

Assessing the ecological sustainability of the Tasmanian rock lobster fishery

A report prepared for Environment Australia as required for assessment under guidelines for Schedule 4 listing under the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*

Wes Ford



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Wes Ford

Principal Fisheries Management Officer
Department of Primary Industries, Water and Environment
GPO Box 44
HOBART TAS 7001

Wes.Ford@dpiwe.tas.gov.au

Contents

A	INTRODUCTION	4
A.1	History of the fishery	4
A.2	Context of the current management plan	6
A.3	Objectives of the management plan	7
A.3	Availability of the management plan	11
A.4	Consultative process for developing a management plan under the Act	11
A.5	Stakeholder involvement in the development and assessment of a management plan	11
B	ESD ASSESSMENT	13
B.1	PRINCIPLE 1.	13
B.1.1	Objective 1.	13
B.1.1.1	Information requirements	13
B.1.1.2-5	Assessment	14
B.1.1.6-9	Management responses	27
B.1.2	Objective 2.	33
B.1.2.1-2	Management responses	33
B.2	PRINCIPLE 2.	35
B.2.1	Objective 1.	35
B.2.1.1	Information requirements	35
B.2.1.2	Assessments	36
B.2.1.3-6	Management responses	36
B.2.2	Objective 2.	38
B.2.2.1	Information requirements	38
B.2.2.2-3	Assessments	39
B.2.2.4-6	Management responses	40
B.2.3	Objective 3.	42
B.2.3.1	Information requirements	42
B.2.3	Assessment	42
B.2.3.3-5	Management responses	43
C	REFERENCES	44

A INTRODUCTION

A.1 History of the fishery

The Tasmanian rock lobster fishery targets the southern rock lobster (*Jasus edwardsii*) in the waters adjacent to Tasmania. Since 1986 Tasmania has had jurisdiction of the fishery in waters generally south of 39° 12', and out to 200 nautical miles from the coastline (Anon. DPIF 1997b). This jurisdiction is provided to Tasmania by way of an Offshore Constitutional Settlement with the Commonwealth Government (Anon. DPIF 1997b). However the fishery has been operating within the coastal waters (inside 3 nautical miles) off Tasmania since around 1830.

Management of the fishery effectively commenced in the late 1800s with a Royal Commission on fisheries in Tasmania in 1882, which led to the introduction of the *Crayfish Act 1885* (Winstanley 1973). This Act introduced the first size limits and prohibited the taking or sale of spawning female rock lobster. Over the following century the fishery was managed by an increasing number of controls on seasons, licences, vessels and pot numbers.

The combination of declining catches and increasing effort in the mid 1980s prompted a serious review of future management options, commencing with an industry seminar in 1986 (Bear 1988). Increasing concern about the future of the fishery led to a Government review in 1992 (Anon. DPIF 1993). After much analysis, debate, and lobbying, the decision to introduce individual transferable quota management (ITQ) was taken in 1996 (Ford and Nicol 2000) and the new management regime commenced in March 1998.

The history of the fishery and its management has been well documented (Winstanley 1973, Harrison 1986, Anon. DPIF 1997b, Ford 1999, Ford and Nicol 2000, Ford 2000a, Ford 2000b, Frusher 1997a).

Prior to 1966 access to commercial rock lobster licences was not limited but there were limitations on the number of rock lobster pots that could be used by each vessel. During the period from 1956 to 1966 the number of pots in the fishery increased from 4,000 to 8,900 (Winstanley 1973, Harrison 1986) and by 1972 had increased to 10,930, when the number of pots became limited. The number of pots then declined as surrender provisions were introduced upon the transfer of licences. In 1966 the number of commercial licences was limited to 442 (Harrison 1986). During the following 30 years there were a number of effort and licence reduction strategies that resulted in the number of licences falling to 321 in 1996 operating 10,507 pots.

During the early 1980's the fishery was still expanding its fishing grounds as fishers were moving their fishing operations further offshore with more advanced equipment. Catches peaked at 2,217 tonnes in 1985 (Ford 2000b) and then began to decline. This decline in catch occurred despite an increase in effort, which peaked at nearly 2.1 million pot lifts, or about 50,000 vessel days, in 1992. During the period from 1985 to 1992 the fishing effort increased by about 30%, and as the catch was declining the catch rate began to fall dramatically (Ford 2000b).

Following the peak catch in 1985, and the subsequent decline coinciding with a substantial increase in effort, the industry, scientists and managers became increasingly concerned about the sustainability of the fishery. This, combined with concern about the economic viability of a large percentage of the fleet, were the drivers for change.

During the early 1990s various management options were explored and debated within the industry, and with Government. The Government established a working group to investigate the management options and their suitability for the rock lobster fishery (Anon DPIF 1993). By 1993 it was apparent that there were only two options, either a substantial reduction in the fishing effort (about 30%) or the introduction of a total allowable catch (Anon DPIF. 1993). The industry was divided on the issue, with the majority recognising there needed to be reductions in the catch and effort, but no agreement about how to do it.

Recognising that long term arrangements could not be implemented quickly, the Government of the day shortened the fishing season commencing in November 1993. During the period from November 1993 to February 1997 the Government used a number of additional seasonal closures to try to limit effort by reducing the available fishing days, in an attempt to reduce catch (Ford 2000b). This was successful for three seasons, but an increase in abundance due to a very good recruitment into the legal size biomass in 1996 (Frusher 1997a) resulted in an increase in effort, thus increasing catch. This increase in effort resulted from the large capacity for latent effort to be used in the fishery. Only 60% of the available vessel days were actually utilised in 1993, and this had only increased to 78% by 1996.

Finally, in August 1996 the Government supported by a majority of industry, decided that the fishery would be managed by output controls under ITQ. The Government had two objectives in mind, the first was to reduce the catch to a level which would be sustainable, and allow the biomass to rebuild over time. The second was to provide a mechanism whereby the industry could restructure and allow those who wished to leave the fishery to achieve a reasonable return for their previous access.

A.2 Context of the current management plan

The management plan for the rock lobster fishery is contained within a set of statutory rules titled the *Fisheries (Rock Lobster and Giant Crab) Rules 2001*, which have been made under Part 3 of the *Living Marine Resources Management Act 1995* (the Act). The management plan will be supported by the policy document for the rock lobster and giant crab fisheries which is about to be released for public comment (Anon DPIWE 2001).

The Act sets out the objectives for the sustainable management of living marine resources in Tasmania and provided the framework for developing and implementing management plans for each of the State's fisheries. The objectives of the legislation are provided in Section 7 and Schedule 1 of the Act, they are consistent with the objectives of the resource management planning system of Tasmania.

- 7(1) The purpose of this Act is to achieve sustainable development of living marine resources having regard to the need to -
- (a) increase the community's understanding of the integrity of the ecosystem upon which fisheries depend; and
 - (b) provide and maintain sustainability of living marine resources; and
 - (ba) take account of a corresponding law; and
 - (c) take account of the community's needs in respect of living marine resources; and
 - (d) take account of the community's interests in living marine resources.
- 7(2) A person must perform any function or exercise any power under this Act in a manner which furthers the objective of resource management.

SCHEDULE 1 - OBJECTIVES OF THE RESOURCE MANAGEMENT AND PLANNING SYSTEM OF TASMANIA

1. The objectives of the resource management and planning system of Tasmania are -
 - (a) to promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity; and
 - (b) to provide for the fair, orderly and sustainable use and development of air, land and water; and
 - (c) to encourage public involvement in resource management and planning; and
 - (d) to facilitate economic development in accordance with the objectives set out in paragraphs a, b and (c); and
 - (e) to promote the sharing of responsibility for resource management and planning between the different spheres of Government, the community and industry in the State.
2. In clause 1a, "sustainable development" means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety while -
 - (a) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and
 - (b) safeguarding the life-supporting capacity of air, water, soil and ecosystems; and
 - (c) avoiding, remedying or mitigating any adverse effects of activities on the environment.

A.3 Objectives of the management plan

In addition to meeting the objectives of sustainability prescribed by the Act the management plan addresses a number of objectives provided in the Rock Lobster and Giant Crab Fishery Policy Document (Anon. DPIWE 2001 pp 10-13). These are summarised in the following in table 1. The objectives have been proposed as the basis for the management of the rock lobster fishery for the next five years, and will be reviewed in 2005, or if one of the trigger points is reached. These objectives will be released for public comment shortly after this ESD assessment.

Table 1

Management objectives proposed in the draft Rock Lobster and Giant Crab Policy Document (April 2001)	Management strategies to achieve the objectives.
<p>Objective 1</p> <p>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.</p>	<ol style="list-style-type: none"> 1. Limiting the commercial catch through setting a total allowable commercial catch (TACC) and using individual transferable quotas to allocate proportions of the TACC. 2. Minimising the opportunity for illegal activity through a monitoring, compliance and enforcement strategy. 3. Limiting the recreational catch through the use of daily bag limits and possession limits, requiring fishers to be licensed and limiting fishers to one rock lobster pot per person or other specified fishing gear or methods. 4. Conserving egg production and containing fishing mortality on spawning female lobster by the use of minimum size limits and the closure of the fishery for female lobster during the peak spawning period. 5. Restricting the of size at first capture by requiring rock lobster pots to have escape gaps and to conform to size specifications. 6. Ensuring minimum incidental mortality by limiting the duration that rock lobster pots can be set. 7. Setting appropriate performance indicators and trigger points that can be monitored and provide meaningful results. 8. Conducting an annual fishery assessment reporting against each of the performance indicators.
<p>Objective 2</p> <p>Where the assessment of the fishery suggests that the fish stock are below the defined reference points, the fishery will be managed to promote recovery to ecologically viable stock levels within nominated timeframes.</p>	<ol style="list-style-type: none"> 1. Review the strategies under objective 1 if any of the trigger points are reached.

<p>Objective 3</p> <p>Have an appropriate compliance strategy which minimises the opportunity for illegal activity through monitoring, compliance and enforcement measures that are supported and aided by the industry.</p>	<ol style="list-style-type: none"> 1. Review the current enforcement and compliance strategies in conjunction with industry and Tasmania Police to determine its effectiveness. 2. Collect statistics on the enforcement and compliance activities to ensure adequate State, regional and seasonal coverage of vessel and processor inspections. 3. Use industry sources to assist in the detection of illegal activity.
<p>Objective 4</p> <p>Optimise the economic value of the fishery within the constraints of objective 1.</p>	<ol style="list-style-type: none"> 1. Increase the legal size biomass and the sustainable catch can be set to maximise the value of the fishery. 2. Increase the estimated legal size biomass at a rate which would see 70% of the estimated increase over the previous three years as the target for the next three years and the other 30% used to increase the TACC. If it is estimated that the legal size biomass increased by 15% between 1998 to 2001 then the target rate of increase for 2002-2005 will be 10.5%, and the TACC set at a level which produces 90% probability of achieving this increase.
<p>Objective 5</p> <p>Recover a financial contribution from both commercial and recreational rock lobster fishers to contribute to the real costs of management, compliance and research.</p>	<ol style="list-style-type: none"> 1. Determine the real costs of management, compliance and necessary research costs for the rock lobster fishery. 2. Equitably pass on management and research costs to participants in the rock lobster fisheries, sufficient to achieve cost recovery of attributable costs.
<p>Objective 6</p> <p>Ensure the rock lobster fishing fleet continues to provide employment and an economic return to coastal communities of Tasmania.</p>	<ol style="list-style-type: none"> 1. Assist industry to develop a strategic vision for the fishery. 2. Maintain limits on quota ownership and the amount of quota that can be fished from one vessel or licence.
<p>Objective 7</p> <p>The fishery is conducted in a manner that minimises the effect on by-catch or by-product species.</p>	<ol style="list-style-type: none"> 1. Harvesting and recording the catch of by-product species in accordance with the management arrangements for those species. 2. Requiring rock lobster pots to have adequate escape gaps in which most of the by-catch species can leave the pot, while retaining legal size rock lobster. 3. Limiting the duration that rock lobster pots can be set to reduce incidental mortality. 4. Undertaking fishery independent research that collects and analyses data on by-catch species.
<p>Objective 8</p> <p>The fishery is conducted in a manner that minimises mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts</p>	<ol style="list-style-type: none"> 1. Requiring interaction with endangered, threatened or protected species, as listed in the Threaten Species Act 199X or the Environment Protection, Biodiversity and Conservation Act 2000 (Commonwealth), to be recorded on monthly catch returns and requiring fishers to complete documentation necessary under other legislation

on threatened ecological communities.	<p>relating these species.</p> <ol style="list-style-type: none"> Monitoring the recorded interactions to establish a baseline. Develop a code of practice which encourages fishes to consider potential impacts on such species. Protect any threatened ecological community type through the development and implementation of comprehensive, adequate and representative marine protected areas (This would be done under the Marine Protected Area Strategy being developed by the Government).
<p>Objective 9</p> <p>The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally.</p>	<ol style="list-style-type: none"> Develop a code of practice in conjunction with the industry which encourages fishes to consider potential impacts on the ecosystem and employ methods of fishing that minimise any impacts.
<p>Objective 10</p> <p>Maintain a fishery that is conducted in an orderly manner recognising different participants need to access shared fishing grounds.</p>	<ol style="list-style-type: none"> Restrict the number of rock lobster pots that can be used from individual fishing vessels. Restrict the maximum number of rock lobster fishing vessels in the fishery. Require rock lobster fishing vessels to be able to carry all pots on the vessel at any one time. Discuss the need for a limit to the number of pots that can be used from recreational vessels and limiting the possession limit in State waters.
<p>Objective 11</p> <p>Provide reasonable recreational access to the fishery.</p>	<ol style="list-style-type: none"> Establish an ongoing communication process between commercial and recreational sectors to discuss perceived or real concerns with the management of the fishery.
<p>Objective 12</p> <p>To provide access to the fishery for Aboriginal people to undertake cultural activities.</p>	<ol style="list-style-type: none"> Allowing Aborigines to take rock lobster for Aboriginal cultural activities without holding a recreational licence.
<p>Objective 13</p> <p>To promote and maintain handling and processing practices which attempt to ensure the highest quality rock lobster product for human consumption.</p>	<ol style="list-style-type: none"> Promote quality carrying, handling and storage practices for rock lobster on board fishing vessels and by fish processors, through the use of codes of practice and industry initiatives.

This new set of management objectives differs from the way the objectives have been presented in the past, therefore, it is appropriate to note the changes since management objectives were agreed to in 1997. The aim of the objectives have changed little, the changes are more in the way the objectives are expressed. Likewise

the strategies have changed little, however they have been expanded to set a target for rebuilding the stock. The target for legal size biomass, if successful, will mean that the annual catch after 2010 will be in the order of 30% of the legal size biomass. Table 2 details the management objectives as determined in 1997 when the ITQ regime was agreed to by the Parliament (Anon DPIF 1997 pp 19-22).

Table 2

Objective	Strategies
<p>To maintain fish stocks at sustainable levels by constraining the total catch and size of individual rock lobster taken by the commercial and recreational sectors. In particular, to ensure that:</p> <ul style="list-style-type: none"> • Rock lobster are harvested at sustainable levels. • Biomass and egg production do not decrease and that reasonable levels of egg production are maintained in all regions of the fishery. • Biomass levels are increased over time to the level required for producing the maximum yield from the fishery. 	<ol style="list-style-type: none"> 1. Limiting the commercial catch through setting a total allowable commercial catch (TACC) and using individual transferable quotas to allocate proportions of the TACC. 2. To minimise the opportunity for illegal activity through a monitoring, compliance and enforcement strategy. 3. Limiting the recreational catch through the use of daily bag limits and possession limits, requiring fishers to be licensed and limiting fishers to one rock lobster pot per person or other specified fishing gear or methods. 4. Conserving egg production and containing fishing mortality on spawning female lobster by the use of minimum size limits and the closure of the fishery for female lobster during the peak spawning period.
<p>To take fish at a size likely to result in the best use of the yield from the fishery. To provide measures to protect under size lobster. To minimise incidental fishing mortality as a result of fishing operations.</p>	<ol style="list-style-type: none"> 1. Maintenance of size limits. 2. Restriction of size at first capture by requiring rock lobster pots to have escape gaps and to conform to size specifications. 3. Limiting the duration that rock lobster pots can be set to reduce incidental mortality. 4. Require rock lobster fishing vessels to be able to carry all pots on the vessel at any one time.
<p>To mitigate any conflict that results from competition between different fishing methods for access to shared fishing grounds.</p>	<ol style="list-style-type: none"> 1. Restrict the number of rock lobster pots that can be used from individual fishing vessels. 2. Restrict the number of rock lobster fishing vessels in the fishery.
<p>To maintain or provide reasonable access to rock lobster stocks for recreational fishers.</p>	<ol style="list-style-type: none"> 1. Encourage communication between the commercial and recreational sectors. 2. Promote the development of a Code of Practice for recreational fishing for rock lobster. 3. Maintain existing recreational fishing areas where no commercial rock lobster fishing will be permitted.
<p>To minimise the environmental impact of rock lobster fishing methods particularly on areas of special ecological significance and reduce bycatch of juveniles and non-target species.</p>	<ol style="list-style-type: none"> 1. Establish marine protected areas for the protection of valuable coastal habitats and to maintain biodiversity. 2. Require rock lobster pots to be fitted with escape gaps

A.3 Availability of the management plan

The rock lobster management plan is a public document and is available from the Printing Authority of Tasmania or at the legislation website (www.thelaw.tas.gov.au). The Rock Lobster and Giant Crab Fisheries Policy Document will also be a public document and will be able to be obtained from the Department or from the web (www.dpiwe.tas.gov.au), in July 2001. It will also be able to be obtained via the Tasmanian Rock Lobster Fishermen's Association site – (www.tasrocklobster.com.au). The fishery assessment reports for 1998/99 and 1999/00 produced by the Tasmanian Aquaculture and Fisheries Institute are also available from the web (www.utas.edu.au/docs/tafi/TAFI_Homepage.html).

A.4 Consultative process for developing a management plan under the Act

The Act prescribes a consultative process for the development of a management plan. However, in practice the consultation process is more comprehensive than the minimum requirements prescribed in the Act, the process used for the introduction of ITQs into the rock lobster fishery is summarised in Anon DPIF (1997 pp14-16, p76).

The consultative process which has evolved to date for the development or amendment of a management plan includes:-

- Consulting with the relevant Ministerial Fishery Advisory Committee, in this case the Crustacean Fisheries Advisory Committee (CFAC) and the Marine Recreational Fishing Council;
- Consulting with any appointed fishing body, in this case the Tasmanian Rock Lobster Fishermen's Association (TRLFA);
- The preparation and distribution of an options paper to licence holders and representative bodies supported by regional port meetings prior to the preparation of a draft management plan;
- Having the draft plan approved by the Minister for release for public comment, which in practice means sending it to licence holders and various recreational, conservation and aboriginal groups and placing notices of its availability in the papers and on the web;
- A public comment period of at least 60 days;
- Conducting regional port meetings to present the draft proposals, in general these are only attended by licence holders and processors;
- A report must be submitted to the Minister on issues raised during the public comment period;
- Once approved the management plan is tabled in Parliament for 15 sitting days and is considered by the Standing Committee on Subordinate Legislation, which may disallow all or part of the rules. This committee may take submissions and conduct a hearing if satisfied the rules are not in the interest of the public, or can not be justified, or have not been made lawfully.

A.5 Stakeholder involvement in the development and assessment of a management plan

The management and assessment process for the rock lobster fishery in Tasmania is reliant upon three advisory groups, which include various combinations of industry and/or conservation/community representatives.

The Crustacean Fisheries Advisory Committee (CFAC) is appointed by the Minister under the Act to provide advice about the management of the rock lobster fishery. The committee includes: 8 representatives from the various industry sectors, 1

conservation/community representative, 1 processor, Marine Police, research scientists, the Department's fishery managers, and an independent Chairman.

The Crustacean Research Advisory Group provides strategic research planning advice to the Tasmanian Aquaculture and Fisheries Institute (TAFI) and the Tasmanian Fisheries Research Assessment Board. It is appointed by the Director of TAFI. This group includes research scientists from TAFI, CSIRO and the Australian Maritime College, the fishery manager, 3 industry representatives and 1 community representative.

The Crustacean Fishery Assessment Working Group provides advice to the Department and the CFAC relating to the assessment of the fishery and the total allowable catch. It is appointed by the Director (Marine Resources) and the Director of TAFI. This group contributes to the development of the annual fishery assessment report (Frusher 1997a, Frusher 1997b, Frusher and Gardner 1999, Gardner 1999, Gardner *et al.* 2001). This group includes 3 research scientists from TAFI, CSIRO, the fishery manager, 4 industry representatives.

There is currently no formal relationship between the three advisory groups but the tasks of each are well understood by the respective members, as most of the members are common to all three.

A6 Assessment Documentation

The following sections of this assessment report are presented to address the "Guidelines for assessing the ecological sustainability of fisheries management regimes" Approved by the Minister for the Environment, Senator Hill, in August 2000. The headings, principles and objectives are present using the same numbering as Environment Australia's guidelines.

B ESD ASSESSMENT

B.1 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 .

B.1.1 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.

B.1.1.1 Information requirements

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.

Information for assessing the rock lobster fishery is collected from a number of sources, both fishery dependent and fishery independent.

The fishers are required to complete a daily catch logbook (attachment 1). This daily logbook book must be completed each day and requires fishers to provide: the fishing block (30nm x 30nm blocks); whether the shot was during the day or night; the depth; the number of potlifts; the number of rock lobster taken and retained; the number of rock lobster killed by octopus. Weight information is also provided as a daily estimate or the total weight for the fishing trip. The catch return must be sent to the Department by the end of the following month. The current daily catch logbook has been in place since 1992. Compulsory catch logbooks for rock lobster have been in place since the early 1970s.

The catch information is compared with the quota landing documentation, and during the past three years the estimated catches have been about 1.5% less than the recorded landings under the ITQ system. This difference is explained by the options for recording the catch on a daily basis, one option allows fishers to estimate their daily catch. The assessment process is currently looking at how to standardise the daily estimates of catch against the reported catch recorded in the quota documentation. The recording of catch in the future may be limited to recording the daily number taken and the weight unloaded at the end of each trip.

It is the view of the Department and TAFI that the data is very reliable and meaningful. The penalties associated with under declaring the landed catch on the quota documentation are a significant deterrent to landing more rock lobster than a fisher has quota for. The majority of fishers catch records match their quota

records. These two facts provide us with a high degree of confidence in the data provided.

The Department follows up discrepancies in the catch returns with the fisher at the time of data entry, which is generally within 7 days of receipt of the catch return.

The fishery dependent data set also includes rock lobster size structure data from a small group of fishers who record information on the size structure of the rock lobster taken in some of their shots. Typically, the fisher might nominate that a few pots from each shot will be set aside to have all the rock lobster measured and the lengths recorded. This supplements the fisheries independent size structure data.

Fishery independent information is collected from a catch sampling program which is looking at providing information about exploitation rates. This project samples two geographic locations three times a year, before the season opens, mid season and towards the end of the fishing season.

B.1.1.2-5 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.

General

The rock lobster fishery is formally assessed annually through the preparation of a fishery assessment report. The fishery assessment is based around the performance indicators and trigger points specified in the draft Rock Lobster and Giant Crab Fisheries Policy Document and are provided in section 1.1.6.

The assessment is undertaken by the crustacean research scientists at TAFI, in consultation with the CFAWG. The last two fishery assessment reports are available from www.utas.edu.au/docs/tafi/TAFI_Homepage.html. Various extracts from these reports will be referred to in the following sections.

A summary of the available data and the level of knowledge is provided in Table 3.

The fishery is assessed annually, and a recommendation for the TACC is provided to the Minister by the Department and CFAC. Each annual assessment looks at the performance indicators to see if the relevant trigger point has been reached. The current TACC is resulting in an increase in the biomass and levels of egg production, therefore the performance indicators are moving away from the trigger points. In light of these new trigger points have been proposed for the assessments for the next 5 years.

The data required for the assessment is obtained via fishers catch returns, fisheries independent catch sampling, puerulus monitoring, catch sampling on commercial vessels, and the historic data set. The way in which the data is collected and used is reviewed periodically, on average the data collection process has been reviewed about every three years but there is now set review timeframe or process. The assessment model was reviewed by Gardner (2000) and is currently being modified to address some areas of concern. There have been a number of similar such reviews undertaken in the past (Gardner *et al.* 1998, Gardner and Frusher 2000)

There is no evidence available to suggest changes to the biodiversity on a regional basis of an on going harvest of rock lobster. It may be reasonable to conclude that the biodiversity is now different to what existed when there was no harvesting of rock lobster 150 years ago. It should also be noted that we may detect changes in biodiversity in coming years as the harvest of rock lobster has been reduced, leaving more rock lobster on the bottom may change the abundance of predator/prey species. However, any such detection will rely on having appropriate assessment methodologies that provide meaningful information on changes in biodiversity.

The work of Barrett and Edgar (1998) and Edgar and Barrett (1997) in Marine Protected Areas (MPAs) in Tasmania demonstrates changes in biodiversity inside MPAs five years after their implementation. However, these changes can only be attributed to all fishing ceasing rather than just a result of stopping the harvest of rock lobster from these areas.

Table 3 Summary of the state of knowledge of the rock lobster resource

Parameter	Data source for estimation/knowledge	Level of knowledge
Commercial catch	Monthly catch returns since 1970 and quota docket per unloading since March 1998	High
Commercial fishing effort, catch distribution by depth and area.	Monthly catch returns since 1970	High
Recreational catch	ABS survey 1987 diary and recall surveys 1997 and 2001	low
Recreational licence numbers	Licence database	High
Growth by sex and region	Tagging studies	High Low
Size structure	Catch sampling independent and fishery based	High
Adult		Low
Mortality	Tag recapture data	Medium
Adult		Low
Juvenile		
Behaviour	PhD study	Medium
Reproduction	Egg counts, egg per recruit modelling	High
Female		Low
Male		
Movement	Tagging studies	High
Adult		Low
Juvenile		
Recruitment		High Medium

Assessment against performance indicators

The fishery assessment is done in such a way that each performance indicator is compared with its related trigger point. The following is an extra from the draft Rock Lobster and Giant Crab Fisheries Policy Document.

3.7 PERFORMANCE INDICATORS

The performance of the management plan in meeting its objectives will be measured through a combination of performance indicators concerning the sustainability of the rock lobster resource, the level of the by-catch and any impact with threatened or endangered species.

An annual fishery assessment will be undertaken and will report against each performance indicator with reference to the trigger point(s) for that indicator.

Analysis of fishery performance under this management plan will be examined and measured variously by the use of, but not restricted to, the following items:

3.7.1 Commercial catch

The commercial catch in any year may fall below the TACC for a number of reasons, which must be accounted for before any action is taken. The total commercial catch will be monitored against the TACC for the fishery.

3.7.2 Catch per unit effort (CPUE)

Catch per unit of effort is a measure of the standardised catch rate and is also commonly used as a index of relative abundance. For the purpose of this management plan, CPUE is defined as the kilograms of lobster caught per pot lift and will be calculated separately from both commercial catch returns and independent research surveys.

3.7.3 Estimated legal size biomass

While CPUE can provide a relative index of abundance, it does not provide an actual estimate of legal size biomass. For the purpose of this management plan, legal size biomass will be defined as the estimated tonnage of legal sized lobster on the bottom at a stated point in time (1 November). Changes in the biomass are important because this will affect the catch rate, productivity, sustainable harvest level and egg production of the fishery.

Biomass will be estimated by two separate techniques. The first will be a length structured, spatial stock assessment model of the rock lobster fishery and the second method will be through independent research surveys in selected regions of the fishery.

3.7.4 Egg production

Maintenance of sufficient levels of egg production is crucial to prevent declining recruitment and eventual recruitment failure of the fishery. Unfortunately there is a high degree of uncertainty in terms of both the level of egg production required and whether there are certain regions which are most important as the source of future recruitment. In light of this uncertainty, it is important to apply a precautionary approach and to ensure that both global and regional egg production does not fall below the lowest levels that have been experienced in the past.

Both global and regional egg production will be estimated through the previously mentioned stock assessment model of the rock lobster fishery.

3.7.5 Puerulus settlement index

The puerulus settlement index involves monitoring puerulus settlement at a number of locations, with Bicheno being the main site. The data series from this sites extends back 12 years. The indications are that puerulus settlement at these sites gives a measure of the potential catch available 5 years after settlement. At this stage the index is only applicable to assessment areas 2,3and 4.

3.7.6 *The size of the rock lobster fleet*

During the first two years under quota management the number of vessels operating in the rock lobster declined by about 25%. The number of vessels operating between mid 1999 and early 2001 remained fairly stable at about 235. It is important to monitor this decline to assess possible social and economic impacts on the coastal communities where rock lobster fishing is an important industry.

3.7.7 *The recreational catch*

The recreational catch will be monitored through the continuation of recreational surveys. The recreational catch is not limited directly. It is important to monitor the catch and to take corrective action if it increases above what it may have been in the past. In the last 10 years the recreational catch has ranged between 5% and 11% of the commercial catch, based on surveys conducted in 19XX and 19YY. It is recommended that the recreational catch on a State and regional level be assessed in detail at least every second year. Future assessments of the recreational fishery should include an assessment of recreational fishing power.

3.7.8 *The recreational licence numbers*

As the legal size biomass rebuilds it is likely that there will be an increase in the number of recreational licences as people find rock lobster easier to catch it will encourage more fishers to take out a recreational licence. The number of licences needs to be monitored.

3.7.9 *The by-product species*

The by-product species are likely to be giant crab, scalefish species or octopus, which will be monitored in conjunction with the annual assessments under the scalefish and octopus management plans respectively.

3.7.10 *The by-catch species*

By-catch species will continue to be monitored through the fishery independent catch sampling program, any changes in biodiversity or abundance should be detected from this program. This will be supplemented with targeted catch sampling on commercial vessels in an ad hoc manner as time permits.

3.8 TRIGGER POINTS

Trigger points are levels of, or rates of change in, the above performance indicators that are considered to be too low or outside the normal variation of the stocks and the fishery. When one or more of the following trigger points have been reached the circumstances relating to the trigger being reached will be investigated and if necessary it will be recommended that the Minister will review the management of the rock lobster fishery. These trigger points may be reached by themselves or in combination. There may, also, be additional factors, such as those relating to the environment or market, or requests from sectors of the fishery that could lead to a review of the management of the rock lobster fishery.

A trigger point will be reached when one or more of the following criteria are met. Performance indicators will be compared with the reference year 1999 and with the state of the fishery in 1994 when catch rates, biomass and egg production were at their lowest, or near to it.

3.8.1 *Commercial catch*

The total annual commercial catch falls below 95% the TACC for any year. The analysis will consider the reasons for the actual catch falling below the TACC, these may include weather factors, quota availability factors or market factors.

3.8.2 *Catch per unit effort (CPUE)*

Annual CPUE from commercial catch returns falls below 95% of the CPUE for the reference year 1999. The analysis to assess this trigger point must standardise CPUE to take account of possible biases caused by changing fishing patterns on at least a regional and monthly basis.

Annual CPUE from commercial catch returns for any region falls below 85% of the CPUE for the reference year 1999. The analysis to assess this trigger point must standardise CPUE to take account of possible biases caused by changing fishing patterns on at least a depth stratified and monthly basis. This analysis should also take into account any other mitigating factors which might artificially affect regional catch rates.

CPUE from research surveys in available regions declines significantly from matching surveys (location and month) from that of the reference year with the lowest matching survey catch rate. The analysis of this trigger point should consider mitigating factors such as variations in catchability due to weather or variation in moult timing or seasonal influences. External factors like beach prices also need to be taken into account.

3.8.3 *Estimated legal size biomass*

The estimate of global (state-wide) biomass from the stock assessment model falls below 95% of that estimated for the reference year 1999.

The biomass estimate from the stock assessment model for any region falls below 85% of that estimated for the reference year 1999.

Biomass estimates from research surveys in available regions declines significantly from one survey year to the next (technique still being developed). An exception to this trigger can be invoked if the stock assessment model or other methods can adequately demonstrate that the decline in biomass seen through research surveys results in a biomass that remains higher than that which existed in the reference years.

3.8.4 *Egg production*

The estimate of global (state-wide) egg production falls below 95% of that estimated for the reference year 1999.

Any regional estimates of egg production falls to less than 85% of that estimated for the reference year 1999.

For regions in which the estimated value of egg production is less than 10% of that of the estimated unfished stock, no reduction in egg production below the 1999 level is permissible.

For regions 3,4 and 5 the level of egg production increases less than 5% in any one year (that is a 5% increase on the level of relative egg production in the previous year).

3.8.5 *Puerulus settlement index*

At this stage insufficient data is available to set a meaningful trigger point. This performance indicator is an early warning one. Any resulting declines in biomass will be detected in future assessments. This index may become a trigger point if the fishery is zoned in any way.

3.8.6 *The size of the rock lobster fleet*

The number of fishing vessels operating in the fishery falls below 220. The analysis will consider factors that have caused the number of vessels to fall to this level. Action may be taken to ensure there

is no further decline in the number of vessels if it is considered necessary by the industry or the Government.

3.8.7 *The recreational catch*

The recreational catch reaches 10% of the TACC in a year there will be a review of the recreational management arrangements such that the total catch or potential catch is capped at 10% of the TACC.

The recreational catch reaches 50% of the TACC in a year in any of the depth strata in any of the 8 assessment areas there will be a review of the recreational management arrangements.

3.8.8 *The recreational licence numbers*

The number of recreational rock lobster licences increases by more than 10% in any year.

The number of recreational licences increases by more than 30% between the year 2000 and 2004.

3.8.9 *The by-product species*

The total landings of by-product species increases by 25% in any year.

The total landings of any single species increases by 50% in any two year period.

3.8.10 *The by-catch species*

The standardised total abundance of by-catch taken by the catch sampling program decreases by 25% in any year or by 50% in any three year period.

The standardised species assemblage of the by-catch changes by 30% in any two year period.

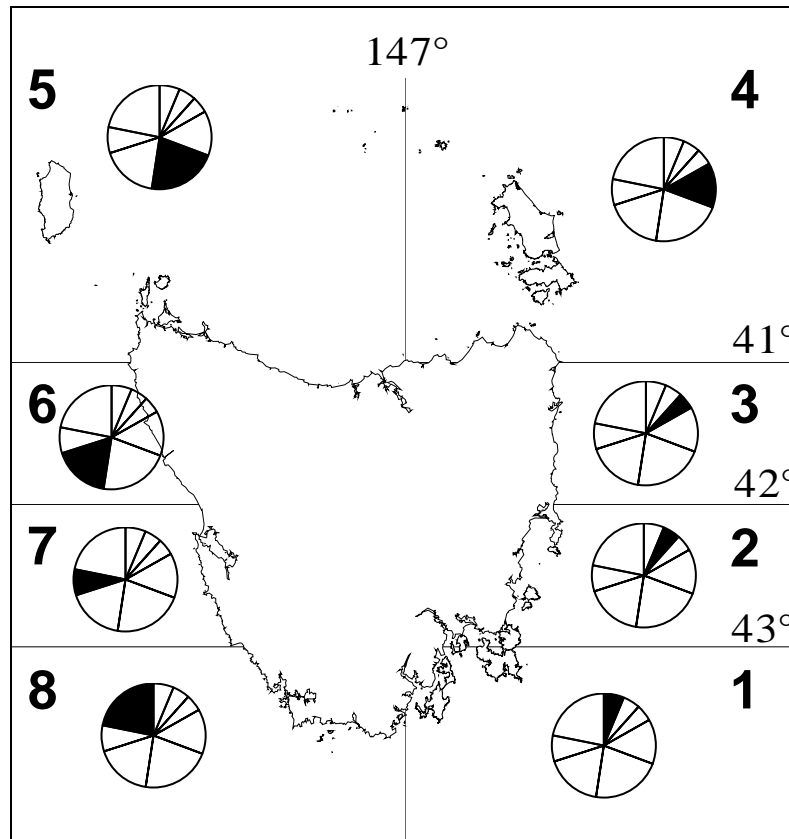
Assessment model

The major tool for conducting the assessment of the fishery is a spatially explicit size structured population model developed by Punt and Kennedy (1997) specifically for this fishery. The model produces outputs for 8 regions by sex (figure 1) and can provide information on the estimated legal size biomass, estimated undersize biomass, and percentage of virgin egg production. The model is also capable of projecting forward the population under different total allowable catch scenarios. This is achieved by running 100 simulations to determine the probability of the effects of a given harvest strategy.

The model has been reviewed (Gardner 2000) and a number of amendments are being made to correct identified weaknesses. This review was done as Gardner believed the model was over estimating legal size biomass in final year of the time series, this is demonstrated by the output shown in figure 1. As more information becomes available it will be incorporated into the model. The review of the model confirmed Gardner's belief that it was over estimating the legal size biomass in the last year in which it was run for, this issue is dealt with in Gardner *et al.* (2001, pp3-5).

The model and the assessment methodologies will be reviewed periodically in coming years, as and when the need arises.

Figure 1 The assessment model looks at the fishery by sex for 8 areas as shown along with the share of the catch taken from each area during 1999/00.



The estimated legal size biomass

The estimate of legal size biomass is calculated and compared using 5 different methods as described by this extract from Gardner *et al.* (2001 pp-11-12).

Biomass estimates are derived from the model and also from data collected during research surveys. These data are used to estimate exploitation rate, which is a measure of the proportion of legal sized lobsters available at the beginning of the season that are actually captured. A biomass estimate is obtained by dividing the commercial catch by the exploitation rate (eg 1000 tonnes caught / exploitation rate of 0.5 = initial biomass of 2000 tonnes). Since 1992, fisheries independent research has tested techniques for determining exploitation rates in the south (Area 8) and east coast (Area 2) regions of the fishery (Frusher *et al.*, 1998; Frusher *et al.*, 1997). The techniques are still being evaluated for the east coast and no east coast data is presented.

Biomass estimates for Area 8 using south coast exploitation rates derived from change-in-ratio (CIR) and index removal (IR) are presented in figure 2. Biomass estimates derived from the commercial catch data using the Leslie depletion method (Leslie, 1945), biomass estimates from the model and, the commercial catch are also included in figure 2.

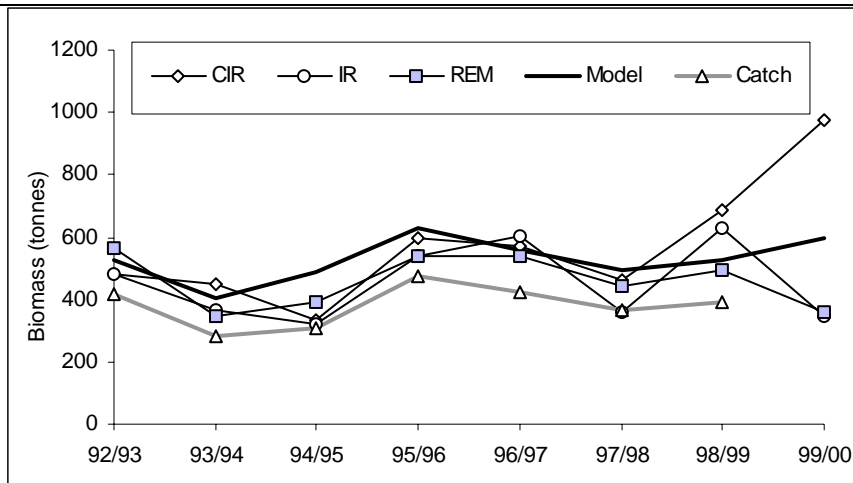


Figure 2. Estimates of legal sized biomass in Area 8 using change-in-ratio (CIR), index removal (IR), depletion (REM) techniques and from the rock lobster assessment model (Model). The commercial catch (Catch) is also shown. All biomass estimates are at the beginning of the open season in November and catch is for the period from that November until the following August. Estimates for 99/00 are based on partial year sampling to March 2000.

There is close agreement between the trends for all estimates until the 1998/99 season. Whether the lack of agreement between estimates is an artefact of quota implementation is being investigated. The impact of the extended season and the decline in fishing effort and catch from November to March would be expected to impact on the CIR and IR techniques. Both methods are more robust when exploitation rates are high. The 99/00 CIR, IR and REM figures are only for the period from November to end of February. The full year's exploitation is expected to improve these estimates. The impact of the harvesting of newly recruited lobsters in September 1999 on the exploitation rate estimates needs to be investigated.

The type of outputs the model can be seen in the fishery assessment reports (Frusher 1997a, Frusher 1997b, Frusher and Gardner 1999 Gardner 1999, Gardner *et al.* 2001). The following is an extract from Gardner *et al.* (2001 p4), it is provided to demonstrate the outputs from the models and how they are used for conducting the assessment.

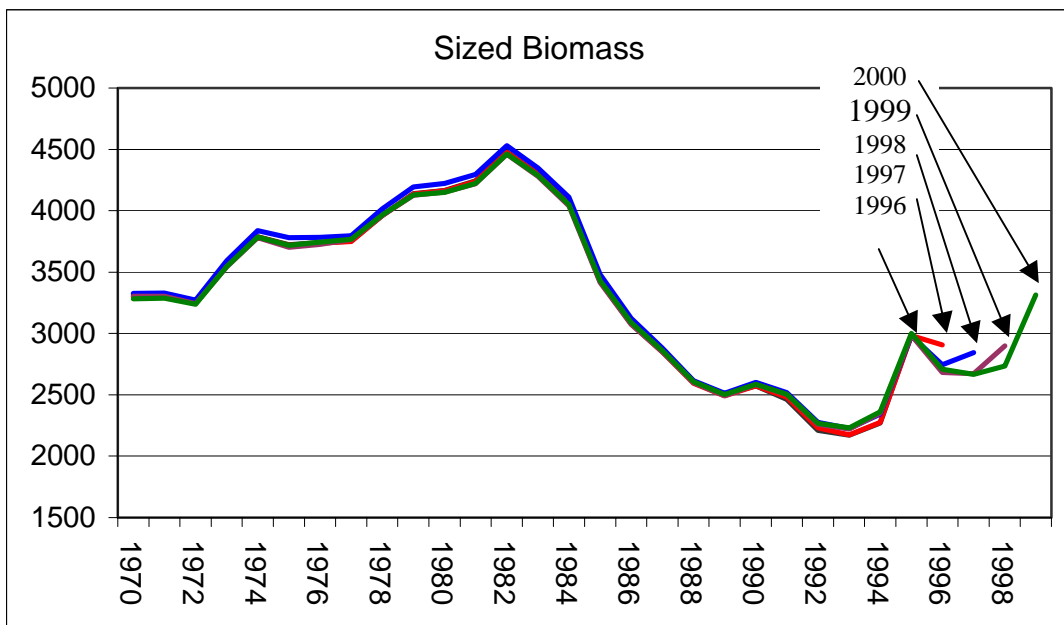


Figure 3. Model estimated statewide legal-sized biomass (tonnes) using 5 different model fits from 1996 to 2000. It can be seen that model estimates of biomass tend to be slightly optimistic in the final year of estimation. This has occurred for all model fits except the first (1996) which is completely overlayed by later model estimates of biomass. The reason for this consistent error in the final year is that there is less data for the model to estimate biomass, relative to estimates two or more years in the past. The implication of this observation is that biomass estimates from the most recent year need to be treated with a degree of caution – a more reliable indicator is a trend in biomass that occurs over several years.

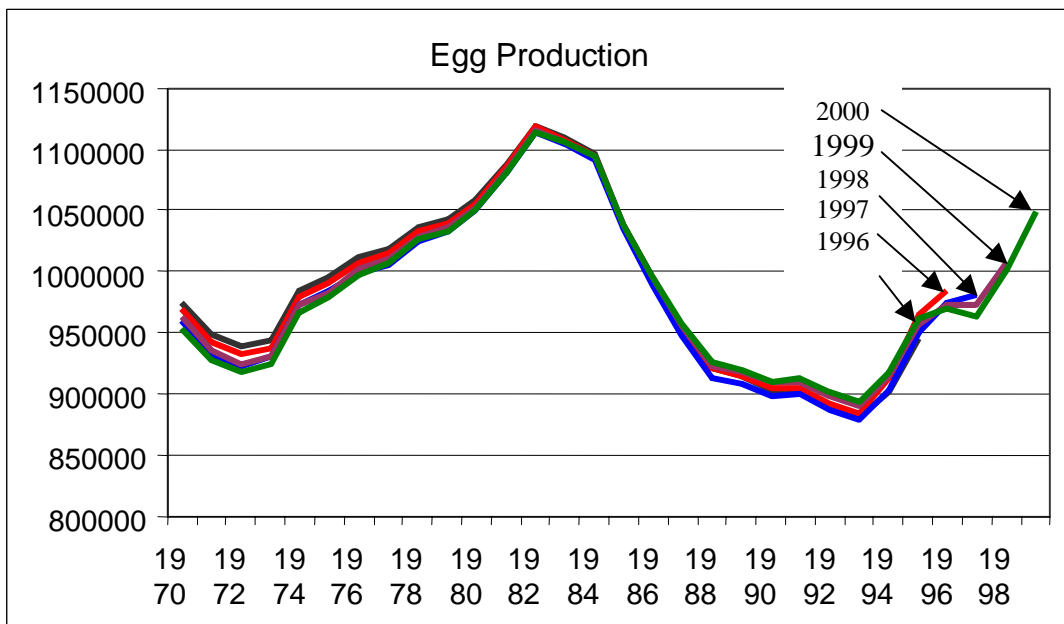


Figure 4. Model estimated statewide relative egg production using 5 different model fits from 1996 to 2000. It can be seen that model estimates can be slightly optimistic depending on the year of estimation. The implication of this observation is that egg production estimates from the most recent year need to be treated with a degree of caution – a more reliable indicator is a trend in egg production that occurs over several years.

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

The distribution and spatial structure of the rock lobster fishery is well understood as demonstrated by the outputs from the assessment model.

Growth rates of lobsters show substantial differences around the State with growth rates fastest in the north. At the legal size limit, male and female lobsters in the north undertake two moults annually compared to a single moult for lobsters in southern waters (Gardner 1999). The growth increment (change in the length of the carapace with each moult) is also substantially different with northern males at approximately the legal size limit increasing their carapace length by 11 to 13mm whereas their southern counterparts grow less than 6mm (Gardner 1999). Thus on an annual basis northern lobsters are growing up to 4 times faster than southern lobsters. Lobsters also grow faster in shallower waters than deeper waters. The main factors considered to influence lobster growth are water temperature (lobster grow faster in warmer waters) and food availability (Gardner 1999).

The size at which lobsters become mature appears to be related to age rather than size and thus faster growing lobsters mature at a larger size than slower growing lobsters. In southern waters greater than 40m in depth, female lobsters mature at 60 to 65mmCL. In contrast, in shallower (<40m) water in northern regions of the fishery, female lobsters mature at sizes greater than 110mmCL (Gardner 1999).

While different growth rates and sizes at maturity are present, the fishery is managed on a State wide size limit for males (110mm) and females (105mm). This may mean that egg production is lower than it could be in the north of the State while yield is less than it could be in the south of the State.

The fact that female rock lobster in the north of Tasmania (Areas 4 and 5) reach maturity at a size higher than the legal size limit is of concern. This may well have contributed to the very low levels of egg production in the region. One solution would be to increase the size limit in the north of the state, thus increasing the level of egg production protected. However while the level of egg production appears to be increasing in assessment areas 4 and 5 (figure 1) under the current management arrangements (Gardner *et al.* 2001, Gardner 1999) zoning is not required immediately. Any fall in the level of egg production in the north (Areas 4 and 5) will be cause for concern, particularly if egg production was to fall below 10% of virgin egg production, and an appropriate response may be the consideration of zones. However, the introduction of zoning would probably take several years to ensure all the issues of access were properly addressed.

This issue has been identified in the past (Anon DPIF 1997a, Frusher 1997a) and may be considered at some stage in the future if there is no real improvement in the levels of egg production in the north of the State. At this stage there is no target timeframe to reach a more appropriate level of egg production in Areas 3, 4, and 5. At this stage the perceived enforcement difficulties and lack of industry support for fishing zones based on size limit outweigh any management need to introduce split size limits.

Kennedy (1998) reviewed the size limits to determine the benefits of increasing the minimum legal size under a TACC of 1,550 tonnes. Kennedy found that there was no significant increase in egg production by increasing the female size limit to 110mm and suggested that the female size limit would need to increase to 120mm to see egg production increase. He found the importance of considering an increase in the size limit increased if the TACC was significantly above 1,500 tonnes before 2008. Such an increase in size limit has not been considered as it would be the first step into the zoning of the fishery.

The Department believe that the risk of egg production failure in the north of Tasmania, or of recruitment failure in the area is low given the increases in the biomass in the area. However, there is still a level of concern that will see the situation monitored closely. At this stage the view of the Department is that zones are not warranted in the rock lobster fishery.

Differential growth rates and a longer male fishing season may skew the sex ratio, particularly in the south of Tasmania. While there is a higher female/male sex ratio in the south there is no real evidence to suggest that females are not mating and producing clutches of eggs. Frusher (Personal communication) found that male rock lobster were successfully able to mate with at least 16 females in a tank environment, each female produced viable eggs. Similar work has been done in New Zealand, where it has been suggested that the behavioural characteristic of male lobsters change at very high sex ratios, which may lead to females not mating, and that this may be fatal or at least reduce their ability to reproduce in subsequent years. (MacDiarmid *et al.* 2001). However, the sex ratios used by MacDiarmid are far more skewed than are seen in the wild in Tasmania.

The following figures have been extracted from Gardner (1999) to demonstrate the regional differences in size structure of the rock lobster as obtained from fishery independent surveys of the fishing grounds.

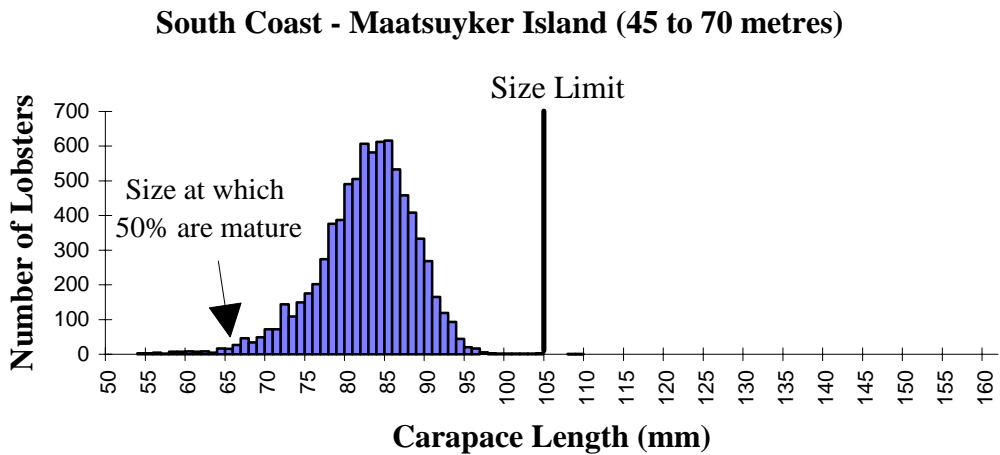
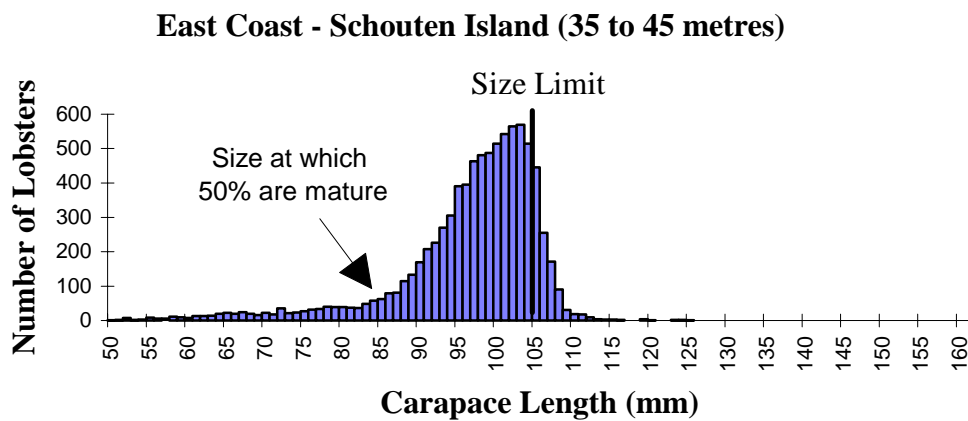
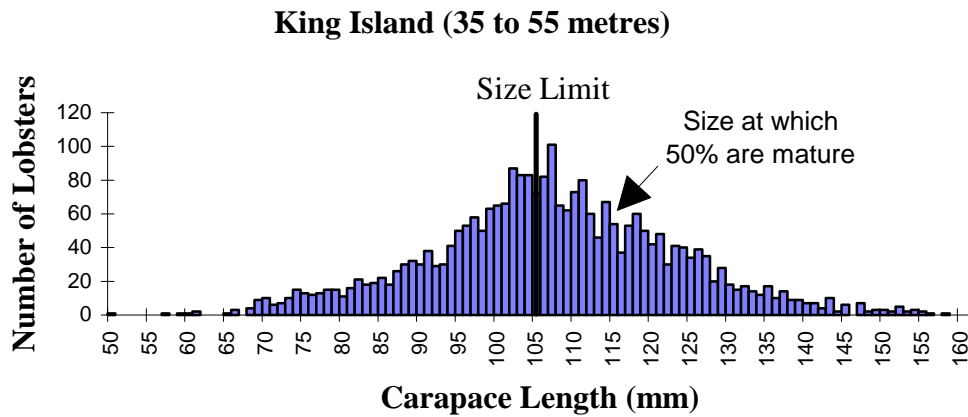


Figure 4. Size structure and size at maturity of female lobsters caught at three locations in Tasmania.

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.

There is very good information about commercial catches over the past 30 years, particularly for the last ten years (Anon DPIF 1997a, Ford 2000b, Frusher 1997a). Information about future landings will be even more accurate as fishers must lodge quota documentation for all rock lobster unloaded from fishing vessels.

The recreational catch is estimated to be between 5%-10% of the commercial catch. Work by Lyle and Smith (1998), using phone surveys and fisher diaries, estimated the recreational catch of rock lobster in 1997 to be about 5% of the commercial catch. A survey conducted by the Department in 1987 suggested the recreational catch was about 11% of the commercial catch (Anon. DPIF 1997a). The recreational catch of rock lobster is currently being assessed by Lyle for the 2000/01 year.

Further phone survey work and fisher diary surveys will be undertaken in 2001 to estimate the recreational catch for the period from November 2000 to April 2001.

Both recreational and commercial catches are factored into the fishery assessment process (Frusher and Gardner 1999, Gardner 1999). The recreational catch is assumed to be 5% of the commercial catch and this is factored into the estimation process for Statewide biomass.

No information about indigenous fishing activity is collected but it is thought that the aboriginal take is fairly small, possibly less than 5% of the recreational catch. This is thought to be the case as the number of aboriginal gear tags issued is about 5% of the number of recreational pot licences issued.

There is no estimate of illegal catch, but again it is not thought to be large. Tail clipping of recreational catch and tagging of domestic sales have been introduced in recent years (1995 and 1998 respectively) to minimise illegal activity. Police records indicate that detected illegal activity is low. This is thought to be the case because the few breaches are found in the high number of vessel and processor inspections.

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

The fishery assessment model suggests that the current harvest strategy, which limits the total allowable commercial catch (TACC) to 1,500 tonnes, will allow the legal size biomass to rebuild and increase the level of egg production. This indicates that the fishery can sustain the current levels of fishing, and as legal size biomass increases, may be able to sustain a higher TACC. The Draft Rock lobster and Giant Crab Policy Document sets a target for rebuilding the legal size biomass by ensuring any increase in the TAC in the next five years will still result in the legal biomass increasing by at least half the rate it has over the past three years. This should mean that a legal size biomass of 4,500 tonnes can be achieved 2010, this was the estimated

level of legal size biomass in the early 1980s. This target represents a 50% increase over the next ten years.

A 4,500 tonne legal size biomass is likely to be about 15% of the virgin legal size biomass. However, the estimate of virgin legal biomass is based on the estimate of natural mortality, which is very low as the lobster are long lived, therefore any variation in the estimate of natural mortality will put substantial error bars around the estimate of the virgin stock. In addition, the estimate of virgin legal size stock does not include any density dependent limitation, meaning the virgin stock may have had some density dependent carrying capacity prior to exploitation. However, we know from size structure data for Flinders Island that even in the 1960s there were many more legal size rock lobster taken in surveys than were in the 1980s and 1990s.

Assuming that recruitment of puerulus (pre-juvenile stage) remains within the historic pattern, the estimate annual recruitment to the fishery (sub legal animals growing to legal size) is such that under a TACC of 1,500 the stock will rebuild.

The total biomass of the fishery includes the legal size biomass and the undersize biomass, which is likely to be similar to the virgin undersize biomass. This assumes that the fishery did not get to a point of recruitment overfishing. The undersize biomass could have increased if there is a density dependent relationship for abundance. That is, as more legal size animals are removed there is space and food for more undersize animals to survive to legal size.

B.1.1.6-9 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 Rock Lobster Fishery Policy Document (Anon DPIFb 1997 p23-26) was the first to provide performance indicators and trigger points for the rock lobster fishery. These have been further developed and refined in the draft policy document for the rock lobster and giant crab fishery (2001).

The following table summarise the reference points, trigger points and the findings of the fishery assessments fro the first 3 years under quota management. The revised performance indicators and triggers points are also provided.

Performance indicator – total catch	
Reference point in 1997	The TACC set for the fishery.
Trigger point in 1997	The total landed commercial catch is less than 95% of the TACC.
1998/99 Fishery Assessment (Gardner 1999)	The total catch was 1,476 tonnes or 98.2% of the TACC.
1999/2000 Fishery Assessment (Gardner <i>et al.</i> 2001)	The total catch was 1,480 tonnes or 98.5% of the TACC.
Reference point in 2001	The TACC set for the fishery.

Trigger point in 2001	The total landed commercial catch is less than 95% of the TACC.
Performance indicator – catch per unit effort (CPUE) Reference point in 1997 Trigger point in 1997 1998/99 Fishery Assessment (Gardner 1999) 1999/2000 Fishery Assessment (Gardner <i>et al.</i> 2001) Reference point in 2001 Trigger point in 2001	CPUE in kilograms per potlift in the lowest year of 1993-95. The year will depend on the region A CPUE statewide of less than 95% of the reference year, regional CPUE of less than 75% of the reference year (lowest year of 1994-1995). The statewide CPUE increased by 14% Regional catch rates increased between 2% and 36% The statewide CPUE increased by 22% Regional catch rates increased between 13% and 56% CPUE in kilograms per potlift in 1999/00 A CPUE statewide of less than 95% of the reference year, regional CPUE of less than 85% of the reference year (2000).
Performance indicator – estimated legal size biomass Reference point in 1997 Trigger point in 1997 1998/99 Fishery Assessment (Gardner 1999) 1999/2000 Fishery Assessment (Gardner <i>et al.</i> 2001) Reference point in 2001 Trigger point in 2001	The estimate of legal size biomass for the State or each region that is the lowest for the period 1993-95. An estimate of statewide biomass that is less than 95% of the reference year or an estimate of regional biomass that is less than 85% of the reference year. The estimate of statewide legal size biomass was 29% higher than the reference year. Regional estimates increased by between 7%-57%. The estimate of statewide legal size biomass was 44% higher than the reference year. However estimates for areas 1,4 &8 were over estimated by 5% in the 1999 assessment, as the same problem will have occurred in 1999 the corrected estimate is 40%. Regional estimates increased by between 14%-106%. The estimate of legal size biomass for the State or each region in 1999. An estimate of statewide biomass that is less than 95% of the reference year or an estimate of regional biomass that is less than 85% of the reference year (2000)
Performance indicator – egg production Reference point in 1997 Trigger point in 1997 1998/99 Fishery Assessment (Gardner 1999)	The estimate of egg production for the State or each region that is the lowest for the period 1993-95. An estimate of statewide egg production that is less than that of the reference year or an estimate of regional egg production that is less than 95% of the reference year. If the estimated level of egg production is less than 10% of virgin stock then no reduction is acceptable. The estimate of statewide egg production was 13% higher than the reference year. Regional estimates increased by between -4% and 84%.

<p>1999/2000 Fishery Assessment (Gardner <i>et al.</i> 2001)</p> <p>Reference point in 2001</p> <p>Trigger point in 2001</p>	<p>The estimate of statewide egg production was 17% higher than the reference year. Regional estimates increased by between -5% and 114%. The -5% is in area 1 where the level of egg production is estimated to be 61% of virgin levels and is of no concern.</p> <p>The estimate of egg production for the State or each region in 1999</p> <p>An estimate of statewide egg production that is less than 95% of the reference year (2000) or an estimate of regional egg production that is less than 85% of the reference year. If the estimated level of egg production by assessment area (1-8) is less than 10% of virgin stock then no reduction is acceptable.</p>
<p>Performance indicator – Relative abundance of undersize rock lobster</p> <p>Reference point in 1997</p> <p>Trigger point in 1997</p> <p>1998/99 Fishery Assessment (Gardner 1999)</p> <p>1999/2000 Fishery Assessment (Gardner <i>et al.</i> 2001)</p> <p>Reference point in 2001</p>	<p>The estimate of the abundance of undersize lobsters the period 1993-95.</p> <p>An estimate of abundance of undersize lobsters that is less than 95% of the reference years.</p> <p>Estimates of undersize biomass show some declines but this may be related to the uncertainty in the model and limited size structure information on undersize biomass.</p> <p>Estimates of undersize biomass show some declines but this may be related to the uncertainty in the model and limited size structure information on undersize biomass.</p> <p>Dropped until more reliable data can be obtained. Over the next three years the independent catch sampling program will focus on this area of data collection.</p>
<p>Performance indicator – recreational catch</p> <p>Reference point in 1997</p> <p>Trigger point in 1997</p> <p>1998/99 Fishery Assessment (Gardner 1999)</p> <p>1999/2000 Fishery Assessment (Gardner <i>et al.</i> 2001)</p> <p>Reference point in 2001</p> <p>Trigger point in 2001</p>	<p>The percentage of the recreational catch related to the commercial catch</p> <p>The estimate of the recreational catch exceeds 10% of the total allowable commercial catch.</p> <p>No new survey work had been done to revise the estimate of 5%</p> <p>No new survey work had been done to revise the estimate of 5%. Survey work is underway for 2000/01. Concern noted about the increase in recreational licence numbers.</p> <p>The percentage of the recreational catch related to the commercial catch</p> <p>The number of recreational licences</p> <p>The estimate of the recreational catch exceeds 10% of the TACC.</p> <p>The number of recreational licences increases by more than 10% in any year.</p>
<p>Performance indicator – by-product species</p> <p>1998 Fishery Assessment – Scalefish (Lyle and Jordan 1999)</p> <p>Reference point in 2001</p> <p>Trigger point in 2001</p>	<p>Between 11 and 17 tonnes of finfish and octopus were recorded in the general fish logbook as by-product in rock lobster pots for the period from 1995 to 1998. The difference between the annual by-product catches report is most likely reflected in the accuracy with which by-product is reported in the logbooks rather than any change in abundance. This represents about 1-2% of the commercial catch of finfish species taken by trawling, gillnets, hooks and traps. These catches are factored in to the assessments for the scalefish fishery.</p> <p>The landing of by-product species increased by 25% in any year or</p>

	the landings of a single species increase by 50% in any year. Note that appropriate triggers will also be included in the Scalefish Policy Document which is to be updated this year.
Performance indicator – by-catch species 1999/2000 Fishery Assessment (Gardner <i>et al.</i> 2001) Reference point in 2001 Trigger point in 2001	Lobster pots have been recorded to catch over 9 species of crustaceans, 33 species and finfish, 21 species of molluscs and 7 species of echinoderms in Tasmanian waters when the escape gaps are not present. Escape gaps of the minimum size to allow undersize rock lobster to escape also reduce by catch by 80%. Data set collected from fishery independent catch sampling project between 1994 and 2000 By-catch abundance changes by 25% in any year or 50% in any 3 year period. By-catch species assemblage changes by 30% in any two year period.

The triggers set at 95% effectively mean any reduction in the performance indicators may be a chance probability rather than a real reduction. Regional triggers of 85% reflect the influence that recruitment pulses on a regional level can have on the catch rate, biomass, egg production estimates. The triggers related to changes in by-catch and by-product are large as the sensitivity of any analysis will be such that only large changes are detectable at without undertaking expensive targeted research. This is justifiable in the case of by-product species as they form part of a commercial fishery in their own right and the catch taken by rock lobster fishery is less than 5% of the total catch. With by-catch species the feasibility of collecting data and undertaking research to detect lower small changes cannot be justified, particularly as the impact on by-catch species is likely to be low.

Trigger points for by-catch and by-product species are somewhat arbitrary and will be reviewed after the first two year of reporting against them.

If any one or more of the triggers is reached the management strategies will be reviewed. The management response could be to do one or more of the following:

- Introduce regional total allowable commercial catches, or amend the TACC.
- Introduce or change the size limits on a regional basis.
- Introduce area or seasonal closures.
- Impose additional gear restrictions.
- Other appropriate management measures.

If the assessment determines that immediate action is required the Minister can respond by making emergency changes under the provisions of the Act.

Given that the estimated legal size biomass and egg production on both a Statewide and regional basis have increased during the past three years under quota management, and the fishery is in a more sustainable position than it was in the mid 1990s, it is unlikely that reaching any of the trigger points will have any long term affect on the sustainability for the fishery.

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

The commercial rock lobster fishery is controlled by quota management and has an annual TACC set. This has been 1,502,5 tonnes for the last two years. At this stage there is nothing to indicate that it should be changed for the 2000/2001 fishing season. The recreational fishery has daily bag limits and possession limits. There are size limits for males and females. Rules relating to possession, tail clipping, tagging and sales provide significant restrictions for those who try to sell rock lobster illegally.

The management strategies are described in detail in the Draft Rock Lobster and Giant Fishery Policy Document (Anon DPIWE 2001 p10-13) and are summarise in Table 1 in the introduction.

The fishery is managed by individual transferable quota under a total allowable catch (TAC), which is currently 1,502.5 tonnes. The quota units are allocated as equal shares of the TAC and there are 10,507 rock lobster quota units. The number of licences that can be issued is limited to 315. There are limits on the numbers and types of rock lobster pots (traps) that can be used from each vessel. There are minimum size limits, 105 millimetres for female rock lobster and 110 millimetres for male rock lobster. There are also season closures to protect breeding females and the predominant moulting period for males. There are currently about 235 vessels operating in the fishery.

The report and documentation requirements are summarise in the following table.

Unloading report	An unloading phone report must be made 2 hours before rock lobster or giant crabs are unloaded.
Fish cauf report	A fish cauf phone report must be made within 30 minutes of placing rock lobster or giant crabs in to a fish cauf or holding tank.
Leaving port report	A leaving port phone report must be made at least 2 hours before a person who holds a rock lobster or giant crab licence in another State which is attached to the fishing vessel licensed in Tasmania who intends fishing for rock lobster or giant crabs in State waters.
Movement report	A movement phone report must be made by a licence holder who is not selling their rock lobster or giant crab to a licensed processor or licensed handler before rock lobster or giant crabs are moved from the site where they were unloaded.
Dispatch report	A dispatch phone report must be made by a licence holder who is selling their rock lobster or giant crab directly to a person outside Tasmania, other than a licensed processor or handler.
Commercial quota docket	A licence holder must complete Part A of a commercial rock lobster quota docket or commercial giant crab quota docket a when rock lobster or giant crab are unloaded from the fishing vessel. The pink page is to be sent to DPIWE within 48 Hours of completing it, the yellow page is provided to the person completing Part B and the white page is kept by the fisher for five years.
Catch and effort record	A licence holder must complete the catch and effort record each day, with that days' fishing activity. This is submitted to the DPIWE monthly.

A recreational fishing licence is required for rock lobster diving (5154 licences in 2001) and rock lobster potting (9711 licences in 2001), and rock lobster ring(2448 licences in 2001). A person under ten years of age is not permitted to hold either a fishing licence (recreational rock lobster pot) or a fishing licence (recreational rock

lobster dive) or a fishing licence (recreational rock lobster ring). There is a simple numbering system for recreational pots, without the need to remark gear each year. There is also requirement for the rock lobster pot to be tagged with a gear tag that is issued each year.

If recreational catch reaches the trigger point of 10% of the commercial catch then management measures included season reductions, bag limit reductions and further gear restrictions.

Commercial fishers who are not part of the rock lobster and giant crab fisheries are prohibited from using a recreational rock lobster pot for recreational fishing, or diving for rock lobster, while on a fishing trip where fish are being taken for sale or commercial gear is used.

The recreational catch and possession limits are 5 per day and a total of 10, for people who hold either a fishing licence (recreational rock lobster pot) or a fishing licence (recreational rock lobster dive) or a fishing licence (recreational rock lobster ring) respectively. The possession limit for people who do not hold a recreational licence for rock lobster or a fishing licence (rock lobster) is 5 rock lobster, unless they have a receipt proving the rock lobster were purchased. A person who holds a fishing licence (recreational special rock lobster) can have a possession limit of 20 rock lobster for a period of 45 days for a 14 day special licence or 90 days for a 28 day special licence.

There is a requirement for rock lobster taken for recreational purposes to be tailfan punched or tailfan clipped, this is aimed at reducing the illegal sale of rock lobster.

1.1.8 Fishing is conducted in a manner that does not threaten stocks of by-product species.

There are a number of species of fish, sharks and octopus that are taken as a by-product of rock lobster fishing. These retained species are utilised in three ways, they are used as bait for rock lobster pots or sold commercially or retained for personal consumption. Fishers are required to record their retained catch on a daily catch record for general fishing, this is the same catch logbook completed by the majority of the State's scalefish fishers.

Lyle and Jordan (1999) report that between 11 and 17 tonnes of finfish and octopus were recorded in the general fish logbook as by-product in rock lobster pots for the period from 1995 to 1998. The difference between the annual by-product catches report is most likely reflected in the accuracy with which by-product is reported in the logbooks rather than any change in abundance. This represents about 1-2% of the commercial catch of finfish species taken by trawling gillnets, hooks and traps (Lyle and Jordan 1999)

Frusher and Gibson (1999) believe the by-product recorded in the general fish logbooks may be inaccurate because some fishers:

- can not be bothered to fill out a second logbook (scale fish by-catch/by-product needs to be recorded in a separate logbook to the rock lobster logbook);

- believed that they only had to fill the general fish logbook out if they were retaining fish for commercial sale and thus fish which were discarded or used as bait did not need to be recorded;
- were concerned that new management plans would restrict the amount they could catch if they were seen to be catching quantities of fish.

Frusher and Gibson (1999) concluded that rock lobster pots have the potential to impact on southern coastal reef communities as they are capable of catching many species of reef fish and macro invertebrates. Frusher and Gibson (1999) concluded that the by-product and by-catch of commercial finfish species could be significant relative to volumes harvested by targeted fishing. However, the incorporation of escape gaps in the pots, to reduce catches of undersized lobsters, is also effective in reducing the number of by-product/by-catch species. They believe further studies on the number of escape gaps could further improve current lobster pot design to minimise by-product/by-catch. Although, improved recording of the by-product/by-catch is required if logbook data is to be used to quantify the amounts caught.

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

The quota management has achieved early results on both the sustainability and restructuring objectives and is now well accepted and supported by the vast majority of fishers and licence holders. The effect has been to reduce the fishing effort by 29% and the number of fishing vessels by 23% (Ford 2000a&b) while the reduction in catch has resulted in an increase in the estimated legal size biomass of between 24% and 44% and increases in the level of egg production after three years (Gardner *et al.* 2001). Fishers now spend less days at sea and catch rates are improving. These changes are reducing the fishing costs, which in time should increase profitability (Ford 2000b).

The Department believes that the ITQ system will ensure the future sustainability of the resource and the fishery as quota management has seen the declines in catch, catch rates, estimated legal size biomass and egg production increase while fishing effort has decreased. Assuming that the level of illegal activity is low, it is reasonable to conclude that under the current management arrangements the fishery will continue to improve.

B.1.2 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.

B.1.2.1-2 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.*

Currently not applicable. To comply with the objectives of the Act the Minister must take appropriate action to ensure a fishery is managed sustainably. The Act provides powers to review or revoke management plans or to take emergency action to rectify threatening actions.

The Rock Lobster Fishery Policy Document (Anon DPIFb 1997 p27) describes what is to happen if one or more of the trigger points is reached.

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.*

Currently not applicable

B.2 PRINCIPLE 2.

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

B.2.1 Objective 1.

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

B.2.1.1 Information requirements

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

Information on by-catch is currently collected from the catch sampling work undertaken as part of the fisheries independent research. By-catch information has been recorded for 18,302 rock lobster pots, without escape gaps, set for catch sampling from 1992 to 1997 (Frusher and Gibson 1999). Information continues to be collected by the catch sampling program. The following species list has been adapted from Frusher and Gibson (1999).

List of species and numbers caught in 18,302 rock lobster pots without escape gaps from 1992 to 1997.

		Total catch (numbers)	No. of pot lifts to take 1 animal
<u>CRUSTACEANS</u> : 9 species			
Hermit Crab	<i>Strigipagurus strigimanus</i>	88486	
Rough Rock Crab	<i>Nectocarcinus tuberculosis</i>	9253	2
Cleft Fronted Shore Crab	<i>Plagusia chabrus</i>	606	30
Great Spider Crab	<i>Leptomithrax gaimardii</i>	65	282
Giant Tasmanian Crab	<i>Pseudocarcinus gigas</i>	49	374
Pie Crust Crab	<i>Cancer novaezealandiae</i>	25	732
Others	3 species	15	1220
<u>FINFISH</u> : ~33 species			
Rosy Wrasse	<i>Pseudolabrus psittaculus</i>	2192	8
Degen's Leatherjacket	<i>Thamnaconus degeni</i>	2175	8
Barber Perch	<i>Caesioperca rasor</i>	1980	9
Blue-Throat Wrasse	<i>Pseudolabrus tetrians</i>	1452	13
Purple Wrasse	<i>Pseudolabrus fucicola</i>	883	21
Southern Conger Eel	<i>Conger verreauxi</i>	865	21
Red Gurnard Perch	<i>Helicolenus papillosus</i>	690	27
Draughtboard Shark	<i>Cephaloscyllium laticeps</i>	539	34
Bearded Rock Cod	<i>Pseudophycis barbata</i>	558	33
Brown-Striped Leatherjacket	<i>Meuschenia australis</i>	505	36
Velvet Leatherjacket	<i>Parika scaber</i>	389	47
Morwong	<i>Nemadactylus macropterus</i>	231	79
Toothbrush Leatherjacket	<i>Penicpelta vittiger</i>	99	185
Scorpaenid-Unidentified		88	208
Senator Wrasse	<i>Pictilabris laticlavus</i>	80	229
Butterfly Perch	<i>Caesioperca lepidoptera</i>	51	359
Others	17 species	97	189

MOLLUSCS : ~21 species

Octopus	<i>Octopus maorum</i>	647	28
Others	~20 species	96	191

ECHINODERMS : ~7 species

Starfish and Urchins	7 species	3	
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No by-catch information is recorded by fishers on their catch and effort returns. Anecdotal information from fishers agrees with findings of Frusher and Gibson (1999) that by-catch is very low, and often non-existent.

B.2.1.2 Assessments

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

Frusher and Gibson (1999) looked at the potential catch of all by-product/by-catch species by scaling up information from research catches taken using a mixture of rock lobster pots with and without escape gaps.. Frusher and Gibson (1999) conclude that the use of escape gaps in rock lobster pots reduces the by catch by at least 80%. Using Frusher and Gibson (1999) estimates of catch of wrasse species in research pots, and their estimate that the by-catch of wrasse species is reduced by between 90% and 100% through the use of escape gaps, the potential catch can be estimated. It is possible that the rock lobster fishery might catch about 5% of the recorded landings of wrasse.

Rock lobster pots have had to be fitted with escape gaps for more than 30 years.

There are no specific assessments or risk analyses on by-catch species as the impact is believed to be low, particularly as many of the species can be returned to the water alive. Anecdotal information suggests this is happening, for example fishers used to routinely kill draughtboard sharks instead of releasing them, but changed their practice when they realised the draughtboard sharks prey on octopus. This view is also supported by research staff who have undertaken catch sampling trips on commercial vessels. There has been no specific work to assess the survival of by-catch species, but in some instances species, like draughtboard sharks, are tagged and have been recaptured at a later date, indicating they survive the first return.

B.2.1.3-6 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.

Rock lobster pots are required to have one or two escape gaps to allow juvenile rock lobster to escape for at least 30 years. Escape gaps are an effective means of reducing bycatch in rock lobster pots with most finfish and invertebrates catches being reduced by over 80%. Larger species such as draughtboard sharks would not be able to utilise

escape gaps to leave pots and, as expected, escape gaps had a negligible effect on the amount of catch of these species. (Frusher and Gibson, 1999).

The following table is adapted from Frusher and Gibson (1999) and shows the percentage reduction in by-catch species comparing rock lobster pots that had no escape gaps with pots where escape gaps were present.

Reduction in bycatch of rock lobster pots due to the inclusion of escape gaps (esc. gaps).

Coast/pot type <i>Pots sampled (esc. gaps / no esc. gaps)</i>	south/steel 247 / 1219	east/steel 236 / 1039	east/stick 60 / 296
SPECIES	% reduction		
Hermit Crab	92.4	96.3	66.7
Rough Rock Crab	96.6	74.2	100.0
Southern Conger Eel	87.3	86.2	17.8
Rosy Wrasse	100.0	100.0	97.8
Draughtboard Shark	7.5	-3.6	
Cleft Fronted Shore Crab	91.2	83.7	100
Purple Wrasse	90.7	100.0	100
Great Spider Crab	75.9		
Bearded Rock Cod	86.7	81.7	38.3
Degen's Leatherjacket	100.0	94.2	100.0
Octopus	100.0	95.4	-146.7
Blue Throat Wrasse	100.0	96.4	100.0
B'wn Striped Leatherjacket	75.3	35.0	93.0
Velvet Leatherjacket	100.0	76.8	100.0
Red Gurnard Perch	34.2	92.2	71.0
Butterfly & Barbers Perch	100.0	100	100.0
Toothbrush Leatherjacket		80.0	
Triton Shell		-46.8	

This comparative data has been obtained from the independent catch sampling program which has undertaken research fishing with bot steel and stick pots, some with no escape gaps and some with.

There have not been specific trials of pot designs to minimise by-catch, nor is there perceived to be such a need from the fishers.

2.1.4 An indicator group of bycatch species is monitored.

Not at this stage. None of the by-catch species are believed to be taken in sufficient quantities to result in a negative impact on the species. However by-catch information continues to be collected from the research catch sampling program. At this stage no species appear to be caught frequently enough by commercial rock lobster pots to be used as an indicator, statistically much of the by-catch could be taken as a chance event. There are no plans to determine if any of the by-catch species are good indicator species, particularly where they also are fished commercially in their own right.

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

Not specifically. However, the Act provides for amendments to management plan and emergency responses which would be used to protect a species that was perceived to be under threat. A general reference point relating to the impact on by-catch/by-product species has been included in the Draft Rock Lobster and Giant Crab Policy Document.

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

Not applicable at this stage. However, the Act provides for amendments to management plan and emergency responses which would be used to protect a species that was perceived to be under threat. In the absence of a targeted research program to monitor by-catch species it is likely that in the first instance the Department would become and any concerns via anecdotal information from fishers.

The costs of establishing such broadscale monitoring program to detect changes in abundance of by-catch species would far exceed and demonstrable benefit of doing the research, particularly as the finfish species are subject to fishing in their right.

B.2.2 Objective 2.

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

B.2.2.1 Information requirements

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

Two groups of marine animals that may be affected by rock lobster fishing are seals and turtles. This report does not include the impact caused by fishers shooting seals, which is believed to occur very occasionally, as this is illegal and is not directly related to an interaction with the fishing activity.

Turtles

Information is collected on an ad-hoc basis, with fishers encouraged to report entanglement interactions with seals, turtles, seabirds and whales. From time to time fishers report entanglements of turtles and seals. The incidence appears to be very low.

The Draft Recovery Plan for Marine Turtles in Australia (Anon EA 1998) requires Tasmania to quantify the entanglement events and the mortalities as a result of rock lobster pot lines.

Information collected for inclusion in the draft recovery plan concluded there had been 118 sightings of turtles in 10 years. These sightings are not separated to provide mortalities, but it is reasonable to assume that the number of interactions that result in the death of the turtle is likely to be a rare. In the last 10 years only 4 turtle deaths have been recorded from entanglements in fishing gear (Anon. EA 1998). Information is currently collected on an ad-hoc basis with fishers lodging an occurrence form with the Nature Conservation Branch of the Department. It is intended that the catch and effort logbook be amended to include information about interactions with threatened species, these can then be followed up to obtain more details.

Bone (1998) undertook a preliminary investigation into the abundance and occurrences of the leatherback turtle *Dermochelys coriacea* in waters around Tasmania. This investigation concluded that the presence of turtles in Tasmanian waters may be higher than previously thought. If this is the case then the number of interactions with rock lobster pots may be higher than has been reported, likewise the mortality rate from such interaction may be higher.

Seals

Information on the interactions with seals is being collated currently. Commercial fishers were surveyed in 2000, they were asked to provide information on interactions with seals. This process is part of the Government's wider interest in seals, and the Minister has established an advisory group to provide him with advice about fisher/marine farmer interactions with seals.

Data collated at this stage suggests that the level of interaction between rock lobster fishers and seals is low, but difficult to assess. The most frequently reported interaction is the removal of bait savers from rock lobster pots and predation on undersize rock lobster returned to the water. One fisher reported catch 2-3 juvenile seals drowned in his pots. This work will be reported upon in the next six months (Sean Riley personal communication, member of seal advisory group).

Seal interactions with discarded rubbish and ropes have been documented, some of this may have originated from rock lobster vessels. The Nature Conservation Branch of DPIWE and the Tasmanian Fishing Industry Council have been promoting retaining all rubbish and rope discards and bring it back to port.

Future assessments of the impact on seals are likely as part of the wider interest in seals.

B.2.2.2-3 Assessments

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

While no formal assessment exists specifically for the impact of the rock lobster fishery on endangered, threatened or protected species, rock lobster fishing impacts

have been identified for marine turtles and seals in the Tasmanian threatened species handbook (Bryant and Jackson 1999).

The impacts, while low in number, can generally be attributed to accidental capture in buoy lines, this may result in cuts or lesions or death by drowning.

Management recommendations proposed by Bryant and Jackson (1999) to minimise any impacts on turtles include checking rock lobster pots frequently. The main impact on seals from the rock lobster fishery is through discarded rubbish like bait straps (strapless bait boxes have been developed but are not used on most of the bait which is imported) and used netting. The main threat to sea birds from the rock lobster fishery is via entanglement in fishing gear and marine debris.

The assessments undertaken by Bryant and Jackson (1999) suggest that where rock lobster fishing is mentioned as having an impact it is not major when compared with other impacts on such threatened species.

There is currently no research into the impacts of rock lobster fishing on either turtles or seals.

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

No assessments are being done to look at the impacts on threatened ecological communities. However, the assessment of the State's MPAs is on going and this work may lead to specific research about the impact of rock lobster fishing on communities. Such research has been identified in the strategic research plan for the rock lobster fishery.

B.2.2.4-6 Management responses

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

Commercial and recreational fishers must not leave rock lobster pots in the water for more than 48 hours, and in practice the gear is attended more frequently. Commercial fishers will often haul their gear twice a day, or at least once a day. This practice should help minimise the mortalities resulting from entanglements that occur near the surface. This practice adds the rock lobster fisher and allows him to maximise his catch as there is less time for octopus predation and for the bait to be eaten by sea "lice".

Devices to deter seals entering rock lobster pots have been trialed in South Australia (Leadbitter 1999), these "seal spike" have not been trialed in Tasmania. The perception amongst many fishers was that if the seals were a real problem then fishers might be tempted to try a device like a seal spike.

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

There are currently a number of locations where fishers cannot set rock lobster pots, these include areas that have been established as marine protected areas. One such example is an area closed to fishing with rock lobster pots to protect some unique habitat on the eastern side of King Island.

In defining Tasmania's bioregions Edgar (ref) did not identify any threatened marine ecological communities, although these have been recorded in several of Tasmania's estuaries (Edgar *et al.* 1999), where commercial rock lobster fishing is not allowed/restricted.

Since 1991, researchers in Tasmania have been monitoring the change in Marine Reserves [gazetted in 1991]. While there has been substantial changes in the average size and density of lobsters in the reserve, surveys have not identified any significant change in biodiversity. This research is ongoing and a detail assessment of changes in the reserves is planned for 2001.

There is some concern that there may be some impact on the stands of the giant string kelp *Macrocystis pyrifera*. The main threat to these communities comes from a number of possible causes including: the effects of marine pollution; the introduction of the Japanese Kelp (*Undaria pinnatifida*); and/or large scale oceanographic changes. However, rock lobster fishing may also have some impact. A research project is underway which will assess if rock lobster fishing has any impact on the kelp communities.

Of greater concern to ecological communities in Tasmania is the spread of introduced species (seaweed - *Undaria*, the North Pacific seastar - *Asterias*) and new invasions (long spined sea urchin - *Centrostephenious*). Research is currently underway (*Undaria*, *Asterias*) or proposed (*Centrostephenious*) to evaluate the impact of these species.

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

Any impact on threatened ecological communities will be managed under various sections of the Act, either by direct controls on the fishing activity of by the introduction of a habitat management plan.

At present there are no monitoring programs or research underway to detect any impact caused by rock lobster fishing. The issues will need to be given a high priority in coming year.

B.2.3 Objective 3.

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

B.2.3.1 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.

In the assessment work conducted on marine protected areas in Tasmania, Eggar and Barrett (1997), found higher abundances of rock lobster within the marine protected areas but no ecological or environmental differences between similar sites.

However, recognising that there may be such an impact it is intend to undertake some small scale research to determine if there is any impact on the environment or reef communities that can be attributed to the use of baited pots on reefs. Similar work was also proposed for South Australia but failed to secure the necessary funding.

B.2.3 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*
- *Ecologically related, associated or dependent species*
- *Water column communities*

2. Impacts on food chains

- *Structure*
- *Productivity/flows*

3. Impacts on the physical environment

- *Physical habitat*
- *Water quality*

No information is being collected specifically, however, one source of information is the wealth of knowledge contained in marine ecology Hons and PhD theses. It would be appropriate to review any relevant studies over the past 10 years to see what data has been collected and analysed.

A program for future data collection can then be devised and appropriate research undertaken.

B.2.3.3-5 *Management responses*

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.*

No management actions are in place. Appropriate actions will be developed once the data collection process is resolved.

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 currently, but will follow from 2.3.3.

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

Not currently, but will follow from 2.3.3.

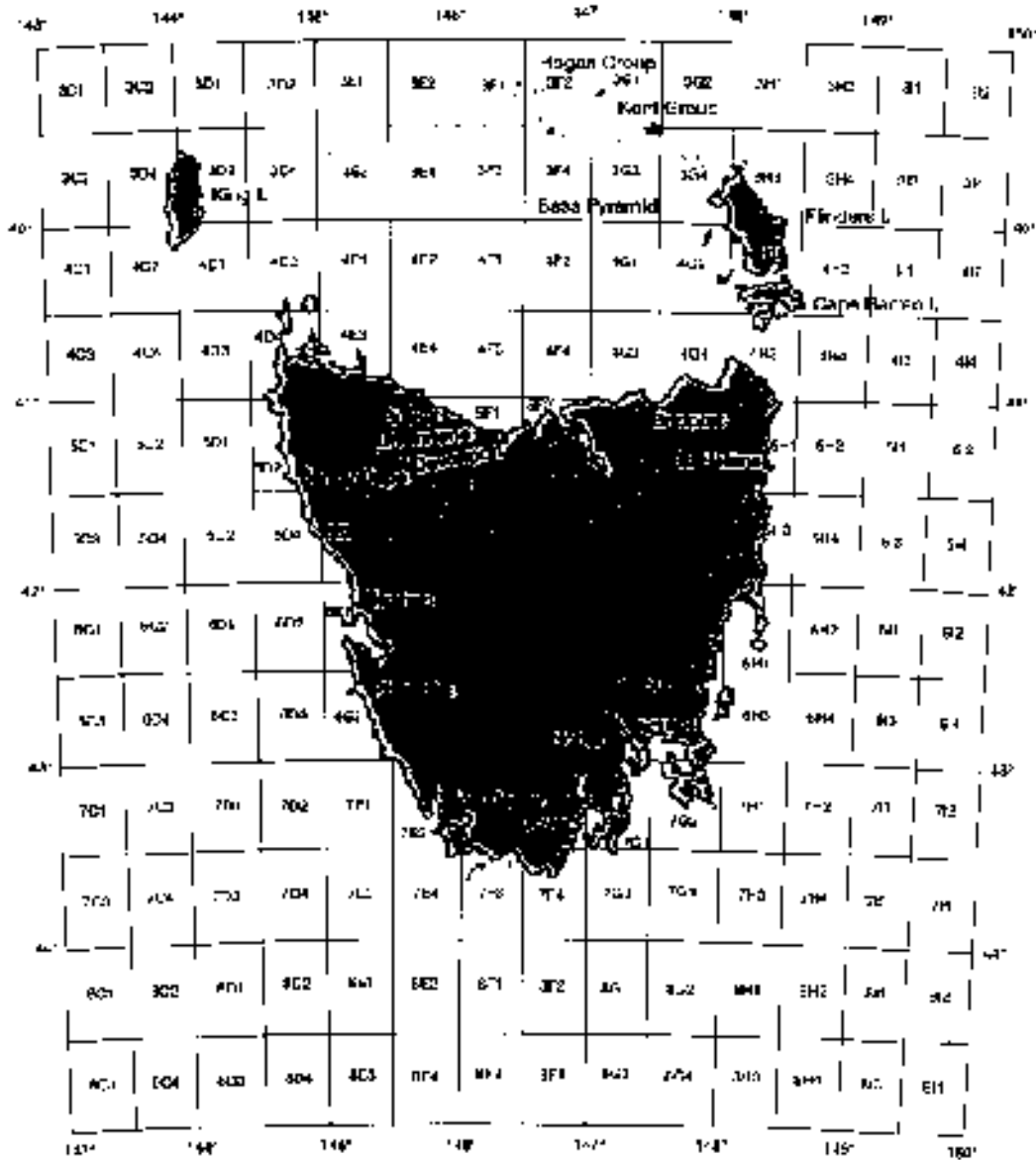
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TASMANIAN ROCK LOBSTER FISHERY MAP



NOTE: The Tasmanian Rock Lobster Fishery Map is based on a 30 x 30 minute grid system. Please indicate Fishing Block Number in the Block Number column.