cologne Gardens and Rose Wall.

6.3 Improving community stewardship - education and compliance

6.3.1 *Key issues and proposals*

A major objective is to establish and maintain a clear standard of community fishing behaviour, which aims to ensure people voluntarily abide by the rules and where non-compliance is detected, appropriate sanctions applied.

Recreational fisheries management currently relies upon an effective and broadly based set of compliance and education strategies, structured around activities designed to encourage peer education.

6.3.2 Education and compliance strategies

With the future quality of the recreational fishing resource largely being dependent on the majority of people abiding by fishing rules voluntarily, a structured communications and community education plan is needed that focuses on the issues and species pertinent to recreational fishing on the Cocos (Keeling) Islands.

Such a plan should seek to ensure the community is properly informed of management decisions, and given a clear lead on the values and attitudes which will assist in sustaining fish stocks.

The plan should also seek to help develop a broad community recognition of the value of fishing, as well as promote community support for responsible fishing behaviour and key management initiatives.

While the plan will seek to promote awareness of the fishing rules and encourage fishers to treat fish stocks with a sense of personal responsibility and stewardship, a compliance presence is needed to enforce breaches of the rules. In WA, Fisheries and Marine Officers conduct inspections of catches, monitor “no fishing zones” and inspect vessels to ensure they are carrying the required safety equipment.

It may be appropriate if a member of the Home Island community was appointed as a “fish warden” with some powers to help educate fishers of the need for rules and the authority to make people stop illegal activities.

In WA, Police Officers have the full range of powers to enforce fisheries legislation. Under the applied fisheries legislation, Police Officers on Cocos are also authorised with the powers of Fisheries Officers.

The following proposals are recommended for education and compliance.

Proposal 11 – Education and compliance

11 (a) Fishing guide

A guide to recreational fishing in the Cocos (Keeling) Islands be produced to inform and educate local and visiting fishers about recreational fishing management controls and promoting stewardship for fish stocks and the environment. All guides and educational material will need to be available in Cocos Malay and English.

11 (b) Educational resource materials

Adequate quantities of practical educational tools such as fish measuring rulers, measuring gauges for rock lobster and crabs, adhesive bag limit guides should be produced to support the regional fishing guide.

11 (c) Compliance

1. That a member of the Home Island community be appointed as a “fish warden” and undergo training to educate and enforce fisheries controls.
2. That Fisheries and Marine Officers visit the island regularly to assist in providing training, education and raise awareness of fisheries rules.
3. The Department of Fisheries hold discussions with on-island authorities such as the Australian Federal Police and Parks Australia over possible involvement in enforcing fisheries legislation.

11 (d) Schools program

That a school education program is established to promote awareness of fishing rules, the need to protect breeding stocks and the best methods for handling fish.

6.3.2 *Fishing competitions*

On a regular basis fishing competitions are held between island residents. The Department of Fisheries accepts that these competitions have value as a social activity for the community. To ensure these competitions are conducted with an appropriate conservation ethos, the Department supports establishing a code of conduct for fishing competitions which includes the following elements:

- The competition should be limited to edible species only.
- Promote species based competitions rather than heaviest bag.
- Dumping of any fish should not be condoned.
- Fish should be stored in a way to ensure they are kept in the best possible quality for eating.

APPENDIX 1 SPECIES VULNERABILITY TO OVEREXPLOITATION

	COD	CORAL TROUT	GARFISH
	<i>Epinephelus species</i>	<i>Plactropomus maculatus</i>	<i>Hyporhamphus melanochir</i>
Biology			
Age maturity (years)	Possible hermaphrodite – change sex from female to male.	2 - 3 years Change sex from female to male at 4.42 yrs	3yrs (SA)
Size at maturity (mm)		350	250
Max weight/size	2.9kg breaksea cod	70cm	520mm
Spawning times			Oct – Nov (SA)
Fecundity/no of eggs			10,000
Abundance	Moderate	Low	High
BIOLOGICAL RISK	HIGH	HIGH	LOW

Habitat	Reefs. Often found in caves and around rock ledges.	Reef structures, inshore and offshore.	Sheltered embayments and over seagrass beds.
Behavioural traits	Ambush feeders. Often found as single fish rather than in schools.	Individual fish often territorial.	Can form large schools
Fishing pressure	High	High/increasing	Medium/increasing
Value eating/fishing	High	High	Medium/low
Other issues	Possible mortality issue with fish caught in deep water.	Use of technology to improve efficiency at targeting.	
VULNERABILITY DUE TO FISHING AND ENVIRONMENTAL FACTORS	HIGH	HIGH	LOW

LEVEL OF RISK OF OVEREXPLOITATION	High, due to low abundance, possible sex change and limited biological information.	High, due to low abundance, highly targeted and hermaphrodite.	Low, due to abundant nature
------------------------------------------	-------------------------------------------------------------------------------------	----------------------------------------------------------------	-----------------------------

CURRENT APPROPRIATE CONTROLS FOR MANAGEMENT

Size limits	Yes (if survive release)	Yes	No
Species bag limits	Yes	Yes	Yes
Mixed bag limits	Yes	Yes	Yes
Gear restrictions (over and above standard hook and line controls)	No	No	No
Species possession limits	Yes	Yes	No
Area closures	No	No	No
Season closures	No	No	No
Individual quota: tags, licences	No	NO	NO
Total allowable recreational catch	No	NO	NO

	MAHI MAHI <i>Coryphaena hippurus</i>	MAORI WRASSE <i>Cheilinus undulatus</i>	SWEETLIP EMPEROR <i>Lethrinus xanθοcheilus</i>
Biology		Not known – may change sex from female to male	
Age maturity (years)	7 months		
Size at maturity (mm)	700		280mm(fl)
Max weight/size	39kg	190kg/220cm	7kg/50cm
Spawning times	Summer		
Fecundity/no of eggs			
Abundance	Moderate/low *more abundant in specific locations where aggregations occur.	Low	Moderate
BIOLOGICAL RISK	LOW	HIGH	MODERATE/HIGH

Habitat	Offshore open water environment.	Coral reefs	Coral reefs, usually adjacent to sandy areas.
Behavioural traits	Will often form aggregations around floating objects.	Residential reef fish	
Value eating/fishing	High	High	High in region
Other issues	Fast growing. Ability to target due to aggregating Behaviour.	Highly targeted, easy fish to spear.	Highly targeted as the primary <i>lethrinus</i> species.
VULNERABILITY DUE TO FISHING AND ENVIRONMENTAL FACTORS	MODERATE/HIGH	HIGH	MODERATE/HIGH

LEVEL OF RISK OF OVEREXPLOITATION	Moderate/high, fast growing and early age at maturity, however, heavy targeting of aggregations.	High, due to targeting and low abundance.	High, due to low abundance in region and fishing pressure.
------------------------------------------	--------------------------------------------------------------------------------------------------	-------------------------------------------	------------------------------------------------------------

CURRENT APPROPRIATE CONTROLS FOR MANAGEMENT

Size limits	Yes	Yes	Yes
Species bag limits	Yes	Yes	Yes
Mixed bag limits	Not essential due to targeting of species	Yes	Yes
Gear restrictions (over and above standard hook and line controls)	No	No	No
Species possession limits	Yes	Yes	Yes
Area closures	No	Possible	No
Season closures	No	No	No
Individual quota: tags, licences	No	No	No
Total allowable recreational catch	No	No	No

	TUNA Southern Bluefin Yellowfin Bigeye	SEA MULLET <i>Mugil cephalus</i>	SHARK DUSKY AND BRONZE WHALERS <i>Carcharinus species</i>
Biology	8 years (bluefin)		
Age maturity (years)	3+ years (bigeye) 2 years (yellowfin)		m = 13 bronze whaler F = 19 bronze whaler 14 – 18 dusky whalers
Size at maturity (mm)	1200(bluefin) 1000(bigeye) 1000(yellowfin)		2800 dusky whaler
Max weight/size	200kg(bluefin) 210kg(bigeye) 176kg(yellowfin)		323kg dusky whaler 295kg bronze whaler
Spawning times	Sept – Mar (bluefin) Jan – Mar (bigeye)	March - September	Peak in summer
Fecundity/no of eggs	14 –15 mil(bluefin)		Give birth to live young – bronze whaler 3 –14 pups
Abundance	Moderate in region	High	Low
BIOLOGICAL RISK	HIGH	LOW	HIGH

Habitat	Open ocean, juveniles often found inside continental shelf.	Estuary systems, sheltered embayments, near shore marine environments.	Continental shelf waters
Behavioural traits	Highly migratory schooling fish.	Migrate into upper reaches of estuaries.	Both species will move inshore to drop their young
Value eating/fishing	High	Low	High
Other issues	Significant fishing pressure. Mortality issues may exist for fish caught on light line.	Not targeted by line fishers	
VULNERABILITY DUE TO FISHING AND ENVIRONMENTAL FACTORS	HIGH	LOW	HIGH

LEVEL OF RISK OF OVEREXPLOITATION	High, particularly for bluefin which take longer to reach maturity. Significant fishing pressure on stocks.	Low, given abundance and non-targeting by line fishers.	High, due to time to reach maturity, low fecundity and highly targeted.
------------------------------------------	-------------------------------------------------------------------------------------------------------------	---------------------------------------------------------	-------------------------------------------------------------------------

CURRENT APPROPRIATE CONTROLS FOR MANAGEMENT

Size limits	Yes (if fish survive release)	No	Yes
Species bag limits	Yes	Yes	Yes
Mixed bag limits	Yes	Yes	Yes
Gear restrictions (over and above standard hook and line controls)	No	Yes (netting)	No set lines
Species possession limits	Yes	No	Yes
Area closures	No	To gear (nets)	No
Season closures	No	To gear (nets)	No
Individual quota: tags, licences	No	No	No
Total allowable recreational catch	No	No	No

REFERENCES

Australian Nature Conservation Agency (1995) Cocos (Keeling Islands: Quantitative Baseline Surveys for Core Marine Reserves and Biosphere Reserves in the South Keeling Lagoon.

G. Allen (1988) Marine Fishes of Tropical Australia and South-East Asia

J. Hender, C.A. McDonald, J.J Gilligan (2001) Baseline survey of Marine Environments and Stock Size Estimates of Marine Resources of the South Cocos (Keeling) Atoll (0-15m), Eastern Indian Ocean.

Lincon-Smith, Skilleter. G.A. Underwood, A.J. Smith, A.K. Hawes, P.M.H. Howitt, L.Stark, J and Chapman, M.G. (1993) Study of the impact of Harvesting Marine Invertebrates and Fish on the Marine Ecosystems of the Cocos (Keeling) Islands, Indian Ocean. *Final Report*.

Parks Australia (1997) Draft Integrated Management Programme for Conservation of Marine Wildlife. *Report No RS80D*

FISHERIES MANAGEMENT PAPERS

- No. 1** The Report of the Southern Western Australian Shark Working Group. Chairman P. Millington (1986)
- No. 2** The Report of the Fish Farming Legislative Review Committee. Chairman P. Rogers (1986)
- No. 3** Management Measures for the Shark Bay Snapper 1987 Season. P. Millington (1986)
- No. 4** The Esperance Rock Lobster Working Group. Chairman A. Pallot (1986).
- No. 5** The Windy Harbour - Augusta Rock Lobster Working Group. Interim Report by the Chairman A. Pallot (1986)
- No. 6** The King George Sound Purse Seine Fishery Working Group. Chairman R. Brown (1986)
- No. 7** Management Measures for the Cockburn Sound Mussel Fishery. H. Brayford (1986)
- No. 8** Report of the Rock Lobster Industry Advisory meeting of 27 January 1987 . Chairman B. Bowen (1987)
- No. 9** Western Rock Lobster Industry Compensation Study. Arthur Young Services (1987)
- No. 10** Further Options for Management of the Shark Bay Snapper Fishery. P. Millington (1987)
- No. 11** The Shark Bay Scallop Fishery. L. Joll (1987)
- No. 12** Report of the Rock Lobster Industry Advisory Committee to the Hon Minister for Fisheries 24 September 1987. (1987)
- No. 13** A Development Plan for the South Coast Inshore Trawl Fishery. (1987)
- No. 14** Draft Management Plan for the Perth Metropolitan Purse Seine Fishery. P. Millington (1987)
- No. 15** Draft management plan, Control of barramundi gillnet fishing in the Kimberley. R. S. Brown (1988)
- No. 16** The South West Trawl Fishery Draft Management Plan. P. Millington (1988).
- No. 17** The final report of the pearling industry review committee . F.J. Malone, D.A. Hancock, B. Jeffriess (1988)
- No. 18** Policy for Freshwater Aquaculture in Western Australia. (1988)
- No. 19** Sport Fishing for Marron in Western Australia - Management for the Future. (1988)
- No. 20** The Offshore Constitutional Settlement, Western Australia 1988.
- No. 21** Commercial fishing licensing in Western Australia. (1989)
- No. 22** Economics and marketing of Western Australian pilchards. SCP Fisheries Consultants Pty Ltd (1988)
- No. 23** Management of the south-west inshore trawl fishery. N. Moore (1989)
- No. 24** Management of the Perth metropolitan purse-seine fishery. N. Moore (1989)
- No. 25** Rock Lobster Industry Advisory Committee report to the Minister for Fisheries November 1988. (1989)

- No. 26** A report on marron fishing in Western Australia. Chairman Doug Wenn MLC (1989)
- No. 27** A review of the Shark Bay pearling industry. Dr D.A.Hancock, (1989)
- No. 28** Southern demersal gillnet and longline fishery. (1989)
- No. 29** Distribution and marketing of Western Australian rock lobster. P. Monaghan (1989)
- No. 30** Foreign investment in the rock lobster industry. (1989)
- No. 31** Rock Lobster Industry Advisory Committee report to the Hon Minister for Fisheries September 1989. (1989)
- No. 32** Fishing Licences as security for loans. P. Rogers (1989)
- No. 33** Guidelines for by-laws for those Abrolhos Islands set aside for fisheries purposes. N. Moore (1989)
- No. 34** The future for recreational fishing - issues for community discussion. Recreational Fishing Advisory Committee (1990)
- No. 35** Future policy for charter fishing operations in Western Australia. P. Millington (1990)
- No. 36** Long term management measures for the Cockburn Sound restricted entry fishery. P. Millington (1990)
- No. 37** Western rock lobster industry marketing report 1989/90 season. MAREC Pty Ltd (1990)
- No. 38** The economic impact of recreational fishing in Western Australia. R.K. Lindner, P.B. McLeod (1991)
- No. 39** Establishment of a registry to record charges against fishing licences when used as security for loans. P. Rogers. (1991)
- No. 40** The future for Recreational Fishing - Forum Proceedings. Recreational Fishing Advisory Committee (1991)
- No. 41** The future for Recreational Fishing - The Final Report of the Recreational Fishing Advisory Committee. Recreational Fishing Advisory Committee (1991)
- No. 42** Appendix to the final report of the Recreational Fishing Advisory Committee. (1991)
- No. 43** A discussion of options for effort reduction. Southern Gillnet and Demersal Longline Fishery Management Advisory Committee (1991)
- No. 44** A study into the feasibility of establishing a system for the buy-back of salmon fishing authorisations and related endorsements. (1991)
- No. 45** Draft Management Plan, Kimberley Prawn Fishery. (1991)
- No. 46** Rock Lobster Industry Advisory Committee, Chairman's report to the Minister (1992)
- No. 47** Long term management measures for the Cockburn Sound restricted entry fishery. Summary of submissions and final recommendations for management. P. Millington (1992)
- No. 48** Pearl oyster fishery policy guidelines (Western Australian Pearling Act 1990) Western Australian Fisheries Joint Authority (1992)
- No. 49** Management plan, Kimberley prawn fishery. (1992)
- No. 50** Draft management plan, South West beach seine fishery. D.A. Hall (1993)

- No. 51** The west coast shark fishery, draft management plan. D.A. Hall (1993)
- No. 52** Review of bag and size limit proposals for Western Australian recreational fishers. F.B. Prokop (May 1993)
- No. 53** Rock Lobster Industry Advisory Committee, Chairman's report to the Minister for Fisheries. (May 1993)
- No. 54** Rock Lobster Industry Advisory Committee, Management proposals for 1993/94 and 1994/95 western rock lobster season (July 1993)
- No. 55** Rock Lobster Industry Advisory Committee, Chairman's report to the Minister for Fisheries on management proposals for 1993/94 and 1994/95 western rock lobster seasons (September 1993)
- No. 56** Review of recreational gill, haul and cast netting in Western Australia. F. B. Prokop (October 1993)
- No. 57** Management arrangements for the southern demersal gillnet and demersal longline fishery 1994/95 season. (October 1993)
- No. 58** The introduction and translocation of fish, crustaceans and molluscs in Western Australia. C. Lawrence (October 1993)
- No. 59** Proceedings of the charter boat management workshop (held as part of the 1st National Fisheries Manager Conference). A. E. Magee & F. B. Prokop (November 1993)
- No. 60** Bag and size limit information from around Australia (Regulations as at September 1993) F. B. Prokop (January 1993)
- No. 61** Economic impact study. Commercial fishing in Western Australia Dr P McLeod & C McGinley (October 1994)
- No. 62** Management arrangements for specimen shell collection in Western Australia. J. Barrington, G. Stewart (June 1994)
- No. 63** Management of the marine aquarium fish fishery. J. Barrington (June 1994)
- No. 64** The Warnbro Sound crab fishery draft management plan. F. Crowe (June 1994)
- No. 65** Not issued
- No. 66** Future management of recreational gill, haul and cast netting in Western Australia and summary of submissions to the netting review. F.B. Prokop, L.M. Adams (September 1994)
- No. 67** Long term management strategies for the Western Rock Lobster Fishery. (4 volumes) Evaluation of management options Volume 1. B. K. Bowen (September 1994)
- No. 68** Long term management strategies for the Western Rock Lobster Fishery. (4 volumes) Economic efficiency of alternative input and output based management systems in the western rock lobster fishery, Volume 2. R.K. Lindner (September 1994)
- No. 69** Long term management strategies for the Western Rock Lobster Fishery. (4 volumes) A market-based economic assessment for the western rock lobster industry, Volume 3. Marec Pty Ltd (September 1994)
- No. 70** Long term management strategies for the Western Rock Lobster Fishery. (4 volumes) Law enforcement considerations, Volume 4. N. McLaughlan (September 1994)

- No. 71** The Rock Lobster Industry Advisory Committee Chairman's Report, October 1994, The Western Rock Lobster Fishery - Management proposals for the 1994/95 and 1995/96 seasons (November 1994)
- No. 72** Shark Bay World Heritage Area draft management plan for fish resources. D. Clayton (November 1994)
- No. 73** The bag and size limit review: new regulations and summary of submissions. F. Prokop (May 1995)
- No. 74** Report on future management options for the South West trawl limited entry fishery. South West trawl limited entry fishery working group (June 1995)
- No. 75** Implications of Native Title legislation for fisheries management and the fishing industry in Western Australia. P. Summerfield (February 1995)
- No. 76** Draft report of the South Coast estuarine fishery working group. South Coast estuarine fishery working group. (February 1995)
- No. 77** The Offshore Constitutional Settlement, Western Australia. H. Brayford & G. Lyon (May 1995)
- No. 78** The Best Available Information - Its Implications for Recreational Fisheries Management. Workshop at Second National Fisheries Managers Conference, Bribie Island Queensland. F. Prokop (May 1995)
- No. 79** Management of the Northern Demersal Scalefish Fishery. J. Fowler (June 1995)
- No. 80** Management arrangements for specimen shell collection in Western Australia, 1995. J. Barrington & C. Campbell (March 1996)
- No. 81** Management Options (Discussion Paper) for the Shark Bay Snapper Limited Entry Fishery. Shark Bay Snapper Limited Entry Fishery Working Group, Chaired by Doug Bathgate (June 1995)
- No. 82** The Impact of the New Management Package on Smaller Operators in the Western Rock Lobster Fishery R. Gould (September 1995)
- No. 83** Translocation Issues in Western Australia. Proceedings of a Seminar and Workshop held on 26 and 27 September 1994. F. Prokop (July 1995)
- No. 84** Bag and Size Limit Regulations From Around Australia. Current Information as at 1 July 1995. Third Australasian Fisheries Managers Conference, Rottneest Island. F. Prokop (July 1995)
- No. 85** West Coast Rock Lobster Fishery Management Plan 1995 - Draft for Public Comment. Edited by M. Moran (August 1995)
- No. 86** A Review of Ministerial Policy Guidelines for Rock Lobster Processing in Western Australia from the Working Group appointed by the Minister for Fisheries and chaired by Peter Rich (December 1995)
- No. 87** Same Fish - Different Rules. Proceedings of the National Fisheries Management Network Workshop held as part of the Third Australasian Fisheries Managers Conference. F. Prokop
- No. 88** Balancing the Scales - Access and Equity in Fisheries Management - Proceedings of the Third Australasian Fisheries Managers Conference, Rottneest Island, Western Australia 2 - 4 August 1995. Edited by P. Summerfield (February 1996)
- No. 89** Fishermen's views on the future management of the rock lobster fishery. A report. Prepared on behalf of the Rock Lobster Industry Advisory Committee by The Marketing Centre. (August 1995)

- No. 90** A report on the issues effecting the use of the Dampier Archipelago. Peter Driscoll, Landvision Pty Ltd (March 1996)
- No. 91** Shark Bay World Heritage Property - Management Paper for Fish Resources. Kevin A Francesconi (September 1996)
- No. 92** Pearling and Aquaculture in the Dampier Archipelago - Existing and Proposed Operations. A report for public comment. Compiled by Ben Fraser (September 1996)
- No. 93** Shark Bay World Heritage Property - Summary of Public Submissions to the Draft Management Plan for Fish Resources. Kevin A Francesconi (September 1996)
- No. 94** Rock Lobster Industry Advisory Committee Report - Management arrangements for the Western Rock Lobster Fishery for the 1997/98 season. Frank Prokop (May 1997)
- No. 95** Australian Salmon and Herring Resource Allocation Committee. P McLeod & F Prokop (*in press*)
- No. 96** Summary Report of the Freshwater Aquaculture Taskforce (FAT) by Chris Wells (*in press*)
- No. 97** (*in press*)
- No. 98** A Pricing Policy for Fisheries Agencies - Standing Committee on Fisheries and Aquaculture Management Committee. P Millington (March 1997)
- No. 99** Management of the South Coast Purse Seine Fishery. J Fowler, R Lenanton, Kevin Donohue, M Moran & D Gaughan. (n.d.)
- No. 100** The Aquaculture of non-endemic species in Western Australia - Redclaw crayfish (*Cherax quadricarinatus*). Tina Thorne (June 1997)
- No. 101** Optimising the worth of the catch - Options and Issues. Marec Pty Ltd (September 1997)
- No. 102** Marine farm planning and consultation processes in Western Australia. Dave Overall (August 1997)
- No. 103** Future management of the aquatic charter industry in Western Australia by the Tour Operators Fishing Working Group (September 1997).
- No. 104** Management of the Houtman Abrolhos System (draft). Prepared by the Abrolhos Islands Management Advisory Committee in conjunction with Fisheries Western Australia (October 1997)
- No. 105** Plan for the Management of the Houtman Abrolhos Fish Habitat Protection Area (draft). Prepared by the Abrolhos Islands Management Advisory Committee in conjunction with Fisheries Western Australia (October 1997)
- No. 106** The impact of Occupational Safety and Health on the management of Western Australian Fisheries. Cameron Wilson (*in press*)
- No. 107** The Aquaculture of non-endemic species in Western Australia - Silver Perch (*Bidyanus bidyanus*). Tina Thorne (June 1997)
- No. 108** Issues affecting Western Australia's inshore crab fishery - Blue swimmer crab (*Portunus pelagicus*), Sand crab (*Ovalipes australiensis*). Cathy Campbell (September 1997)
- No. 109** Abalone Aquaculture in Western Australia. Cameron Westaway & Jeff Norriss (October 1997)

- No. 110** Proposed Voluntary Fishery Adjustment Scheme - South Coast Purse Seine Managed Fishery Report by Committee of Management (October 1997)
- No. 111** Management Options for Pilbara Demersal Line Fishing. Gaye Looby (December 1997)
- No. 112** Summary of Submissions to Fisheries Management Paper No. 108 - issues affecting Western Australia's inshore crab fishery. Compiled by Cathy Campbell (April 1998)
- No. 113** Western Rock Lobster Management - Options and Issues. Prepared by Kevin Donohue on behalf of the Rock Lobster Industry Advisory Committee. (June 1998)
- No. 114** A Strategy for the Future Management of the Joint Authority Northern Shark Fishery. Prepared by Tim Bray and Jo Kennedy. (June 1998)
- No. 115** Guidelines for granting Aquaculture Leases. Prepared by Fisheries WA, the Aquaculture Development Council & the Aquaculture Council of WA. (July 1998)
- No. 116** Future Management of the Aquatic Charter Industry in Western Australia - Final Report. By the Tour Operators Fishing Working Group (September 1998)
- No.117** Management of the Houtman Abrolhos System. Prepared by the Abrolhos Islands Management Advisory Committee in conjunction with Fisheries Western Australia. (December 1998)
- No. 118** Plan for the Management of the Houtman Abrolhos Islands Fish Habitat Protection Area (Schedule 1)
- No. 119** Access to Wildstock for Aquaculture Purposes (not published)
- No. 120** Draft Management Plan for Sustainable Tourism at the Houtman Abrolhos Islands. Prepared by LeProvost, Dames and Moore for the Abrolhos Islands Management Advisory Committee in conjunction with Fisheries WA. (December 1998)
- No. 121** Future Directions for Tourism at the Houtman Abrolhos Islands - Draft for Public Comment. Prepared by LeProvost, Dames and Moore for the Abrolhos Islands Management Advisory Committee in conjunction with Fisheries WA. (December 1998)
- No. 122** Opportunities for the Holding/Fattening/Processing and Aquaculture of Western Rock Lobster (*Panulirus cygnus*). A discussion paper compiled by Fisheries WA. (November 1998)
- No. 123** Future directions for the Rock Lobster Industry Advisory Committee and the Western Rock Lobster Managed Fishery. A discussion paper prepared by Kevin Donohue on behalf of the Rock Lobster Industry Advisory Committee. (December 1998)
- No. 124** A Quality Future for Recreational Fishing in the Gascoyne. Proposals for Community Discussion. A five-year management strategy prepared by the Gascoyne Recreational Fishing Working Group (May 1999).
- No. 125** Changes to Offshore Constitutional Settlement Arrangements; North West Slope Trawl Fishery and Western Deepwater Trawl Fishery. A discussion paper by Fiona Crowe and Jane Borg (May 1999)[not published]
- No. 126** The South Coast Estuarine Fishery. A discussion paper by Rod Pearn and Tony Cappelluti. (May 1999)
- No. 127** The Translocation of Barramundi. A discussion paper by Makaira Pty Ltd.[July 1999]

- No. 128** Shark Bay Pink Snapper Managed Fisheries in WA
- No. 129** Review of the Western Australian Pilchard Fishery 12 - 16 April 1999. Prepared by K.L. Cochrane, Fisheries Resource Division, Food and Agriculture Division of the United Nations (November 1999)
- No. 130** Developing New Fisheries in Western Australia. A guide to applicants for developing fisheries Compiled by Lucy Halmarick (November 1999)
- No. 131** Management Directions for Western Australia's Estuarine and Marine Embayment Fisheries. A strategic approach to management (November 1999)
- No. 132** Summary of Submissions to Fisheries Management Paper No. 126 - The South Coast Estuarine Fishery - A Discussion Paper. Compiled by Rod Pearn (November 1999)
- No. 133** Abalone Aquaculture in Western Australia, A Policy Guideline (December 1999)
- No. 134** Management Directions for WA's Coastal Commercial Finfish Fisheries. Issues and proposals for community discussion (March 2000)
- No. 135** Protecting and Sharing Western Australia's Coastal Fish Resources. The path to integrated management. Issues and proposals for community discussion (March 2000)
- No. 136** Management Directions for WA's Recreational Fisheries (March 2000)
- No. 137** Aquaculture Plan for the Houtman Abrolhos Islands (April 2000)
- No. 138** Information on Quota Management of Rock Lobster Fisheries in South Australia, Tasmania and New Zealand. By Kevin Donohue and Eric Barker (May 2000)
- No. 139** A Quality Future for Recreational Fishing on the West Coast. Proposals for Community Discussion. A five-year management strategy prepared by the West Coast Recreational Fishing Working Group (June 1999)
- No. 140** Aquaculture Plan for the Recherche Archipelago, Western Australia. (June 2000)
- No. 141** Fish Protection Measures in Western Australia (June 2001)
- No. 142** Fisheries Environmental Management Plan for the Gascoyne Region (June 2002)
- No. 143** Western Rock Lobster. Discussion paper for seasons 2001/2002 and 2002/2003 (July 2000)
- No. 144** The Translocation of Brown Trout (*Salmo trutta*) and Rainbow Trout (*Oncorhynchus mykiss*) into and within Western Australia. Prepared by Jaqueline Chappell, contributions from Simon Hambleton, Dr Howard Gill, Dr David Morgan and Dr Noel Morrissy. (*not published, superseded by MP 156*)
- No. 145** The Aquaculture of non-endemic species in Western Australia - Silver Perch (*Bidyanus bidyanus*). As amended October 2000. Tina Thorne. This replaces Fisheries Management Paper No. 107.
- No. 146** Sustainable Tourism Plan for the Houtman Abrolhos Islands (February 2001)
- No. 147** Draft Bycatch Action Plan for the Shark Bay Prawn Managed Fishery (Full Report) (April 2002)
- No. 148** Draft Bycatch Action Plan for the Shark Bay Prawn Managed Fishery (Summary Report) (April 2002)
- No. 149** Final Plan of Management for the Lancelin Island Lagoon Fish Habitat Protection Area (March 2001)

- No. 150** Draft Plan of Management for the Cottesloe Reef Proposed Fish Habitat Protection Area (April 2001)
- No. 151** Inventory of the Land Conservation Values of the Houtman Abrolhos Islands (July 2003)
- No. 152** Guidelines for the Establishment of Fish Habitat Protection Areas (June 2001)
- No. 153** A Five-Year Management Strategy for Recreational Fishing on the West Coast of Western Australia. Final Report of the West Coast Recreational Fishing Working Group (August 2001).
- No. 154** A Five-Year Management Strategy for Recreational Fishing in the Gascoyne. Final Report of the Gascoyne Recreational Fishing Working Group (September 2001)
- No. 155** Plan of Management for the Cottesloe Reef Fish Habitat Protection Area (September 2001)
- No. 156** The Translocation of Brown Trout (*Salmo Trutta*) and Rainbow Trout (*Oncorhynchus mykiss*) into and within Western Australia (June 2002)
- No. 157** Policy for the Implementation of Ecologically Sustainable Development for Fisheries and Aquaculture within Western Australia. By W.J. Fletcher (May 2002)
- No. 158** Draft Plan of Management for the Miaboolya Beach Fish Habitat Protection Area (March 2002)
- No. 159** The Translocation of Barramundi (*Lates calcarifer*) for Aquaculture and Recreational Fishery Enhancement in Western Australia. By Tina Thorne.
- No. 160** The Introduction and Aquaculture of Non-endemic Species in Western Australia: the 'Rotund' Yabby *Cherax rotundus* and the All-male Hybrid Yabby. A Discussion Paper. (June 2002)
- No. 161** Plan of Management for the Miaboolya Beach Fish Habitat Protection Area (September 2002)
- No. 162** Reseeding of grazing gastropods and bivalves into the marine environment in Western Australia – a discussion paper. By Jane Borg.
- No. 163** Review of recreational take of coral in Western Australia – a discussion paper October 2002.
- No. 164** Report of the Mackerel Independent Advisory Panel to the Executive Director, Department of Fisheries, on criteria for access to, and management arrangements for, the proposed Mackerel Fishery (Interim) Management Plan (November 2002)
- No. 165** Report to the Minister for Agriculture, Forestry and Fisheries by the Integrated Fisheries Management Review Committee (November 2002)
- No. 166** Fisheries Statutory Management Authority Inquiry. A background paper (February 2003)
- No. 167** Draft Fisheries Environmental Management Plan for the Northern Region (*in press*)
- No. 168** Aboriginal Fishing Strategy: Report to the Minister for Agriculture, Forestry and Fisheries by the Hon E. M. Franklyn QC, Chairman of the Aboriginal Fishing Strategy Working Group (May 2003)
- No. 169** Hardy Inlet discussion paper (February 2004)
- No. 170** Management of the proposed Geographe Bay Blue Swimmer and Sand Crab Managed Fishery. By Jane Borg and Cathy Campbell (August 2003)
- No. 171** Draft Aquaculture Plan for Shark Bay (April 2004)

- No. 172** Draft Aquaculture Plan for Exmouth Gulf (April 2004)
- No. 173** Draft Plan of Management for the proposed Point Quobba Fish Habitat Protection Area (August 2003)
- No. 174** Translocation of Golden Perch, Murray Cod and Australian Bass into and within Western Australia for the Purposes of Recreational Stocking, Domestic Stocking and Commercial and Non-commercial Aquaculture (December 2003)
- No. 175** Fish Stock and Fishery Enhancement in Western Australia - a discussion paper. By Jane Borg (February 2004)
- No. 176** Fish Stock and Fishery Enhancement in Western Australia - a summary report. By Jane Borg (February 2004)
- No. 177** Fisheries Environmental Management Plan for the Gascoyne Region (*in press*)
- No. 178** Draft Plan of Management for the Kalbarri Blue Holes Fish Habitat Protection Area (March 2004)
- No. 179** A Draft Policy for the Translocation of Brown Trout (*Salmo trutta*) and Rainbow Trout (*Oncorhynchus mykiss*) into and within Western Australia for the Purposes of Recreational Stocking, Domestic Stocking and Commercial and Non-Commercial Aquaculture (August 2004)
- No. 180** The Sustainable Management of Western Australia's Temperate Shark Fisheries (July 2004).
- No. 181** A Quality Future for Recreational Fishing in the Pilbara/Kimberley. Proposals for Community Discussion. A five-year strategy for managing the recreational component of the catch, prepared by the Pilbara/Kimberley Recreational Fishing Working Group (July 2004)
- No. 182** A Quality Future for Recreational Fishing in the Southern Region of WA. Proposals for Community Discussion. A five-year strategy for managing the recreational component of the catch, prepared by the Southern Recreational Fishing Working Group (July 2004)
- No. 183** Final Report of the Fisheries Statutory Management Authority Advisory Committee. Published by the Department of Fisheries (*in press*)
- No. 184** South West Beach Seine Management Discussion Paper (*in press*)
- No. 185** Plan of Management for the Point Quobba Fish Habitat Protection Area (July 2004)
- No. 186** Management of the West Coast Rock Lobster Fishery - Advice to Stakeholders on Resource Sustainability Matters. (*in press*)
- No. 187** Proposals for community discussion on the future management of pink snapper fishing in Cockburn Sound and surrounding waters. (October 2004).
- No. 188** Plan of Management for the Kalbarri Blue Holes Fish Habitat Protection (*in press*).
- No. 189** Proposed Management Arrangements for the Gascoyne Commercial 'Wetline' Fishery. A Discussion Paper Prepared By The West Coast And Gascoyne Wetline Review Management Planning Panel (January 2005).
- No. 190** Management Arrangements for the West Coast Commercial 'Wetline' Fishery. A Discussion Paper Prepared By The West Coast And Gascoyne Management Planning Panel (January 2005).
- No. 191** Access And Allocation Arrangements For The Commercial 'Wetline' Fisheries, Proposals For Discussion. A Report To The Minister For Fisheries Prepared By The Commercial Access Panel. (January 2005).

No. 192 A Sustainable Future for Recreational Fishing in the Cocos (Keeling) Islands. Proposals for Community Discussion on a Five-Year Strategy for Managing the Recreational and Subsistence Catch. (March 2005).