

REVIEW OF THE NORTHERN TERRITORY MUD CRAB FISHERY MANAGEMENT PLAN DISCUSSION PAPER

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Executive Summary

It is timely to review the Mud Crab Fishery Management Plan while it is believed that the Northern Territory mud crabs stocks are healthy and the risk of overfishing is low. This allows consideration of future management directions in a more conducive and proactive environment and this discussion paper is the initial step in the process.

The inaugural Mud Crab Fishery Management Plan was enacted in 1991 and proved invaluable in capping fishing capacity within both the commercial and recreational sectors. Amendments were enacted in 1993 and 1996 to provide further protection for female mud crabs and restrict the use of bait nets in certain areas. These measures were developed by the Mud Crab Fishery Management Committee (MCFAC) in conjunction with Industry sectors.

Since the Plan was put in place, the nature of the commercial fishery has changed significantly. Commercial catches have increased over five fold and nearly all licences are fully utilised. Most are operated in temporary transfer arrangements.

The recreational and fishing tourism sectors have also grown significantly over the last decade because of increased tourism related fishing and the growing population of the NT. Areas close to Darwin and the McArthur River are the main focus for recreational crabbing. The indigenous people of the Territory also continue to harvest mud crab as a source of food.

Commonwealth, State and Territory Governments have agreed that the use of natural resources should be in line with the concept of Ecologically Sustainable Development (ESD) and these matters need to be considered as part of any natural resource management arrangements that are in place.

With increasing fishing activity, the review will ensure that the management regime continues to provide an appropriate level of protection to the mud crab resource over the longer term.

The proposed objectives for the future management of the fishery are to:

- Maintain long term sustainability of the mud crab resource.
- Achieve the optimal and quality yield mix from the resource.
- Minimise impact on unretained catch, protected wildlife, the environment and the ecological processes on which they rely.
- Create equitable, quality fishing opportunities for all stakeholder groups.
- Govern the fishery through a cost effective, easily understood and administered management regime.

This discussion paper suggests that the bulk of the current management arrangements should be continued, but that new strategies are also put in place to enhance effort controls, and the value of commercial catches whilst maintaining recreational and indigenous catch.

Considerations are given to address a number of ESD principles by raising matters dealing with permitted fishing gear, bycatch and identification of triggers that will initiate a defined management response if there is a possible threat to the stock.

The paper also canvasses the matter of catch shares of each sector being determined as a benchmark for future management discussion, using the National Recreational and Indigenous Fishing Survey and catch reports provided by fishing tour operators and commercial fishers.

Members of the public, commercial and recreational fishers, non-government organisations, indigenous groups and others are encouraged to comment on matters raised in this paper, especially focussing on the **discussion points** which are highlighted throughout the paper and listed in the response proforma at the back of this paper. The discussion points are not necessarily recommended actions, but rather matters raised to elicit comments and views on particular issues.

1 INTRODUCTION

The Mud Crab Fishery Management Plan (Appendix I) provides for the regulation, conservation and management of the mud crab resource in the Northern Territory. This review will consider existing controls and arrangements and identify any new challenges for the fishery so as to put in place a framework in the management plan to deal with such matters.

The best scientific advice available at this time indicates that while catch rates in the fishery are high, the resource is in a healthy state. However continuing caution is required to ensure total fishing effort does not increase to a level that generates an unacceptable risk to the sustainability of the resource.

The mud crab fishery was formalised in 1985 when limits were placed on the number of licences and gear allowed.

The initial Management Plan, developed in conjunction with industry sectors and the MCFAC, was enacted in February 1991. The Plan put in place arrangements for the commercial sector which limited the number of licences and gear that could be used as well as specifying some closures to commercial crabbing in the vicinity of Darwin. The recreational sector had gear and possession limits introduced and a minimum carapace size limit was put in place for both sectors.

Some preemptive protection was included in the management plan in 1993 and 1996 to provide additional protection for female mud crabs by increasing the size limit and prohibiting the taking of berried mud crabs. The history of the major management arrangements that have been put in place for the fishery is summarised in Appendix II.

Catches have continued to increase and the commercial fishery is now the most valuable NT managed wild harvest fishery, while for the non commercial sector, mud crabs provide recreation, enjoyment and food to a large number of Territorians and visitors alike.

Since the initial Plan came into force in 1991, a number of factors have changed at the international, national and local levels. The principles of ESD and the use of the precautionary principle in fisheries management have been adopted as per the 1992 National Strategy for Ecological Development (Appendix III).

Management arrangements to meet the objectives of ESD should:

- Enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations.
- Provide for equity within and between generations.
- Protect biological diversity and maintain essential ecological processes and life-support systems; and
- Deal cautiously with risk and irreversibility.

In simple terms, ESD means using and conserving the community's resources so that ecological processes on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

The consideration of ESD principles are even more important with respect to the commercial sector when it is read in conjunction with new provisions of Schedule 4 of the *Commonwealth Wildlife Protection Act*. This Act will only allow exports of native Australian wildlife if they are harvested under a regime that has met certain criteria in respect to sustainability.

This review seeks to ensure the best utilisation of the NT mud crab resources for the benefit of the community into the future by building on the success of the initial plan and adopting best practice principles and taking cognizance of the Government's role to manage the resource responsibly.

The issues contained in this Discussion Paper, together with public comments received, will be considered by MCFAC in preparing its advice to the Director of Fisheries on future management arrangements for the fishery. Appendix IV gives a diagrammatic view of the process for development of a revised plan.

2 THE FISHERY

The mud crab fishery encompasses tidal waters from the Queensland border to Western Australia and is managed by the Northern Territory.

It is basically a single species fishery in which baited pots are normally used to take live mud crabs. *Scylla serrata* accounts for more than 99% of the catch, with very small numbers of another species of mud crab, *S. olivacea*, taken. The major user groups are the commercial and recreational sectors, but mud crabs are an important food source for traditional fishers. In the future there may also be a limited aquaculture broodstock requirement.

Crabbing is confined to coastal and estuarine areas and the fishery covers most of the coast and adjacent islands. However, not all NT waters are available, as some access restrictions occur due to the presence of Aboriginal sacred sites, land or waters, aquatic reserves, closures specified in the Management Plan or by authorities such as Environment Australia, which prohibits commercial fishing within Kakadu National Park.

Mud crabs live for up to four years and the fishery targets mud crabs in the one to three year age groups. The fishery most likely depends on annual recruits entering it, rather than an accumulation of stock from previous seasons. There are still significant areas of the fishery that are not worked commercially because of remoteness, but there is a gradual expansion occurring as access problems are overcome.

3 STATUS OF THE RESOURCE

Extensive information on the current status of the fishery is dealt with in more detail in the recently published Fishery Assessment Report (Fishery Report No. 53), but a brief overview follows.

The resource is generally in a healthy state. Research indicates that, in areas where significant fishing occurs, the abundance of the resource depends on annual recruits entering the fishery rather than an accumulation of stock from previous seasons. Up to 70% of available stock may be harvested each year in these areas.

Even though this harvesting rate is high, historically other crab fisheries with similar characteristics to the NT mud crab fishery can generally support a high harvesting rate due to the relatively short life span, early maturity and high fecundity of the species. Also, the NT with its relatively undeveloped coastline provides ideal conditions for the wild population of mud crab to flourish.

Significant research on mud crabs has been continuing since 1990, when the Northern Territory Government initiated a mud crab research program. That research program provided a sound understanding of the basic biology of the mud crab. A number of findings, including basic information on growth, size at maturity, reproductive behaviour, movement and mortality are summarised in Appendix V.

A major management outcome arising directly from the research programs occurred in 1996, when the minimum size limit of female mud crabs was raised from 130 mm carapace width to 140 mm. This precautionary strategy means that more than 70% of females are protected from direct fishing mortality until they reach maturity.

A monitoring program of commercially harvested crabs was also put in place and mud crabs from the three most commercially important areas in the NT, the McArthur, Adelaide and Roper

River regions continue to be measured on a monthly basis, together with the collection of other biological data. More recently, data is also being collected from Blue Mud Bay.

While size and sex compositions vary throughout the year, over the years there is no evidence of any decline in carapace width of either male or female mud crabs. This area of monitoring is being assessed and may need to be increased to provide more statistically valid results.

An extensive workshop in Darwin in 1996 concluded that, based on the response of the fishery to high harvesting rates and the fishing practices to that time, there was very little risk of recruitment overfishing occurring. The workshop also found that the research undertaken and assessments of commercial logbooks to that date was of major importance to understanding the effects of fishing on the stocks, but it did not appear to provide sufficient information to determine stock size estimates.

As a result of the above finding, in 1999 a national workshop was held in Darwin to assess current research and develop a five year national strategy for mud crab research. An outcome of that strategy has been the funding to the tune of \$690,000 by the Fisheries Research and Development Corporation (FRDC) of a research project by the NT Fisheries Division mud crab research section titled "Methods to estimate abundance and habitat for northern Australian mud crab (*Scylla serrata*)".

Commencing this year, the project, which will be conducted in conjunction with Queensland Fisheries, aims to identify and quantify critical mud crab habitat throughout the NT and Queensland and to estimate corresponding mud crab abundance per unit of critical habitat.

4 STAKEHOLDERS

4.1 Commercial Fishery

Since 1985 the commercial fishery has had limited entry, which means that no new licences are issued and only existing licences can be renewed annually.

Licencees can either permanently transfer (sell) or temporarily transfer (lease) their licences. Currently most of the licences are not operated by their owners, but "leased" to others who either fish them themselves or employ people to do so.

There are 49 transferable licences in the commercial fishery and most of these are fully utilised throughout the licencing year. Each licence entitles the holder to use a maximum of 60 pots which must comply with specified dimensions and construction materials.

Crabbers utilise outboard powered dinghies to set and retrieve pots by hand, with the majority at present having land based camps that they operate from. Technological aids such as radar, sounder or GPS are uncommon, although radio communications are at times used.

Baited pots are checked at least once every 24 hours and usually more frequently if the tides and other conditions are appropriate. Working from dinghies, crabbers can travel in excess of 100 km from their base camps to set their pots and may stay in the area for a number of days before returning to a base to unload and store crabs. Live mud crabs are stored in moist hessian lined crates and transported to Darwin at least weekly prior to onshipping by air to various markets interstate and to a lesser extent, overseas.

The major commercial crabbing areas are the McArthur, Roper and Adelaide River regions with Blue Mud Bay now developing into a significant area as well. Fishing activity has primarily focussed on areas where road access has been available so as to transport the live mud crab to Darwin for forwarding on to markets.

Catches on individual licences have increased substantially as the fishery has developed. In 1984, 60% of licences were inactive, 30% caught less than 1 tonne, no licences caught more

than 5 tonnes whilst the average was 0.5 tonnes. In 1999, no licences were inactive, all caught more than 5 tonnes, 90% caught more than 10 tonnes and the average catch was 15.5 tonnes.

The total retained catch in the commercial sector in 1999 was 754 tonnes. A reported 889,000 pot lifts of effort were used in the harvesting of this catch. The catch was valued at approximately \$10 million, making it the most valuable wild harvest fishery in the Northern Territory. The preliminary figure for 2000 indicates landings will be in excess of 1,000 tonnes.

From 1996 both catch and effort have had significant increases. Although the specific reasons for this are not fully known, a combination of environmental factors providing favourable conditions for recruitment and some expansion of fishing grounds are the most likely reasons.

As a guide to the trends in the fishery, the catch and effort for the fishery are shown in Figure 1.

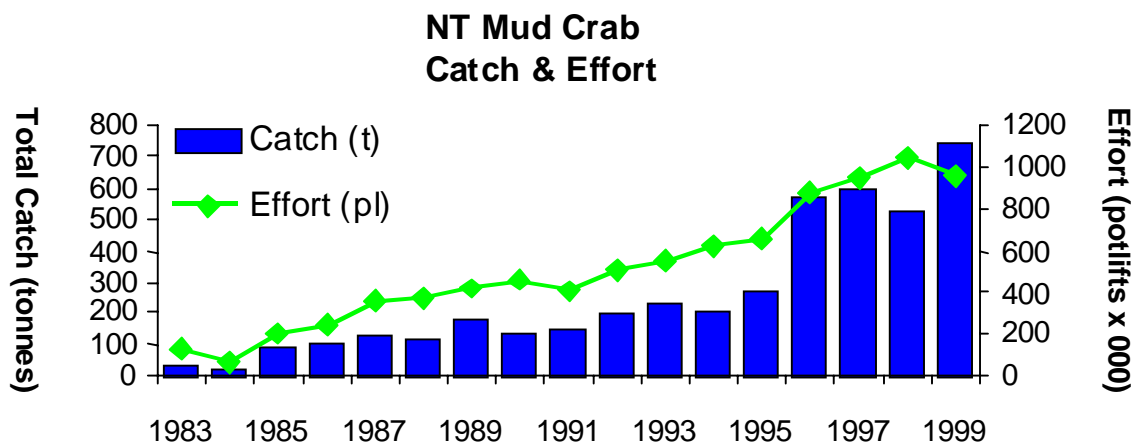


Figure 1. Catch and effort for the NT mud crab fishery, 1983 – 1999

The bycatch of non target species taken in pots is minimal due to the fishing gear and practices of commercial crabbers. What little bycatch there is consists mainly of catfish, cod, puffer fish and occasionally, other species of crab. All these are generally returned to the water.

The major non retained catch relates to what have been termed empty or soft crabs, but are now referred to by industry as commercially unsuitable crab. For crabs to grow in size they must shed their shell. During this process their water content increases the shell cracks open and the crab then extracts itself from the old shell and the new shell begins to harden at a greater size. Crabs in this form contain little meat.

Very recently the NT Crab Fishermen’s Association, in conjunctions with major NT licensed Trader/Processors and the NT Fisheries Division developed a Code of Practice for the NT mud crab fishery which has been endorsed by the MCFAC. The code covers the three operational sectors, harvesting, transport and marketing and its goals are to maximise sustainability, quality and market value.

/// **Discussion Point 1:** The desirability of returning berried crabs; undersize, commercially unsuitable or damaged crabs immediately to the water unharmed prior to returning to the fishing base and tying retained crabs prior to returning to the fishing base

Background

The current Mud Crab Management Plan does not allow the taking of berried or undersized crab to ensure that these animals have the best chance to contribute to the continuing healthy

state of the resource. Berried animals are rarely encountered during fishing operations and must be returned immediately to the water so as not to cause damage to the egg mass.

The new industry Code of Practice identifies that for both safety and operational reasons, it may not be possible to release harvested mud crabs that are not to be retained (except for berried animals) at the exact point of capture, although this is the preferred option if conditions allow. The code and newly implemented condition of licence state that all retained mud crab must be released before returning to the crabbers' base.

As previously mentioned, commercially unsuitable crab describes those which are often called "empty" or "soft" within the industry. These crab are considered less than premium quality and command significantly lower prices than full, healthy crabs. More importantly, the weak condition of these crabs means they can not survive transport as well as healthy, full crabs. A dead crab on a transport truck can often lead to the death of a number of healthy, full crabs adjacent to it.

It is widely believed that if returned to the water, commercially unsuitable crabs will become acceptable within a few weeks.

Discussion Point 2: The appropriateness of guidelines for the use of crab holding cages located at a crabbers' base

Background

The commercial industry has sought to maintain the health and quality of harvested mud crabs by placing them in holding cages in the water at crabbers' bases. This is a relatively recent development following an approach from the NT Crab Fishermen's Association. The Association, the Fisheries Division and Fisheries Enforcement have developed draft guidelines for the use of such holding cages.

The guidelines require that the mud crabs are restrained (tied), are not fed, the cages are adequately marked, they do not pose a hazard to other users or breach other legislation and the dimensions do not exceed 130 cm x 90 cm x 35 cm.

These maximum dimensions are proposed to avoid any potential need for aquaculture licences. The intention of the guidelines is to allow maximum commercial operations with minimal prescriptive regulations.

Discussion Point 3: Is it reasonable to allow commercial crabbers to use their "restricted bait net" entitlement wherever they are allowed to fish?

Background

Most commercial crabbing operations have as their bases, small, temporary land based camps. Some of these have generators and freezers to store bait. It is generally anticipated that as crabbers expand into newer areas, mother boats, pontoons or barges will become more common.

Each mud crab licence has a restricted bait net entitlement attached to it. This allows a maximum of 100 m of 65 mm mesh net (the same mesh size as presently allowed in the recreational sector) to be used in open waters for the catching of bait for crab pots. The operator must be present at the net at all times when it is set. Logbook returns indicate around 40-60 tonnes of fish, mainly catfish, blue salmon and shark are taken each year.

In 1994, to protect juvenile fish and protected species, the use of restricted bait nets associated with a mud crab licence was prohibited in the southern Gulf of Carpentaria area between Bing Bong Creek (north of Borroloola) and the Queensland border (see Figure 2).

In 1996, the possession of a restricted bait net attached to a mud crab licence was also prohibited in this area. While the restricted bait net entitlement can be operated in other areas, the present regulations mean that people commercially crabbing between Bing Bong Creek and the Queensland border have no option but to buy crab bait for their pots.

Over recent years the NT Crab Fishermen's Association has, on a number of occasions, formally requested that the restricted bait net entitlement associated with a mud crab licence be allowed to be used between Sharker Point (east of Borroloola) and the Queensland border (see Figure 2).

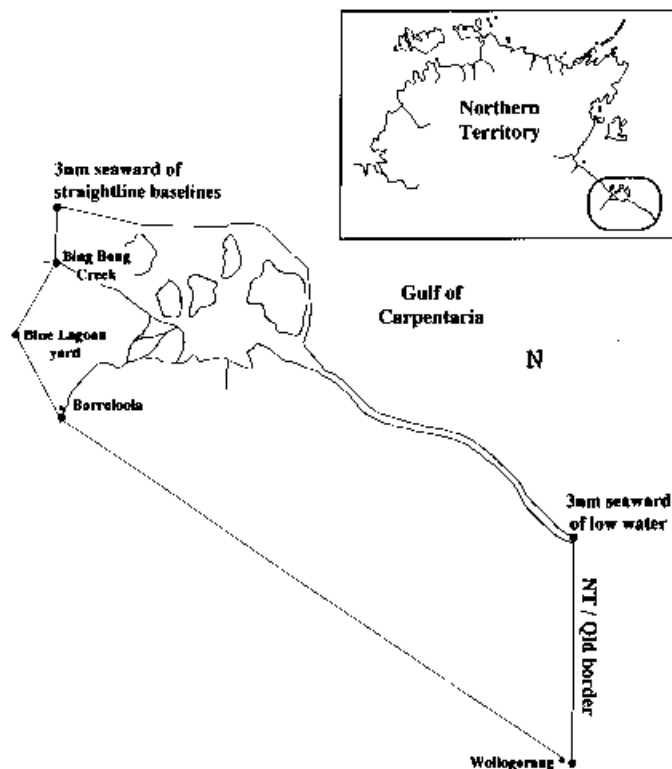


Figure 2. Map showing the southern Gulf of Carpentaria from Bing Bong Creek to the Queensland border

/// **Discussion Point 4:** If the prohibition on using restricted bait nets was to be continued in the area from Sharker Point to the Queensland border, should extra pots be allocated to licences to offset for the loss of the use of bait net? If extra pots were allowed in a specific area, what effort adjustments should be made to maintain a cap on total effort in the fishery?

Background

In 1994 the use of restricted bait net entitlements linked to mud crab licences was banned between Bing Bong Creek and the Queensland border (see Figure 2). At that time the Minister for Primary Industry and Fisheries agreed, for one year only, to allow the operators of commercial licences who had a history in this area, to use an additional five crab pots to offset any additional costs that this decision may have caused. That entitlement was conditional on the operator meeting clear entry criteria and agreeing to provide precise data on fishing activities. Of the 20 or so licences operating in the area, one took up the offer, but did not use the extra pots.

In 1996 the Minister approved legislation that banned the possession of restricted bait nets in the area from Bing Bong Creek to the Queensland border.

Industry have requested that an extra five pots per licence be permitted for those that work in this designated area. This is not supported by the Fisheries Division.

It must be remembered that as the fishery is managed based on total effort across the whole fishery, any increase in effort in one area would need to be offset by a reduction in others.

Discussion Point 5: The adequacy of the proposed penalty structure as a deterrent for overpotting in commercial harvesting operations

Background

In response to concerns about the deterrent factor of present penalties in regard to overpotting under commercial licences, the NT Crab Fishermen's Association approached both Fisheries Enforcement and the Fisheries Division with a proposal to significantly increase the penalty regime for commercial overpotting. This proposal was endorsed by the MCFAC.

For such a regime to be implemented, amendments to the *Fisheries Act* will be required together with an amendment to the Mud Crab Fishery Management Plan.

The proposed amendments mean that those persons operating commercial licences who are convicted twice of overpotting will be suspended from any mud crab fishing operation at any level for a period of two years and the following monetary penalties will apply. It is the person, not the licence that will be suspended.

First offence	up to 10 pots in excess	\$5,000
First offence	10 to 30 pots in excess	\$10,000 + \$500/pot
First offence	over 30 pots in excess	\$10,000 + \$1,000/pot
Second offence	up to 10 pots in excess	\$5,000
Second offence	over 10 pots in excess	\$20,000 + \$500/pot
Second offence (within 2 years)	\$ penalty, plus suspension from operating in the fishery for a 2 year period.	

Discussion Point 6: The possible unitisation of commercial mud crab fishery licences in terms of numbers of pots per unit and the desirability or otherwise of making such units both temporarily and permanently transferable

Background

The concept of unitisation allows licensees to convert their one 60 pot licence into a number of transferable units to allow operators the flexibility to legally use more than 60 pots. This system is used in a number of fisheries such as the Western Australian rock lobster fishery.

Given that most commercial mud crab licences are fully utilised, the NT Crab Fishermen's Association has discussed this matter on several occasions and rejected the concept.

On the other hand it may be appropriate to consider the flexibility of business decision-making that a unitisation scheme may provide.

Prior to any such scheme coming into force there would need to be a great deal of discussion with stakeholders to weigh the benefits against the costs of a unitisation scheme that maintained adequate protection of the resource under ESD guidelines.

Discussion Point 7: Should a nil bycatch of mud crab continue to apply in all other commercial fisheries in the Northern Territory?

Background

There is nil bycatch of mud crab allowed in other commercial NT fisheries. From time to time small amounts of mud crabs are caught in the barramundi and coastal net fisheries and it has been mooted on occasion that mud crabs caught in this situation should be allowed to be retained.

This is not the present policy position of the Fisheries Division or the NT Crab Fishermen's Association.

Discussion Point 8: Should the current prohibition of processing crabs except at a registered trader/processor establishment continue?

Background

Processing of mud crab is not permitted except at a registered fish trader/processor establishment. This was put in place at the time when the Management Plan came into force when concerns were expressed about enforceability of minimum size limits if crabs could be broken into smaller pieces or processed.

On industry's request some attempts have been made by the Fisheries Division to identify an alternative measurement for mud crabs that have been cleaned and halved. At this stage there does not appear to be a readily useable measurement that correlates satisfactorily with the existing minimum size limits.

Discussion Point 9: The appropriateness of restricting each mud crab licence to the use of one fishing platform, that is, vessel, at any one time during a harvesting operation

Background

Most commercial operators use one vessel per licence when actually fishing. However, some do have more vessels registered against their licence, usually one small dinghy and one larger dinghy for working in open waters. It is not suggested that this should not be permitted.

However there is an argument that, by restricting actual fishing activity to one vessel at a time, effort increase would be more satisfactorily controlled.

Discussion Point 10: Should all persons who trade in mud crab be required to have appropriate premises to store and pack crabs, pay appropriate licence fees and report on sales that they make

Background

Marketing is generally an industry/consumer issue, but government assists in facilitating and regulating aspects of this sector.

Mud crabs are a premium seafood preferred live airfreighted to southern markets, primarily Sydney and Melbourne. It is anticipated there will be growth in overseas markets in the future.

The Industry Code of Practice also includes those in the marketing sectors who support how fishers deal with unsuitable crabs.

Opposition has been expressed by major mud crab trader/processors, the NT Crab Fishermen's Association and the Amateur Fishermen's Association of the NT (AFANT) to persons selling live

mud crab to the public at markets without a full trader/processor licence. A number of complaints have also been received from the public about the sale of commercially unsuitable crabs through this process.

Both the commercial sector and AFANT suggest that a person who wishes to trade in live mud crabs should have premises that meet general health standards in which to pack and store crabs and that a significant licence fee and detailed reporting conditions should be introduced.

4.2 Recreational Fishery

Fishing for mud crab is a popular recreational activity in the Northern Territory, providing both enjoyment and food for a large number of Territorians and visitors alike. It is often undertaken in conjunction with other fishing activities in coastal and estuarine regions using a wide variety of vessels particularly dinghies.

Detailed historical information on the recreational catch of mud crab is limited. However, a survey of the NT recreational fishing sector (FISHCOUNT) undertaken in 1995, estimated that 75,000 mud crabs were landed by this sector during the survey period, and 52,000 were retained. This is the equivalent to between 40 and 50 tonnes.

Darwin Harbour accounted for around 65% of the catch, and the McArthur River region 25%.

A comprehensive National Survey of Recreational and Indigenous fishers is being undertaken during 2000/2001 and will provide further information on the mud crab catch by the recreational sector. Complementary creel surveys are being undertaken as an adjunct to the national survey.

Discussion Point 11: The appropriateness of keeping the present recreational sector mud crab possession limits in place:

- **10 mud crabs in possession per person or 30 per vessel (if three or more people are on the vessel)**

Background

The present possession limit of 10 mud crabs per person and 30 per vessel (if three or more persons are on a vessel) provides large numbers of mud crabs per person, generally in excess of what an individual can consume.

The 30 mud crab per vessel limit is almost equal to a “crate” of mud crabs, on which, most commercial crabbers historically based their daily “break-even” commercial catch rates.

The commercial mud crab sector has been calling for reductions in the recreational mud crab possession limits for several years and the matter has been discussed at the Ministerial Advisory Committee on Recreational Fishing (MACRF). However in 2000 MACRF decided to retain the current possession limits at this time.

Discussion Point 12: The adequacy of the current penalty regime as a suitable deterrent for people in the recreational sector who exceed the mud crab possession limits

Background

From time to time, concern has been expressed about the amount of mud crab believed to be taken and sold by those without a commercial licence. In the same way that the commercial sector voluntarily imposed a stricter penalty regime on itself, AFANT has suggested that there should be substantial penalty increases in the recreational sector for those persons caught with mud crabs in excess of the prescribed possession limits, that is:

1-10 mud crabs in excess	\$ 5,000 plus \$ 500 per crab
Over 10 mud crabs in excess	\$ 10,000 plus \$ 1,000 per crab

Discussion Point 13: The appropriateness of reintroducing the requirement for recreational mud crabbers to register their pots

Background

Prior to 1985 all recreation pots had to be registered with the Fisheries Division and this provided information for management and assisted enforcement. From 1985, the NT Government has allowed the recreational harvesting of mud crabs without registration or licences.

Discussion Point 14: Should the use of the currently permitted recreational fishing gear of spears and crab hooks be prohibited?

Background

Non-commercial crabbers are permitted to take mud crabs by spear and crab hook.

A crab hook is generally a piece of wire of sufficient length to extract mud crabs from their burrows. Both of these methods have the capacity to critically injure or kill the crab, while the use of a crab hook can also damage the burrows, particularly if inexperienced people attempt to remove a crab.

Once speared, a mud crab has little or no chance of survival, even if returned to the water because it is undersized or soft. Crab hooks can cause similar damage.

4.3 Fishing Tour Operators

A Fishing Tour Operator licence allows a person to conduct the commercial activity of taking people on fishing tours. Only recreational fishing gear can be used and the catch cannot be sold, traded or bartered. The recreational pot and possession limits apply on such tours.

Although there are currently over 180 licensed Fishing Tour Operators in the Northern Territory, the targeting of mud crab is not the primary activity of any of them. However, occasionally mud crabs are taken and in 1999 the reported catch of this sector was in the vicinity of 1 tonne, 20% of which were released.

Discussion Point 15: The appropriateness of continuing the requirement for Fishing Tour Operators to abide by the recreational pot and possession limits

Background

While licensed FTO's can be considered as commercial operators, their clients fish as non licensed people in the same way as the recreational sector. This is why the current recreational pot and possession limits apply.

4.4 Indigenous Sector

Mud crabs are believed to be a significant food source for Aboriginal people living in coastal areas. Section 53 of the *Fisheries Act* guarantees Aboriginal people the right to utilise fish and other aquatic resources for food and traditional use such as ceremonies and customs, without the need to abide by either the recreational or commercial rules. The exception is that crabs taken cannot be sold.

Aboriginal people are entitled to use recreational fishing gear, but they often spear or hand-harvest crabs.

No information has been gathered on the use of mud crabs for traditional or subsistence purposes. However the present National Survey of Recreational and Indigenous Fishers, which is still in progress, will provide valuable information that can be factored in to stock assessments.

4.5 Community and Environment

Community and environmental stakeholders include non-extractive or passive users of the resource who maintain an interest in the fishery and wish to ensure the pursuit of long-term ecological sustainability of the resource and dependent species.

In general, the community interest focuses on the way in which the resource is used, conserved and enhanced, to ensure that quality of life is preserved for future generations and that fishing activities do not detrimentally affect the environment.

4.6 Aquaculture

Production of juvenile crabs from larvae is becoming increasingly reliable at the Darwin Aquaculture Centre. Survival rates through the hatchery process are approaching what may be considered economically viable. This outcome has resulted from a collaborative research program on mud crab aquaculture with Queensland and institutions from the Philippines and funded by the Australian Centre for Agricultural Research (ACIAR).

Considerable work is still required on the commercial nursery production of mud crabs, the growout of large crabs and adult nutrition. However, it is anticipated that commercialisation of research results is possible in the near future and this project has now received additional support from the FRDC.

4.7 Formal Consultative Groups

MCFAC is the peak advisory body to the Director of Fisheries and comprises representatives from key user groups and Government. MCFAC was responsible for the development of the initial plan of management in 1991 and has continued to supply advice to the Director of Fisheries since then.

Formal and informal discussions also take place regularly with major stakeholder peak bodies and individuals.

As well as MCFAC, a series of regional Aboriginal consultative committees have been formed. These provide formal advice from the Aboriginal constituents of the regions on all aspects of fishing, including mud crab.

4.8 Compliance

Compliance is undertaken by the NT Police Marine and Fisheries Enforcement Unit. The unit has 14 officers responsible for providing compliance on all fisheries managed by the NT, including the mud crab fishery.

5 OBJECTIVES OF THE MANAGEMENT PLAN

The *Fisheries Act* specifically outlines what matters management plans should consider in achieving the overall goals within a framework that will conserve, enhance, protect, utilise, and manage the fish and aquatic life resources of the Territory to:

- promote, develop and maintain commercial and amateur fishing;
- provide for optimum yields and maintain the quality of them;
- ensure that fisheries are not endangered or overexploited;
- encourage tourist and scientific interest; and
- ensure that the habitats of fish or aquatic life and the general environment are not detrimentally affected.

These overarching goals also need to be read in conjunction with the commitment as described in the Act to continued access to the resource for indigenous people.

In considering any change to possible management options for the mud crab fishery, it is necessary to have stakeholder and community discussion on the issues raised and to try and gain general agreement on desired objectives of the Management Plan.

The final objectives must also identify means to achieve those objectives and outcomes must be measurable. Performance Indicators are used to measure the success, or otherwise, of achieving the objectives of the management plan. The Standing Committee on Fisheries and Aquaculture (SCFA) has recommended some indicators that can be used when assessing the status of a fishery (Appendix VI) and it is recommended that these be adopted where appropriate for this fishery.

An overview of the proposed Objectives and Performance Indicators for the mud crab fishery are provided in Table 1.

Discussion Point 16: The appropriateness of the following objectives and performance indicators for the fishery to meet the needs of stakeholders and provide adequate protection for the resource and environment

Recommended objectives for the Mud Crab Fishery Management Plan are:

- To maintain long term sustainability of the mud crab resource.
- To achieve the optimal and quality yield mix from the resource.
- To minimise impact on unretained catch, protected wildlife, the environment and the ecological processes on which they rely.
- To create equitable, quality fishing opportunities for all stakeholder groups.
- To govern through a cost effective, easily understood and administered management regime.

Table 1. Proposed objective and performance indicators for the Mud Crab Fishery Management Plan

Objective	Performance Indicators
To maintain long term sustainability of the mud crab resource	<ul style="list-style-type: none"> • An annual review of catch and effort will be prepared as an indicator by 1 May each year. If catch shows a downward trend of greater than 10% per annum for two or more consecutive years, MCFAC will review existing controls. • An annual review of the monthly sample of the size of mud crab harvested in the commercial catch will be prepared by 1 May each year. If average sizes in the sample show a downward trend of greater than 5 mm per annum for two or more consecutive years, MCFAC will review existing controls (NB. this will require a substantial increase in the number of mud crabs being measured). • A compliance report will be prepared by 1 May each year, specifically indicating instances of prosecutions for over potting in the fishery. • The landings and proportion of total landings by all sectors (recreational, traditional and commercial sectors) will be estimated by 1 May 2003. • The current five year Strategic Research plan for Mud Crab will be reviewed by 1 September 2003. • A report will be prepared by 1 May 2004 on the suitability of the FRDC project "Methods to Estimate Abundance and Habitat for Northern Australian Mud Crab" as an indicator of fishing mortality or potential stock size.
To achieve the optimal and quality yield mix from the resource	<ul style="list-style-type: none"> • A code of practice for catching, handling, storing and transporting mud crab will be developed by 1 May 2001 with a view to minimising mortalities and maximising quality and value. • Effort levels will be monitored in the commercial and recreational sectors and any significant increase in either sector will be reviewed by MCFAC together with existing controls.
To minimise impact on unretained catch, protected wildlife, the environment and the ecological processes on which they rely	<ul style="list-style-type: none"> • A report will be prepared by 1 May 2003 which outlines the impacts the fishery has on protected wildlife and the environment. • A code of practice for catching, handling, storing and transporting mud crab will be developed by 1 May 2001 with a view to minimising mortalities and maximising quality.
To create equitable, quality fishing opportunities for all stakeholder groups	<ul style="list-style-type: none"> • The share of the 2000/01 annual catch, based on the National Recreational and Indigenous Fishing Survey, fishing tour operator and commercial catch statistics will be estimated, and used as a benchmark for future management decisions.
To govern through a cost effective, easily understood and administered management regime	<ul style="list-style-type: none"> • The management plan will be produced in a form that has explanatory notes provided. • Copies of the Plan will be produced in appropriate other languages such as Vietnamese and Khmer. • An education and information program will be developed for the fishery by 1 May 2002 or to coincide with the implementation of the new Management Plan.

6 MANAGEMENT FRAMEWORK FOR THE MUD CRAB FISHERY

The Mud Crab Fishery Management Plan was enacted in 1991 to formalise and cap potential effort and commercial access to the mud crab resource and place controls on the recreational sector. The conservative management regime was put in place early in the development of the fishery to ensure its sustainability by minimising the chance of effort overrun and allowing it to develop within discrete boundaries.

The fishery is managed by controlling effort, through input controls, in the commercial fishery and, through input controls (controlling effort) and output controls (possession limits) for the recreational sector.

The commercial sector is restricted to 49 fully transferable licences, each licensee is entitled to use up to 60 pots. The management plan must therefore have provisions that ensure overpotting does not occur, or if effort increases significantly by some other means, such as multiple pulling of pots or the development of new technology or techniques, changes to management arrangements can be made.

Similar restrictions will be necessary for the recreational sector if effort increases substantially or if it is found that the individual possession limit is too high and the total take of mud crabs exceeds what is considered sustainable. In the recreational sector there is no ceiling on the number of fishers who can take mud crab. This increased activity may be more evident in some localised areas such as Darwin Harbour and areas of Shoal Bay where commercial fishing is prohibited and the vast majority of recreational crabbing takes place.

Based on existing evidence, the mud crab resource is not under threat, but if fishing pressure is excessive there may be instances of localised depletion and a chance that some stock - recruitment relationship may become evident, particularly when the fishery possibly removes a large proportion of the resource, up to 70%, on an annual basis.

As a guiding principle, it is recommended that the bulk of the current management arrangements for the fishery be maintained, but that measures are put in place to strengthen effort controls. However, if one or more of the indicators outlined in Table 1 are triggered, it may be necessary to implement an agreed management response to ensure that the combined landings by all sectors do not threaten the long-term sustainability of the mud crab stocks.

Discussion Point 17: The appropriateness of setting a benchmark for catches or effort in each sector as a basis for future management arrangements

Background

It is suggested that the catch shares of each stakeholder group be determined as a benchmark for future management arrangements, with the National Recreational and Indigenous Fishing Survey to complement the current reports provided by fishing tour operators and commercial fishers. Such an approach will not only determine overall catches by all sectors, but will also provide a basis for evaluating future management arrangements. It may prove difficult to fully canvass the implications of alternative management directions without a well-developed understanding of the relative catch of individual sectors.

7 MANAGEMENT OPTIONS

A range of possible management options are canvassed in the following sections as potential directions for the mud crab fishery if any of the triggers in the performance indicators outlined in Table 1 are reached and remedial action is required.

Fisheries management measures generally fall within three broad categories: input controls, output controls or a combination of the two.

Input controls are measures that restrict catching potential by placing limits on fishers to restrict their fishing effort and include tools such as area and seasonal closures, gear and vessel restrictions and limits on the number of fishers or fishing days.

Output controls restrict what can be taken from the fishery and include size limits, possession limits and catch quota. Often a combination of both input and output controls are used in the management regime that is in place, e.g. restricted licence numbers and minimum size limits for permitted species and no bycatch allowed of other species.

Input and output controls seek the same result, that is, to ensure that the overall catch (all sectors) is within some measure of sustainable yield. The choice of controls that might be used depends on the characteristics of the fishery and the type of information required for cost effective assessment, management and compliance.

A number of management issues have been raised by various stakeholder groups or through workshop processes and these matters are generally discussed in the next sections. Views and comments are sought on the suitability of individual or a combination of management options to be implemented if overall effort in the fishery becomes excessive, or for some other reason further controls are required.

7.1 Input Controls

Landings within an input managed fishery are generally linked to the availability of stocks and are not constrained by a pre-determined calculated annual total allowable catch (TAC).

Input controls have been promoted in many fisheries as they are generally relatively cheap to administer, allow fishers to land more fish when they are abundant or available, and fewer fish when stocks are low. This is especially the case in fisheries where recruitment levels fluctuate, based on factors such as environmental perturbations, as is most likely the case with mud crab.

This means that there is some resilience from over-fishing in fisheries when there is a little latent (unused) effort, as is the case for the commercial mud crab fishery.

When using input controls, consideration must be made for circumstances where the catchability of the animal changes. For the purpose of this discussion paper, catchability means the proportion of the fished stock that is taken by one unit of fishing effort, for example the weight of crab taken per pot per day.

If catchability increases due to either technological improvements, crabbers behaviour or experience, catch rates may remain steady or increase even when stock levels could be declining. This means that management controls must deal with improved efficiency by operators, or take into account changes in fishing strategies if more crabs are taken for each unit of effort.

The existing input controls in the fishery are restricted licence numbers, some closures for the commercial sector and pot numbers and limitations on the type of gear that can be used for both the commercial and recreational sectors. The existing controls are included in the copy of the current Management Plan at Appendix I.

To stimulate discussion, a description of some possible input controls that could be considered for the fishery follow.

7.1.1 Minimum Size Limits and Sex Specific Protection

Discussion Point 18: The appropriateness of the present minimum size limits for mud crabs and both sex harvesting regime

Background

The minimum size limits for mud crabs were initially set at 130 mm across the widest part of the carapace of both males and females. This was based on best estimates when the initial management regime was put in place in the late 1980's.

Subsequent research indicated that at the 130 mm minimum size limit, only some 15% of female mud crab were reaching maturity before they were vulnerable to capture in the fishery.

This led to an agreement between user groups and the Fisheries Division to lift the minimum size limit for females to 140 mm. At this size around 70% have reached maturity before being subject to capture in the fishery.

From a sustainability perspective, there has been no indication that the present male minimum size limit of 130 mm is inappropriate.

Based on information obtained from commercial catch sampling, there has been no evidence of significant decline in average carapace width for either male or female mud crab. It should also be noted that the average size of mud crabs taken is still in excess of the minimum size limits. However, the current assessment is based on a very small sample size and thus there is a degree of uncertainty in the current conclusions.

An option that has been raised is a total protection of female mud crabs as is the case in Queensland. This has been rejected in the NT as a management option, as only harvesting one sex from a fishery can lead to a number of biological, compliance and marketing concerns. Some of the benefits of taking females are that total catches are increased, an even sex ratio is maintained in the population and females are preferred by some sections of the market.

7.1.2 Closures

Discussion Point 19: The appropriateness of extending the present closures in the mud crab fishery and areas, times and reasons for any extension

Background

Closures can be for a number of reasons such as social, economic or biological factors and seek to restrict fishing either during a particular time or season, or within a particular area, or a combination of the above. Closures may be fixed or rotational, in which different areas or seasons are alternatively open and closed. The introduction of a closed season may reduce overall fishing capacity.

A social closure is when an area is closed to minimise interaction between stakeholder groups. An example is Darwin Harbour and most of the creeks in Shoal Bay, which are closed to commercial crabbing, but open to other stakeholders. There have been some representations from recreational fishers to further partition the commercial sector from some of the recreational sector in other heavily crabbled areas such as the McArthur River.

Further examples of these types of closures are the use of "weekend" closures to commercial fishing where commercial fishers remove their gear over weekends or public holidays so as to again minimise stakeholder conflict (e.g. WA Cockburn Sound Blue Swimmer Crab Fishery). There are no such closures in the Northern Territory.

Economic closures can be used to maximise the return to the commercial sector. Examples of this are closures of total fisheries until the harvest species has reached a certain size which then provides a greater yield per recruit. The animal has been allowed to grow to a size where the return in weight or value is optimal. This strategy is used in a number of prawn fisheries which have an extended closure for biological reasons, but also a number of spatial closures for economic reasons. Closures could also be considered in times where the financial return from fishing is low due to a poor quality product.

Most closures are imposed for biological reasons such as during a well-defined spawning season to allow adults to breed and spawn without interference (e.g. NT barramundi fishery seasonal area closures). For a closure to protect spawners and be effective, it would be necessary to know the most important spawning areas and times.

Spatial closures, or the use of Marine Protected Areas (MPA's) have also been discussed as a management tool to ensure that a proportion of the total stock is protected from fishing and this then provides a safeguard against overfishing an entire stock down. Due to the spatial and temporal uncertainty of the entire lifecycle and what factors affect recruitment of mud crab, this option has not been considered particularly useful for this fishery at this time.

It must be remembered that the major down side to any closure is that during that period, the resource is not available to stakeholders to utilise which could cause difficulties with marketing, or reduce the availability of mud crabs in a popular area or time.

7.1.3 Adjustment of Fishing Capacity

Discussion Point 20: The appropriateness of the present pot entitlements for both the commercial and recreational sectors

Background

With the existing number of pots allowed for each sector, - 60 per commercial licence and five per person in the recreational sector - it appears that stocks are not under threat while good catches are being reported.

In the management of a fishery it is important to document changes in fishing practices and determine if they are leading to a significant increase in "real" fishing effort that may adversely impact on stocks.

In the commercial sector, the past 10 years have seen a number of changes such as increased size of vessel motors, pulling pots more than once a day and, in some instances, the use of an assistant to the crabber. At the same time the area of the declared fishery being worked has significantly expanded. This area expansion is expected to continue over the next few years as there are a significant number of areas around the coast that are not commercially harvested due to current poor access.

In the recreational sector, there is no limit on the total number of pots allowed in the fishery, but there is a five pot per person restriction as well as a maximum number of 10 per vessel. Any reduction of fishing capacity for this sector could involve either a reduction in the personal pot limit or the introduction of a system that limited the number of total entitlements of pots. This limited entitlement system has been used in South Australia for the issuance of rock lobster pots in the recreational sector.

7.1.4 Limiting of Commercial Fishing Days

This approach places a limit on the total number of fishing days available to the commercial sector to land the estimated annual harvest from the fishery. This is based on estimating the total available catch and how much fishing effort is required to take that amount of mud crab over the fishery.

Allocation of fishing days is always a contentious issue, but fishing days can be issued as a competitive allocation, that is simply limit the total number of commercial fishing days in any given period (month, six monthly, season, annually) or as an individual transferable effort unit.

As there are apparent fluctuations in recruitment to the fishery, most likely due to environmental factors, there is no clear estimate of total annual landings that can be taken from the fishery. It is therefore difficult to accurately determine the total effort required to take the catch each year.

This option would require a heavy financial and human resource commitment and an effective and comprehensive record keeping and compliance program would also need to be developed. It is not recommended at this time.

7.1.5 Gear Restrictions

/// **Discussion Point 21: The appropriateness of the present maximum dimensions for pots in light of the dimensions of existing pots in use and the need for escape gaps for undersize crabs**

Background

Under present legislation crab pots are allowed to have a maximum volume of 0.5 m³ and be up to 1 m in length. Most pots in use by both the commercial and recreational sectors at this time however are quite a bit smaller than this. Commercially they are normally made from steel mesh, with dimensions of approximately 70 cm x 60 cm x 20 cm, giving a volume of less than 0.1 m³. They have entrance funnels at both ends.

The recreational sector uses a wider variety of pot constructions from materials such as weldmesh, chicken wire or prawn netting.

The steel mesh in most pots has a 75 mm x 50 mm openings and this allows the majority of undersized mud crabs to escape. In his Ph D thesis Dr Ian Knuckey suggested that legislating for such mesh size, or ensuring that pots made of other material have escape hatches that let immature crabs escape, may be a prudent move.



Figure 3. Example of a typical commercial pot

Discussion Point 22: Should the use of “finger” type obstructions in crab pot funnels be prohibited?

Background

Entrance funnels in most commercial crab pots are made from 25 mm x 25 mm or 40 mm x 40 mm plastic mesh, are cone shaped with external dimensions about 225 mm x 150 mm and are fixed so that the funnel slopes downwards with the smaller aperture in the interior of the pot (see Figure 3).

This is one of the few design areas that have changed in at least some pots, the aim being to minimise the ability of mud crabs to escape once captured.

Although not widely used in the Northern Territory at present, in some fisheries in other states the entrance funnels have finger devices or non-return gates which close the entrance so that there can be no escape, even if pots are lost.

A prohibition on devices that close the funnel entrance may need to be considered, not only for the commercial sector, but also the recreational sector.

Discussion Point 23: The appropriateness of all commercial pots and all recreational pots and dillies to have tags attached to them in addition to a float with the name of the user or licence number on it

Background

While all pots are required by law to have, in the case of the commercial sector, the licence number on their floats and, in the recreational sector, the owner’s name, it is easy to place pots in the water without such identification.

It has been suggested that the capacity of enforcement to adequately deal with illegal overpotting would be enhanced if all pots and dillies had a tag attached to them with appropriate identification, in addition to that on floats.

7.1.6 Allocation of Fishing Territories

On occasion in past years the concept of allocation of fishing territories, or “regionalisation”, of the commercial fishery has been put forward.

In 1997, Professor Carl Walters from Canada, while leading an extensive workshop in Darwin to determine the status of NT mud crab stocks, the state of the fishery and possible management options, included the allocation of specific crabbing areas to particular licences.

Whilst “regionalisation” may be a legitimate management technique in some fisheries, it is not considered applicable to the mud crab fishery for a number of reasons, including:

- Uncertainty about annual recruitment and the fluctuations that this may bring to particular regions.
- Concerns and difficulties associated with rights to access and the conflicts/disadvantages that could arise due to legislation other than that from the Fisheries Division jurisdiction.
- Significant difficulties associated with designing a fair and equitable allocation process.

7.2 Output Controls – Commercial Fishery

In commercial fisheries, output control is a style of management that is suited to species that are long lived, stocks that are relatively stable or for which resource fluctuations are well known,

fishing methods are selective and details about bycatch species are well understood. Most importantly, to be an effective management tool, output controls require comprehensive annual predictive estimates of the abundance of the fished stock.

The success of output controls to ensure sustainability is linked to the setting of the annual catch level, often termed the Total Allowable Catch (TAC). This is usually made on the basis of historical abundance, using indices such as series of catch and effort or survey estimates. To be completely effective the annual total catch should include estimates of all fishing related mortalities of the resource, including commercial, recreational and indigenous extraction as well as mortalities related to other aspects of fishing, such as survival of released bycatch.

A miscalculation of available quota may lead to fishers overfishing a stock if the TAC is set too high, or a loss of economic return if the TAC is set too low, especially in the case of short lived species which may not be available for harvest the following season.

The financial cost of running quota programs is generally much higher than for input controlled fisheries and is often more difficult to administer and enforce, especially for high value products that have a significant black market potential, such as abalone.

With the current level of knowledge of the commercial mud crab fishery, it would not be possible, based on scientific quantification, to determine an annual TAC. If the TAC is set on average catch over a period of time, in a fishery with uncertainty over recruitment, the chance of the TAC being too high or too low is likely.

The threats to sustainability described previously for changes in catchability are even more pronounced than for input controls, as output controls have no inherent response to changes in abundance.

7.3 Output Controls – Recreational Fishery

For the recreational sector the use of possession limits are a commonly used management tool. They can engender a conservation ethic, reduce localised depletions, protect heavily fished areas or species, assist in reducing the sales of illegally caught fish on the black market and generally enhance compliance.

In some other fisheries, a notional allowable catch for the recreational sector has been determined and the limits are based on estimated recreational participation rates and individual catches. However as the number of fishers in the recreational sector are not generally limited, individual possession limits are often based on what is perceived as a reasonable or conservative amount of catch per person.

Even with the significant recreational fishery around Darwin and large commercial and recreational fishery in the McArthur River, most recreational crabbers still seem to be able to take sufficient crab. This could of course change in the future if recruitment levels decrease, or there is greater crabbing activity leading to less available crab for each crabber.

APPENDIX I: MUD CRAB FISHERY MANAGEMENT PLAN

**NORTHERN TERRITORY OF AUSTRALIA
MUD CRAB FISHERY MANAGEMENT PLAN
As in force at 29 November 1995
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Mud Crab Fishery Management Plan

NORTHERN TERRITORY OF AUSTRALIA

This reprint shows the Plan as in force at 29 November 1995. Any amendments that may come into operation after that date are not included.

MUD CRAB FISHERY MANAGEMENT PLAN
Plan under the *Fisheries Act*

PART 1 - preliminary

1. Citation

This Plan may be cited as the Mud Crab Fishery Management Plan. (*See back note 1*).

2. Commencement

This Plan shall become operative on 1 February 1991.

3. Application

This Plan applies to the managed fishery relating to the species of crustacean of the genus *Scylla* known as mud crabs declared by notice in *Gazette* No. G12 of 28 March 1990.

PART 2 - controls

Division 1 - Preliminary

4. Interpretation

(1) In this Part, unless the contrary intention appears –

"berried female mud crab" means a female mud crab on which eggs are attached to the pleopods under the abdominal flap;

"day" means a 24 hour period from midnight to midnight;

"entanglement material" means material or twine less than 1.5 mm in diameter but does not include wire;

"mud crab" means a crab, or part of a crab, of the genus *Scylla* and includes, in relation to a mud crab -

- (a) an egg or larva;
- (b) a dead body or part of a dead body; and
- (c) a shell or exoskeleton or part of a shell or exoskeleton;

"mud crab licence" means a licence entitling the holder to fish in the mud crab fishery referred to in clause 3;

"mud crab licensee" means a person holding a mud crab licence;

"pot" includes a dilly pot, crab pot and a device designed to act as a trap or that may act as a trap for mud crabs;

"river closure line" means, in respect of a river specified in Schedule 1, a straight line drawn through the co-ordinates specified in that Schedule for that river so as to intersect with and be on the same plane as the highwater mark of the coast.

(2) An approval of the Director under this Part shall be in writing and may be subject to such conditions, restrictions or limitations as the Director thinks fit and specifies in the approval.

4A. Berried mud crab not to be taken

(1) A person shall not take a berried female mud crab.

Penalty: \$5,000

(2) A berried female mud crab shall be deemed not to have been taken if, immediately after capture, it is returned to the body of water or the mud from which it was taken, with as little injury to the crab as possible.

5. When mud crab not taken or in possession

Subject to this Part, a mud crab, other than a berried female mud crab, shall be deemed not to have been taken by, or to be in the possession of, a person if, as soon as practicable after it has been taken and the expiration of such time as is reasonably necessary to enable the mud crab to be measured, it is returned to the water with as little damage to it as possible.

Division 2 - Commercial Fishing

6. Division applies to commercial fishing

This Division applies to a mud crab licensee and a person assisting a mud crab licensee, and a reference to a mud crab licensee includes such a person.

6A. Number of licences

The Director shall not issue more than 49 Mud Crab Fishery licences.

6B. Transfer of licence

A mud crab licensee may transfer his or her licence.

7. Processing of mud crabs

A mud crab licensee shall not process mud crabs for sale, other than by cooking, freezing or chilling, except on the premises of a person licensed to buy and sell fish.

Penalty: \$5,000.

8. Fishery area

(1) Subject to this clause, a mud crab licensee shall not fish for mud crabs under a mud crab licence in a river specified in Schedule 1 landward of the river closure line.

Penalty: \$10,000.

(2) A mud crab licensee shall not fish under a mud crab licence in the Port of Darwin landward of a straight line running across the harbour entrance, the co-ordinates of which are:

Port of Darwin Map Sheet: Darwin 5073

6919 E 86236 N to 7059 E 86360 N

Penalty: \$10,000.

(3) A mud crab licensee shall not fish for mud crabs under a mud crab licence in waters which are not subject to tidal influence.

Penalty: \$10,000.

9. Possession of pots

A mud crab licensee shall not have possession of pots other than -

(a) at a permanent residence of a mud crab licensee;

(b) at an approved site;

(c) on or in waters referred to in clause 8 which are open to mud crab fishing;

(d) in a port; or

(e) in transit, by the most practicable direct route, to or from a place referred to in paragraph

(a), (b), (c) or (d).

Penalty: \$5,000.

10. Minimum size - commercial

A mud crab licensee shall not, under the mud crab licence, take or have possession of -

(a) a female mud crab that measures less than 140 mm; or

(b) a male mud crab that measures less than 130 mm,

across the widest part of the carapace.

Penalty: \$5,000.

10A. Certain fish not to be taken

A mud crab licensee shall not take, using a restricted bait net, barramundi, threadfin salmon or Spanish mackerel under the licence.

11. Commercial gear

(1) Subject to this clause, a mud crab licensee shall fish for mud crabs under a mud crab licence only using pots.

Penalty: \$5,000.

(2) A mud crab licensee shall not fish for mud crabs under a mud crab licence using a pot that -

- (a) has a capacity greater than 0.5 m³;
- (b) exceeds 1 m in length on its longest side or 1 m in height or diameter;
- (c) has more than 2 openings into any enclosure (excluding any opening for emptying mud crabs from, or for placing bait in, the pot);
- (d) is constructed of entanglement material; or
- (e) does not have attached to it a float, having a minimum diameter or length of 80 mm, on which is clearly and legibly marked only the mud crab licensee's licence number, in Arabic numerals, either -
 - (i) incised into;
 - (ii) painted with waterproof paint on; or
 - (iii) marked with indelible material on,

the float.

Penalty: \$5,000.

(3) A mud crab licensee shall not fish for mud crabs under a mud crab licence using more than 60 pots.

Penalty: \$5,000.

(4) Subject to this clause, a mud crab licensee may, under a mud crab licence, use a restricted bait net only -

- (a) if the net -
 - (i) is not fixed, anchored or staked; or
 - (ii) is fixed, anchored or staked at one end only, whereupon it may be used by -
 - (A) hauling the other end by hand; or
 - (B) attaching the other end to a vessel which is not anchored or fixed, in which case the vessel may be used for hauling the net;
- (b) within the area extending seaward from the coast from the high water mark to an imaginary line following the coastline 3 nautical miles from the low water mark;
- (c) for the taking of fish to be used by the licensee as bait for use with pots in the fishery;
- (d) if it is, when catch is being cleared, in not less than 30 cm of water; and
- (e) if it is not left unattended while in use.

(5) Subject to this clause, a mud crab licensee shall not have possession of a restricted bait net in the area specified in Schedule 2.

(6) A mud crab licensee may have possession of a restricted bait net in the area specified in Schedule 2 -

- (a) in an area in respect of which he or she has been granted an approval under subclause (8); or
- (b) on a road extending from Borrooloola to Bing Bong.

(7) A mud crab licensee may apply in writing to the Director for approval to have possession of a restricted bait net in the area specified in Schedule 2.

(8) The Director may -

- (a) grant, in writing, on such conditions as the Director thinks fit; or
- (b) refuse to grant,

an approval for a mud crab licensee to have possession of a restricted bait net in the area specified in Schedule 2.

(9) Where a mud crab licensee has been granted an approval under this clause, he or she shall keep the approval, or a copy of the approval, in the proximity of the restricted bait net while in the area specified in Schedule 2.

Division 3 - Amateur Mud Crab Fishery

12. Amateur fishing gear

(1) Subject to this Part, a person shall not fish for mud crabs except by hand or by the use of a pot, hand-spear, hand-held hook, hook and line, hand-net, cast-net or beach seine.

Penalty: \$5,000.

(2) Subject to this Part, a person shall not fish for mud crabs using a pot that -

- (a) has a capacity greater than 0.5 m³;
- (b) exceeds 1 m in length on its longest side or 1 m in height or diameter;
- (c) has more than 2 openings into any enclosure (excluding any opening for emptying mud crabs from, or for placing bait in, the pot);
- (d) is constructed of entanglement material; or
- (e) does not have attached to it a float, having a minimum diameter or length of 80 mm, on which is clearly and legibly marked the person's name either -
 - (i) incised into;
 - (ii) painted with waterproof paint on; or
 - (iii) marked with indelible material on,

the float.

Penalty: \$2,000.

13. Possession of pots by amateur fishermen

(1) Subject to this Part, a person shall not -

- (a) have possession of, other than at a permanent residence; or
- (b) fish for mud crabs using,

more than 5 pots unless under a mud crab licence.

Penalty: Possession or use of 6 to 10 pots - \$2,000; or

Possession or use of more than 10 pots - \$10,000.

(2) Notwithstanding subclause (1), where more than one person is in or on a vessel the maximum number of pots that may be -

- (a) in or on the vessel; or
- (b) used to fish for mud crabs while using the vessel,

is 10 unless otherwise permitted under a mud crab licence.

Penalty: Presence or use of 11 to 20 pots - \$2,000; or

Presence or use of more than 20 pots - \$10,000.

(3) Where the number of pots in the possession of a fisherman exceeds the number prescribed in subclause (1) and paragraphs (a) or (b) of that subclause do not apply, then, notwithstanding that possession, if the fisherman establishes that -

- (a) he or she is a member of a fishing party; and
- (b) if the number of pots were to be apportioned as equally as possible amongst those fishermen in the party who are present or able to be assembled in a short period of time, no fisherman in the party would be guilty or contravening subclause (1),

the fisherman shall be regarded as having possession only of the number of pots so apportioned to him or her.

(3) For the purposes of subclause (1), where the number of pots in the possession of fishermen who are members of a fishing party exceeds 5 pots for each fisherman and it is not readily ascertainable which fisherman has possession of the pots, then each fisherman in the fishing party shall be regarded as having possession of all of the pots and to have more than the number of pots permitted under that subclause.

14. Certain waters not open to amateur fishing

A person shall not fish for mud crabs in waters that are not subject to tidal influence.

Penalty: \$2,000.

15. Minimum size - recreational

A person shall not take or have in possession, except under a licence or permit -

- (a) a female mud crab that measures less than 140 mm; or
- (b) a male mud crab that measures less than 130 mm,

across the widest part of the carapace.

Penalty: \$2,000.

16. Number of mud crabs in possession

(1) A person shall not fish for mud crabs on any one day if that person has previously taken 10 mud crabs on that day unless under a mud crab licence entitling the person to do so.

Penalty: \$2,000.

(2) A person shall not have possession of more than 10 mud crabs, unless -

(a) under a licence entitling the person to do so;

(b) the person has a receipt or proof that the mud crabs were obtained legally from a licensee; or

(c) in a permanent residence.

Penalty: Possession of 11 to 20 mud crabs - \$2,000; or

Possession of more than 20 mud crabs - \$10,000, and,

in addition, \$50 for each mud crab in excess of 10.

(3) Notwithstanding subclause (2), where more than 3 persons are in or on a vessel the maximum number of mud crabs that may be in or on the vessel is 30, unless -

(a) otherwise permitted under a licence; or

(b) a person in or on the vessel has a receipt or proof that the mud crabs were obtained legally from a licensee.

Penalty: Presence of 31 to 40 mud crabs - \$2,000; or

Presence of more than 40 mud crabs - \$10,000, and,

in addition, \$50 for each mud crab in excess of 30.

(4) Where the number of mud crabs in the possession of a fisherman exceeds the number prescribed in subclause (2) and paragraphs (a), (b) or (c) of that subclause do not apply, then, notwithstanding that possession, if the fisherman establishes that -

(a) he or she is a member of a fishing party;

(b) the mud crabs taken will be shared amongst the members of the fishing party; and

(c) if the sharing was to take place amongst those fishermen in the party who are present or able to be assembled in a short period of time, no fisherman in the party would be guilty of contravening subclause (2),

the fisherman shall be regarded as having taken, and having possession of, his or her share only of the mud crabs in possession.

(5) For the purposes of subclause (2), where the number of mud crabs in the possession of fishermen who are members of a fishing party exceeds the number prescribed in that subclause, paragraph (a), (b) or (c) of that subclause does not apply and it is not readily ascertainable which fisherman is in possession of the mud crabs, then each fisherman in the fishing party shall be regarded as having possession of the mud crabs permitted under that subclause.

SCHEDULE 1

Clauses 4, 8

RIVER CLOSURE LINES

Buffalo Creek Map Sheet: Darwin 5073

Co-ordinates:

7073 E 86353 N to 7077 E 86351 N

Micket Creek Map Sheet: Darwin 5073

Co-ordinates:

7115 E 86344 N to 7119 E 86342 N

King Creek Map Sheet: Koolpinyah 5173

Co-ordinates:

7181 E 86332 N to 7183 E 86330 N

Howard River Map Sheet: Koolpinyah 5173

Co-ordinates:

7208 E 86324 N to 7219 E 86329 N

Leaders Creek Map Sheet: Koolpinyah 5173

Co-ordinates:

7301 E 86527 N to 7301 E 86534 N

SCHEDULE 2

Clause 11

AREAS IN WHICH LICENSEE NOT TO BE IN POSSESSION OF OR USE RESTRICTED BAIT NET

All that part of the Northern Territory bounded by an imaginary line -

(a) to the north commencing on the western side of Bing Bong Creek at grid reference 6410E 82759N (Sheet 6166 Edition 1 Bing Bong); then due north to a point 3 nautical miles past the straight baselines surrounding the Sir Edward Pellew Group then easterly and southerly parallel to the straight line baseline to within 3 nautical miles of the coast at low water mark then south easterly and parallel to the coast 3 nautical miles from low water to the border of the Territory with Queensland;

(b) from there to the east commencing at a point along the border of the Territory with Queensland 3 nautical miles from low water mark then south to a point where the border intersects the northern side of the Carpentaria Highway near Wollogorang at grid reference 8191E 80944N (Sheet 6463 Edition 1 Wollogorang);

(c) from there to the south commencing at a point where the border intersects the northern side of the Carpentaria Highway at grid reference 8191E 80944N (Sheet 6463 Edition 1 Wollogorang) then in a north westerly direction towards the township of Borroloola to the turn off from the Carpentaria Highway to Borroloola at grid reference 6394E 82207N (sheet 6165 Edition 1 Borroloola);

(d) from there to the west in a north, north westerly direction from grid reference 6394E 82207N (Sheet 6165 Edition 1 Borroloola) to the Blue Lagoon Yard at grid reference 6238E 82498N (Sheet 6166 Edition 1 Bing Bong) then north east back to the point of commencement at the western side of Bing Bong Creek at grid reference 6410E 82759N (Sheet 6166 Edition 1 Bing Bong).

NOTE: All maps referred to are part of the National Topographic Map Series Australia 1:100,000.

Notes

The Mud Crab Fishery Management Plan in force under sections 25 and 49 of the *Fisheries Act* as amended by section 3 of the *Statute Law Revision Act 1991*, comprises the Mud Crab Fishery Management Plan as published in *NT Government Gazette* No. 56 of 31 January 1991, as amended by the Regulations specified in the following table:

Year and number	Date made	Date notified in the <i>Gazette</i>	Date of commencement
Mud Crab Fishery Management Plan (a)	24 Jan 1991	31 Jan 1991	1 Feb 1991 (<i>See</i> clause 2)
Mud Crab Fishery Management Plan Amendment	2 Apr 1993	5 Apr 1993	5 Apr 1993
1995, No. 38	14 Nov 1995	29 Nov 1995	29 Nov 1995 (a) Section 49(1) of the <i>Fisheries Act</i> was substituted by section 3(3) of the <i>Statute Law Revision Act 1991</i> . Section 3(3) of the <i>Statute Law Revision Act 1991</i> provides as follows:

Table of Amendments

Regulation

4. Amended by *N.T. Gov. Gazette* No. S35 of 5/4/93

4A. Inserted by *N.T. Gov. Gazette* No. S35 of 5/4/93

5. Amended by *N.T. Gov. Gazette* No. S35 of 5/4/93; substituted by 1995, No. 38

6A. Inserted by 1995, No. 38

6B. Inserted by 1995, No. 38

10. Amended by 1995, No. 38

10A. Inserted by 1995, No. 38

11. Amended by 1995, No. 38

15. Amended by 1995, No. 38

Schedule 2 Added by 1995, No. 38

APPENDIX II: SUMMARY HISTORY OF MANAGEMENT ARRANGEMENTS

Year	Catch	Milestone
1972	na	<ul style="list-style-type: none"> Recreational crabbers required to register up to 3 pots for a \$5.00 fee.
Prior 1980	na	<ul style="list-style-type: none"> Mud crabs could be taken commercially on a General Fishing Licence. No restriction on number of pots allowed.
1980	na	<ul style="list-style-type: none"> Specific fishery for Mud Crabs developed in 1980 with 61 licence. No restriction on number of pots allowed.
1982	na	<ul style="list-style-type: none"> licence numbers peak at 112.
1984	24 t	<ul style="list-style-type: none"> Increasing fishing effort so \$5/pot fee introduced with no restriction on number of pots allowed. 45 licences issued.
1985	91 t	<ul style="list-style-type: none"> Effort continues to increase so moratorium placed on issuing of any new mud crab licences and cap set at a maximum of 55. Agreed management regime put in place which allowed transferability of licences, 60 pot maximum and some closures to commercial crabbing in Darwin Harbour, Leaders Creek and most of the creeks in Shoal Bay. Minimum size limit for males and female mud crabs of 130 mm. Recreational crabbers no longer required to register pots.
1988	116 t	<ul style="list-style-type: none"> Maximum number of licences permitted in the fishery reduced to 49. This was the number that were active immediately prior to the 1985 limitation.
1990	134 t	<ul style="list-style-type: none"> Fishery declared a managed fishery and the Mud Crab Fishery Advisory Committee formed to develop a Plan of Management.
1991	143 t	<ul style="list-style-type: none"> Management Plan in force 1 February 1991. Commercial licence numbers set at 49 using 60 pots. Closures around Darwin remain in place. Recreational crabbers entitled to use 5 pots each, with a maximum of 10 per vessel. A recreational possession limit in place of 10 per person with a maximum of 30 per vessel.
1993	226 t	<ul style="list-style-type: none"> Amendment to the Management Plan saw the protection of berried female mud crabs and prohibiting the use of tangle nets.
1996	569 t	<ul style="list-style-type: none"> Amendment to the Management Plan saw the increase of the minimum size limit for female mud crabs increased to 140 mm and the prohibition of possession of restricted bait nets for commercial crabbers in the area from Bing Bong Creek to the Queensland border.
1999	757 t	<ul style="list-style-type: none"> National Five Year Research Strategy Developed for Mud Crab.
2000	≈ 1000 t	<ul style="list-style-type: none"> Review of Plan Commenced.

APPENDIX III: AUSTRALIA'S GOAL, OBJECTIVES AND GUIDING PRINCIPLES FOR ESD

THE GOAL IS:

Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

THE COPE OBJECTIVES ARE:

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations
- to provide for equity within and between generations
- to protect biological diversity and maintain essential ecological processes and life-support systems

THE GUIDING PRINCIPLES ARE:

- decision making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations
- where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- the global dimension of environmental impacts of actions and policies should be recognised and considered
- the need to develop a strong, growing and diversified economy which can enhance the capacity for, environmental protection should be recognised
- the need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised
- cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms
- decisions and actions should provide for broad community involvement on issues which affect them

These guiding principles and core objectives need to be considered as a package. No objective or principle should predominate over the others. A balanced approach is required that takes into account all these objectives and principles to pursue the goal of ESD.

**APPENDIX IV: THE PROCESS FOR DEVELOPMENT OF THE
MANAGEMENT PLAN**

DISCUSSION PAPER PREPARED



***PUBLIC COMMENT SOUGHT
(* we are here)***



COMMUNITY RESPONSES RECEIVED AND CONSIDERED



DEVELOPMENT OF DRAFT MANAGEMENT PLAN



PUBLIC COMMENT SOUGHT



COMMUNITY COMMENT RECEIVED AND CONSIDERED



FINAL MANAGEMENT PLAN IN PLACE

APPENDIX V: MUD CRAB (*SCYLLA SERRATA*) THE SPECIES

The mud crab, *Scylla* sp, are a large aggressive portunid crab which feeds on shellfish, worms, small crustaceans, vegetation as well as fish and meat scraps. Four species of *Scylla* have been identified, *S. serrata*, *S. paramamosain*, *S. oceanica* and *S. tranquebarica*, but the NT fishery is based on *S. serrata* with very small numbers of *S. oceanica* taken (less than 0.5% of the catch).

S. serrata has a broad smooth shell (carapace) with nine equally sized spines on either side of the eyes. Its two large claws are used for feeding and defence, and the most posterior legs are flattened for swimming. The colour can range from dark brown to blue to a mottled green. Mud crabs are widely distributed throughout the Indo-west Pacific region usually in mangrove and estuarine habitats. In Australia, the mud crab extends from the mid coast of New South Wales north through Queensland and the Northern Territory to the mid coast of Western Australia.

The mud crab, like all hard shelled crustaceans, must undergo the complicated process of moulting if it is to grow. When a crab is ready to moult, it splits out of its old shell and forces itself out backwards using body fluids to expand to a larger size. It may take two days before the crab can defend itself until the new soft shell slowly hardens at the larger size. Mud crabs in this phase are often termed "soft" or "empty" because the meat has not yet had time to develop within the weak shell and this may take a few weeks.

Juvenile mud crabs have proved difficult to find in the NT, but it is believed that they generally live in the high mangrove zone of tidal areas where they scavenge for plant and animal matter. The mud crabs moult often as they grow and based on research undertaken in the Northern Territory, it appears that they reach about 100 to 120 mm carapace width in the first year. Within the second year, mud crabs are between 130 - 170 mm width and have reached maturity. The larger mature mud crabs tend to feed more in sub-tidal areas in creeks and rivers and on the mud flats.

As juveniles, male and female mud crabs are difficult to differentiate. However, noticeable differences between the sexes become obvious as they reach maturity. Females develop a large, rounded, pigmented abdominal flap which is modified to carry and protect the eggs, whereas males have a thin, unpigmented triangular abdominal flap and develop very large claws compared to the females. Juvenile females do not have the same rounded pigmented flap as mature females, but exhibit a broadbased, triangular shaped, unpigmented flap.

Based on the presence of a mature abdominal flap, around 50% of females have reached maturity at 136.5 mm carapace width and most mature females have mated.

For males, it appears that based on the presence of sperm, mud crabs around 110 – 120 mm are physically mature. Functional maturity (males that have mated) can be determined based on the presence of what are termed mating scars on the sternum and first walking leg. The minimum size that these scars were found was around 125 mm, but most males with these marks were on average between 150 to 165 mm in carapace width. Although it appears that all female mud crabs mate, only around 30% of males have mating scars.

Mating can only occur after a mature female, or an immature female about to reach maturity, has moulted and the new shell is still soft. When a female is about to moult, a male will hold her underneath him with the first pair of his walking legs. In this "doubled" position, which may be maintained for up to one week, the male can protect the female during moulting and mating, until she can defend herself. The female is turned upside down during mating, her abdominal flap is lifted over the back of the male shell. In this position the male transfers gelatinous bags of sperm to the female which are stored until her eggs have matured enough to be fertilised. Females can mate more than once and can spawn up to three times from a single mating.

Around November, December, which may be up to several months after mating, the females migrate offshore to spawn. Specimens have been reported up to 50 km from land. The eggs (up to 8 million) developing in the ovaries are fertilised as they are transferred to the feather like structures that carry the eggs under the female's abdominal flap. The eggs hatch into free-

swimming larvae called zoea 20-40 days after fertilisation. As the zoea drift with other plankton inshore with the currents, they moult and change from zoea through the megalopa phase until they attain the form of a juvenile mud crab with a shell width of 3 - 5 mm. They then remain in the estuarine environment as they grow to maturity. Mud crabs live for 3 to 4 years.

APPENDIX VI: SCFA – POSSIBLE INDICATORS FOR MAJOR FISHERY COMPONENTS

Information from SCFA, FRDC ESD Case Study Package

Possible Indicators for each Major Component - Retained Species

- Catch -Commercial, Recreational, Illegal
- Five Year Catch Trend
- Predicted versus Actual Catch
- Predicted versus actual effort level (quota fisheries)
- Trends in catch rates
- Trends in fishing area
- Distributional range of stock
- Comparison of current catch to harvest strategy prediction
- Recruitment Index
- Ratio of Current to Unfished Spawning Biomass
- Relative levels of Egg Production (e.g. current/unfished)
- Probability of future biomass being above reference point (conditional on current exploitation rate)
- Estimate of Total Mortality
- Estimate of Fishing Mortality
- Average Size
- Average Age
- Ratio of fishing to natural mortality
- Ratio of fishing mortality to reference points (e.g. F0.I, F_{rep} etc)
- Eggs or breeding opportunities per recruit.

Stock Status	Definition
Under Fished	The appraisal of a fish stock that suggests that the stock has the potential to sustain catches higher than those currently being taken without significant risk of overfishing
Moderately Fished	The stock is assessed to be fished at levels which would probably allow only limited increases in catches without significant risk of overfishing.
Fully Fished	The appraisal of the status of a stock which suggests that current catches are sustainable and close to optimum levels (the definition of which may vary between fisheries; e.g. catches are close to maximum sustainable yield, or fishing effort is close to a biological reference point). In a fully fished fishery, significant increases in fishing effort above current levels may lead to overfishing
Over Fished/Depleted	The appraisal suggests that current fishing levels may not be sustainable, and/or yields may be higher in the long term if the fishing level is reduced in the short term. This may be due to recruitment overfishing, growth overfishing and/or as a result of habitat degradation.
Uncertain	There is insufficient information to allow a reliable assessment of stock status the status of this stock.

FURTHER SUGGESTED READINGS

- Calogeras, C.E. (2000). Towards a National Strategy for Mud Crab Research, Mud Crab Workshop, Darwin, Northern Territory 29-31 May 1999. DPIF Fishery Report No. 48.
- Calogeras, C.E. and Hay, T.A. (1997). Mud Crab Fishery Status Report - 1996.
- Calogeras, C.E. and Hay, T.A. (1997). Mud Crab Fishery Status Report - 1999.
- Calogeras, C.E. and Knuckey, I. (1995). Don't be Caught Short, The Minimum Size Limit of Female Crabs in the NT will increase in January 1996, DPIF Fishnote No. 18.
- Calogeras, C.E. and Knuckey, I.A. (1995). Mud Crab Fishery Status Report - 1994.
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- Calogeras, C.E., Johnson, P. and Hay, T.A. (1997). How to Catch Crabs in the Top End, DPIF Fishnote No. 24.
- Coleman, A.P.M. (1998). FISHCOUNT: A survey of recreational fishing in the Northern Territory. NT DPIF. Fishery Report 43.
- Hay, T. (2001). Northern Territory Mud Crab Fishery Assessment Report – 2000. DPIF Fishery Report No. 53.
- Knuckey, I.A. (1996). Maturity in male mud crabs, *Scylla serrata* (Forsk.) and use of mating scars as a functional indicator. *Journal of Crustacean Biology* 16(3):487-495.
- Knuckey, I.A. (1999). Mud crabs, *Scylla serrata*, Population Dynamics in the Northern Territory, Australia and their Relationship to the Commercial Fishery. Ph.D. Thesis (Northern Territory University).
- Knuckey, I.A. and Calogeras, C.E. and Johnson, P. (1992). Muddle Muddies, A Look at the Parasite *Loxothylacus ihlei* and its Effect on the Mud Crab, *Scylla serrata*, DPIF Fishnote No. 13.
- Knuckey, I.A. and Calogeras, C.E. (1995). Tie Me Muddie Up Tight Sport, How to Handle, Tie and Store Mud Crab, DPIF Fishnote No. 14.
- Knuckey, I.A., Davie, P.J.F. and Canon, L.R.G. (1985). *Loxothylacus ihlei* (Boschma) and its effects on the mud crab, *Scylla serrata* (Forsk.) in northern Australia. *Journal of Fish Diseases* 18:389-395.
- Mounsey, R. (1989) Northern Territory Mud Crab Fishery Investigation. DPIF Fisheries Report No.19.
- Ramm, D. ed. (1997) Towards the Sustainable Use of NT Fishery Resources (a series of 4 week long workshops), Darwin, NT (1996, Dr Carl Walters).

RESPONSE PROFORMA

This form and postage paid envelope at the back of the document have been provided to assist you in considering and responding to the discussion paper and especially the Discussion Points raised in the document.

To ensure that MCFAC and the Director of Fisheries can fully assess your comments, respondents are requested to provide a brief reason for the particular views provided. If appropriate, please advise of sources of information and suggest alternate ways to resolve any of the issues raised.

Discussion Points	Comments and reasons for views
<p>/// Discussion Point 1:</p> <p>The desirability of returning berried crabs; undersize, commercially unsuitable or damaged crabs immediately to the water unharmed prior to returning to the fishing base and tying retained crabs prior to returning to the fishing base</p>	
<p>/// Discussion Point 2:</p> <p>The appropriateness of draft guidelines for the use of mud crab holding cages located at a crabber's base</p>	
<p>/// Discussion Point 3:</p> <p>Is it reasonable to allow commercial crabbers to use their "restricted bait net" entitlement wherever they are allowed to fish?</p>	

<p>/// Discussion Point 4:</p> <p>If the prohibition on using restricted bait nets was to be continued in the area from Sharker Point to the Queensland border, should extra pots be allocated to licences to offset for the loss of the use of bait net? If extra pots were allowed in a specific area, what effort adjustments should be made to maintain a cap on total effort in the fishery?</p>	
<p>/// Discussion Point 5:</p> <p>The adequacy of the proposed penalty structure as a deterrent for over potting in commercial harvesting operations</p>	
<p>/// Discussion Point 6:</p> <p>The possible unitisation of commercial mud crab fishery licences in terms of numbers of pots per unit and the desirability or otherwise of making such units both temporarily and permanently transferable</p>	
<p>/// Discussion Point 7:</p> <p>Should a nil bycatch of mud crab continue to apply in all other commercial fisheries in the Northern Territory?</p>	

<p>/// Discussion Point 8:</p> <p>Should the current prohibition of processing crabs except at a registered trader/processor establishment continue?</p>	
<p>/// Discussion Point 9:</p> <p>The appropriateness of restricting each mud crab licence to the use of one fishing platform, that is, vessel, at any one time during a harvesting operation</p>	
<p>/// Discussion Point 10:</p> <p>Should all persons who trade in mud crab be required to have appropriate premises to store and pack crabs, pay appropriate licence fees and report on sales that they make</p>	
<p>/// Discussion Point 11:</p> <p>The appropriateness of keeping the present recreational sector mud crab possession limits in place:</p> <ul style="list-style-type: none"> • 10 mud crabs in possession per person or 30 per vessel (if 3 or more people are on the vessel) 	

<p>/// Discussion Point 12:</p> <p>The adequacy of the current penalty regime as a suitable deterrent for people in the recreational sector who exceed the mud crab possession limits</p>	
<p>/// Discussion Point 13:</p> <p>The appropriateness of reintroducing the requirement for recreational mud crabbers to register their pots</p>	
<p>/// Discussion Point 14:</p> <p>Should the use of the currently permitted recreational fishing gear of spears and crab hooks be prohibited?</p>	
<p>/// Discussion Point 15:</p> <p>The appropriateness of continuing the requirement for Fishing Tour Operators to abide by the recreational pot and possession limits</p>	
<p>/// Discussion Point 16:</p> <p>The appropriateness of the following objectives and performance indicators for the fishery to meet the needs of stakeholders and provide adequate protection for the resource and environment</p>	

<p>/// Discussion Point 17:</p> <p>The appropriateness of setting a benchmark for catches or effort in each sector as a basis for future management arrangements</p>	
<p>/// Discussion Point 18:</p> <p>The appropriateness of the present minimum size limits for mud crabs</p>	
<p>/// Discussion Point 19:</p> <p>The appropriateness of extending the present closures in the mud crab fishery and areas, times and reasons for any extension</p>	
<p>/// Discussion Point 20:</p> <p>The appropriateness of the present pot entitlements for both the commercial and recreational sectors</p>	
<p>/// Discussion Point 21:</p> <p>The appropriateness of the present maximum dimensions for pots in light of the dimensions of existing pots in use</p>	
<p>/// Discussion Point 22:</p> <p>Should the use of “finger” type obstructions in crab pot funnels be prohibited?</p>	

Discussion Point 23:

The appropriateness of all commercial pots and all recreational pots and dilly's to have tags attached to them in addition to a float with the name of the user or licence number on it

OTHER COMMENTS OR SUGGESTION