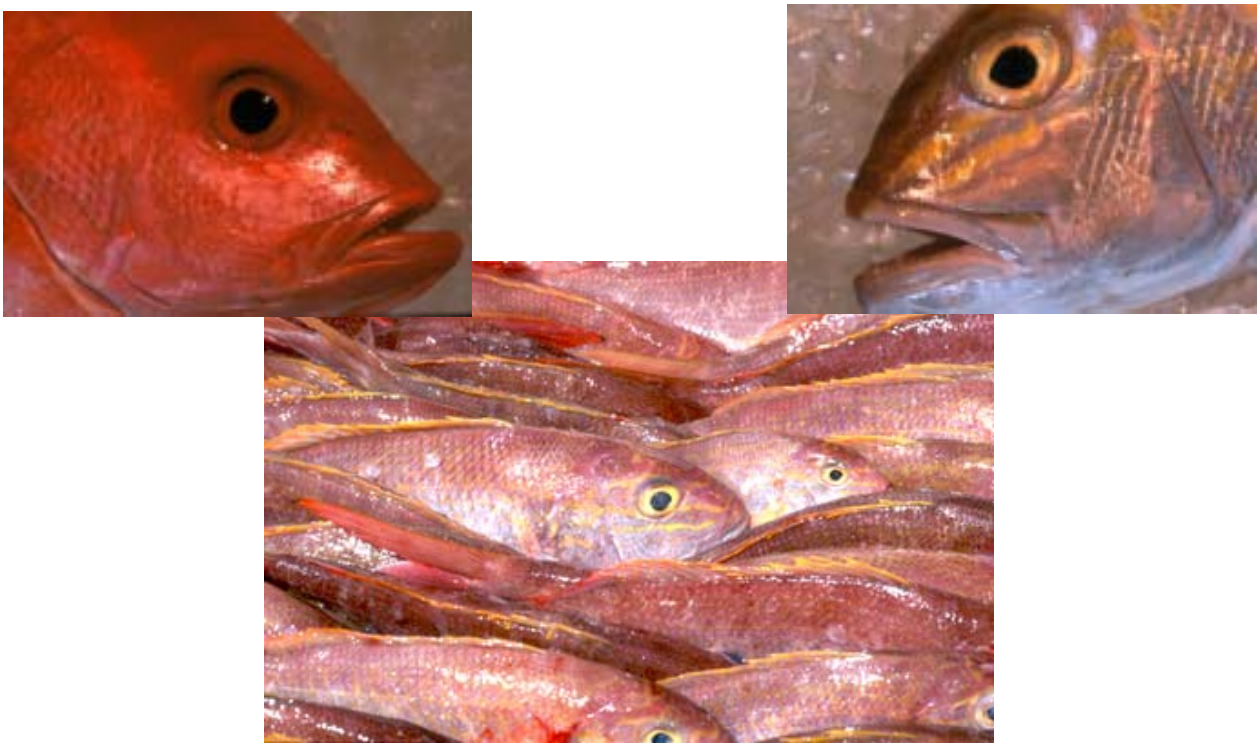
ASSESSING THE ECOLOGICAL SUSTAINABILITY OF THE NORTHERN TERRITORY TIMOR REEF FISHERY

A report prepared for Environment Australia (EA) to assess the Timor Reef fishery against the Commonwealth Guidelines for Ecologically Sustainable Management of Fisheries.



Northern Territory Government
Department of Business, Industry & Resource Development

Compiled By:
Steve Sly
Fisheries Group
April 2002

Disclaimer

This submission has been prepared by the Fisheries Division of the Northern Territory, Department of Business, Industry and Resource Development. The views and opinions expressed in this publication are those of the authors and do not necessarily reflect those of the Department of the Environment and Heritage, the Minister for the Environment and Heritage or the Commonwealth Government. The Commonwealth does not accept responsibility for the accuracy or completeness of the contents, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this publication.

TABLE OF CONTENTS

Overview of Application

A report prepared for Environment Australia (EA) to assess environmental performance of the management of the Timor Reef fishery against the Commonwealth Guidelines for Ecologically Sustainable Management of Fisheries. The report is necessary to meet the requirements under Part 13A of the *Environmental Protection and Biodiversity Conservation Act* 1999 *(EPBC Act),* to continue the listing of all species harvested in the Timor Reef fishery in section 303DB of the *EPBC Act*.

Executive Summary

The Timor Reef fishery is a multi-species dropline and trap fishery operating in the remote north west corner of the Northern Territory portion of the Australian Fishing Zone (AFZ). It is managed with a clear mandate for ecological sustainability by the Northern Territory Government. A formal management regime for the Timor Reef fishery has been implemented under the *NT Fisheries Act* 1988.

A small number of commercial operators (15 licence holders, 6 active) restricted to the use of droplines and traps reduces the potential for any adverse impact to the ecosystem and the environment. All other demersal fishing methods, including trawling, are prohibited within the fishing area. The remoteness of this offshore fishery precludes the involvement of the recreational and indigenous fishing sectors.

The fishery is monitored by logbook data coupled with regular biological sampling collected by Fisheries Research Officers. This information provides the necessary biological data for regular stock assessments.

Stock assessment workshops are conducted regularly and involve all stakeholders, including national and international expertise in stock assessment and industry and government representatives. These workshops review the current status of the fishery and provide future strategic management and research direction.

An annual status report is published and distributed to all stakeholder groups and the wider community to ensure all with an interest are fully informed about the current and predicted future status of the resource.

The most recent stock assessment workshop determined a biomass estimate of 9000 t for [*]goldband snapper, *Pristipomoides* spp.. A conservative annual yield of 900 t (10% of biomass estimate) has been adopted as the trigger value that if exceeded will prompt a management response.

[*] Unless referred to individually, Goldband snapper refers to the three target species of *Pristipomoides* spp in the Timor Reef fishery ; *P. multidens, P.typus and P.filamentosus.*

A key issue for the Timor Reef fishery is the degree of mixing of goldband (*Pristipomoides* spp) and red snapper (*L. malabaricus and L. erythropterus*) stocks between Australia and Indonesia, and respective management strategies, across a shared continental shelf in an area known as the Sahul Banks.

Previous assessments involving Indonesian and Australian managers and researchers indicate that uncontrolled fishing effort, applied to either the Australian or Indonesian component of the fishery may cause a gradual decline in stocks. As a consequence, the Northern Territory Fisheries Group has adopted a precautionary approach to management and is working towards achieving a joint agreement with Indonesia to ensure that the stocks are managed for their long-term sustainability.

History of fishery

There is an extensive history of foreign fishing activity in the Timor and Arafura Seas. Japanese stern trawlers fished the area in the late 1950's, whilst Thai and Taiwanese pair trawlers operated in the area in the 1970's. Following the declaration of the AFZ in 1979, foreign fishing vessels continued to operate in Australian waters under licence arrangements.

A feasibility study to investigate the potential for a domestic dropline fishery commenced in 1980-1982 as a joint venture between a Japanese and an Australian fishing company. The study proved successful, with a domestic line and trap fishing operation commencing trials in the mid 1980's. However, lack of consumer familiarity with tropical snappers coupled with low prices received for frozen product led to poor returns and the subsequent abandonment of the fishery. A further attempt to develop the fishery in 1987 proved to be more successful when it was recognised that interstate demand was for fresh, rather than frozen fish (Lloyd et al 1999).

With the passage of the revised jurisdictional arrangements contained in the Offshore Constitutional Settlement (OCS) of 1988, management responsibility for all line fishing and trapping passed to the Northern Territory Government.

Following concerns that excess fishing capacity may lead to the over-exploitation of goldband snapper stocks, a moratorium on the issuance of further entitlements for what is now known as the Timor Reef fishery was announced in December 1991. Only those fishers active in the fishery or licence holders able to demonstrate a commitment to entering the fishery retained access.

In 1993, the Timor Reef fishery was annexed from the demersal fishery. Overall fishing capacity within the boundary of the Timor Reef fishery was reduced from a potential 60 to 22 licences. Limits on the number of operators was implemented in response to concerns that may lead to over exploitation of goldband snapper stocks. This was particularly pertinent given the displacement of fishers in adjacent jurisdictions as a consequence of industry restructuring programs.

In February 1995, as an outcome of the revised OCS, agreed between the Commonwealth and the NT, management responsibility for the Timor Reef fishery was passed to the Northern Territory Fisheries Joint Authority (NTFJA). The NTFJA provided for the Commonwealth and the

Northern Territory to jointly manage the fishery given the likelihood of shared resources with adjacent national and international jurisdictions. The Fisheries Group on behalf of the NTFJA undertakes the day-to-day management of the fishery.

Concurrent to the above amendments to the OCS, the boundary of the Timor Reef fishery was altered to more accurately encompass the distribution of goldband snapper resources. It was also at this time that the Timor Reef fishery was declared a separate management area to that of the Demersal fishery. Details of the transferable licence arrangements for the Timor Reef fishery are outlined in Appendix 4.

The licence reduction program has now seen a ceiling on the number of licence holders with access to the Timor Reef fishery reduced further from 22 restricted licences in 1995 to a total of 15 licences in 2002, comprising 8 restricted licences and 7 unrestricted licences (Appendix 4).

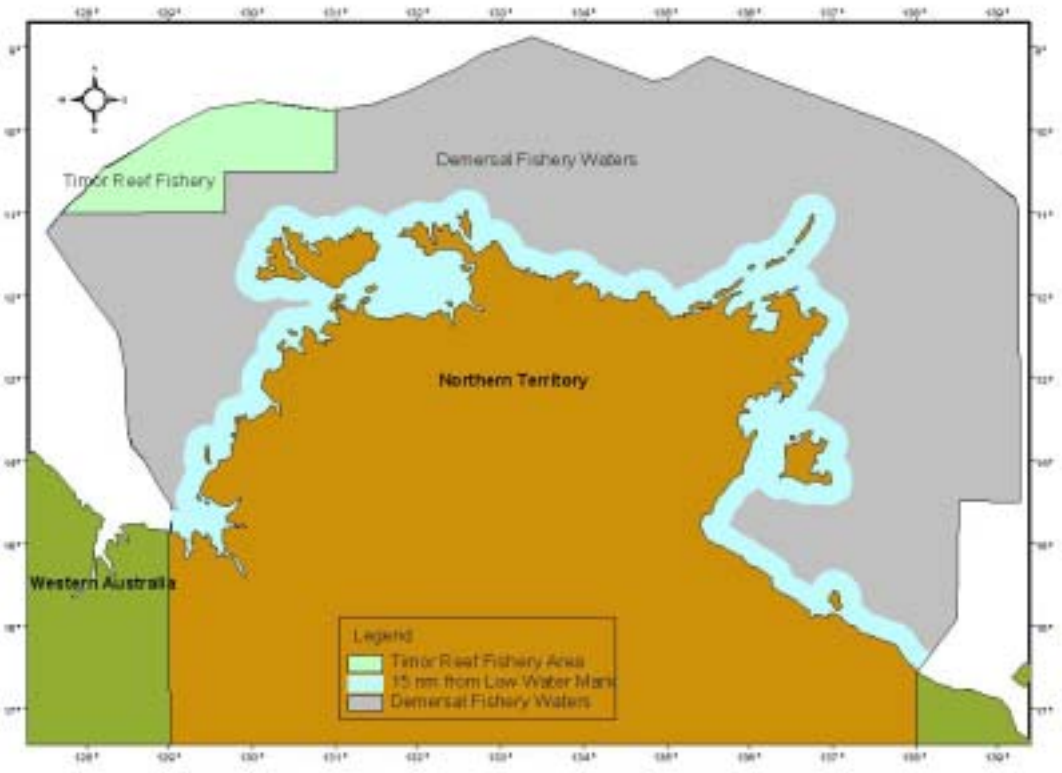


Figure 1. Area of Timor Reef fishery.

Area of fishery

The Timor Reef fishery operates in the remote region extending northwest of Darwin to the Western Australian / Northern Territory border and the outer limit of the AFZ, as shown in Figure 1.

Target species

The principal target species of the Timor Reef fishery is the goldband snapper, *Pristipomoides spp*. Onboard monitoring reveal that the most commonly caught of the *Pristipomoides genus* are *P. multidens* (51.73%), *P. typus* (11.85%) and *P. filamentosus* (3.58%) (Appendix 7).

Although all goldband species are monitored and assessed individually, *P. multidens* is the principal species caught in the Timor Reef fishery and as such the focus of management and research. However, due to similarity between species (only separated by the trained eye) all species are grouped as goldband snapper for marketing purposes.

In addition to goldband snapper other key target species in the fishery are red snappers (*Lutjanus erythropterus* and *L. malabaricus*), red emperor (*L. sebae*) and cods (Family *Serranidae*) (Figure 2). Byproduct and bycatch species are minimal contributing less than 5 % of the total catch.

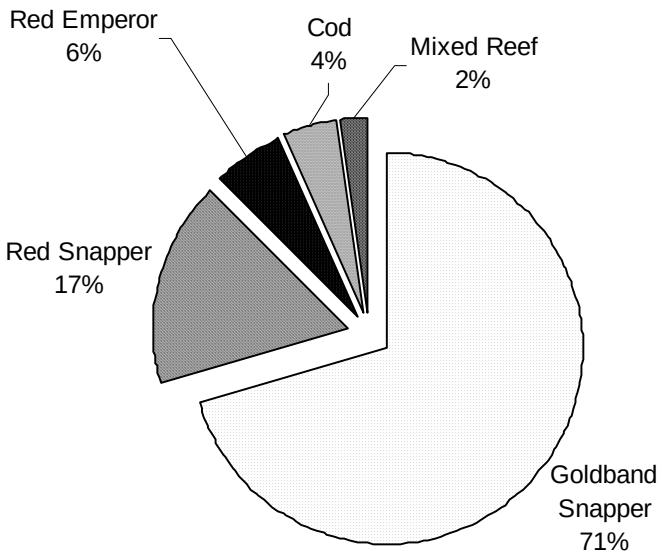


Figure 2. Landed commercial catch, Timor Reef fishery logbook data 1995-2001.

Fishing method

Commercial fishers are permitted to use traps and droplines to target goldband snappers, red snappers, red emperors and cods. Although traps were used by some operators during the early development of the fishery, most fishers in the past have used droplines to target goldband snapper. With improved catch rates and profitability, trapping is now the preferred method of fishing. Pilchards are the most commonly used bait for trapping, with squid the preferred bait for droplining.

Dropline

Fishers using colour sounders, GPS, plotters, bathometric charts (particularly depth soundings appearing on the reverse side) and experience, search for schools of tropical snappers in depths of 80–160 m along reef fronts and on sand flats located near pinnacles. In particular, fishers use colour sounders to detect schools of fish, with experienced operators able to determine the type of fish from the colour and formations of the sonar reading. It would appear from catch information and fishers comments that the majority of fishing time is dedicated to landing the higher value goldband snapper in preference to other species.

Multiple droplines may be deployed at any one time, each with 30 to 40 tuna circle hooks (size 11/0 to 13/0) attached to a heavy cord mainline. Hooks are attached by snoods (short lengths of monofilament fishing line) to a short section of line that is then attached to the mainline with a 'shark' (quick release) clip and weight attached. The use of a quick release clip allows operators to attach pre-baited hooks and continue fishing, while the hauled section with fish attached is cleared. Hooks, generally baited with squid, are set within 25 m of the seabed for 3 to 15 minutes. Longer soak times may lead to lower catch rates due to shark predation or snappers struggling free from the hooks. The fishery developed using lines buoyed and set free of the vessel and later retrieved and hauled aboard by a mechanised winch, however most vessels have hydraulic or electric reels.

Traps

While traps were occasionally used in the early development of the fishery to target goldband snapper, red snappers and red emperor, the trend is for the majority of offshore snapper fishers to use traps in preference to baited lines. Fishers generally set 30 to 40 baited traps in depths of 80 to 120m along reef fronts and on open ground. Fishing with traps commences at around 4 am with fishers using an echo sounder to search for suitable bottom type and the presence of fish. Baited traps are then set for two to six hours depending on catch rates, and retrieved with the aid of a mechanised hauler. The traps are then re-baited and reset on suitable grounds. The preferred bait is pilchards. Fishing generally continues until 11pm.

Tropical snappers caught by traps and baited lines are bled and held in an ice slurry or chilled seawater for a short time. The catch is then packed "on ice" and stored in insulated storage containers or a purpose built hold onboard the vessel.

Fishing trips are generally of five to ten days duration, with the length of the fishing trip determined by weather conditions, the distance to the fishing grounds, overall catch rates and the need to market a premium quality 'fresh on ice' fish.

ASSESSMENT OF THE TIMOR REEF FISHERY MANAGEMENT REGIME AGAINST THE COMMONWEALTH (EA) GUIDELINES FOR ASSESSING THE ECOLOGICALY SUSTAINABLE MANAGEMENT OF FISHERIES

General Requirements of the EA Guidelines

The management arrangements must be:

Documented, publicly available and transparent

The management regime for the Timor Reef fishery is documented in Part 8, Division 15 of the Fisheries Regulations as a component of the *NT Fisheries Act 1988*.

The *NT Fisheries Act 1988* is publicly available on request from the Department of Business, Industry and Resource Development (DBIRD) or from the departmental web site www.dbird.nt.gov.au. Any discussion papers or proposals for amendments to the Timor Reef fishery management arrangements are distributed widely to stakeholder groups and other interested individuals.

Prior to participating in the commercial fishery, all fishers are briefed on the regulations and licence conditions when they undertake their compulsory interview with the Management Officer responsible for the fishery.

An annual status report is published and distributed to all stakeholder groups to ensure that management advice is transparent and that the community is fully informed about the current and predicted future status of the resource.

Developed through a consultative process providing opportunity to all interested and affected parties, including the general public

The management regime for the Timor Reef fishery was developed through a consultation process involving broad stakeholder representation.

A Discussion Paper canvassing management options, circulated to industry and community groups, provided the impetus for an industry workshop to discuss future management arrangements in 1993. As an outcome of the industry workshop, the Minister endorsed the declaration of the Timor Reef fishery (1995) together with the implementation of revised management arrangements. The revised management arrangements were achieved through changes to the *NT Fisheries Act* 1988.

The recently established Timor Reef Fishery Management Advisory Committee (TRFMAC) formally represents all stakeholders and provides a forum for comment on any proposed amendments to the management regime (Section 24, *NT Fisheries Act 1988*) – Appendix 6. The TRFMAC consists of three commercial fishers, a fisheries manager, a fisheries researcher, an

independent chair and a compliance officer. There are no recreational or indigenous representatives as the fishery is not utilised by these groups.

Ensure that a range of expertise and community interests is involved in individual fishery management committees and during the stock assessment process.

There is a broad stakeholder involvement (including community and conservation representatives) in both the assessment and the management decision making process for the Timor Reef fishery. An advisory committee (TRFMAC see above) has been established that will formally review and make recommendations to the Fisheries Group on appropriate management arrangements for the fishery.

In recognising the specific cultural needs of indigenous stakeholders a separate committee process has been established by the Northern Territory Fisheries Group considering fishery related issues. Given the offshore nature of the Timor Reef fishery there has been little interaction with Aboriginal stakeholders. Stock assessment workshops are conducted on a regular basis involving specialised scientists, broad stakeholder representatives including non-government organisations and advisory committee members. The assessment process involves community participation through regular workshops as outlined in section 1.1.2.

Environmental groups and non-government organisations are also advised and consulted on topical fisheries issues, including the Timor Reef fishery, through monthly advisory meetings with senior fisheries officers and the Director of Fisheries.

Be strategic, containing objectives and performance criteria by which the effectiveness of the management arrangements is measured.

The management objectives for Northern Territory Fisheries as outlined in the *NT Fisheries Act 1988* are to "conserve, enhance, protect, utilise, and manage the fish and aquatic life resources of the Territory to:

(a) Promote, develop and maintain commercial and amateur fishing;

(b) Provide for optimum yields from a fishery and maintain the quality of the yield;

(c) Ensure that the fisheries of the Territory are not endangered or overexploited;

(d) Encourage tourist and scientific interest in fish and aquatic life; and/or

(e) Ensure that the habitats of fish or aquatic life and the general environment is not detrimentally affected".

These objectives for the management of all Northern Territory Fisheries, including the Timor Reef fishery, are strategically assessed through the annual Northern Australian Fisheries Management Workshop (NAFMW). Membership to the workshop includes State, Territory and Commonwealth Fisheries managers, researchers and compliance staff. The workshop is undertaken annually to assess the status of northern Australian fisheries and to measure the effectiveness of the management arrangements.

The key objective of the management arrangements for the Timor Reef fishery is to ensure that the overall landings of target species do not exceed the annual estimates of yield. Logbook data (validated by observer data) together with annual assessments are the performance indicators applied to ensure landings remain at or below yield estimates. The Fisheries Group considers that the current performance indicators are appropriate given the scale and scope of the fishery.

The Northern Territory is a signatory to the National Strategy on ESD.

Be capable of controlling the level of harvest in the fishery using input and/or output controls.

The level of harvest in the Timor Reef fishery is controlled by limiting the number of operators in the fishery, a licence reduction scheme and gear restrictions as detailed in the *NT Fisheries Act 1988*. The objective of the licence reduction scheme is to reduce capacity from 22 to 11 entitlements in seeking to ensure the sustainability of the fishery.

The low number of operators combined with a licence reduction program seeks to further reduce the capacity of the fishery. Such management arrangements are adequate to ensure sustainability of stocks and importantly allow an appropriate level of profitability for individual fishers. The low number of operators (6 active in 2002) allows the current management regime to function adequately without the need for extensive input and output controls evident in many other fisheries with high rates of participation. However, should overall landings reach or exceed available yield estimates, further management interventions will be implemented to maintain catches at sustainable levels. A complete overview is provided in section 1.1.7.

A recent report of abandoned traps in the fishery or ghost trap fishing is of particular concern to fellow fishers and the Fisheries Group. Consequently, the Marine and Enforcement Unit is investigating the report further to stop any further illegal practice. The industry association, in conjunction with the Fisheries Group, is investigating the implementation of compulsory sacrificial anodes on any trap used in the fishery. Sacrificial anodes attached to the clip door of the trap will corrode away on a trap abandoned or left for an extended period of time, leaving an escape route for any captured fish.

Contain the means of enforcing critical aspects of the management arrangements.

The management regime provides for enforcing critical aspects of the management arrangements as documented in the *NT Fisheries Act 1988.*

The Marine and Fisheries Enforcement Unit (MFEU) of the Police and Emergency Services undertake compliance on behalf of the Fisheries Group. A single port (Darwin) in which to operate from, and unload to, greatly assists the ability of the MFEU to perform the necessary compliance activities. The recent leasing of a 20m Police boat will now allow the MFEU to patrol and carry out compliance activities in the region of the Timor Reef fishery. The MFEU ensure compliance with bycatch and gear restrictions and the operations of any unlicensed operators within the confides of the Timor Reef fishery.

The enforcement and compliance operations for the Timor Reef fishery are appropriate to the scale and scope of the fishery.

Provide for the periodic review of the performance of the fishery management arrangements and the management strategies, objectives and criteria.

There are periodic workshops organised by the Fisheries Group to review and undertake an assessment of the fishery in line with current management strategies and objectives. These are public forums in which all stakeholders, and the wider community, are provided an opportunity to participate. Outcomes from the workshops are widely publicised through technical reports, annual status reports and the annual report of the NTFJA.

The strategic management directions of the Timor Reef fishery are also reviewed and assessed at the NAFMW.

Be capable of assessing, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which the target species lives and the fishery operates.

The characteristics of the Timor Reef fishery such as the use of passive gear, remoteness of area fished and the low number of operators reduces the potential risk for any adverse impacts on the marine ecosystem for which the fishery operates.

A complete overview of the impacts of the fishery on the wider marine ecosystem is addressed in sections 2.2.1 – 2.3.5 of this report.

Section 29 of the *NT Fisheries Act 1988* provides for the Minister, to impose emergency restrictions if the ecosystem is adversely affected by fishing operations (Appendix 5).

Require compliance with relevant threat abatement plans, recovery plans, the National Policy on Fisheries Bycatch, and bycatch action strategies developed under that policy.

There are no threat abatement plans applicable at this juncture to the Timor Reef fishery (see section 2.2.1-2.2.6 for complete details). If a threat abatement plan does become relevant, NT fisheries will ensure that its recommendations are incorporated into management arrangements.

Bycatch in the Timor Reef fishery is low (less than-1%, see section 2.1.3) and there is no recorded or observed interaction with threatened species (section 2.2.2). Subsequently a bycatch reduction plan is not required for this fishery. If the level of bycatch should increase to 10% of the catch legislation under the *NT Fisheries Act 1988* (Appendix 5) will initiate a review of management of the fishery or evoke an emergency response to reduce the level of bycatch (see 2.1.5 for further details).

PRINCIPLE 1

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

Objective 1.

The fishery shall be conducted at catch levels that maintain ecologically viable stock levels at an agreed point or range, with acceptable levels of probability.

1.1.1 There is a reliable information collection system in place appropriate to the scale of the fishery. The level of data collection should be based upon an appropriate mix of fishery independent and dependent research and monitoring.

Fishery dependent and fishery independent data, are collected as part of the assessment process for the Timor Reef fishery.

Fishery Dependent

Fishers are required as a condition of the Timor Reef fishery licence administered by the Fisheries Group to complete and return daily logbook data (Appendix 2). The logbook must be completed for each day that fishing takes place and includes; fishing method (dropline or traps); catch (numbers and species); effort (number of shots and fishing time); depth fished and fishing location (Latitude/Longitude).

As a multi-species fishery, operators report on the most commonly caught species by recording individual numbers of fish together with their combined weight. The species reported on the logbooks are:

Goldband snapper (*P. multidens*)

Sharptooth snapper (*P. typus*)

Saddle-tail snapper (*L. malabaricus*)

Red emperor (*L. sebae)*

Red snapper (*L. erythropterus*)

Rosy snapper (*P. filamentosus)*

Cods (Family Serranidae)

Others, allows the operator to identify and record any other species landed.

Fishers are required to provide marketing details including point of sale, the level of processing undertaken and the combined weight of individual species sold (Appendix 3). This information also provides a validation mechanism for assessing the catch reported in the logbook. Logbook data provides catch by numbers and market returns provide catch by weight. From this the Fisheries Group can estimate the average weight of all target species.

Compulsory logbook data must be returned together with monthly market summary sheets by the 28th day of the following month. Any discrepancies provided by fishers is investigated by the Logbook Coordinator to ensure reliability.

The logbook data provides valuable catch and effort information used specifically for stock assessment workshops. Commercial logbook data has been collected from fishers operating in the Timor and Arafura Seas since 1979 and from fishers operating specifically under the conditions of the Timor Reef fishery licence since 1995.

The logbooks have been designed to provide the necessary details for stock assessment modeling. The level and reliability of information is appropriate given the size and extent of the fishery.

The level of bycatch in the fishery is low and includes a variety of individual species (Table 1). It is appropriate that monitoring of bycatch be undertaken by independent observers.

Monitoring

Monitoring on vessels operating in the region of the Timor Reef fishery has been conducted on commercial boats since 1990 (Clarke and Lloyd 2002). While onboard, observers document vessel and gear information, location and depth fished, fishing practices, catch composition and where possible, measure all species landed (Lloyd et al. 1999). Monitoring is conducted approximately two to three times a year within current resource constraints.

Fishery Independent

Two key independent research projects have been undertaken;

(A) The Timor Reef fishery was assessed as part of the wider Timor Sea, on the basis of demersal trawl surveys during October-December 1990. During this survey, 276 random trawls were undertaken over a 57-day period and covered the grounds within the Timor and Arafura Sea (between 127°-137°E).

The objectives of the program were to:

- assess the size of groundfish stocks in the Australian sectors of the Timor and Arafura Seas and specifically;
- acquire data on the status of groundfish stocks;
- obtain fishery-independent indices of abundance for groundfish in the study area;

- determine important population parameters for abundant taxa; and assess ground fish stocks between 127°-137°E (Ramm 1997a).

The 1990 trawl surveys provided a wealth of data used to determine the spatial structure of snapper stocks, model the potential size of snapper stocks and make predictions regarding sustainable yields in each of the areas surveyed. Results from the research enabled the development of a model for determining the effect of fish herding when using trawl nets of different width and door spread (Ramm and Xiao 1995). This allowed definition of the effective trawl path width and substantially improved the sweep area method used for fishery stock assessment purposes.

The project also provided information on the relative abundance and biomass of major fish species in the Timor and Arafura Seas. This information allowed fishery scientists and mangers to review yield estimates and resource management strategies for the major red and goldband snapper species.

(B) The concern for more reliable estimates of goldband snapper stocks (principal target species) initiated the need to develop a repeatable sampling strategy to provide an independent index of abundance for long term monitoring. The methods selected to test these assumptions were:

- droplines (vertical long lines), with 15 10/0 or 13/0 tuna circle hooks; and,

- trammel nets, to determine if this capture method could be used at depths of around 100 m effectively.

Trammel nets consisted of a loosely hung centre wall of fine (55 mm) mesh net bordered on each side by tightly hung walls of 175 mm mesh netting. Fish are entangled as they pass through the large outer meshes and encounter the smaller centre panel of net and push their way through the larger outer meshes. Fish become trapped in the pockets that are formed.

The results of this trial suggest that trammel nets are a practical independent sampling tool. Their main advantages being, their ability to capture the full size range within a population in comparison to baited hooks which are size selective and rely on bait to attract fish for capture (Lloyd 1995).

Further tests conducted using a smaller mesh to capture juvenile fish in shallow water were successful. It is now the intention to examine the effectiveness of smaller mesh trammel nets in deeper water to assist in confirming aging techniques and estimates.

Assessment

1.1.2 There is a robust assessment of the dynamics and status of the species/fishery and periodic review of the process and the data collected. Assessment should include a process to identify any reduction in biological diversity and/or reproductive capacity. Review should take place at regular intervals but at least every three years.

Annual Review

The status of the Timor Reef fishery is reviewed annually and reported through the publication of a fishery status report (Appendix 1) and the NTFJA Annual Report. The fishery status report provides current information on catch/effort, stakeholder participation, research, compliance and management together with major issues that have occurred throughout the year. The status report is distributed to all stakeholders and available from the Fisheries Group or online from the Department's website, www.dbird.nt.gov.au.

The NTFJA Annual Report provides information on the status of northern fisheries jointly managed by the Commonwealth and the Northern Territory. This Report provides details of all functions and activities associated with the management of these fisheries, including the Timor Reef fishery. The NTFJA annual report is distributed to key stakeholder groups and available on request from the Fisheries Group.

Stock assessment workshops

The initial assessments of the status of the Timor Reef fishery were undertaken as part of the wider assessments for the then Northern Trawl fishery of the Arafura and Timor Seas. The 1991 assessment examined historic logbook and observer data from foreign and domestic vessels (surplus reduction model) and the independent demersal trawl survey data (yield per recruitment model) to estimate biomass in different management zones. A complete overview of these models and assessment is provided in Ramm (1994).

Resource estimates were updated in 1992 and 1994 through the Joint Australian – Indonesian Workshops on the Arafura Sea Fisheries. Although these workshops primarily focused on stocks in the Arafura Sea rather than the Timor Sea, they did provide an indication of likely red snapper harvest levels across northern Australia.

Further fisheries stock assessment workshops convened in 1996 and 2000 assessed all available information, earlier yield estimates for red snappers in the Arafura Sea and goldband snappers in the Timor Sea. Specifically, the workshops aimed to:

- re-assess major fisheries in the Northern Territory, including the Timor Reef fishery and the Demersal fishery;
- advise the Northern Territory Government on the biological status of these fisheries, any changes required in their management and any necessary changes to future research programs;

- provide comment on stock assessment and management strategies for other fisheries;
- provide Northern Territory fisheries scientists and managers with training in recent stock analysis and resource management methodologies; and
- include industry and interested parties in the discussion of the workshop results and contribute to the workshop findings.

These stock assessment workshops were led by internationally and nationally recognised stock assessment scientists in developing modeling techniques to improve the precision of assessments. The assessments involved industry participants (both Northern Territory and Western Australia) together with scientists, and fishery managers from the Northern Territory, Queensland, Western Australia and the Commonwealth.

The current stock assessment model used to assess the goldband snapper stocks in the Timor Reef fishery was developed through the 1996 stock assessment workshop and reviewed in the 2000 workshop. The report of the 1996 workshop (Ramm 1997b) provides information on model structure. A suite of models – surplus production model (using catch and CPUE as well as survey information), delay difference model (using catch and CPUE) and stock synthesis models (using age structure and catch information) were examined. The 2000 workshop further developed the models developed through the 1996 workshop.

The modeling approach combined the best available information provided by logbooks, both historical and recent, length frequency data from monitoring trips, age at length data from otolith analysis, published reproductive information and Coastwatch observations on Indonesian fishing effort in estimating the biomass and the sustainable harvest level of the fishery. A report on the 2000 workshop (Buckworth R in *prep*) providing details of models assembled by workshop participants and the current assessment of the fishery is near completion.

Key outcomes from the 1996 workshop for the Timor Reef fishery as reported in Ramm (1997b) are;

- a recommended harvest level of 10-15% per year of the stock;
- a biomass estimate for goldband snapper between 3000 to 20000 t or more depending on how catch rates, age and survey details are interpreted, with a biomass estimate of 9000 t determined to be a more realistic figure for modelling and management purposes.

The uncertainty about the size of the goldband snapper stock relates to the 3000 t estimate determined from 1990 trawl survey data. This estimate assumes a 100% trawl efficiency (i.e. every fish in the trawl path survey was captured), which was considered by workshop participants to be unlikely. It is for this reason that suggested yields are probably underestimated. The 1996 workshop identified a stock size of 9000 t to be a more realistic estimate (Ramm 1997b). The harvest rate and biomass estimates are discussed in more detail in section 1.1.5.

The Fisheries Group has undertaken assessments of the principal target species (goldband snappers and red snappers) for the Timor and Arafura Seas. Should composition of the catch change significantly, management arrangements and research priorities can be altered to provide greater protection of these species. It is considered on the basis of available information, that present precautionary management arrangements provide ample protection and are adequate given the current scale and capacity of the fishery.

More recent assessments (second and third Stock Assessments Workshops Cianjur, Indonesia 2000 and 2001) seek to refine the spatial distribution of goldband and red snapper stocks and fishing effort in the Indonesia regions of the Timor and Arafura Seas. Preliminary results from these workshops are discussed in greater detail in section 1.1.3. No new biomass estimates could be determined for the Timor Reef fishery due to the recent change in fishing method from dropline to trap. This means that catch rate series of the fishery is no longer continuous and an updated assessment will be undertaken at a latter date (Anon 2001).

The Fisheries Group is currently reviewing its strategic research needs for all Northern Territory fisheries including the Timor Reef fishery, with a 5 year plan to be finalised by 2003. Such a review canvasses the need for additional research initiatives for the Timor Reef fishery. The annual NAFMW reviews the current stock assessment estimates and research priorities for all NT fisheries. Information and discussion from this workshop determine the need and timing for any future Timor Reef fishery related workshops.

1.1.3 The distribution and spatial structure of the stock(s) has been established and factored into management responses.

The Timor Reef fishery operates in a region extending from the Western Australian / Northern Territory border to northwest of Darwin and to the outer limit of the AFZ, (Figure 1). It is a multi-species fishery primarily targeting goldband snapper (*Pristipomoides spp.*), red snappers (*L. malabaricus and L. erythropetus)*, red emperor (*L. sebae*) and cods (*Epinephelus spp*.).

Historically, goldband snapper *Pristipomoides* spp., have been the principal target species of the Timor Reef fishery (Lloyd et al. 1999). The genus is widely distributed throughout northern Australia and the tropical Indo-Pacific region (Allen 1985). The main focus of research has been *P. multidens,* which comprises 80% of the goldband snapper catch.

Recent research indicates that *P. multidens* now appears to consist of several separate adult stocks across northern Australia, Indonesia (Kupang) and Papua New Guinea (Lloyd et al. 2000). Chemical analysis of otoliths (stable isotopic ratio analysis of sagittal otolith carbonate) suggests that two stocks are present in the Timor and Arafura Seas (Newman et al. 2000). This research implies that there is unlikely to be substantial movement of fish between these distinct adult assemblages.

P. multidens is distributed across the continental shelf adjacent to the NT. The degree of mixing has not yet been determined, however, given that the continental shelf extends beyond the AFZ, it is assumed that the stocks are likely to be shared. For this reason the Fisheries Group will continue to take a precautionary approach to management and work towards a complementary

management with Indonesia. Until such time, the current management arrangements and input controls are considered adequate to ensure overall landings in the fishery are below current sustainable yield estimates.

The distribution of [*]goldband snapper and concentration of fishing effort facilitated the management decision to more accurately define the Timor Reef fishery boundary. In 1995 the southern boundary of the Timor Reef fishery was altered from 12° 30' S to 11°S (Lloyd et al. 1999).

Commercially caught red snapper species inhabit coastal and offshore reefs to depths of 100 m throughout the Indo-pacific region (Allen 1985). Given a shared continental shelf and activity by Australian and Indonesian fishing immediately adjacent to the AFZ boundary, there is a strong likelihood that red snapper stocks are shared between Indonesia and Australia (Clarke and Lloyd 2002). For this reason the Fisheries Group is collaborating with Commonwealth Scientific and Industrial Research Organisation and Agriculture, Fisheries and Forestry Australia in a Australian Centre for International Agricultural Research (ACIAR). The project will examine *the "Biology, stock assessment and management of shared snapper fisheries in northern Australia and eastern Indonesia*". The project, due to be completed in 2003, aims to identify the population dynamics, stock structure and biology of goldband and red snappers relevant to the cooperative management of stocks shared between Australia and Indonesia. Preliminary investigations indicate that very few juvenile species of goldband snapper are caught in the Timor Reef fishery. Histology work, currently undertaken as part of ACIAR project (outline below) will provide more defined maturity stages at point of capture.

Specific biological objectives of the ACIAR project are:

- Describe the genetic population structure of the two red snapper species (*L. malabaricus and L. erythropterus*) and the goldband snapper (*P. multidens*) in northern Australia and southeast Indonesia, in order to define the extent of shared populations;

- Examine the movement patterns of the two red snapper species in northern Australia and souteast Indonesia using otolith microchemistry. This will enable the estimation of the proportion of shared populations, which migrate between Indonesia and Australia;

- Describe the reproductive biology of the red snappers (*L. malabaricus and L.erythropterus*) and goldband snappers (*Pristipomoides* spp.), including age at maturity, reproductive lifespan, spawning seasons and fecundity estimates;

- Investigate the location of nursery habitats of red snappers, these are currently unknown.

---

[*] [*] Unless referred to individually, Goldband snapper refers to the three target species of *Pristipomoides* spp in the Timor Reef fishery ; *P. multidens, P.typus and P.filamentosus.*

Stock Assessment and Management Strategies of the ACIAR project:

- Determine the sustainability of current catches of snapper species and evaluate the impact of different management strategies on the stocks. Stock assessments based on the collected biological information and the historical catch data will be completed and used to indicate possible management strategies.

- Develop strategies and plans for complementary conservation, management and utilisation of shared stocks. These strategies will be in accordance with the objectives of the 1992 Fisheries Cooperation Agreement (FCA) between Australia and Indonesia and consistent with United Nations Implementation Agreement on straddling stocks and migratory stocks.

Expected outputs from the project are;

- A greater understanding of the degree to which snapper stocks are shared between Australia and Indonesia;

- Information regarding the movements and life history of snapper species, which can be integrated into stock assessments and management policies;

- Knowledge of the organisation and socio-economic status of different sectors of the snapper fishery;

- A comprehensive assessment of the current status of the stocks of each species and whether current harvesting rates are sustainable;

- An evaluation of impact of different management strategies on snapper stocks;

- The development of a novel and important strategy for internationally shared fisheries resources.

Preliminary results from the ACIAR project suggest that red snapper stocks in the Timor Reef fishery are likely to be shared between Australia and Indonesia (Jenny Overden pers. comm.). For goldband snapper, samples collected from the Indonesian continental shelf adjacent to Timor (Indonesia) are dissimilar to those from the Australian fishery on the Sahul Banks (Overden et al. 2002). The degree of mixing across the Sahul Banks shared with Indonesia has not been determined. However, otolith data on northern Australia goldband snapper populations do indicate that adult goldband snapper stocks are relatively sedentary (Newman et al. 2000).

Fishing Activity

Commercial fishers in the Timor Reef fishery distribute their fishing effort according to catch rates. The small number of operators in the fishery (6 active) enables individual fishers, should catch rates decline in a localised area, to relocate to alternative fishing grounds. This action reduces the likelihood of localised depletion due to profitability considerations in a fishery with few operators.

It is not, feasible for fishers to operate in areas of low catch rates. The small number of operators can relocate to new grounds with the assurance of improved catch rates.

The recent transition from dropline to traps has extended the area of the fishery. In line with the change in fishing method, the Fisheries Group is investigating the feasibility of a study, using time series data, to examine the spatial distribution of fishing effort using Geographical Information System (GIS). A pilot investigation is to be finalised by January 2003.

Such spatial information, together with biomass estimates, is factored into management measures outlined in section 1.1.7 for sustainability of the fishery.

1.1.4 There are reliable estimates of all removals, including commercial (landings and discards), recreational and indigenous, from the fished stock. These estimates have been factored into stock assessments and target species catch levels.

Catch data is available from fishing effort in the region of the Timor Reef fishery since the early 1970's. It includes data collected by Tiawanese and Australian authorities since 1974 and 1979 respectively. Exploratory surveys were conducted on the northwest shelf, and the Kimberly-Timor Region, Arafura Sea and Gulf of Carpantaria during 1978-80. There is also fish trawl catch and effort data available from AFZ logbooks for Taiwanese (1980–1990), Thai (1985-1990) and Mainland Chinese (1989) fleets operating in the Timor and Arafura Seas.

Reliable estimates of total removals (since 1989) by domestic operators in the Timor Reef fishery are provided from logbook returns and monitoring by fishery observers. The logbook data can be validated by comparison with processor/trader returns. This information allows for accurate estimations of stock removals by licensed Australian vessels, which inturn contributes towards fish stock assessments and sustainable catch rates.

All commercial fish processor/traders are licensed by the Fisheries Group and are required to complete compulsory log sheets identifying the quantity and source of the product. This information can then be compared with reported landings from commercial fishers. The Fisheries Group undertakes an annual review of logbook data to ensure the data collected provides an appropriate level of information for stock assessment.

The total stock removal from the Timor Reef fishery in 2001 was 360.4 tonnes. A comprehensive time series of catch and effort data specifically for the Timor Reef fishery is available from the inception of the fishery in 1995 (Figure 3). The catch and effort data collected from the fishery is outlined in section 1.1.1.

Preliminary results from the ACIAR project outlined in section 1.1.3 suggest that red snapper stocks in the Timor Reef fishery are likely to be shared between Australia and Indonesia (Jenny Overden pers comm.). For goldband snapper, samples collected from the continental shelf adjacent to Timor (Indonesia) are dissimilar to those from the Australian fishery on the Sahul Banks (Overden et al., 2002). The degree of mixing across the Sahul Banks shared with Indonesia has not been determined. However, otolith data on northern Australia goldband

snapper populations indicate that adult goldband snapper stocks are sedentary (Newman et al., 2000).

Current conservative management arrangements for the Timor Reef fishery (see section 1.1.7) take into account the possibility of shared stocks between Australia and Indonesia. The Fisheries Group recognising the likelihood of shared stocks across the Sahul Banks is working towards complementary management arrangements with Indonesia to enhance current removal estimates (see section 1.1.3).

The Fisheries Group is also analysing Coastwatch flight observations of Indonesian Iceboats from 1991 and interviews with detained skippers to attempt to ascertain the average catch rate of these iceboats and determine an estimate of illegal Indonesian fishing effort in the fishery. The interviews also attempt to estimate the removals by Indonesian fishers operating on the Indonesian component of the Sahul Banks. These estimates are provided as information for review at stock assessment workshops and where possible incorporated into stock assessment modelling.

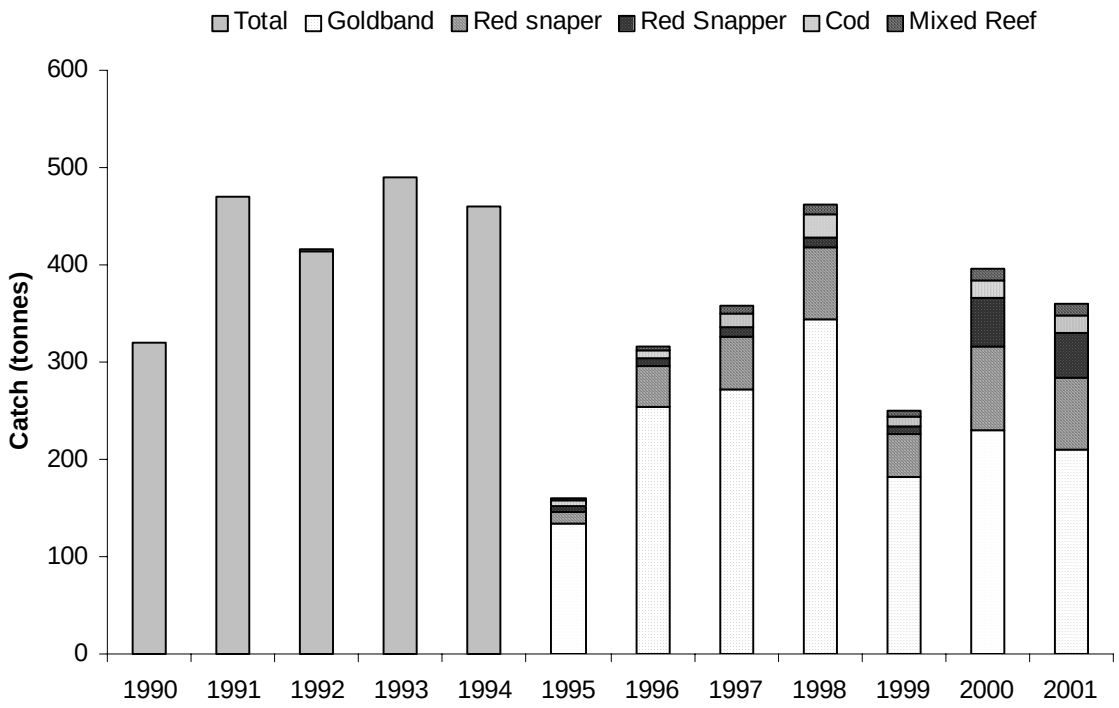


Figure 3. Total catch (tonnes) of all removals recorded from fishers logbooks from 1990-2001. Note: Timor Reef fishery declared in 1995

As previously mentioned, the remoteness of the fishery preclude the involvement of the recreational and indigenous sector.

1.1.5 There is a sound estimate of the potential productivity of the fished stock/s and the proportion that could be harvested.

There has been a number of stock assessments on tropical snappers, including the Timor Reef fishery (Ramm 1992, 1994 and 1995). Initial assessments of the Timor Reef fishery, as discussed in section 1.1.2, were undertaken as part of the wider assessment for the then Northern Trawl fishery of the Timor and Arafura seas (Ramm 1993). Annual yield estimates at the time for red snapper and goldband snapper in what was then known as the Timor Box ranged between 1300-2900 for red snapper and 400-1000 for goldband snapper (Ramm 1993). A 1995 assessment predicted a combined unexploited deepwater snapper (mainly *P. multidens*) biomass for both sectors of the Sahul Banks (Indonesia and Australia) in the range of 2990-9520 t (Ramm 1997a). More recent assessments undertaken in 1996 and 2000, as described in section 1.1.2, were applied to the principal target species the Goldband Snapper, mainly *P. multidens.*

Global experience of species with a similar life history to goldband snapper indicates that the sustainable harvest rates are in the order of 10-15% per year of the standing stock. As an outcome from the workshop, biomass estimates of goldband snapper range between 3,000 t and 20,000 t for the Timor Reef fishery. The broad range in biomass estimates of the goldband snapper stock relates to the 3,000 t estimate determined from the 1990 trawl survey data. This estimate assumes a 100% trawl efficiency (i.e. every fish in the trawl path survey was captured), which was considered by workshop participants to be unlikely. It is for this reason that suggested yields are probably underestimated. On the basis of the best available information, workshop participants identified a stock size of 9,000 t to be a more realistic estimate for modelling and management purposes. A stock size of 9,000 t and assuming a sustainable harvest rate of 10-15% per year allows an estimated sustainable yield between 900 t and 1,350 t for the Timor Reef fishery (Ramm 1997b).

The workshop also identified that there is no immediate risk of stock collapse within the Timor Reef fishery (Ramm 1997b). In the unlikely event that catches exceed sustainable yields, the stock size would be eroded slowly as the accumulated stock of older fish are harvested. It is anticipated that this would occur over a decade until the fishery had to rely primarily on new recruits for stock replenishment (Ramm 1997b).

Biomass estimates and associated sustainable harvest estimates will be refined as results on the degree of mixing between Australian and Indonesian stocks, information on fishing effort and fishery independent techniques become available.

The strategic management directions of the Timor Reef fishery, including potential productivity of all stocks, are reviewed and assessed at the annual Northern Australian Fisheries Managers Workshop (NAFMW) and through the completion of the annual status report (Appendix 1). The annual status report is produced and published following an annual review of the fishery.

Management responses

1.1.6 There are reference points (target and/or limit), that trigger management actions including a biological bottom line and/or a catch or effort upper limit beyond which the stock should not be taken.

The workshops to assess the status of the Timor Reef fishery as described in sections 1.1.2 identified research needs and management options for the fishery. Suggested management options identify conservative reference points that if exceeded will trigger a review of current management arrangements.

Goldband Snapper

Reference points to trigger a management response depend on the estimate of the current stock size. As the preferred estimate of stock size is 9,000 t (Ramm 1997b), sustainable yields may range from 900 to 1350 t. The Fisheries Group has undertaken the precautionary approach and will commence a review of the management arrangements when the lower estimates of yields are reached. If 900 t (10% of estimated stock) or more of Goldband Snapper are captured in any given year, and subsequent assessment determines that immediate action is required, the Director will respond by directing the TRFMAC to review management arrangements of the fishery. Alternatively, TRFMAC or the Director can request the Minister to declare emergency changes (immediately) under the provisions of the *NT Fisheries Act 1988*, (subsection 29 - Appendix 5). The same emergency provisions apply for the target species, byproduct and bycatch species listed below.

Overall landings of Goldband Snapper, 209.4 t in 2001, are below the reference point (900 t) for a trigger response for a review of management of the fishery. If the reference point is exceeded, powers under the *NT Fisheries Act 1988* provides for a review of management arrangements of the fishery.

Red Snapper

Available yield estimates for the Timor Box are between 1,300 and 2,900 t (Ramm1994). Current harvest levels for red snappers (75 t in 2001) are well below the lower conservative yield estimate of 1,300 t. Further assessments are to be undertaken to refine yield estimates so that appropriate triggers can be implemented. Alternatively a trigger will be implemented if catches reach 1,300 t in any 12-month period.

Red emperor and Cods

There are no biomass estimates available for the targeted red emperors and cods of the Timor Reef fishery. The size and scale of the fishery (small number of operators, limited resources) has

directed stock assessments more towards the key targeted species (goldband and red snappers). As a consequence the Fisheries Group has adopted a precautionary management strategy.

If the catch rates of red emperors increase to 25% of the annual catch, the Fisheries Group will call for a review of existing management arrangements of the fishery.

If the catch rates of cods increase to 10% of the annual catch, the Fisheries will call for a review of existing management arrangements of the fishery.

Byproduct species

There are no biomass estimates available for byproduct species harvested in the Timor Reef fishery (Appendix 7). Byproduct is currently only 3.7% (2001) of the overall catch. The Fisheries Group has undertaken the precautionary management strategy to review the management arrangements if the byproduct harvested levels should rise above 10% of the overall catch of the fishery. A review will initiate management measures for the protection of these species.

Bycatch species

Bycatch levels are exceedingly low (less than 1% of catch) in the Timor Reef fishery (Table 1 and Appendix 7). A rise in bycatch to 10% of the total catch in successive years will trigger a review of management arrangements to ensure the protection of bycatch species.

1.1.7 There are management strategies in place capable of controlling the level of take.

The Timor Reef fishery is managed by input controls to regulate fishing effort and gear restrictions to ensure minimal disturbance to demersal habitats, and to maximise community benefits. The effort controls seek to ensure overall landings of target species do not exceed sustainable yield estimates.

In 1993, the Timor Reef fishery was annexed from the demersal fishery. Overall fishing capacity within the boundary of the Timor Reef fishery was reduced from a potential 60 to 22 licences. Limits on the number of operations was implemented in response to concerns that may lead to over exploitation of goldband snapper stocks. This was particularly pertinent given the displacement of fishers in adjacent jurisdictions as a consequence of industry restructuring programs.

Licence reduction program

A licence reduction program was introduced to further reduce fishing capacity in the fishery. The 2 for 1 licence reduction policy requires any new entrant to surrender two “restricted” Timor Reef licences for the issue of a transferable “unrestricted” licence, or alternatively, aquire an “unrestricted licence” from an existing operator. After the initial reduction in licences from 60 to 22 (1993), the licence numbers have now been reduced further from 22 restricted to 15 entitlements, comprising 8 “restricted” licences and 7 “unrestricted” licences. All fishers in the Timor Reef fishery must also hold a Demersal fishery license (Appendix 4 provides an explanation of restricted and unrestricted licences).

Capacity in the Timor Reef fishery is expected to continue to reduce with the continuation of the 2 for 1 licence reduction program.

Gear limitations

Pursuant to section 141G (Appendix 4) of the Northern Territory Fisheries Act (Regulations) the holder of a Timor Reef Fishery licence shall not use under the licence fishing gear other than –

- a vertical line;
- a drop line attached to, or "free from, a vessel";
- a fish trap; and
- a scoop net or gaff.

Area restrictions

In 1995, the southern boundary of the Timor Reef fishery was altered from 12° 30' S to 11° S'. The realignment of the boundaries sought to better define the distribution of the principal target species (goldband snapper, *Pristipomoides* spp.) of the Timor Reef fishery (Appendix 4).

Catch restrictions

The holder of a Timor Reef fishery licence shall not take barramundi, threadfin salmon, Spanish mackerel, shark or mudcrab under the licence (Fisheries Regulation 141J – Appendix 4).

In the event of a triggered response, the Director, through a consultative process, can call for a review of the fishery and undertake appropriate action to ensure sustainability of the fishery (Appendix 5). See section 1.1.6 for trigger values for the Timor Reef fishery.

Compliance

Compliance with management controls is achieved through wharf-side inspections and as an adjunct to surveillance activities undertaken for other NT and Commonwealth managed fisheries. Offshore surveillance of fishing activities is undertaken periodically or on a "as needed " basis.

1.1.8 Fishing is conducted in a manner that does not threaten stocks of by-product species. Where possible guidelines 1.1.1 to 1.1.7 should be applied to by-product.

The Timor Reef fishery is a multi-species fishery whereby any species, apart from barramundi, threadfin salmon, spanish mackerel, shark or mudcrab, can be kept and sold as part of the catch.

Goldband snapper species are the principal target species for the Timor Reef Fishery. Other target species landed in the fishery are described in section 1.1.1. Non-target species or byproduct species currently only comprise of 3.7% of the commercial catch (2001 logbook data).

Fisheries Research observers regularly monitor the composition of catch in addition to an annual review (Appendix 1) of all species landed, including byproduct and bycatch species. If the proportion of byproduct should increase to 10% of the overall catch there will be a review of management arrangements of the fishery under provisions of the *NT Fisheries Act 1988* (Attachment 5).

1.1.9 The management response, considering uncertainties in the assessment and precautionary management actions, has a high probability of achieving the objective.

The management measures outlined in section 1.1.7 aim to ensure that the Timor Reef fishery is managed in accordance with the National strategy for ESD.

Implementation of the 2-for-1-licence reduction scheme in 1995 has reduced the number of licences from 22 “restricted ”, licences to 8 “restricted” licences and 7 “unrestricted” licences. (March 2002).

The conservative management response measures outlined in section 1.1.5 suggest that there is no immediate risk of stock collapse if the present levels of fishing are maintained. Should catch rates exceed sustainable yields, the stock will be eroded slowly as the fishery relies on accumulated stock of older fish being taken. Should this occur, it is likely to transpire slowly over a decade until the fishery has to rely primarily on new recruits for stock replenishment (Lloyd et al. 1999).

Information on Indonesian fishing effort and movement of snapper across the Australian and Indonesian Fishing zones will refine available stock assessment and subsequent management responses. If there is a high rate of movement and Indonesian fishing effort continues to increase, then stocks will suffer high exploitation rates irrespective of the management responses of the Northern Territory.

If the current catch levels are maintained and there is limited movement between Australia and Indonesian waters the probability of achieving the objective of sustainability is high. However, it is difficult to speculate about the long-term viability without improved biomass estimates and movement rates of fish into Indonesian waters (Ramm 1997b). Preliminary results (section 1.1.3) from the ACIAR project on shared snapper resources suggest that the degree of movement of snapper between the Indonesian and Australian waters is low. When completed, this report will provide information to allow a refinement of the current biomass estimates.

The Fisheries Group has adopted a precautionary approach in managing the fishery. Provisions under the *NT Fisheries Act 1988* allow the Director to take appropriate action for the protection of the fishery by ensuring aggregate landings are below sustainable yield estimates.

Management responses are appropriate to ensure overall landings remain within available yield estimates. Appropriate trigger mechanisms are in place to prompt a review should overall landings approach or reach sustainable yield estimates. Where yield estimates are not known changes in overall landings are monitored (by onboard monitoring) with significant variations prompting a review of management arrangements for protection of the species concerned (section 1.1.6 provides details of trigger values for the fishery).

Objective 2.

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

Management responses

1.2.1 A precautionary recovery strategy is in place specifying management actions, or staged management responses, which are linked to reference points. The recovery strategy should apply until the stock recovers, and should aim for recovery within a specific time period appropriate to the biology of the stock.

and

1.2.2 If the stock is estimated as being at or below the biological and / or effort bottom line, management responses such as a zero targeted catch, temporary fishery closure or a 'whole of fishery' effort or quota reduction are implemented.

Stock assessment workshops of 1992, 1994, 1996 and 2000 and current assessments do not indicate that the stocks of the Timor Reef fishery have been overfished in the past or have been below any biological bottom line. Current precautionary management arrangements (see section 1.1.7) are aimed to ensure that stocks are maintained at sustainable levels.

Based on all available advice the fishery is unlikely to be operating at or below the biological or effort bottom line, (see section 1.1.6). However, the *NT Fisheries Act 1988* provides for a management response, including emergency measures listed under sections 28 and 29 (Appendix 5), if required.

PRINCIPLE 2

Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem.

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

Information requirements

2.1.1 Reliable information, appropriate to the scale of the fishery, is collected on the composition and abundance of bycatch.

Information from fishers suggests that the composition and abundance of bycatch species is very low. Virtually all species caught are sold as part of the combined multi-species catch.

Fisheries research observer records since the inception of the fishery confirm that bycatch is very low (less than 1%). The abundance and composition of bycatch species recorded by observers since 1990 is provided in Table 1. Due to the exceedingly low levels of bycatch, it is appropriate that bycatch, and diversity of species (see below) continues to be monitored by Fisheries Research Observers and not added to commercial fisher logbooks.

At present Fisheries research observers undertake onboard monitoring on commercial Timor Reef fishery vessels 2 to 3 times a year. All landings are recorded, including bycatch species. A rise in bycatch to 10 % of the total catch composition in successive years will trigger a review of management arrangements to ensure protection of bycatch species.

Table 1. Bycatch species recorded from onboard monitoring in the Timor Reef fishery from 1990 to 2001.

Bycatch Species		**% of total catch by weight**
Starry Triggerfish	*Abalistes stellatus*	0.12
*Red Bass	*Lutjanus bohar*	0.12
Amberjack	*Seriola dumerili*	0.05
Trevally	*Carangidae*	0.04
Giant Trevally	*Caranx ignobilis*	0.03
Nine-Spined Batfish	*Zabidius novaemaculatus*	0.02
	Percichthyidae	0.01
Hairtails	*Family Trichiuridae*	0.01
Spotted Soapfish	*Pogonoperca punctata*	0.01
Chinaman Snapper	*Symphorus nematophorus*	0.01

* Red bass are discarded due to human health concerns.

Assessment

2.1.2 There is a risk analysis of the bycatch with respect to its vulnerability to fishing.

Given the very low levels of reported bycatch in the Timor Reef fishery the risks of significant impact on bycatch species is negligible.

Management responses

2.1.3 Measures are in place to avoid capture and mortality of bycatch species unless it is determined that the level of catch is sustainable (except in relation to endangered, threatened or protected species). Steps must be taken to develop suitable technology if none is available.

The current method of catch (dropline and trap) is not considered a threat to stocks of bycatch species due to the low numbers of bycatch species captured. However, if there is a significant change (recorded by observer data) in catch composition and bycatch levels are threatened, legislation under Sections 28 and 29 of the *NT Fisheries Act 1988* allow for a review in the management arrangements of the fishery (Appendix 5).

2.1.4 An indicator group of bycatch species is monitored.

Given the low level of bycatch (currently less than 1 % of onboard observer data) and insufficient quantities of any single bycatch species caught, it is not considered practical to designate a single indicator group of bycatch species. Furthermore, there is no single bycatch species believed to be caught in sufficient quantities to cause significant impact on the species.

2.1.5 There are decision rules that trigger additional management measures when there are significant perturbations in the indicator species numbers.

Onboard monitoring (approximately 2-3 trips per year) indicate that bycatch is less than 1 % of aggregate landings . A review of the management arrangements of the fishery will be initiated if there is a significant change in the composition of catch. If bycatch levels rise to 10 % (although unlikely) of the total catch in successive years the management arrangements of the fishery will be reviewed.

The objective of the review will be to ensure that fishing operations do not continue to threaten the sustainability of bycatch species.

2.1.6 The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.

The *NT Fisheries Act 1988* provides for a review of the management arrangements with stakeholder involvement or if necessary, an emergency measure, to protect species that are under threat (Appendix 5). The management response is appropriate given the scale and scope of the fishery (less than 1 % bycatch).

Objective 2.

The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoid or minimises impacts on threatened ecological communities.

Information requirements

2.2.1 Reliable information is collected on the interaction with endangered, threatened or protected species and threatened ecological communities.

Fisheries Research observer data has been collected from the inception of dropline and trap fishing by domestic operators in the region of the Timor Reef fishery since 1989 (Lloyd et al 1999). Throughout this period, there has been no record of interaction of fishing gear with endangered, threatened or protected species. The fishing gear, either droplines or traps, and the depth at which they are set (80 -100 m), means that it is unlikely to interact with these listed species.

There are no recognised threatened ecological communities in the area of the Timor Reef fishery. Should interaction with endangered, threatened or protected species be recorded either by fishers or by onboard observers the *NT Fisheries Act 1988* provides the necessary provisions to implement appropriate management measures (Appendix 5).

2.2.2 There is an assessment of the impact of the fishery on endangered, threatened or protected species.

Fishery research observer data together with anecdotal information supplied by fishers suggest there is no interaction with species listed as endangered, threatened or protected.

Of the listed species that occur in Northern Territory waters, only the hawksbill turtle is commonly encountered in the Timor Reef fishery. Several members of the Timor Reef fishery fleet record and collect samples of discarded fishing netting material or rescue turtles that have become entangled in the discarded netting. The netting material originates in waters external to Australia. Other than entangled turtles in foreign fishing nets, no other interactions have been observed or recorded historically.

Given the lack of any reported interaction with endangered, threatened or protected species, the risks of significant impact by the Timor Reef fishery on these populations is considered minimal.

2.2.3 There is an assessment of the impact of the fishery on threatened ecological communities.

Not applicable.

No threatened ecological communities have been identified within the confined boundary of the Timor Reef fishery. Equally, no threatened ecological communities have been identified in close proximity of the Timor Reef fishery.

Management responses

2.2.4 There are measures in place to avoid capture and/or mortality of endangered, threatened or protected species

Not applicable.

There is no reported or observed interaction with endangered, threatened or protected species and therefore no measures in place to avoid the capture and or mortality of such species. The method of fishing and the location of the fishery generally prevents the interaction with these species.

2.2.5 There are measures in place to avoid impact on threatened ecological communities.

Not applicable.

No threatened ecological communities have been identified within the designated area of the Timor Reef fishery or within any likely impact range of the fishery. If a threatened ecological community is identified in the future, provisions under the *NT Fisheries Act 1988* can allow appropriate action to be taken.

2.2.6 The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective.

Not applicable.

On the basis of no recorded or observed adverse interaction of the Timor Reef fishery with endangered, threatened or protected species or threatened ecological communities there is currently no management response for the fishery. However, the *NT Fisheries Act 1988* provides a range of controls to protect these species and any threatened ecological community (Appendix 4). If deemed necessary the Minister has the power to apply emergency management action (Appendix 5).

Objective 3.

The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally.

Information requirements

2.3.1 Information appropriate for the analysis in 2.3.2 is collated and/or collected covering the fisheries impact on the ecosystem and environment generally.

Observations from video recordings indicate that the substrate is predominantly muddy sands. The fishing methods (observed from video footage) used in the fishery appear to have minimal impact.

Fisheries Research observers while onboard commercial vessels record all fishing activities and captures. Video monitoring of the fishing gear while in use has also been used to assess fish and benthic community interactions with fishing gear (Julie Lloyd pers. comm. 2002).

Assessment

2.3.2 Information is collected and a risk analysis, appropriate to the scale of the fishery and its potential impacts, is conducted into the susceptibility of each of the following ecosystem components to the fishery.

1. Impacts on ecological communities

Benthic communities

Video footage of droplines, traps and anchors while fishing has shown that the substrate on which fishing takes place is predominantly muddy sands. The communities present are thought to be burrowing species living in the soft sediment, with the occasional sponge or gorgonian attached to solid substrate.

Published literature is scant on the impact this type of fishing has on the ecological communities. However, given the substrate type and quantity of observed biological structures present, it is assumed that any impact on benthic communities is confined to the localised area where the trap or anchor contacts the seafloor.

Ecologically related, associated or dependent species

Due to the relative size of the fishery and small number of participants, research into the ecologically related, associated or dependent species has not been undertaken. The research and management effort to date has been focussed on assessing the sustainability stock of target species only.

Water column communities

Water column communities have not been assessed as part of the fisheries research effort. Fishing takes place at depths of about 100 metres or greater and therefore the only interaction with these communities takes place when the fishing gear is lowered or retrieved and is not anticipated to cause a significant amount of interaction.

2. Impacts on food chains

Productivity/flows

The effect of removing a portion of the upper level predators in a deep-water fish community is not well understood and research specifically designed to address this question is yet to be undertaken.

3. Impacts on the physical environment

Physical habitat

The fishing methods used in the Timor Reef fishery are unlikely to affect the predominantly mud/sand bed structure of the sea floor. Observations of video recordings of traps and anchors indicate minimal disturbance of the substrate.

Although, droplines are often used on soft coral/sand mud reefs, the average 5 kilo weight is still unlikely to have any significant effect on the substrate.

Water quality

The Timor Reef fishery has a small number of commercial vessels that use no chemicals in their operation other than diesel fuel. The vast area covered and the small number of vessels in the fleet limits the likelihood of any significant impact on water quality.

Management measures

2.3.3 Management actions are in place to ensure significant damage to ecosystems does not arise from the impacts described in 2.3.1.

Although no specific scientific research has been undertaken on the impacts of the operations of Timor Reef fishery on the ecosystems, the relatively low number of vessels (currently 6 active) operating in the fleet, the method of fishing, gear restrictions imposed and the extent of fishing area, limits the potential of significant impact. If a threat or significant impact is detected through

logbook data or observer data then there are provisions under the *NT Fisheries Act 1988* (Appendix 5) that enable the Minister to take appropriate action to prevent or reduce the impact and subsequent damage to such ecosystems.

2.3.4 There are decision rules that trigger further management responses when monitoring detects impacts on selected ecosystem indicators beyond a predetermined level, or where action is indicated by application of the precautionary approach.

Not applicable. See 2.3.3 above.

2.3.5 The management response, considering uncertainties in the assessment and precautionary management actions, has a high chance of achieving the objective

Not applicable. See 2.3.3 above.

REFERENCES

Allen, G., (1985) Snappers of the world. An annotated and illustrated catalogue of Lutjanid species known to date. FAO species catalogue. Vol. 6.

Anon, (In pres). Report of the Third Stock Assessment Workshop. ACIAR red snapper project (FIS/97/165). (Cianjur, Indonesia, 18 to 21 September 2001).

Buckworth, R. (Ed) (In press). Northern Territory Fisheries Workshop 2000, Guiding fishery assessments in Northern Australia.

Clarke, R. and Lloyd, J. (2002). Offshore Tropical Snapper Fishery. DBIRD Fishnote No. 29

Lloyd, J. (1995). Goldband Snapper Pilot Project in the Timor Sea. Department of Primary Industry and Fisheries, *Fisheries Report* 37.

Lloyd, J., Clarke, R. and Cann, B., (1999). Interim Fisheries Assessment Report for the Timor Reef Fishery. *Fishery Report* 47.

Lloyd, J., Ovenden, J., Newman, S. and Keenan, C. (2000). Stock Structure of *Pristipomoides multidens* Resources across Northern Australia. Department of Primary Industry and Fisheries, *Fishery Report* 49. ISBN 0 7245 3066 5.

Newman, S. Stekis, R., Edmonds, J., Lloyd, J. (2000) Analysis of the stable isotopic composition of the otoliths of Goldband Snapper, *Pristipomoides multidens*, as an aid to the determination of stock structure. Fisheries Western Australia, *Project No*. 98/154.

Overden, J.R., Lloyd, J., Newman, S., Keenan, C.P., Slater, L.S., (In press)., Spatial genetic subdivision amoung northern Australian and southeast Asian populations of *Pristipomoides multidens*: a tropical marine reef fish species. Fisheries Research 1363.

Ramm, D. (1993). Estimation of biomass and fishery yield for snapper stocks in northern Australian waters. *In* Australia's Northern Trawl fishery. Final report to the Fisheries Research and Development Corporation on project 86/049 "Assessment of the Status, Composition and Market Potential of Demersal Trawl Fish Resources in Northern Australian Waters". Northern Territory Department of Primary Industry and Fisheries. *Fishery Report* 32.

Ramm, D. (1994). Australia's Northern Trawl fishery. Final report to the Fisheries Research and Development Corporation on project 86/049 "Assessment of the Status, Composition and Market Potential of Demersal Trawl Fish Resources in Northern Australian Waters". Northern Territory Department of Primary Industry and Fisheries. *Fishery Report* 32.

Ramm, D. (1997a). Assessment of Groundfish Stocks in Northern Australian Waters between 127-137°E. Department of Primary Industry and Fisheries, *Fisheries Report* 38.

Ramm, D. (Ed) (1997b). Towards the Sustainable Use of Northern Territory Fishery Resources: Review Workshop led by Carl J. Walters. Final report to the Fisheries Research and Development Corporation on project 96/158. Northern Territory Department of Primary Industry and Fisheries. *Fisheries Report* 39.

Ramm D, and Xiao (1995) Herding of groundfish and effective pathwidth of trawls. Department of Primary Industry and Fisheries, Fisheries Research 24.

Appendix 1. Offshore Snapper Status Report example.

Offshore Snapper Status Report 2000

Saddletail snapper

Lutjanus malabaricus

Key Features

Fishery	Timor Reef	Demersal	Finfish trawl
Fishery Status or Development Stage:	Nearing full utilisation	Under-utilised	Developing, but under-utilised
Stock Assessment Reliability:	Low (although there is a long time series of commercial catch and effort data, this data is poorly informative about stock status)		
Commercial Harvest 2000:	397.9 tonnes	68.4 tonnes	Confidential (<5 operators)
Value of commercial harvest (including byproducts):	$2.1million	$364,217	Confidential (<5 operators)
5-year trend and average (commercial):	Catch: Fluctuating, average 359t Effort: stable 848	Confidential (<5 operators)	
Recreational Harvest 1999	Nil	unknown	
Commercial licences issued:	15 licences 5 licensees land 90% of catch	60	1
Number of FTO's landing offshore tropical snappers	Unknown, but probably very low		
Management Arrangements, General:	Commercial: Input controls. Limited entry, licence transfer arrangements, gear restrictions Recreational: Output controls, possession limits, FTO licensing		

Management Arrangements, fishery specific:	Limited entry. 2 for 1 licence transfer reduction scheme	Limited commercial entry.	One licence only. Gear and area restrictions

INTRODUCTION

Goldband snapper is the most important commercial species landed in the Timor Reef fishery in terms of quantity and value, with red emperor landings increasing significantly as operators now use baited traps in preference to mechanised droplines. The value of the trap and dropline fishery in 2000 was approximately $2.1M for reported landings of 359 t

Comparatively low levels of fishing effort continue in the demersal fishery, with the majority of fishing activity targeting goldband snapper and emperors in waters with similar habitat and depth to the adjacent Timor Reef fishery. The remainder of the demersal trap and line fishery is underdeveloped.

Ruby emperor (or saddle tail snapper) and red snapper dominate the trawl catch, with overall landings remaining well below estimated sustainable limits. Confidentiality considerations preclude the publishing of catch information for the single trawl operator.

Timor Reef Fishery

The offshore Timor Reef fishery extends from the WA/NT border to the northwest of Darwin and to the outer limit of the Australian fishing zone (see map).

Current legislative arrangements allow fishers to use droplines, handlines, mechanically assisted haul lines and traps to land tropical snappers and emperors. Despite the use of traps by some operators in the early development of the fishery, most operators in the past chose to use buoyed individual droplines, and then mechanised droplines to target schools of goldband snapper. With improved catch rates and profitability, the majority of operators now use baited traps. Squid is the preferred bait by dropline fishers whilst trap fishers prefer to use small baitfish such as pilchards.

The Timor Reef commercial fleet operates semi-displacement vessels between 15 and 24 m in length, with 4 to 6 crewmembers. Fishing trips are generally 7 to 10 days in duration depending on fish availability and market demands.

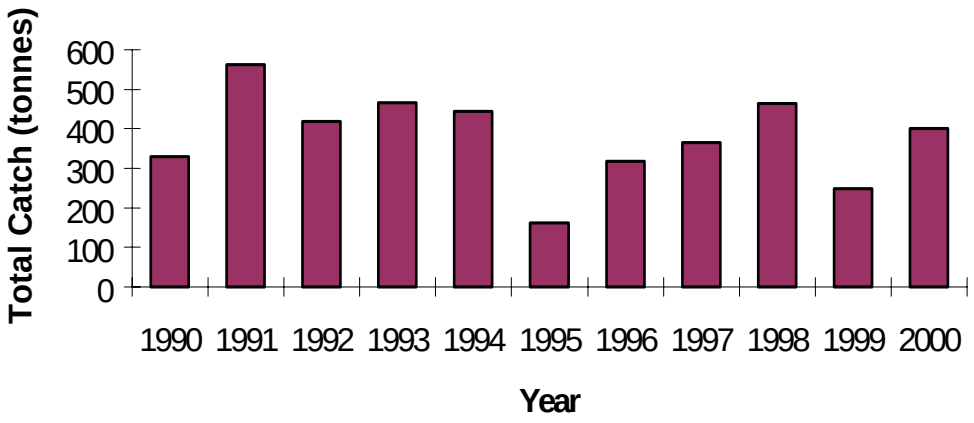


Figure 1. Catch for the Timor Reef fishery for the period 1990 to 2000

Demersal Fishery

The demersal fishery operates in waters seaward of 15 nautical miles from the shore to the outer limit of the AFZ. The Timor Reef fishery was annexed from the Demersal Fishery due to concerns about the likely impact on the resource given the level of interest expressed by commercial operators participating in the fishery, particularly those displaced through restructuring of other Australian fisheries.

With simplified jurisdictional arrangements following the passage of the Offshore Constitutional Settlement of 1995, the boundaries of the inshore and offshore fisheries were realigned to more accurately define the distribution of inshore and offshore fishery resources. Sixty fishery licences were issued for the demersal fishery.

Finfish Trawl Fishery

A single trawl operator continues to harvest the demersal fin fish resources in waters adjacent to the Northern Territory. The finfish trawl fishery operates adjacent to the northern and northeastern coast of the NT and the northern portion of the Gulf of Carpentaria.

Fishing operations are conducted using a semi pelagic demersal trawl thereby limiting any damage to the seabed. This trawl net was cooperatively developed by the industry and Government in minimising habitat disturbance while ensuring commercial catch rates were maintained. The quality of the retained catch has also improved in reducing the incidence of sponges and other unwanted species associated with the operations of traditional demersal trawls.

HISTORY

Historically, foreign fishing vessels have operated throughout the Timor Sea and Arafura Sea. Japanese stern trawlers fished in northern waters from the late 1950's to the early 1960's, Thai and Taiwanese pair trawlers intensively fished waters throughout northern Australia during the 1970's. Foreign fleets continued fishing under licence agreements following the ratification of Australia's fishing zone (AFZ) in November 1979. Overall catches from the Arafura Sea peaked at approximately 10,000t in 1983.

Dropline fishing in the Timor and Arafura Seas by Japanese vessels from 1975 to 1982 resulted in substantial landings of tropical snapper. Droplining by domestic vessels commenced in the Timor Sea in 1987. Access arrangements to foreign fleets ceased in 1991 following increased interest by domestic operators and concerns about over-fishing of snapper resources.

In 1991, six Australian trawlers were licensed to operate in the then Commonwealth managed Northern Trawl Fishery, which extended from WA, across NT and into Qld waters of the Gulf of Carpentaria. Further management controls were introduced to link access with sustainable yield estimates. The remote location and associated high costs of operation have hindered the development of the fishery, with only a single operator demonstrating an ongoing interest in the fishery.

SUSTAINABLE YIELD ESTIMATES

Sustainable yield estimates have been determined from catch and effort information gathered from Taiwanese, Thai and Chinese trawlers, trawl research surveys and details provided by the Timor Reef and finfish trawl fishers.

Resource estimates were initially conducted by CSIRO in 1991. The estimates were updated in 1992 following trawl surveys undertaken by NTDPIF. The research undertaken by NTDPIF sought to estimate the herding effect and swept area of trawl nets to refine yield estimates, while CSIRO provided age and growth estimates for red snappers. A co-operative approach was engendered with the joint 1992 Australian-Indonesian Workshop on the Arafura Sea Fisheries. This workshop sought to review the available information on both the Australian and Indonesian components of the Arafura Sea. Yield estimates were 7,500 to 19,500 t for the Australian and Indonesian jurisdictions of the Arafura Sea, 4,000 to 10,000 t for Australian waters of the Arafura Sea and 4,100 to 16,500 t for the entire Gulf of Carpentaria.

As an outcome of a second workshop held in October 1994, sustainable yield estimates were revised to 3,700 to 6,800 t for the Australian area of the Arafura Sea and between 2,900 and 9,000 t for the Gulf of Carpentaria.

The most recent yield estimates for these fisheries may be found in the Northern Territory Fisheries Report number 39 "*Towards the Sustainable Use of Northern Territory Fisheries Resources: Review Workshop Led by Carl Walters*", (1996).

From this workshop it has been estimated that the sustainable annual harvest for red snapper is 1,500 t for the Arafura Sea. This estimate is based on the assumption that the stock, prior to commercial fishing, was in the order of 50,000 t and only a small portion can be harvested each year due to their slow growth rates and low natural mortality. Current landings are considerably less than this estimate.

For the Timor Reef fishery, yield estimates range from 3,000 to 20,000 t or more, depending on how the catch rates age and survey details are interpreted. It was also assumed that there was a high level of mixing between Australian and Indonesian stocks. Refinement of the sustainable yield estimates will only be possible with further details on the degree of mixing between the Australian and Indonesian fisheries, information on fishing effort and fishery independent survey techniques.

MANAGEMENT

Management for resource protection and sustainable utilisation of the demersal fisheries is achieved through limited entry arrangements and controls on fishing gear.

In response to concerns about long term sustainable use and excess fishing capacity, a "two for one" licence reduction has been agreed for the Timor Reef fishery. All new entrants to the fishery must acquire and surrender two restricted licences for the issuance of an unrestricted licence, or alternatively, obtain an unrestricted licence previously issued on the surrender of two preexisting licences.

RESEARCH

The following projects are presently being undertaken to assist the NT Fisheries Group in providing more accurate stock assessment parameters and a better understanding of these fisheries.

Stock assessment

Professor Carl Walters of the University of British Columbia conducted a stock assessment workshop in August 2000. Prof. Walters was engaged as a consultant to the Northern Territory Fisheries Group to conduct a review of the major fisheries. This review involved industry participants (both Northern Territory and Western Australia) together with scientists and

managers from Northern Territory, Western Australia and Bureau of Rural Sciences. All available information was drawn together, including details about Indonesian effort from foreign fishing observers in the region immediately adjacent to the Timor Reef fishery. Previous assessments were reviewed and further assessments were undertaken using models assembled by Prof. Walters. Full details of this assessment are presently being written up and will be available as a Fisheries report in the near future.

Monitoring

Monitoring of the Timor Reef fishery has been conducted on commercial boats since 1990. While onboard, officers document fisheries practices, catch composition and, where possible, measure all commercial species landed.

Biological Research

Indonesia and Australia share gold band and red snapper resources in the Timor and Arafura Seas. In order to obtain a better understanding of the biology of these species, together with the stock structure and dynamics, a collaborative Australian Centre for International Agriculture Research (ACIAR) funded project with NT, CSIRO and Indonesia was initiated in 1999. This project is focused on goldband snapper and red snappers (stocks of northern Australia, eastern Indonesia, and East Timor). Monthly samples have been obtained since April 1999 for biological research. Otoliths are removed, sectioned and read to provide growth information, and gonads are initially staged macroscopically, then histology is undertaken to provide reproductive information.

MARKETING

Tropical snappers landed within the line and trap fisheries are sold chilled as fresh whole fish or fillets. As the local Darwin market is small, most tropical snappers are forwarded to interstate markets, and sold on the Brisbane and Sydney fish markets. Increasingly, operators are developing marketing arrangements outside the traditional central marketing systems.

The majority of trawl caught snappers are sold frozen on export markets, particularly US and European markets. Some trawl caught fish are sold as fillets to local and international markets.

COMPLIANCE

Compliance with the management controls is achieved through wharf-side inspections and as an adjunct to surveillance activities undertaken for other NT and Commonwealth managed fisheries.

Appendix 2. Daily logbook example.

CONFIDENTIAL

TIMOR REEF FISHERY DAILY LOG SHEET

Part A

DATE: | LICENCE No.: | SKIPPER: | No. OF CREW:

Signature of Licensee:

Bait Type: | Hook Size: | Quantity Used/Day (Kg):

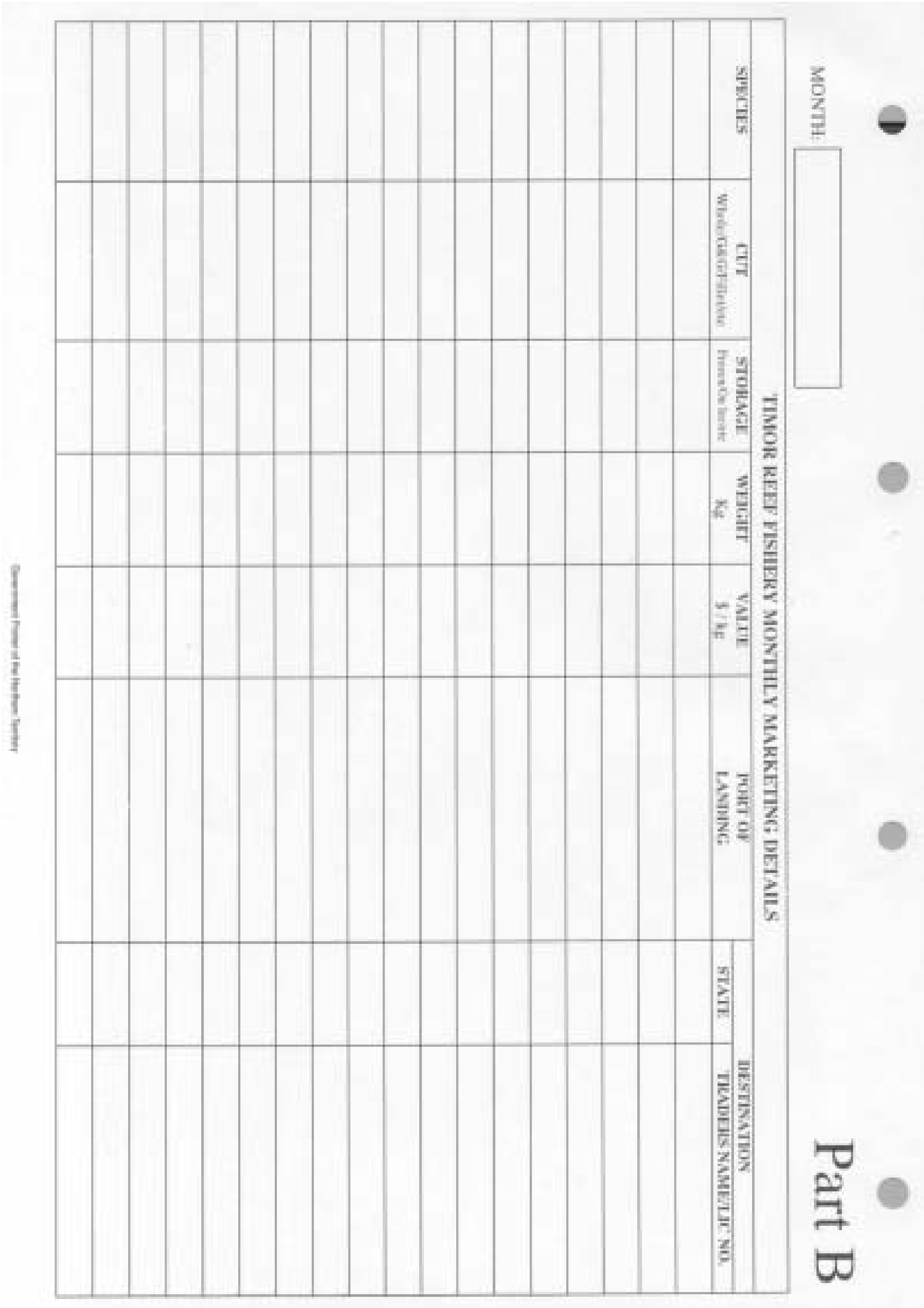
Vessel Name:

FISHING METHOD

Drop Line	Hyd	Hand	Set Line	Other	Trap Type
No. of Lines					No. of Traps
Per Shots					Per Shots
No. of Hooks Per Line					Average Soak Time Per Shot
Average Soak Time Per Line					OFFICIAL USE

FISHING DETAILS							CATCH BY NUMBER AND SPECIES										REMARKS
Trap or Drop Line	No. of Shots	Latitude	Longitude	Depth Fished (m)	Fishing Time: Start	Fishing Time: Stop	Gold Band Snap	Sharp Tooth Snap	Sad Tail	Red Emp	Red Snap	Rosy	Cod	Other (specify)	Summary Total	Weather Fish Size Water Temp

Appendix 3. Monthly market report logbook example.



Appendix 4. Excerpt from Northern Territory Fisheries Regulations.

Division 15 - Timor Reef Fishery

141A. Definitions

In this Division -

"Restricted Timor Reef Fishery licence" means a licence granted in accordance with regulation 141D(2);

"Unrestricted Timor Reef Fishery licence" means a licence granted in accordance with regulation 141F(1).

141B. Declaration of Timor Reef Fishery

The industry of taking fin fish (other than barramundi, threadfin salmon, spanish mackerel, shark or mud crab) by drop line, vertical line and fish trap in the area specified in regulation 141C, is hereby declared to be the Timor Reef Fishery.

141C. Area of fishery

The Timor Reef Fishery area is the area of the sea bounded by a line -

(a) Commencing at the point of intersection of the meridian of longitude 131^{o} east and the parallel of latitude 10^{o} 30 ' south;

(b) From their west along the parallel 10^{o} 30' south to its intersection by the meridian of longitude 129^{o} 40' east;

(c) From their south along that meridian to its intersection by the parallel of latitude 11^{o} south;

(d) From their west along the parallel of latitude 11^{o} south to its intersection by the outer boundary of the Australian fishing zone;

(e) From there generally north-easterly along the outer boundary of the Australian fishing zone to its intersection by the meridian of longitude 131^{o} east;

(f) From there south along that meridian to its intersection by the parallel of latitude 10^{o} 30' south.

141D. Restricted Timor Reef Fishery licences

(1) Except in accordance with this Division, the Joint Authority shall not grant a licence in respect of the Timor Reef Fishery.

(2) Where, immediately before 3 February 1995, a person held a Demersal Fishery licence permitting the taking of fish in the Timor Box (Drop Line and Trap) Fishery declared in *Gazette*

No. G18 of the Commonwealth published 9 May 1990, the Joint Authority shall grant to the person a restricted Timor Reef Fishery licence.

(3) The holder of one or more restricted Timor Reef Fishery licences granted to him or her in accordance with sub regulation (2) shall not take fish under such a licence, unless he or she holds one Demersal Fishery licence (other than such a licence temporarily transferred under section 12A of the Act to another) in respect of each restricted Timor Reef Fishery licence under which fish may be taken by him or her.

141E. Transfer of restricted licence

(1) The holder of a restricted Timor Reef Fishery licence may transfer the licence under section 12B, but not section 12A, of the Act.

(2) Subject to sub regulation (3), a person to whom a restricted Timor Reef Fishery licence is transferred shall not take fish under the licence.

(3) Where -

(a) Immediately before 3 February 1995, the Director permitted, under section 14(1) of the Act, a person to carry out fishing operations under a Demersal Fishery licence referred to in regulation 141D(2) held by a licensee; and

(b) On or after 3 February 1995, the restricted Timor Reef Fishery licence granted to that licensee under that regulation is transferred by him or her to that person,

That person may take fish under the restricted Timor Reef Fishery licence if he or she holds one Demersal Fishery licence (other than such a licence temporarily transferred under section 12A of the Act to another) in respect of each restricted Timor Reef Fishery licence under which fish may be taken by him or her.

(4) The holder of 2 restricted Timor Reef Fishery licences may transfer the licences under section 12B of the Act to the Territory and the Joint Authority shall approve such a transfer.

141F. Unrestricted Timor Reef Fishery licences

(1) Where 2 licences are transferred in accordance with regulation 141E(4) by a licensee, the Joint Authority shall grant to him or her one unrestricted Timor Reef Fishery licence.

(2) The holder of an unrestricted Timor Reef Fishery licence may transfer the licence.

(3) The holder of one or more unrestricted Timor Reef Fishery licences shall not take fish under such a licence, unless he or she holds one Demersal Fishery licence in respect of each Timor Reef Fishery licence under which fish may be taken by him or her.

141G. Fishing gear

The holder of a Timor Reef Fishery licence shall not use under the licence fishing gear other than -

(a) A vertical line;

(b) A drop line attached to or free from a vessel;

(c) A fish trap; and

(d) A scoop net or gaff.

141H. Vessels

(1) Subject to sub regulation (3), the holder of -

(a) A restricted Timor Reef Fishery licence granted to him or her in accordance with regulation 141D; or

(b) An unrestricted Timor Reef Fishery licence who held, immediately before 3 February 1995, a Demersal Fishery licence referred to in regulation 141D(2),

Shall not, under the licence, use a vessel other than the vessel nominated in respect of the Demersal Fishery licence referred to in regulation 141D(2), except with the written permission of the Joint Authority.

(2) Subject to sub regulation (3), the holder of an unrestricted Timor Reef Fishery licence who did not hold, immediately before 3 February 1995, a Demersal Fishery licence referred to in regulation 141D(2), shall use a vessel not less than 8 m long in the fishery.

(3) A Timor Reef Fishery licensee may use a vessel other than a vessel referred to in sub regulation (1) or (2) if he or she has the approval in writing of the Joint Authority to use the vessel under the licence.

141J. Certain fish not to be taken

The holder of a Timor Reef Fishery licence shall not take barramundi, threadfin salmon, spanish mackerel, shark or mud crab under the licence.

Appendix 5. Excerpt from *Fisheries Act 1988*, Sections 28 and 29.

PART IV - CONTROL AND ENFORCEMENT

Division 1 - Powers of Minister

28. General power of Minister

(1) Notwithstanding anything in this Act or the Regulations, the Minister may, in relation to any matter or thing not dealt with in an operative management plan, by notice in the *Gazette* -

(a) Declare a period to be a period during which the taking of fish or aquatic life or fish or aquatic life of a particular species, sex, size, age, or other characteristic specified in the notice, is prohibited or allowed;

(ab) Declare that the taking of fish or aquatic life or fish or aquatic life of a specified species, sex, size, age or other characteristic is prohibited or allowed;

(b) Declare an item of fishing gear to be an item to be used or not to be used in a fishery specified in the notice;

(c) Declare restrictions relating to -

(i) The size;

(ii) The design;

(iii) The construction materials;

(iv) The quantity; or

(v) Such other specifications as the Minister thinks fit,

Of fishing gear to be used in or in connection with the taking of fish or aquatic life, or fish or aquatic life of a particular species, specified in the notice;

(d) Vary the prescribed closure lines delineating the mouth of a river within the meaning of the Regulations;

(e) Vary the boundaries of any area prescribed for the taking of fish or aquatic life or as waters from which fish may not be taken either generally or in a particular manner, however those areas are described, in relation to a fishery; or

(f) Establish a licence buy-back scheme for a prescribed fishery.

(2) A declaration under subsection (1)(a), (b) or (c) may be expressed to apply generally or in relation to a particular area or fishery specified in the notice.

(3) On the publishing of a notice in the *Gazette* varying a closure line referred to in subsection (1)(d) or the boundaries of an area referred to in subsection (1)(e), that line or those boundaries as so varied shall be the line and boundaries in relation to the river or area specified in the notice and this Act and the Regulations shall apply accordingly.

29. Minister may impose emergency restrictions

(1) If at any time an emergency occurs that, in the opinion of the Minister, endangers or may endanger stocks of fish or aquatic life, or any species or class of fish or aquatic life, in any fishery or part of a fishery where there is no operative management plan, the Minister may, by notice in the *Gazette* after consultation with the appropriate advisory committee (if any) and not with-standing anything to the contrary in this Act or an instrument of a legislative or administrative character made under it, or in any licence or permit granted under or pursuant to any of them -

(a) Halt all or any fishing in that fishery or any specified part of the fishery;

(b) Restrict the number of vessels used in relation to fishing in the fishery;

(c) Restrict the amount of fish or aquatic life which may be taken from that fishery; or

(d) Restrict the quantity or nature of fishing gear that may be used in the fishery.

(2) Any such notice shall contain brief reasons for the restrictions, and shall be given for a period of not more than 28 days but may from time to time be amended, revoked, or renewed by the Minister by a subsequent notice.

(3) The particulars of a notice given under this section shall be advertised twice in at least 1 newspaper generally circulating in the area concerned.

(4) A notice given under this section shall come into force on a day to be specified, being a day no sooner than the date on which the notice is advertised under subsection (3) for the second time.

Appendix 6. Excerpt from *Fisheries Act 1988*, Sections 21 through 24.

PART III - FISHERIES MANAGEMENT PLANS

21. Purposes of Part

(1) The purpose of this Part is to conserve, enhance, protect, utilize, and manage the fish and aquatic life resources of the Territory to -

(a) Promote, develop and maintain commercial and amateur fishing;

(b) Provide for optimum yields from a fishery and maintain the quality of the yield;

(c) Ensure that the fisheries of the Territory are not endangered or overexploited;

(ca) encourage tourist and scientific interest in fish and aquatic life; and/or

(d) Ensure that the habitats of fish or aquatic life and the general environment are not detrimentally affected.

(2) For the avoidance of doubt, "manage" in subsection (1) includes, and shall be taken always to have included, a total prohibition against the taking of fish or aquatic life in all or part of a fishery management area or in a fishery.

22. Management areas and managed fisheries

The Minister may, by notice in the *Gazette*, declare -

(a) An area, place, or any waters to be a fishery management area; or

(b) A fishery to be a managed fishery.

23. Management plans

Where a management area or managed fishery has been declared pursuant to section 22, the Director shall, as soon as practicable after the declaration, prepare a proposed plan for the whole or part of the management area or managed fishery for the purposes specified in section 21 and having regard to the need for co-ordination between management areas or between managed fisheries or among any of them.

24. Fisheries management advisory committees

(1) For the purposes of assisting the Director in preparing proposed plans and giving advice in relation to operative plans, the Minister may, as the Minister thinks fit, from time to time establish and, after having due regard to the users of an area or fishery, appoint members to an advisory committee for each management area or managed fishery.

(2) Each such committee shall be chaired by a person nominated by the Minister and may include members representing commercial, processing, wholesaling, retailing, recreational, consumer, or other interests in the area relating to fishing, fish, or aquatic life.

Appendix 7. Monitoring data catch composition 1990 – 2001.

Common name	Name	Catch type	%
Gold-Band Snapper	*Pristipomoides multidens*	Target	51.73
Sharptooth Snapper	*Pristipomoides typus*	Target	11.85
Red Emperor	*Lutjanus sebae*	Target	8.72
Saddle-Tailed Snapper	*Lutjanus malabaricus*	Target	6.21
Scarlet Snapper	*Lutjanus erythropterus*	Target	4.51
Yellow Spotted Rockcod	*Epinephelus areolatus*	Target	4.50
Rosy Jobfish	*Pristipomoides filamentosus*	Target	3.85
Timor Snapper	*Lutjanus timorensis*	Byproduct	2.21
Grass Emperor	*Lethrinus laticaudis*	Byproduct	1.48
White-Bloched Rockcod	*Epinephelus multinotatus*	Byproduct	0.99
Radiant Sea-Bass	*Epinephelus radiatus*	Byproduct	0.56
Robinson's Sea-Bream	*Gymnocranius grandoculus*	Byproduct	0.46
Red-Spot Emperor	*Lethrinus lentjan*	Byproduct	0.42
Spangled Emperor	*Lethrinus nebulosus*	Byproduct	0.38
Russell's Snapper	*Lutjanus russelli*	Byproduct	0.31
One-Band Sea-Perch	*Lutjanus vittus*	Byproduct	0.21
Long-Spined Snapper	*Argyrops spinifer*	Byproduct	0.18
Maroon Sea-Perch	*Lutjanus lemniscatus*	Byproduct	0.15
Six-Banded Rock-Cod	*Epinephelus sexfasciatus*	Byproduct	0.10
Hussar	*Lutjanus adetii*	Byproduct	0.08
Emperors, sea-breams	*Family Lethrinidae*	Byproduct	0.08
Tomato Rockcod	*Cephalopholis sonnerati*	Byproduct	0.06
Gold-Striped Sea-Perch	*Lutjanus carponotatus*	Byproduct	0.06

Bar Cheeked Coral-Trout	*Plectropomus maculatus*	Byproduct	0.05
Comet Groper	*Epinephelus morrhua*	Byproduct	0.04
Rosy Dwarf Monocle Bream	*Parascolopsis eriomma*	Byproduct	0.04
Painted Sweetlip	*Diagramma pictum*	Byproduct	0.04
Crimson soldierfish	*Myripristis murdjan*	Byproduct	0.03
Duskytail Groper	*Epinephelus bleekeri*	Byproduct	0.03
Large Eye Breams	*Gymnocranius spp*	Byproduct	0.02
Green Jobfish	*Aprion virescens*	Byproduct	0.02
Estuary cod	*Epinephelus coioides*	Byproduct	0.01
White-Cheeked Monocle-Bream	*Scolopsis vosmeri*	Byproduct	0.01
Yellow-Finned Javelin-Fish	*Pomadasys kaakan*	Byproduct	0.01
Naked-Headed Sea-Bream	*Gymnocranius griseus*	Byproduct	0.01
Spangled Emperor	*Lethrinus nebulosus*	Byproduct	0.01
Ornate Emperor	*Lethrinus ornatus*	Byproduct	0.01
Bar-Breasted Rock-Cod	*Epinephelus quoyanus*	Byproduct	0.01
Mangrove-Jack	*Lutjanus argentimaculatus*	Byproduct	0.01
Golden Snapper	*Lutjanus johnii*	Byproduct	0.01
Tang's Snapper	*Lipocheilus carnolabrum*	Byproduct	0.01
Jobfish	*Pristipomoides flavipinnis*	Byproduct	0.01
Lined Javelinfish	*Hapalogenys kishinouyei*	Byproduct	0.01
Long-nosed Emperor	*Lethrinus olivaceous*	Byproduct	0.01
Sweetlip Emperor	*Lethrinus miniatus*	Byproduct	0.01
Swallow-Tail Sea-Bream	*Gymnocranius elongatus*	Byproduct	0.01
Tuskfish and Wrasses	*Labridae*	Byproduct	0.01
Saddleback Pigfish	*Bodianus bilunulatus*	Byproduct	0.01
Starry Triggerfish	*Abalistes stellatus*	Bycatch	0.12

Red Bass	*Lutjanus bohar*	Bycatch	0.12
Amberjack	*Seriola dumerili*	Bycatch	0.05
Trevally	*Carangidae*	Bycatch	0.04
Giant Trevally	*Caranx ignobilis*	Bycatch	0.03
Nine-Spined Batfish	*Zabidius novaemaculatus*	Bycatch	0.02
	Percichthyidae	Bycatch	0.01
Hairtails	*Family Trichiuridae*	Bycatch	0.01
Spotted Soapfish	*Pogonoperca punctata*	Bycatch	0.01
Chinaman Snapper	*Symphorus nematophorus*	Bycatch	0.01