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Department of **Fisheries**

Chapter 2

Western Rock Lobster Ecological Risk Assessment

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Contents

ABBREVIATIONS

AIMAC	Abrolhos Islands Management Advisory Committee
ALARP	As Low As Reasonably Practicable
AS/NZS	Australian Standards/New Zealand Standards
CALM	Conservation and Land Management
DEP	Department of Environmental Protection
EA	Environment Australia
EMS	Environmental Management Strategy
EPBC	Environmental Protection and Biodiversity Conservation
ESD	Ecological Sustainable Development
FRDC	Fisheries Research and Development Corporation
FWA	Department of Fisheries (Western Australia)
IRC	International Risk Consultants
MSC	Marine Stewardship Council
RLIAC	Rock Lobster Industry Advisory Committee
SOF	State of the Fishery
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WRL	Western Rock Lobster
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

This Ecological Risk Assessment, conducted by IRC Environment (part of International Risk Consultants) and Department of Fisheries WA (FWA) was the result of an initiative by the WA Fishing Industry Council (WAFIC) and (FWA). This report is based on a risk assessment workshop undertaken in February 2001 at the FWA Marine Research Laboratories in Waterman but includes additional background material to justify some of the rankings of the workshop.

The broad intent of the workshop was to provide a register of the potential main ecological risks that arise from the various activities carried out by the western rock lobster (WRL) Fishery.

The workshop considered the ecological aspects of the WRL fishing activities including: baiting, potting and fishing. The workshop had 22 participants which were selected on the basis of their involvement with industry, conservation movement and scientific expertise. It included representatives from World Wide Fund for Nature (WWF), FWA, Conservation and Land Management (CALM), Department of Environmental Protection (DEP), WAFIC, WA Museum, Curtin University, Conservation Council of Western Australia as well as WRL fishers. The risk ranking process, using a working group of experts, delivers the ability to prioritise risks and therefore focus on the relevant management actions required for the WRL fishery. A group of experts also avoids the need for time consuming sourcing and review of data during the workshop. Some background information was provided to participants and data known to exist were referenced during the workshop to support the allocation of risk ranking. The report has also been submitted to independent review and for public comment. The risks were described using the factors consequence (where 1 represented minor to 5 representing catastrophic) and likelihood (where 1 represented remote to 6 being likely).

In total, 33 hazards were identified across the WRL fishery. No high risks were identified during the workshop. Risks associated with the hazards identified were ranked as either moderate (12%) or low (88%). The following figure shows the Impact and Numerical Risk Distribution for all risks identified. When sorted according to the risk level, the register of risks has identified the following main issues for the WRL. Within the risk category of moderate, the potential impacts include:

- Sea-lion pups potentially become entangled in pots with the potential for change to the population identified (Consequence 3 Likelihood 4);
- Contact of pots with coral resulting in a potential change to coral abundance (Consequence 3 Likelihood 4);
- Leatherback turtles potentially becoming entangled in rope resulting in a potential change in population (Consequence 3 Likelihood 4); and
- Dumping of domestic waste into the ocean at the Abrolhos Islands resulting in a potential reduction in the ocean environment quality (Consequence 1 Likelihood 6).

For identified hazards with moderate risk, these risks are acceptable, as long as risk reduction is applied to reduce risks to as low as reasonably practicable (ALARP). In these

instances a management strategy needs to be implemented. The focus of this report is in line with risk assessment methodology (section 4 of this report) which involves the review of the risk rankings to determining if the risk is acceptably low, or if management actions are required to reduce the risk to ALARP for the main risks identified during the workshop. As no high risks were identified, moderate risks become the focus of risk management. Low risks are included in this report, but are not dealt with in detail.

The ecological risk assessment workshop participants provided 13 recommendations to address the moderate risks to the WRL fishery. These recommendations are included in Attachment 4 in context with the respective hazards, impacts and risks that the recommendations are designed to address.

These recommendations (not in any order of priority) are:

Sea lion entanglement in pots (see 5.2.1.1 in Attachment 4)

1. Investigate the spatial area of influence of sea lion pups feeding in pots;
2. Look at the South Australian efforts to keep out sea lion pups from pots to see how effective they were;
3. Determine whether sea lion pup mortality from pot capture is an issue – review available data;
4. Investigate gear modification to keep out sea lion pups;
5. Recording interaction with gear and captures of sea lion pups;

Rope entanglement of leatherback turtles (see 5.2.2.1 in Attachment 4)

6. Begin collecting data on turtle entanglement – species, time, location & a systematic study to understand how turtles are caught in ropes and placed in broader population context ie how important are the turtle mortalities in a local and regional context;
7. Ensure that if possible, dead turtles are brought back for analysis or photographs, description, location GPS/depth of turtle in water;
8. Better educate fishers to collect information on turtle sightings and captures;
9. Investigate through newsletters, magazines if other fishing activities regularly sight turtles.

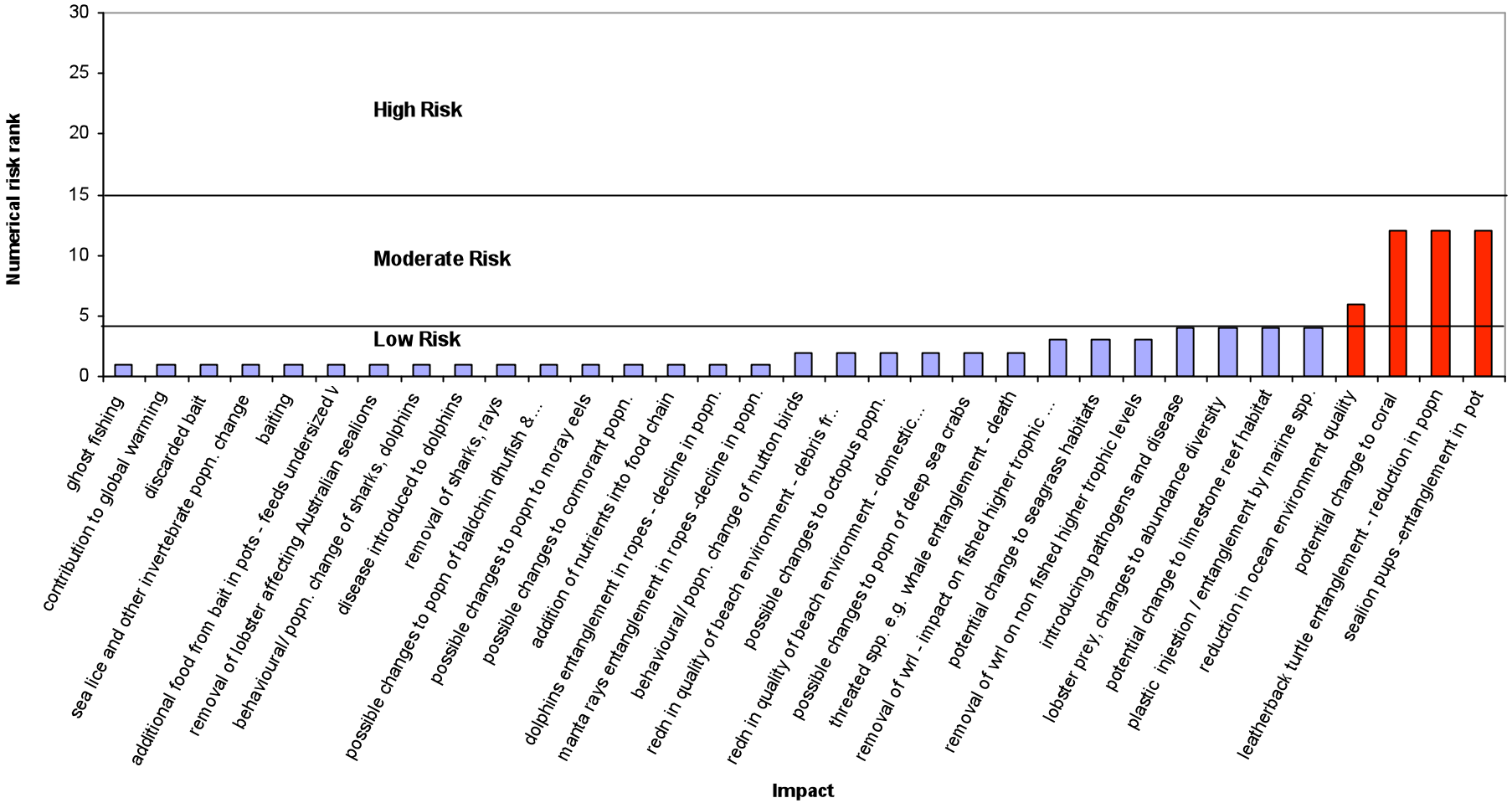
Physical impacts on coral from potting (see 5.3.1.3 in Attachment 4)

10. Implement the outcomes and recommendations for studies/actions from an Abrolhos workshop to be held during 2001;
11. Increase fisher awareness of the importance of coral habitats and environment;
12. Undertake an international review of pot damage to habitats; and

Camping at the Abrolhos Islands (see 5.3.3.1 in Attachment 4)

13. Examine the outcomes of the review by the Abrolhos Islands Management Advisory Committee (AIMAC) to implement appropriate waste management strategies.

Because managing risk for the WRL fishery is an ongoing process, it is recommended that a risk management culture continue to be developed. This culture requires participants in the fishery to be a part of the ALARP process by actively inputting into the development of the hazard and risk register, and assist in defining the fisheries' ecological risk profile.


Numerical risk rank
30
25
20
15
10
5
0
High Risk
Moderate Risk
Low Risk
ghost fishing
contribution to global warming
discarded bait
sea lice and other invertebrate popn. change
baiting
additional food from bait in pots - feeds undersized l
removal of lobster affecting Australian sealions
behavioural/ popn. change of sharks, dolphins
disease introduced to dolphins
removal of sharks, rays
possible changes to popn of baldchin dhuffish &...
possible changes to popn to moray eels
possible changes to cormorant popn.
addition of nutrients into food chain
dolphins entanglement in ropes - decline in popn.
manta rays entanglement in ropes -decline in popn.
behavioural/ popn. change of mutton birds
redn in quality of beach environment - debris ff..
possible changes to octopus popn.
redn in quality of beach environment - domestic...
possible changes to popn of deep sea crabs
threated spp. e.g. whale entanglement - death
removal of wrl - impact on fished higher trophic ...
potential change to seagrass habitats
removal of wrl on non fished higher trophic levels
introducing pathogens and disease
lobster prey, changes to abundance diversity
potential change to limestone reef habitat
plastic injestion / entanglement by marine spp.
reduction in ocean environment quality
potential change to coral
leatherback turtle entanglement - reduction in popn
sealion pups -entanglement in pot
Impact

1. INTRODUCTION

1.1 Background

In March 2000 the western rock lobster fishery was certified and approved under Marine Stewardship Council (MSC) certification requirements.

This report presents the results and findings of an Ecological Risk Assessment Workshop that was conducted for the western rock lobster (WRL) fishery in Western Australia. The findings from the Ecological Risk Assessment Workshop have been used to commence the development of a draft environmental management strategy.

The workshop was the result of an initiative by the WA Fishing Industry Council (WAFIC) and Department of Fisheries WA (FWA). IRC Environment was contracted by FWA to perform the work.

IRC Environment facilitated a risk assessment workshop during February 2001 at the FWA Marine Research Laboratories in Waterman, Western Australia. This report documents the findings of the workshop that was comprised of expert representatives from a variety of organisations with a wide variety of experience and qualifications (see Attachment 1 for a list of participants and their brief CV).

1.2 Ecological Risk Assessment

Within 14 months of certification, WAFIC and FWA agreed to complete a comprehensive and scientifically defensible assessment of the fishery and fishing operations on the ecosystem (ecological risk assessment). The risk assessment is to be based on existing knowledge, should consider risks of all aspects of fishing, identify and prioritise gaps in knowledge, produce a set of prioritised risks, and strategies to address the main risks, including research strategies that make maximum use of comparisons between fished and unfished areas.

1.3 Workshop Intent

The broad intent of the Ecological Risk Assessment Workshop was to provide a register of the potential main ecological risks to the environment that arise from the various activities carried out by the WRL fishery.

This risk register was used to identify the underlying issues so that these may be addressed through the development of an appropriate management strategy (refer to section 6). This enables the fishing activities to focus on reducing the risk of deleteriously affecting the ecosystem in which the WRL occurs.

Section 1.2 outlined the requirement to identify and prioritise gaps in knowledge. This was done during the workshop and the information gaps for the main risks, the moderate risks, are presented in Attachment 5.

1.4 Ecological Risk Assessment Definition

"Ecological Risk Assessment '*evaluates the likelihood that adverse ecological affects may occur or are occurring as a result of exposure to one or more stressors'* (U.S. EPA, 1992).

1.5 Environmental Management Strategy

Within 24 months of certification, WAFIC and FWA agreed to prepare an Environmental Management Strategy (EMS) for the fishery. The EMS will address impacts of the fishery on the environment and will include proposed objectives, strategies, indicators and performance measures. The EMS will specify an operational plan, including implementation actions and a supporting program of research. Future research should aim to provide information on the impacts of the fishery on the ecosystem that is at least as scientifically valid as that produced by studies of fished versus unfished areas. The EMS is discussed further in section 6.

More details of the MSC certification process are available on the MSC's Internet site at http://www.msc.org/index3.htm.

1.6 Review Process

The workshop was set up to be one step in the process in the development, completion and review of the Ecological Risk Assessment report. The steps undertaken can be summarised as follows:

Step 1	The Standing Committee of Fisheries and Aquaculture (SCFA) and the Fisheries Research and Development Corporation (FRDC) have a project to develop reporting mechanisms for Australian fisheries against Ecologically Sustainable Development (ESD). Dr. R Fletcher, as the project leader of this ESD project, conducted a stakeholder workshop in August 2000, as part of a Case Study on the western rock lobster fishery. As part of the workshop, a set of "component trees" identifying ecological and environmental impacts of the fishery was developed by the workshop participants and with additional input from Department of Fisheries. A draft report, including the component trees and a set of comprehensive performance reports was being developed which later became the basis for the application process to Environment Australia (EA) for recognition of the sustainability of western rock lobster fishery under the Commonwealth Environmental Protection and Biodiversity Conservation (EPBC) Act.
Step 2.	15 January 2001 - The component trees and the 29-page draft report from the case study in Step 1 above were sent (by email) to the ERA workshop participants to provide background information.
Step 3.	5-6 February 2001 - The ERA workshop for MSC and EA purposes was conducted. Participants for the workshop were selected based on their involvement in industry, conservation movement and scientific expertise. Two risk assessment experts from IRC Environment were engaged to facilitate the

	workshop, provide an analysis of the information from the workshop, and provide a draft ERA to the FWA. Australian Standard AS/NZS 4360:1999 Risk Management was selected and used as the basis for conducting the workshop and analysing the information on ecological risks in the fishery.
Step 4.	16 March 2001 - The draft ERA developed from the workshop was provided to workshop participants for their comment (Western Rock Lobster Ecological Risk Assessment Rev 0).
Step 5.	3-6 May 2001 - The draft ERA report and the draft ESD report were provided to the SCS Surveillance Team and discussed during the surveillance visit. A revised process for the completion of the ERA report was agreed by the surveillance team at the conclusion of the May audit meetings.
Step 6.	October 2001 - The ERA report (Rev. 2) was revised according to the issues raised at the May audit meeting and additional background material obtained from the ESD report was provided in Attachment 4 to justify some of the rankings of the workshop. Two peer reviewers (Prof. Colin Buxton and Dr. Fred Wells) were selected and given the ERA report for review.
Step 7.	October 2001 - In a second and parallel process to the peer review process, the revised ERA Report was forwarded to the February ERA workshop participants for comment.
Step 8.	October 2001 - in a third and parallel process to the peer review process, a submission was made to EA to enable EA to issue an export permit in keeping with requirements of the EPBC Act. The application included much of the information found in the ERA as well as additional information required by EA. The EA review process included: • A scientific review by EA's Scientific Committee on Wildlife Use; verbal comments by the Chairperson of the Committee indicated that the application to EA, including the ERA report was satisfactory. • A public comment phase where three (3) public comments were received by EA and were forwarded to the FWA.
Step 9.	19 December 2001 - All comments received from initial peer reviewers selected by FWA were addressed (see Attachment 6) in a revised ERA report and forwarded to the Certifier (Rev. 3).
Step 10	13 March 2002 - A review of the public comments was conducted and a response provided to EA and to the Certifier (see Attachment 7 and 8).
Step 11	20 May 2002 - Public comments were addressed in a revised ERA report and forwarded to the workshop participants (Rev. 4).

1.7 Western Rock Lobster Fishery

The western rock lobster fishery is the most valuable single-species fishery in Australia (worth between $AUD200 million and $AUD400 million annually) and usually represents about twenty per cent of the total value of Australia's fisheries.

This fishery also supports a significant recreational fishery with about 37 000 rock lobster licences in 1999/2000 and about 80% of these licences were used to catch 750 tonnes. The licence entitles fishers to use two pots or dive for rock lobster and keep up to 8 lobsters per day.

As one of the first managed fisheries in Western Australia, data has been kept on the western rock lobster fishery since the early 1960s. The rock lobster fishery was declared limited entry in March 1963 when licence and pot numbers were frozen. Since 1963, boat numbers have declined from 836 to 595 (Feb 2000). The commercial catch has varied between 8,000t and 14,500t over the last 20 years.

During the open season between 15 November and 30 June, lobsters are fished using baited pots (commercial diving for lobsters is banned) although the Abrolhos Islands area stays closed until 15 March.

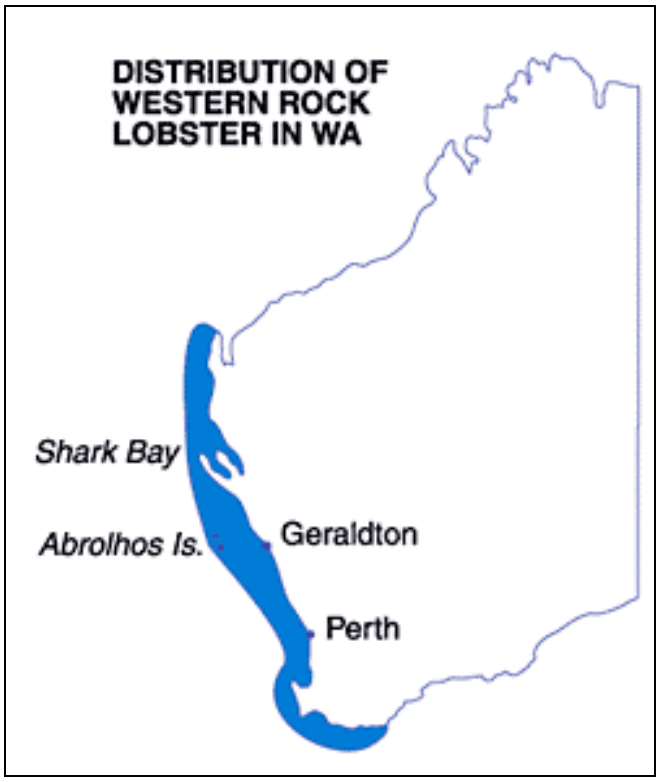
Between 1987/88 and 1991/92, 10 per cent of the lobster pots were removed from the industry. In 1993 management measures were taken which have significantly improved the level of the breeding stock. These measures included an 18% pot reduction, increase in minimum size during the migration period November to January, return of all mature females and introduction of maximum size for females.

The 1999/2000 season produced a record catch of 14,500 tonnes, almost an 11 per cent increase over the 13,000 tonnes landed in 1998/99. This was the highest annual catch for any country fishing rock lobsters in the world.

The Western Rock Lobster Fishery was the first fishery in the world to be certified as ecologically sustainable by the Marine Stewardship Council.

Further details of the fishery are provided in Attachment 3 and can also be obtained from Fisheries WA's Internet Web pages at:

http://www.wa.gov.au/westfish/comm/broc/lobster/lobcm.html.



Source: Fisheries WA Web Page: http://www.wa.gov.au/westfish/comm/broc/lobster/index.html

Figure 1 – Location of the Western Rock Lobster Fishery

1.8 Workshop Benefits

Provided that the results are used correctly, the risk assessment results can provide a number of benefits to the WRL fishery and the marine environment in which the WRL fishery operates, including:

1. Help safeguard the economic and biological integrity and sustainability of the WRL fishery, its environment and related ecosystem;
2. Identify and manage the main risks;
3. Provide a transparent, objective and auditable risk management process which demonstrates that a risk assessment has been carried out for the relevant fishing activities;
4. Develop a set of baseline risk assessment data in the form of a risk assessment report whereby improvements may be made to the risk management activities over a period of time following the initial workshop. This should involve the ongoing capture of data to improve any estimates made or it may involve refinements to the risk treatment options employed;
5. Identify and assess risks such that management may make informed decisions regarding the management philosophy of the WRL fishery;
6. The risk ranking process delivers the ability to prioritise any actions required for the fishery;
7. Provide confidence to third parties interested in the WRL fishery activities that an appropriate risk management process has been conducted;
8. The potential to identify under-addressed risks, but also to maximise opportunities;
9. Improve commercial performance due to the better control over unwanted occurrences and the associated costs; and
10. Improved understanding by industry and other stakeholders of the risk management methodology and the main ecological risks. This is important if risks are to be managed by individuals.

2. OBJECTIVES

The objectives of the Ecological Risk Assessment Workshop were to:

- Perform a hazard identification and ecological risk assessment (risk ranking) for the marine environment in which the WRL fishery operates. Personnel with relevant expertise, from a variety of positions and agencies were invited to participate in the workshop in order to gain maximum benefits from the workshop; and
- Prepare a comprehensive ecological risk assessment report such that FWA management may prioritise and make decisions regarding risk treatment.

3. RISK ASSESSMENT FRAMEWORK

The risk assessment framework that has been applied to the workshop was in line with the Australian Standard AS/NZS 4360:1999 Risk Management, concentrating on the hazard identification and risk assessment components of the whole risk management process.

The following summary has been extracted from AS/NZS 4360:1999;

> *Risk management is an iterative process consisting of well-defined steps which, taken in sequence, support better decision-making by contributing a greater insight into risks and their impacts. The risk management process can be applied to any situation where an undesired or unexpected outcome could be significant or where opportunities are identified. Decision-makers need to know about possible outcomes and take steps to control their impact.*
>
> *Risk management is the term applied to a logical and systematic method of establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating risks associated with any activity, function or process in a way that will enable organisations to minimise losses and maximise opportunities. Risk management is as much about identifying opportunities as avoiding or mitigating losses.*

The risk management process is presented in Figure 2, AS/NZS 4360:1999 Risk Management overview.

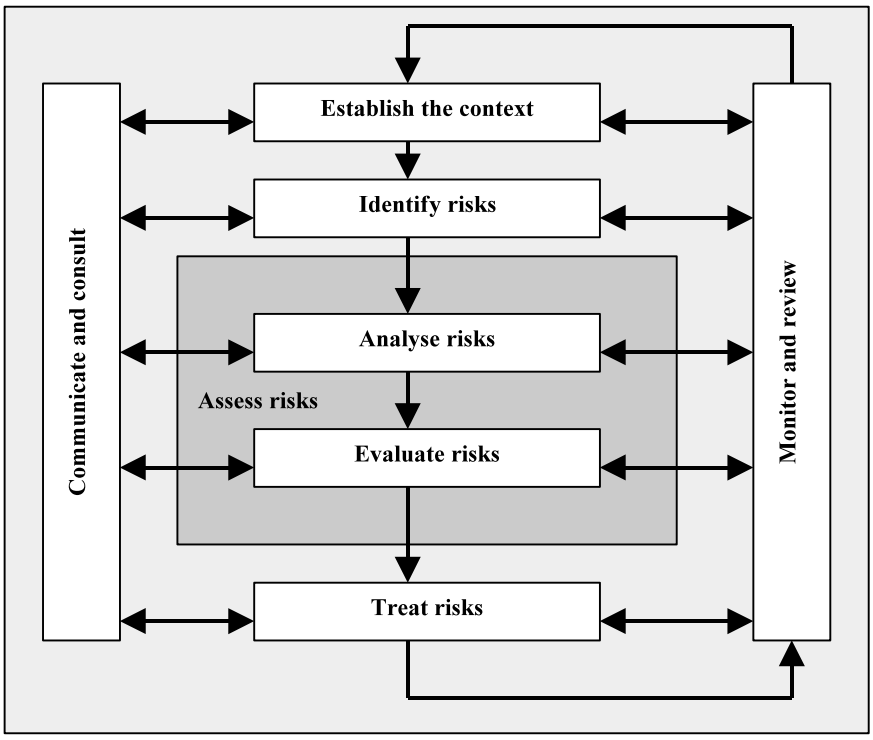


Figure 2 – Risk Management Process

4. ECOLOGICAL RISK ASSESSMENT METHODS

Assessment of risk is an iterative process consisting of well-defined steps which, taken in sequence, enable better decision-making by more clearly defining the risks and their impacts (AS/NZS 4360:1999). The key stages of the assessment of ecological risks in this report are:

- Establish the Context;
- Hazard (leading to impact) Identification;
- Risk Analysis;
- Risk Evaluation; and
- Risk Treatment.

The workshop focused on all stages. Risk Treatment was explored for the moderate risks and, where time permitted, the low risks were addressed.

4.1 Establish the Context

4.1.1 Context

The following key features define the context of the Ecological Risk Assessment Workshop:

- The fishery being studied is the Western Rock Lobster fishery which operates in Western Australia;
- The risk assessment focuses on the main ecological issues across the fishery, and does not include the processing activities associated with the fishery;
- The ecological risk assessment did not focus on the resource assessment and management of the WRL fishery which is covered annually and reported in the State of Fishery Report.
- The ecological risk assessment did not focus on broad environmental, safety, liability, business interruption, production loss, or reputation & integrity issues;
- The ecological risk assessment was conducted as a snapshot in time, capturing the risk profile of the fishery in February 2001. The risk profile may change over time; and
- The segmentation of the fishery, based on the Fisheries Research and Development Corporation (FRDC) Ecological Sustainable Development (ESD) Case Study Report (FRDC 2000/145), into components, sub-components, items and fishing activities provided a better 'system' definition.

4.1.2 Components

The WRL fishery is a large and complex fishery. In order to conduct an Ecological Risk Assessment Study on the WRL fishery, the fishery needed to be segmented into a number of smaller and more manageable components. These components have been defined by the FRDC ESD Case Study Report to describe the fishing and ecological interactions, and are detailed in Table 4.1.

Table 4.1 – Components

No	WRL Fishery - Components
1	Retained Species
2	Indirect impacts on biological communities
3	By-catch

4.1.3 Sub-component

To further facilitate a structured approach to the Ecological Risk Assessment Workshop, each component was then segmented into a number of sub-components as detailed in Table 4.2.

Table 4.2 - Sub-components

No	Component	No	Sub-components
1	Retained Species	1	By-Product Species
		2	Primary Species
2	Indirect impacts on biological communities	1	Removal of/damage to organisms- impact on overall environment
		2	Addition/movement of biological material - impact on overall environment
		3	Other impacts on the overall environment
3	By-catch	1	Capture
		2	Possible direct impact but no capture

4.1.4 Items

Table 4.3 shows that each sub-component was then divided into a number of items which were also defined by the FRDC ESD Case Study Report.

Table 4.3 - Items

No	Component	No	Sub-components	No	Items
1	Retained Species	1	By-Product Species	1	Octopus
				2	Fish & Sharks in pot
				3	Deep Sea Crabs
		2	Primary Species	1	Rock Lobster
2	Indirect impacts on biological communities	1	Removal of/damage to organisms- impact on overall environment	1	Bait Collection
				2	Rock Lobster Fishing
				3	Ghost fishing
				4	Physical impact on coral and other habitats
				5	Physical impact on other benthic types
		2	Addition/movement of biological material - impact on overall environment	1	Stock enhancement
				2	Discarding
				3	Displacement
				4	Bait

No	Component	No	Sub-components	No	Items
		3	Other impacts on the overall environment	1	Air quality
				2	Water quality
				3	Substrate quality
				4	Bird interaction
3	Bycatch	1	Capture	1	Sealions
				2	Moray Eels
		2	Possible direct impact but no capture	1	Turtles
				2	Whales
				3	Manta Rays
				4	Dolphins

The workshop focussed on Component 2 ie Indirect impacts on biological communities. Items relevant to the workshop scope in other components eg Component 3: Bycatch; Subcomponent: Capture; Item: Sealions, were dealt with in Component 2 eg Subcomponent: Removal of/damage to organisms – impact on overall environment; Item: Fishing; Hazardous event: pot entanglement; Impact: Sealion pup entanglement.

A complete list of components, sub-components and items is provided in Attachment 2: Ecological Risk Assessment Workshop Results.

4.1.5 Workshop Schedule

The definition of the components, sub-components and items allowed a structured approach to the conduct of the Ecological Risk Assessment workshop. The workshop was held over a period of 2 days in February 2001. A listing of the components, sub-components and items with a 29 page draft report (see Attachment 4 for final report) discussing these items was provided as background information to workshop participants three weeks before the workshop.

4.1.6 Consistent Assignment of Consequence and Likelihood

The Ecological Risk Assessment workshop participants were selected on the basis of their involvement with industry, conservation movement and scientific expertise and involved many people from a variety of organisations such as the World Wide Fund for Nature (WWF), FWA, Department of Environmental Protection (DEP), Conservation and Land Management (CALM), Western Australian Fishing Industry Council (WAFIC), WA Museum, Curtin University, Conservation Council of Western Australia as well as western rock lobster (WRL) fishers (Attachment 1). It was therefore important to ensure that a consistent approach was taken.

To achieve this, the participants were provided with a presentation before the workshop about the following:

- The aim of the Ecological Risk Assessment workshop;
- Definitions and guidelines for the use of terminology such as hazard, hazardous event, consequence, likelihood, risk, risk ranking, causes & safeguards;
- An outline of the risk management methodology being used;
- An overview of the software used to document the workshop findings;
- An explanation about the use of the risk matrix, consequence and likelihood tables;
- A sample hazard identification checklist, which included the hazard categories; and
- The importance of and opportunity to contribute to the workshop group and to ask questions at any time.

This ensured that each workshop participant had a common understanding of the risk terminology being used and that the assignment of consequence and likelihood levels was being done consistently during the workshop.

A representative from the WRL fishery provided an overview of the fishing activity being studied to ensure that there was a common understanding amongst the workshop group.

The risk ranking process using a working group of experts delivers the ability to prioritise risks and therefore focus on the relevant management actions required for the WRL fishery. A group of experts also avoids the need for time consuming sourcing and review of data during the workshop. Data known to exist was referenced during the workshop to support the allocation of risk ranking.

Risk ranking was generally achieved by consensus after one or more participants with some knowledge on the issue being discussed provided some background information. There was no formal voting on each risk ranking but all participants had an opportunity to express their opinion on the ranking before it was accepted. On some issues, some participants indicated that they would like to see more information on the reason for the risk ranking and it was agreed that this should be provided (see Attachment 4). This was done through presentation of available data and summation of information from appropriate references on the issue.

Some participants indicated that they were uncomfortable agreeing to certain risk rankings when they did not know enough about the subject. Participants were informed that they were not expected to have information on every issue associated with rock lobster fishing and that is why a diverse range of people have been invited with knowledge of different aspects of the rock lobster fishery, marine science and conservation issues.

The depth of the risk assessment workshop was dependent on the amount of time that was available for review within each component, sub-component and item, however, a top down approach was taken whereby the main hazards were explored first.

4.2 Risk Perception

The individuals from different organisations brought a wealth of knowledge and experience to the workshop, however these same individuals perceive risk differently. This should be considered when reviewing the output of the workshop in Attachment 2. Attachment 2 is a record of the information supplied during workshop. Grammar and spelling are the only modifications made to the workshop minutes. Wherever possible, information was recorded to support the risk ranking as well as compiling references both during and after the workshop. Some of the information in Attachment 4 was presented at the workshop while additional information was prepared after the workshop.

4.2.1 Information Capture

The success of risk assessment workshops is dependent upon the contribution by the workshop participants. The capture of this information is assisted by the use of specialist software (**PHA-Pro® 5)** designed to save time and effort, while producing comprehensive and efficient risk assessment.

Hazards identified by the participants within the various components, sub-components and items were documented as the study proceeded and were displayed to the workshop group through the use of a laptop linked to a data projector. This process enabled all participants to see what information and consensus decisions were recorded. This provided the opportunity for the workshop participants to debate and agree on the decisions being made about the workshop output. Justification to support the assignment of likelihood and consequence was also recorded.

The data captured within **PHA-Pro® 5** has been exported to an Excel spreadsheet such that FWA has an electronic copy of the workshop output. These data may then be imported to the WRL fishery EMS.

4.3 Hazard Identification

Hazard Identification involved the brainstorming and identification by the workshop participants of the potential sources of ecological impact ie, those fishing activities that could result in a negative ecological impact.

The workshop groups were encouraged to identify the major concerns that they had about ecological issues within the WRL fishery within each component, sub-component and item listed.

Through hazard identification, the what, why and how risks can arise were identified and were used as the basis for further analysis.

Following the identification of the hazards or the potential sources of harm, the 'Hazardous Event' was then determined. A 'Hazardous Event' is what causes the ecological impact. In ecological terms, the hazard generally becomes real when a habitat, population or community comes into contact with it. A list of hazardous events was compiled, relevant to the activity and hazard being studied.

4.4 Safeguards

Safeguards can be divided into prevention and mitigation:

- prevention methods reduce the likelihood of realising a hazardous event; and
- mitigation methods reduce the consequence of a hazardous event.

Likelihood and consequence ratings are applied after taking into account the existing safeguards.

4.5 Risk Analysis

4.5.1 Risk Assessment Matrix

Risk Assessment considers the range of potential consequences and how likely those consequences are to occur. Consequence and likelihood are combined to produce an estimated level of risk associated with the particular hazardous event in question.

Table 4.4 shows the WRL fishery risk assessment matrix that was used to determine the level of risk associated with the hazardous event.

Table 4.4 – Risk Matrix

		Consequences				
		1	2	3	4	5
Likelihood		Minor	Moderate	Severe	Major	Catastrophic
6	Likely	6	12	18	24	30
5	Occasional	5	10	15	20	25
4	Possible	4	8	12	16	20
3	Unlikely	3	6	9	12	15
2	Rare	2	4	6	8	10
1	Remote	1	2	3	4	5

Table 4.5 shows the definitions for the various risk ranking colours:

Table 4.5 – Risk Ranking Definitions

E	Greater than and equal to 15	**High Risk**. Immediate action is required. For example, Senior Fisheries staff attention required to advise CEO and Minister, call a special meeting of Rock Lobster Industry Advisory Committee and undertake immediate action.
M	Greater than and equal to 5 but less than 15	**Moderate Risk**. Risks are acceptable as long as risk reduction is applied to reduce risks to ALARP. For example, Fisheries staff attention is required to prepare report with recommendations for next scheduled RLIAC meeting, eg phase in effort reduction.
L	Less than 5	**Low Risk**. Risks are broadly acceptable and are managed by current procedures.

Table 4.6 shows the definitions for the various consequence levels:

Table 4.6 – Consequence Definitions

Level	Environment
Minor	Short-term, localised and insignificant impacts to habitat or populations. Rapid recovery measured in days to months.
Moderate	Incidental changes to abundance/biomass of biota in the affected area, insignificant changes overall ecological function. Recovery measured in months.
Severe	Impact that will cause a detectable effect in local ecosystem factors. Recovery measured in months to years.
Major	Detrimental effect that will cause a significant effect on local ecosystem factors. Recovery period measured in years to decades.
Catastrophic	Large scale detrimental effect that is likely to cause a highly significant effect on local ecosystem factors such as water quality, nutrient flow, community structure and food webs, biodiversity, habitat availability and population structure (e.g. abundance, fecundity, age structure). Long-term recovery period measured in decades.

Table 4.7 shows the definitions for the various likelihood levels:

Table 4.7 – Likelihood Definitions

Level	Descriptor
Likely	It is expected to occur in most circumstances
Occasional	Will probably occur in most circumstances
Possible	Might occur at some time
Unlikely	Could occur at some time
Rare	May occur in exceptional circumstances
Remote	Never heard of, but could occur

4.5.2 Assignment of a Consequence Level

In assigning a level of consequence to the hazardous event, the workshop group took into consideration the following factors:

- The present state of safeguards & controls;
- Existing physical and working environment conditions;
- Existing equipment condition;
- Existing procedures, administration, documentation and management systems; and
- Existing levels of training, experience, skills, education, etc. of personnel.

Having considered the above, a realistic estimate was made by the group for the consequence level. In other words, whilst a 'catastrophic' level of consequence could occur for most of the hazardous events, it would not be realistic for this to occur in all instances where the hazardous event occurs.

To illustrate this important point, consider the example taken from the workshop, presented in Table 4.8:

Table 4.8 – Ecological Risk Assessment Example

Component	Sub-component	Item	Hazard	Hazardous Event	Impacts	Consequence	Likelihood	Risk Ranking	Justification for Risk Ranking
Indirect impacts on biological communities	Removal of/damage to organisms-impact on overall environment	Fishing	Pots	Capture of octopus	Possible changes to population	1	2	Low	Octopus have a 1 year life cycle and their recruitment would be highly variable (Joll 1977). Their habitat extends beyond the habitat utilised by the rock lobster fishery eg sea grass, so that only a proportion of their population would be exploited. The increase in the number escape gaps in the rock lobster pots has allowed more octopus to escape from the pot.

During the workshop, the group identified a hazard associated with pots. If the hazardous event of capture of octopus in baited pots occurs resulting in the impact of a possible change to the octopus population, the realistic estimate made by the workshop group for the consequence was a level 1 or 'Minor- Short-term, localised and insignificant impacts to habitat or populations".

This demonstrates that while a level 5 or 'Catastrophic' consequence is a possibility, this would not be expected to occur in the majority of instances. The workshop group agreed that the most realistic estimate was a level 1 consequence. Justification for the assignment of risk was provided where possible (refer to Attachment 4).

4.5.3 Assignment of a Likelihood Level

In assigning a level of likelihood, the workshop group considered the likelihood of the following sequence of events and then assigned a level. The same example is used to illustrate this equally important point.

> *What is the likelihood of capture of octopus in baited pots occurring, resulting in the impact of a possible change to the octopus population and subsequently sustaining a level 1 consequence?*

Having considered the above, a realistic estimate was made by the group, and a likelihood level of 2 (Rare: May occur in exceptional circumstances) was assigned.

4.5.4 Risk Level & Risk Ranking

The difference between the Risk Level and Risk Ranking needs to be made clear.

Risk Ranking is the assignment of one of three categories: High, Moderate and Low. It is a coarse ranking of risk, which results from the use of the risk assessment matrix.

Risk Level on the other hand is the mathematical product of the consequence and likelihood levels and is derived from the basic equation for risk, Risk = Consequence x Likelihood. It is a less coarse measurement of risk. Given that there are 5 levels of consequence and 6 levels of likelihood, there are 17 possible Risk Levels: 30, 25, 24, 20, 18, 16, 15, 12, 10, 9, 8, 6, 5, 4, 3, 2 & 1.

4.6 Risk Evaluation

Risk evaluation involves the review of the risk rankings, ie determining if the risk of an activity or incident is acceptably low, or if management actions are required to reduce the risk to as low as reasonably practicable (ALARP). Table 4.5: Risk Ranking Definitions, clearly highlights the appropriate level of management involvement required for a given level of risk.

4.7 Risk Treatment

Risk treatment involves management actions to reduce ecological risks to ‘as low as reasonably practicable’ (ALARP). This component of the risk management strategy was developed by the workshop group. The recommendations suggested by the workshop participants employed the ALARP principle. This risk treatment information is incorporated into the Ecological Risk Assessment workshop results in Attachment 2. It should be noted that the output of the Ecological Risk Assessment workshop identifies likelihood and consequence values with existing safeguards in place and *prior to* additional management actions being implemented.

5. ECOLOGICAL RISK ASSESSMENT RESULTS

5.1 Risk Assessment Workshop

The following are some broad statistics about the risk assessment workshop:

- Number of Participants - 22
- Number of Workshop Days - 2
- Total number of Issues / Hazards Identified - 33

5.2 Risk Ranking Distribution

Figure 3 shows the risk ranking distribution for *all* the ecological issues / hazards identified during the workshop.

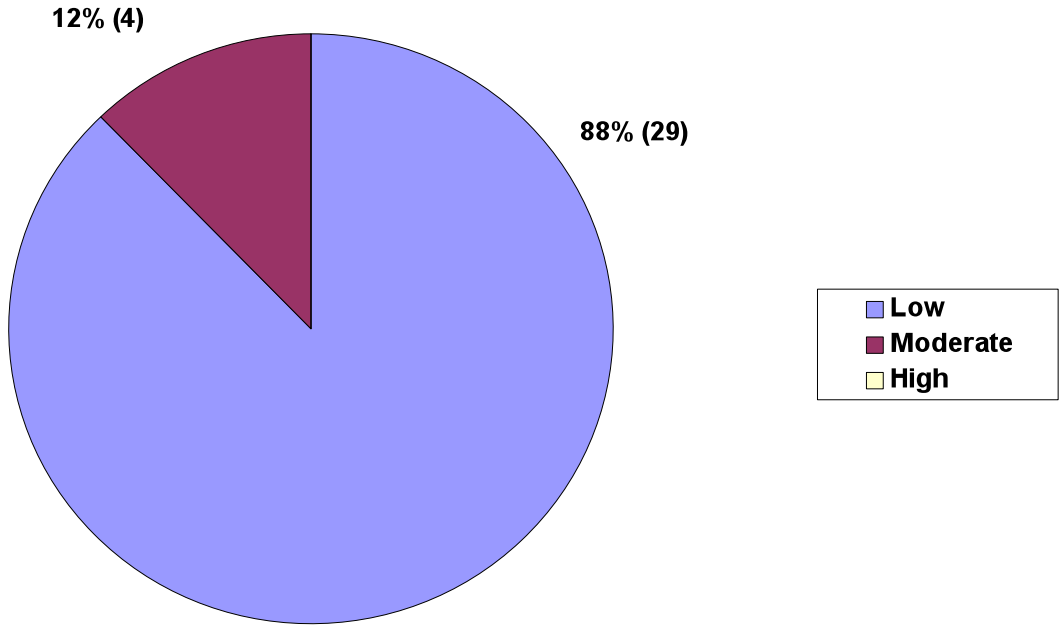


Figure 3 – Risk Ranking Distribution

This figure demonstrates that the hazards identified were either low (88%), or moderate (12%) risks. No high ecological risks were identified at the risk assessment workshop.

5.3 Fishing Activity Risk Distribution

Figure 4 shows the fishing activity risk distribution for *all* the issues / hazards identified. The majority of ecological risks were associated with potting and baiting activities. Of the moderate risk activities, three were associated with potting and one was associated with dumping of domestic waste into the ocean.

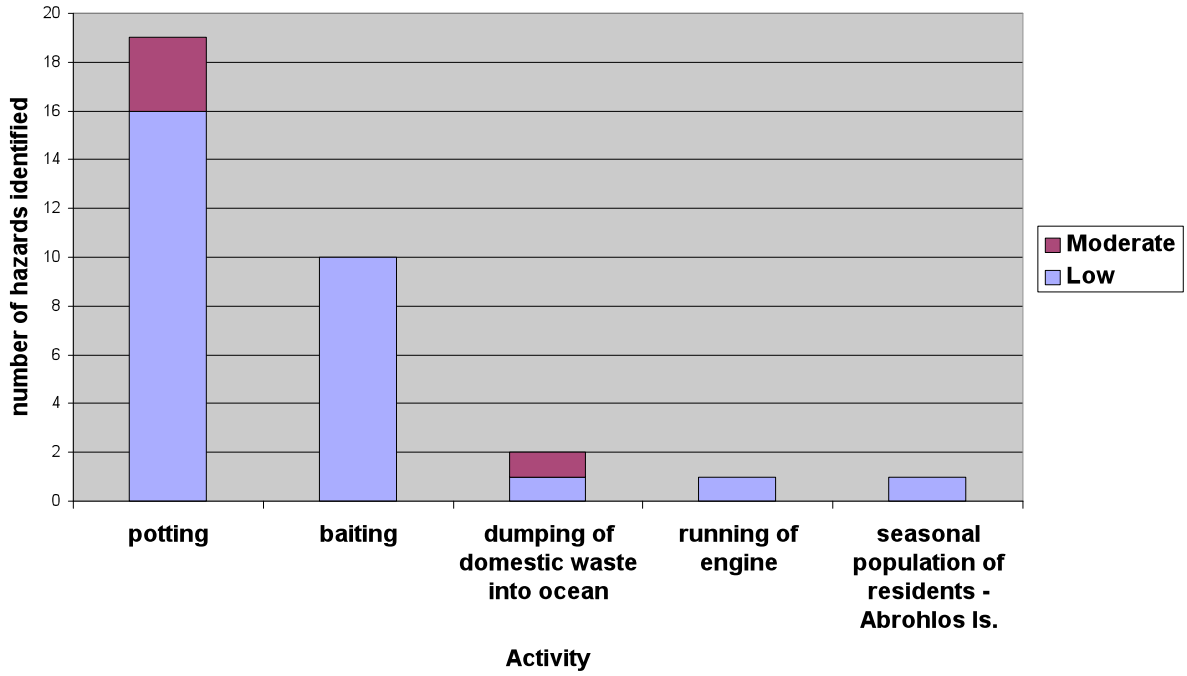


Figure 4 –Fishing Activity Risk Distribution

5.4 Impact and Numerical Risk Distribution

Figure 5 shows the Impact and Numerical Risk Distribution for all risks identified. No high risks were identified during the workshop. Within the risk category of moderate, the potential impacts include:

- Sea-lion pups potentially becoming entangled in pots with the potential for change to the population identified;
- Contact of pots with coral resulting in a potential change to coral abundance;
- Leatherback turtles potentially becoming entangled in rope resulting in a potential change in population; and
- Dumping of domestic waste into the ocean at the Abrolhos Islands resulting in a potential reduction in the ocean environment quality.

These are moderate risks that have a risk level of either 12 or 6.

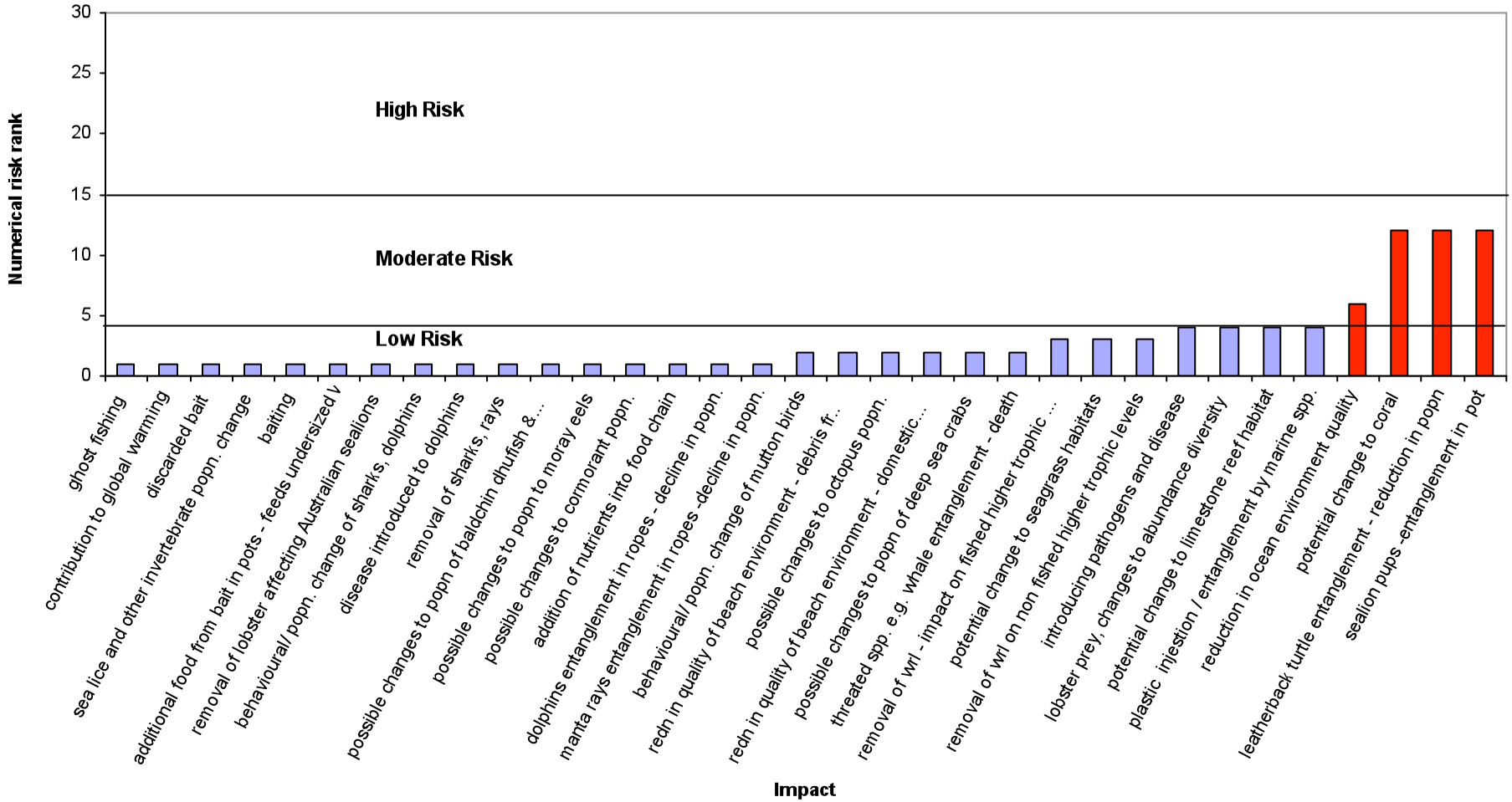


Figure 5 –Impact and Numerical Risk Distribution

Within the low risk category, the risks ranked highest were:

- introducing pathogens and disease;
- items (e.g. small invertebrates) eaten by lobster, changes to abundance diversity lower trophic levels;
- potential impact to limestone reef habitat; and
- plastic (wrapping, straps) ingestion / entanglement by marine spp.

A more detailed discussion on the risk and the justification for its ranking is provided in Attachment 4.

5.5 Main Risks

Table 5.1 provides a list of the top 4 risks. Being the top ranking risks, management actions are required to reduce these ecological risks to 'as low as reasonably practicable' (ALARP). The recommendations suggested by the workshop participants employed the ALARP principle and provide the basis for the development of objectives, indicators and performance measures (as described in Section 6 Environmental Management Strategy).

Table 5.1 – Main Ecological Risks

The main ecological risks identified during the workshop included:

Component	Sub-components	Items	Hazardous Event and Potential Impacts	C	L	Risk Ranking
Indirect impacts on biological communities	Removal of/damage to organisms- impact on overall environment	Fishing	Sea-lion pups potentially becoming entangled in pots / Potential change to population.	3	4	Moderate
Indirect impacts on biological communities	Removal of/damage to organisms- impact on overall environment	Physical Impact on coral and other habitats	Contact of pots with coral / Potential change to coral abundance.	3	4	Moderate
Indirect impacts on biological communities	Removal of/damage to organisms- impact on overall environment	Fishing	Leatherback turtles potentially becoming entangled in rope / Potential change to population.	3	4	Moderate
Indirect impacts on biological communities	Indirect impacts on biological communities - other impacts on overall environment	Water Quality	Dumping of domestic waste into ocean at Abrolhos Is / Potential reduction in ocean environment quality.	1	6	Moderate

5.6 Dynamic Nature of the Risk Profile

Section 5.2 of this report shows the risk ranking distribution for *all* the ecological issues / hazards identified. It is important to acknowledge that:

The risk profile will change over time; and

The proportion of moderate risks should reduce as the ALARP principle is implemented.

6. ENVIRONMENTAL MANAGEMENT STRATEGY

Within 24 months of certification, an Environmental Management Strategy (EMS) for the fishery will be prepared. The EMS will address impacts of the fishery on the environment, and will include proposed objectives, strategies, indicators and performance measures. The EMS will specify an operational plan, including implementation actions and a supporting program of research.

This section describes how the impacts and recommendations for the main (moderate) ecological risks, identified by the ecological risk assessment workshop, are used as the basis for the development of objectives, indicators and performance measures. It is proposed that the objectives, indicators and performance measures will form the basis of the required EMS.

6.1 Recommendations

The ecological risk assessment workshop participants provided 13 recommendations to address the moderate risks to the WRL fishery. These recommendations are included in Attachment 4 in context with the respective hazards, impacts and risks that the recommendations are designed to address.

These recommendations (not in any order of priority) are:

Sea lion entanglement in pots (see 5.2.1.1 in Attachment 4)

1. Investigate the spatial area of influence of sea lion pups feeding in pots;
2. Look at the South Australian efforts to keep out sea lion pups from pots to see how effective they were;
3. Determine whether sea lion pup mortality from pot capture is an issue – review available data;
4. Investigate gear modification to keep out sea lion pups;
5. Recording interaction with gear and captures of sea lion pups;

Rope entanglement of leatherback turtles (see 5.2.2.1 in Attachment 4)

6. Begin collecting data on turtle entanglement – species, time, location & a systematic study to understand how turtles are caught in ropes and placed in broader population context ie how important are the turtle mortalities in a local and regional context;
7. Ensure that if possible, dead turtles are brought back for analysis or photographs, description, location GPS/depth of turtle in water;
8. Better educate fishers to collect information on turtle sightings and captures;
9. Investigate through newsletters, magazines if other fishing activities regularly sight turtles.

Physical impacts on coral from potting (see 5.3.1.3 in Attachment 4)

10. Implement the outcomes and recommendations for studies/actions from an Abrolhos workshop to be held during 2001;
11. Increase fisher awareness of the importance of coral habitats and environment;
12. Undertake an international review of pot damage to habitats; and

    Camping at the Abrolhos Islands (see 5.3.3.1 in Attachment 4)

13. Examine the outcomes of the review by the Abrolhos Islands Management Advisory Committee (AIMAC) to implement appropriate waste management strategies;

6.2 Objectives, Indicators and Performance Measures

The risk rankings of the hazards from this report have been used as the in the development of an Environmental Management Strategy that is required as part of the Marine Stewardship Certification and was also required as part of an Application to Environment Australia for the western rock lobster fishery. Attachment 4 is Chapter 5 of this Application and contains the objectives, indicators and performance measures associated with the moderate risks identified at the workshop. The objectives are based on the recommendations and are therefore designed to address the described impact of a fishing activity on the environment.

NB During the workshop WWF reserved comment on the objective set for recommendation number six of Section 6.1 (comment to be submitted after meeting pending further consultation with WWF).

7. GENERAL SUGGESTIONS

This section is not intended to cover the hazard specific recommendations made during the workshop, but is intended to summarise the general issues which arise from the recommendations and therefore the management strategy. The general suggestions are:

As a way of prioritising management effort, concentrate on risk reduction measures for the moderate risk areas in the first instance;

In addition to moderate risks, more closely review the level 5 consequence and likelihood, as these were defined as 'catastrophic' and 'almost certain' events respectively which may warrant further investigation;

Within the framework of the management strategy:

- Communicate the identified moderate risks and associated impacts to fishers, stakeholders and, if appropriate, the community;
- Complete the important causes, safeguards and recommendations section for all components, sub-components and items;
- Assign an "action officer" and a completion date to all recommendations to ensure that the risk reduction measures are followed through; and
- Include the results of the workshop into an issues register to manage ecological impacts and to maintain a current WRL fishery-wide risk profile;

Conduct a follow up Ecological Risk Assessment Workshop in 3 years, or when a significant change occurs. This study should re-examine the moderate risks and further identify hazards with high, moderate and low risks; and

Maintain a proactive nature and follow up the results of the study as they will be of no use if not pursued.

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ATTACHMENTS

ATTACHMENT 1
WORKSHOP PARTICIPANTS:

THEIR EXPERIENCE AND BACKGROUND

WRL ECOLOGICAL RICK ASSESSMENT ATTENDANCE

Full Name	Title	Company
Brett McCallum	Ex CEO WAFIC	WAFIC
Bruce Phillips	Adjunct Professor	Curtin University
Colin Chalmers	Fish & Fish Habitat Program Manager	FWA
Edwina Davies Ward		Marine Coastal Communities Network
Fred Wells	Senior Curator	WA Museum
Guy Leyland	Acting CEO	WAFIC
Jim Penn	Director of Research FWA	FWA
Jo Bunting (observer)	Policy Officer	FWA
Emma Hopkins	Environmental Officer	Department of Environmental Protection
Tim Bray (observer)	Fisheries Manager	FWA
Katherine Short	Sustainable Fisheries Officer	World Wildlife Fund for Nature
Kevin Donohue	Executive Officer RLIAC	FWA
Lindsay Joll	Commercial Fisheries Manager	FWA
Neil Dorrington	Rock Lobster Fisher	Industry
Nick Caputi	Supervising Scientist	FWA
Nick D'Adamo	Oceanographer	CALM
Nick Dunlop	Sustainable Fisheries Liaison Officer	Conservation Council
Peter Auguston	Rock Lobster Fisher	Industry
Peter Jernakoff	Principal Environmental Scientist	IRC Environment
Rick Fletcher	Principal Scientist	FWA
Rob Rippingale	Senior Lecturer	Curtin University
Ross Gould	Supervising Fisheries Manager	FWA
Roy Melville-Smith	Research Scientist	FWA
Sarah Brown	Principal Environmental Consultant	IRC Environment

Workshop participants: Experience, Qualifications and Expertise

Participants were selected because of their knowledge of the rock lobster fishery as fishers, scientists and managers or as conservation community representatives and independent scientists or representatives of relevant government agencies. Those attending consisted of fishers (2), Rock Lobster Industry Advisory Committee (1), fishing industry representatives (2: WA Fishing Industry Council), rock lobster fisheries researchers (3), fisheries managers including some observers (6), representatives of the conservation community (3: World Wildlife Fund for Nature, Marine Coastal Communities Network, Conservation Council), other government agencies (2: Conservation and Land Management, Department of Environmental Protection), independent marine scientists (3: WA Museum, Curtin University), independent facilitators of workshop(2). Other independent marine scientists were invited but were unable to attend the 2-day workshop. Some Fisheries WA representatives attended the workshop as observers to gain experience in the risk assessment process.

Workshop participants were provided a copy of a draft FRDC report on 'Ecological Sustainable Development case study: western rock lobster' which contained some background information on the fishery and information on ESD issues related to retained and non-retained species, environmental effects of fishing, and governance issues.

The following is a brief background of the participants:

Dr Nick Caputi: Supervising Scientist (Invertebrate Fisheries) with the Department of Fisheries (Western Australia). He has over 25 years experience in the field of invertebrate fisheries research, particularly with rock lobsters and prawns. He has a B.Sc. (Hons) and PhD with expertise in the area of stock assessment, fisheries statistics, relationships between different life history stages including catch predictions and stock-recruitment-environment relationships.

Dr Roy Melville-Smith: Principal Research Scientist with the Western Australian Department of Fisheries. He has over 20 years of experience in the field of rock lobster and crab fisheries research in southern Africa and Australia. He holds a PhD (Zoology) from the University of Cape Town and has expertise in areas of fisheries biology and population dynamics.

Ross Gould: Ross was first seconded to the Department of Fisheries of WA in March 1994 to research the impact of the 18% pot reduction on smaller operators in the West Coast Rock Lobster Fishery. He then became the Department's Senior Economist and undertook a number of projects related to restructuring of various fisheries, national competition policy and fish processing. He also spent some time as Acting Assistant Director of Corporate Services, managing the implementation of the Agency's Financial and Intranet systems and implementing risk management into Department. At the end of 1998, he returned to the Commercial Programs Branch to manage the State's rock lobster fisheries. He is now a supervising fisheries manager overseeing the management of a number of fisheries. Ross

has a Bachelor of Commerce and an MBA from the University of WA, is a FCPA and has worked in numerous other Government agencies in a wide variety of roles.

Nick D'Adamo: 1983 – B. Eng (civil), 1986 – M Eng Sci (Research), 1993 – present – PhD (final year, oceanography of Cockburn Sound and adjacent waters). Currently employed at the Senior Oceanographer and Section Leader of Research Portfolio (Ecological and Social) with Marine Conservation Branch, Dept of Conservation and Land Management. His experience includes:

1983-1985: Study (field and analytical) of the relationships between the hydrodynamics and aquatic/fish biology of the Murray River Estuary, a eutrophic reverine salt wedge estuary of southwest Western Australia.

1986-1988: Studied and numerically modeled the dynamics of the Venice Lagoon and associated rivers, University of Padova, Italy. Studied the stratified hydrodynamics and wind fields of the Lake of Geneva, Ecole Polytechnique Federale de Lausanne, Switzerland. Design engineer, environmental section of Kinhill Engineers, Perth, Western Australia.

1989-1990: Principal Investigator for the characterization of hydrodynamic processes of the southern metropolitan coastal waters off Perth, Department of Environmental Protection of Western Australia.

1996-present: Senior Oceanographer and section leader of Research Portfolio (Ecological and Social) in Marine Conservation Branch, CALM, WA, involved in implementation and management of marine conservation reserves for Western Australia. Role focuses on combined applied and strategic functions to ensure CALM has the required level of understanding of the oceanography and the biological research information required for implementation and management of marine conservation reserves in WA.

Peter Graham Auguston. Fourth generation fisherman. Owner/Operator of 122 cray pots in Western Rock Lobster Fishery. 22 years fishing experience including 10 years in Zone A & B Rock Lobster Fishery. 5 years of experience on research committees in RLIAC, WAFIC and FRDC. Currently a Director of the Geraldton Fishermans Co-operative.

Dr J. N. Dunlop is a vertebrate ecologist with over twenty years research experience in marine ornithology. He has also worked as an environmental officer in the mining industry and in government, as a university lecturer and consulting ecologist. He is currently the Chair of the Australian Marine Conservation Society (WA) and presently engaged as the Sustainable Fisheries Liaison Officer for the WA Conservation Council.

Dr Jim Penn is Director of Fisheries Research in Western Australia. He has had broad experience in managing multi-disciplinary marine research; developing strategic management plans for commercial fisheries, recreational fishing and aquaculture

development; and administering a major research and development institute. Jim has held positions on, and provides expert scientific advice to, a number of fisheries and environmental management bodies within Western Australia. He has extensive specialist knowledge of shellfish fisheries, having been involved in fisheries research in Australia and internationally for 35 years. Jim holds a Doctorate of Philosophy in fisheries science, a degree in zoology and a diploma in agriculture, and has completed the Development Program for Managers at the Australian Graduate School of Management.

Dr Rick Fletcher has a PhD from the University of Sydney in marine subtidal ecology plus fifteen years experience in research and research management on the biology, stock assessment and interactions of a variety of exploited crustacean, molluscan and especially pelagic fish species. Has held a variety of positions within natural resource management agencies of three Australian States and one Pacific Island Country including Director of Research at NSW Fisheries. He is currently heading a national project to develop methods for the reporting and assessment of Ecologically Sustainable Development within the fisheries context.

Dr Rob Rippingale, PhD in aquatic ecology, 30 years university teaching in aquatic ecology. No particular expertise regarding lobsters.

Dr Fred E Wells is Senior Curator, Dept of Aquatic Zoology at the Western Australian Museum. He has worked extensively in the marine environment throughout Western Australia for over 25 years, including all of the areas fished for the western rock lobster. Dr Wells has written or edited 12 books and over 100 scientific papers on a wide variety of marine subjects. In recent years he has been active in marine management issues as an environmental consultant. This included 6 months with the firm of DA Lord & Associates and later 2 years with Le Provost Dames & Moore. Dr Wells has been deeply involved in the development of management plans and environmental assessments for the Houtman Abrolhos Islands and Geraldton areas, two regions of significant fishing for the western rock lobster.

Katherine Short, Sustainable Fisheries Officer, World Wide Fund for Nature Australia. The myriad of life that is biodiversity under and on the water is the inspiration for Katherine's work with the World Wide Fund for Nature. An ecologist, Katherine combines her fascination for the marine environment with a technical approach to identifying and addressing the challenges facing us all. Understanding how those reliant on the marine environment for their livelihoods can and are able to change their practices, adopt more sustainable methods is critical to achieving this and Katherine approaches this with passion, honesty and integrity. Having spent 2 years at WWF New Zealand in the Conservation Science section, her current work with WWF Australia is focused on promoting ecosystem based fisheries management

and working with the Marine Stewardship Council and certified fisheries to develop the tools and methodologies to give meaning to this.

Neil Dorrington; Rock Lobster fisher for over 25 years; owner, operator for the past 20 years. Neil is a member of the Central West Coastal Professional Fishermen's Association. He has held various positions from Secretary to President for over 10 years. Fishing Industry Rep on the Kirki clean up. Ex-Director of Geraldton Coop and RLIAC. WAFIC board member and attended Management Advisory Committee training at Launceston Maritime College. Elected to the Ministerial Fishing Industry Maritime Committee for Department of Transport at the Commercial Fishing representative. Commercial fishing representative on the Department of Transport Safety Committee. Developed the Crays program for fishing returns and the Cray Counter to improve accuracy in log books.

Brett McCallum. Brett has recently taken up the position of Executive Officer of the Pearl Producers Association representing the 16 licensed pearling companies in WA producing an export income per annum of $200 million. Brett was Chief Executive of the WA Fishing Industry Council until January 2001 after 14 years in the role. WAFIC is the peak representative body for the commercial fishing and aquaculture industry in WA including catching, processing and retail sectors as well as pearls. Prior to joining WAFIC in 1987 Brett held managerial positions with the M.G. Kailis Group and the Lombardo fishing companies through the 80's. He holds a Bachelor of Commerce degree from the University of Western Australia. Brett has been a WA delegate to the Australian Seafood Industry Council and has held a number of industry positions on State and Federal government working groups and committees ranging from Biodiversity Conservation through to Quota Allocations. He has held the position of Chairman of the Western Tuna and Billfish Fishery Management Advisory Committee and has been a permanent advisor on several of the major WA commercial fisheries Management Advisory Committees.

Kevin Donohue has been an employee of the Department of Fisheries since 1979. Formal qualifications include a Bachelor of Agricultural Science (Honours) and a Master of Science in Natural Resource Management. He currently holds the position of Policy Officer for the Minister for Fisheries. Other positions held in the Department include Executive Officer for the Rock Lobster Industry Advisory Committee (Ministerial Committee 3 years), Program Officer (commercial fisheries management 2 years) and Technical Officer (Research & Development 15 years).

Colin Chalmers currently holds the position of Manager of Fish and Fish Habitat Protection Branch with the Department of Fisheries. He has a Post Graduate Diploma in Public Administration (1984) Curtin University, a Bachelors Degree in Applied Science - Biology (1979) from Canberra University and a Diploma of Horticulture (1964) from Burnley Horticultural College.

ATTACHMENT 3
BACKGROUND TO WESTERN ROCK LOBSTER FISHERY

(from Chapter 2 of Application to Environment Australia for the western rock lobster fishery, Anon. 2002 – updated to take into account independent reviewers and public comments)

2 BACKGROUND ON THE WRL FISHERY

2.1 Biology of Rock Lobsters

Distribution

The western rock lobster, *Panulirus cygnus*, is a decapod crustacean of the family Palinuridae. Its area of distribution is the continental shelf on the west coast of Western Australia, with greater abundances off the mid west coast (Geraldton – Perth) than the northern and southern parts of the west coast.

Figure 1 Lobster Distribution

Life History

The species can live for over 20 years and reach sizes of up to 5.5 kg, although animals over 3 kg are rarely caught under current harvesting practices. In the southern areas of its distribution, the lobsters become mature at about 6-7 years old at a carapace length of about 90 mm. In the northern waters near Kalbarri and at the Abrolhos Islands, they mature at smaller sizes, usually at about 70mm carapace length.

When lobsters mate, the male attaches a package of sperm, which resembles a blob of tar, to the underside of the female. This “spermatophore” is generally called a tarspot and remains there until the female is ready to spawn her eggs. At spawning, the female releases eggs from small pores at the base of the third pair of walking legs, sperm is released at the same time by the female scratching the spermatophore and the eggs are fertilised as they are swept backwards and become attached to the sticky setae on the pleopods. Females with eggs attached under their abdomen are known as “berried” females. The eggs hatch in about 5-8 weeks (depending upon water temperature), releasing tiny larvae called phyllosoma into the water currents.

The phyllosoma larvae spend 9-11 months in a planktonic state, carried by ocean currents where they feed on other plankton before the last phyllosoma stage moults into what is called the puerulus stage. This stage is now capable of settling out of the plankton into suitable habitats which are mostly shallow inshore reefs where they can begin life as a tiny juvenile rock lobster.

Recruitment

Most lobster larvae do not survive their long oceanic journey. Many are eaten by predators or are not carried close enough to the shallow reefs by the ocean currents to allow them to settle. Therefore, the number settling can vary greatly from year to year largely as a result of changes in environmental factors. When the Leeuwin Current is flowing strongly, a higher proportion of the larval lobsters return to the coast. Westerly winds at the time of year when the puerulus are ready to settle may also help more to reach the shallow reefs along the coast.

The puerulus that successfully return to the coast, moult to become juveniles which look like miniature adults. These juveniles feed and grow on the shallow inshore reefs for the next three or four years. About four years after settlement, the lobsters undergo a synchronised moult in late spring when they change from their normal red shell colour into a paler colour. They are then known as "white" lobsters until they return to their normal red colour at the next moult a few months later. The white phase of a rock lobster's life is the migratory phase. At this time (summer) they leave the coastal reefs and undergo a mass migration into deeper water where they become sedentary again on deeper reefs. A small percentage makes longer migrations, usually following the continental shelf in a northerly direction.

Ecology

Growth rates of rock lobster vary from place to place and also between individuals. In the central west coast region (the middle of the species distribution), most lobsters reach 76mm carapace length (the legal size for most of the fishery – see below) either in their third year after settlement, before they moult into the white phase or in their fourth year, after they have moulted into the white phase.

The western rock lobster is an opportunistic omnivore feeding on a wide range of food items from coralline algae to molluscan and crustacean fauna (Joll and Phillips 1984; Edgar 1990a), the populations of which probably have high productivity, high turnover rates and short life cycles. Studies have found that juvenile rock lobsters show a range of diets and feeding strategies, varying greatly between seasons and between different habitats in the same season (Edgar 1990a). Edgar (1990a) reported that the diet of *P. cygnus* reflected the abundance and size distribution of benthic macrofauna available on all sampling occasions.

As juveniles*, P. cygnus* are eaten by a number of fish species whilst at large sizes they are one of a number of prey items for octopus and a variety of larger finfish. There are no predators that rely on western rock lobster as their only prey item

2.2 Description of the Fishery

The western rock lobster (WRL) fishery began in the 1940's and expanded rapidly over the next 15 years to annual catches in excess of 8000 tonnes in the mid 1950's (Figure 2; see Gray, 1999 for full details on history). During the last 20 years the annual catch has averaged approximately 10,000 tonnes but has varied from 8-14,000 tonnes due to natural variations in the level of recruitment. The catch in 1999/2000 was valued at over $350 million and each transferable lobster pot entitlement (of which there are currently 56906) has a value over $25,000, which combined with the value of the nearly 600 boats in the fishery, results in a market capitalisation of at least $2 billion.

The commercial fishery for western rock lobster is a "potting" fishery. This activity occurs from inshore regions in shallow waters out to the edge of the continental shelf with the only allowable method for capture being from the use of pots (traps) of a batten design made of wood slats or a beehive construction constructed from cane (the precise dimensions including escape gaps and neck sizes are specified in regulations). Baited pots are released (set) from boats in regions thought to have lobsters; often near reefs where the lobsters usually reside or in regions thought to be migration paths. This is based upon a combination of information gained from depth sounders, GPS systems, previous experience and recent catch rates in the area. The pots are left overnight during which time lobsters are attracted to the baits and enter the pots. The pots are generally retrieved (pulled) the following morning with the captured lobsters of legal size and of appropriate reproductive status (e.g. not berried etc.) placed into holding tanks and returned to on-shore processing plants where the majority are prepared for live shipments to overseas markets.

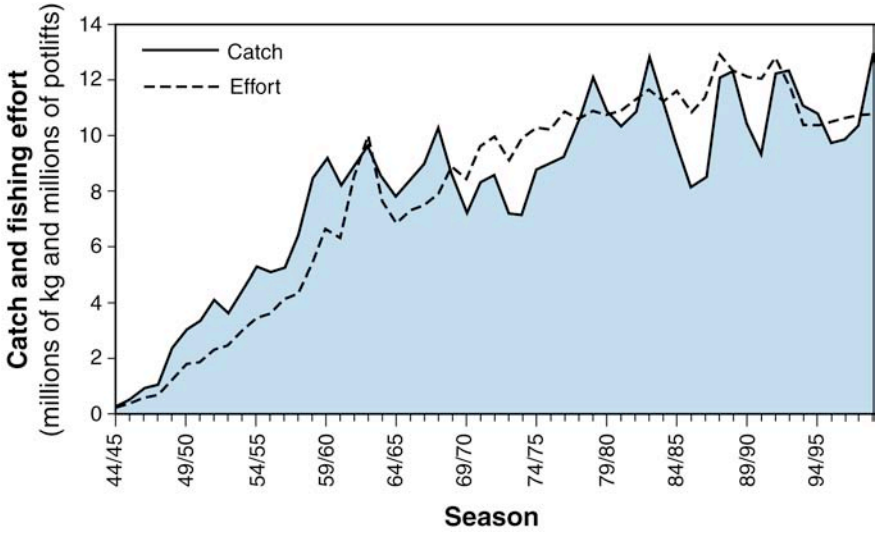

Figure 2 The catch and nominal effort for the WRL fishery

The Western Rock Lobster Managed Fishery is a managed fishery under section 65 of the *Fish Resources Management Act 1994*. The primary management methods in the fishery are input controls, that is, controls that affect the way fishing may be undertaken in order to limit what can be caught. There is a practical limit on the number of licensees that can operate in the fishery (due to the minimum pot holding) and there is also a cap on the total number of pots that can operate in the fishery. Each licence has a number of pots associated with it and this limits the amount of gear that they can use at any given time within the fishing season. Both the managed fishery licences and the individual pot entitlements are transferable (within limits). This style of management for this fishery is often described as being an Individual Transferable Effort (ITE) fishery. It has the advantage that catch will, to a large extent, track any changes in relative abundance caused by recruitment variations without the need for yearly changes in management that would be necessary using output based (eg quota) methods. Changes in harvest rates can be made by varying the level of effort allowed either by changing the number of pots, the time/ areas of operation.

A number of biologically based measures are used to assist the management of this fishery including a minimum legal size for rock lobster of 77mm carapace length from 15 November to 31 January and 76mm carapace length from 1 February to 30 June in any year. This results in the lobsters being recruited to the fishery three or four years after they settle as puerulus. Although there are escape gaps fitted to the lobster pots to minimise the capture of animals below legal size, some are caught anyway and released back into the water. They generally survive this experience provided they are released within 5 minutes of reaching the deck of the boat.

The commercial WRL fishery operates from all the ports between Denham and Bunbury, and numerous anchorages on the whole of the west coast south of Turtle Bay (Shark Bay; Fig. 3). Effort is evenly split between the Southern (zone C) and Northern zones (A & B & Big Bank). Whilst recreational fishermen also fish the whole west coast, their activity is more intense around the main population centres of Perth and Geraldton.

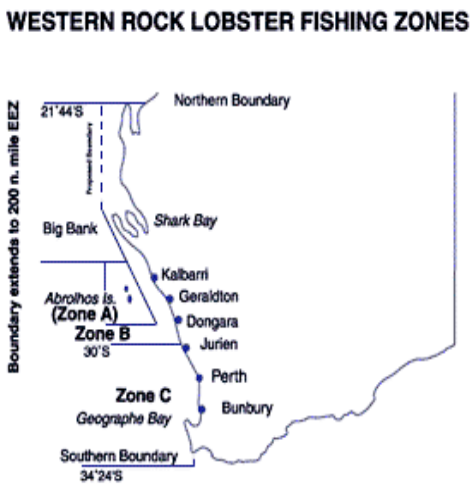

Figure 3 WRL Fishery Zones

The fishing season in coastal waters opens on 15 November. At this time both the commercial and recreational fishermen fish the coastal reefs. When the "whites" (see above) run starts, most of the commercial fishermen follow the migration offshore. Many lobsters grow from less than legal minimum length to greater than legal minimum length as a result of moulting in November so at this time there is a sharp increase in the abundance of legal sized animals. The lobsters are also more catchable during this period, being in a post-moult, active feeding phase, therefore the commercial catch rates are high during the "whites run".

There is another run of whites lobsters out of the Abrolhos Islands area northwards towards Big Bank in February. This is known as the "Big Bank run". There is a restricted season for fishing the Big Bank whites run which is 10th February to the end of February.

The abundance of legal sized lobsters is reduced by fishing over the summer but is replenished by another moult of undersized lobsters in February, when they grow from undersized to legal size, resulting in a second peak in both commercial and recreational catches during March. The season for the Abrolhos Islands area opens on 15 March and catch rates are high for the first few weeks. Catches both on the coast and at the Abrolhos Islands taper off towards the close of the season on June 30.

The commercial fishery was declared a limited-entry fishery in 1963 with about 830 boats having access to the fishery at that time. The total number of pots has been controlled since 1965 when the restrictions on the length of replacement boats were introduced. With the passage of time about 25% of the original number of boats have sold their pot entitlements to other licensees, resulting in a reduction in the fleet size to 594 boats in March 2001. Because the commercial fishers have found many ways to increase their catching efficiency over the years (e.g. radar, GPS, engine power, pot winches etc.), additional fisheries management controls have been used to constrain fishing effort such that the rock lobster

stock can continue to sustain the level of catch. Measures adopted in the past have included shortening the fishing season by six weeks and permanently reducing the pot numbers by 10%.

In the late 1980s and early 1990s the breeding stock had fallen to a level which could have resulted in a reduction in the average levels of recruitment to the fishery. In 1993 a management package was introduced aimed at rebuilding the breeding stock of western rock lobster to levels where this possibility was minimised. This package included a temporary reduction of a further 18% to the commercial pot numbers and prohibition on taking various reproductive stages of rock lobster (in addition to the berried female restrictions) to increase the flow-through of pre-breeding lobsters to the breeding stock and to increase the survival of breeding females.

This package of management measures was originally intended to remain in place for two years while RLIAC developed options for the long-term management of the fishery. However, as the package appeared to be succeeding in its objective of rebuilding the breeding stock, it was extended and has largely continued through to the 2001/02 season.

Summary of WRL Management Arrangements

Closed season July 1 to November 14 (Coastal Zones), March 14 (Abrolhos Is.)

Maximum Number of pots entitlements for fishery (currently 56906 pots distributed amongst 594 boats)

The licensee can only operate in the zone for which he/she is licensed

Minimum size of carapace is 76 mm, except for a period of 2.5 months at the start of the season when the minimum size is 77 mm.

It is illegal to take setose females or those carrying eggs, or tarspot.

A maximum size of 115 mm for lobsters landed south of 30^{o}S and 105 mm for landed north of 30^{o}S (except for 2001/02 only).

The configuration of pots and size and number of escape gaps (54 mm) are regulated.

Pots may only be pulled during specified daylight hours.

To operate in the managed fishery, a licence must have between 63 and 150 units of pot entitlement.

The commercial fishery is divided into a number of zones (see Figure 3). The boundary between the northern and southern zones is at 30^{o}S. The northern zone is further divided in that only A Zone licences fish the Abrolhos Islands area (which does not open until after

March 15) while B Zone licences can only fish the remaining coastal waters. There are also some small areas in the fishery from which all commercial and/or recreational fishing are excluded.

The recreational fishery for lobsters has not been limited in terms of the number of licences issued, but a recreational licence is necessary. There is, however, a limit of two pots per fisherman and a daily bag limit of eight lobsters with the total recreational catch estimated to be between 3% and 6% of the commercial catch. The number of recreational licences issues is monitored and from an annual phone survey, an estimate of the catch by this sector is made. The annual catch of the recreational fishery has comprised a similar percentage of the total catch for the past 8 years. Moreover, methods to forecast the following years recreational catch have now been developed.

The annual catches in the commercial fishery have varied over the past 20 years between 7000 and 14000 tonnes. The variation in the number of puerulus that successfully return to the shallow reefs each year is translated into the number of lobsters recruiting to the fishery, and consequently the catch, 3-4 years hence.

Research and monitoring of the WRL fishery has been conducted for over 50 years and has one of the best biological and fishery datasets in the world. Currently, this work is mostly conducted by the Research Division of the Department of Fisheries. However, during the 1970s-80s, CSIRO was heavily involved in lobster research and a number of tertiary institutions are also currently involved in lobster research, particularly in the area of post harvest technology.

The annual variation in puerulus settlement is estimated from samples taken at a number of locations on the west coast using artificial seaweed puerulus collectors. As well as being an indication of the success of the previous year's spawning, the puerulus estimate is used to predict the approximate size of the commercial catch three or four years ahead. A spawning stock survey is undertaken each year by research staff on commercial and research vessels. About one third of the commercial fishermen assist with monitoring of breeding stock and other facets of the fishery by completing a detailed daily logbook. Finally, Department of Fisheries officers undertake sample monitoring of the fishery onboard commercial vessels where they collect information on the sizes of lobsters caught, noting the reproductive state of rock lobsters along with many other factors.

Enforcement of the rules of commercial and recreational rock lobster fishing is a major part of the work of all Fisheries Officers on the west coast south of Shark Bay. Patrol boats are used for at sea inspection, policing fishing zone boundaries and pot numbers, and shore based officers inspect the landed lobsters, particularly within processing plants for compliance with minimum sizes etc. There is currently a high level of cooperation from the industry and a high level of compliance with the regulations.

In 1999, the WRL was the first fishery worldwide to be awarded Marine Stewardship Council chain of custody certification on the basis of demonstrating the ecological sustainability of its fishing and management operations. To achieve this, the WRL fishery was assessed by an international group of experts against the criteria set out in the MSC guidelines (see web site www.msc.org for details). A number of ongoing requirements are needed to continue this accreditation including a risk assessment of the environmental risks associated with the fishery. This risk assessment formed part of the process for completing this report.

2.3 Major Environments

2.3.1 Physical Environment

The rock lobster fishery operates off the lower-mid west coast of western Australia. This region is characterised by coastal limestone reefs covered in macroalgae. Offshore there are a series of deeper reefs that were formed under previous lower sea level conditions. In between these reefs are extensive areas of sand.

In the northern areas, particularly around the Abrolhos Islands, fishing occurs in regions where there are extensive areas of coral reef, interspersed with limestone reefs covered by macroalgae.

The water in this region is oligotrophic and is influenced greatly by the seasonal flow of the Leeuwin Current, which is a warm body of water of tropical origin that flows most strongly during the winter months of April – September (Pearce et al., 1990). The strength of the Leeuwin Current varies annually depending upon the value of the El Nino-Southern Oscillation index (ENSO), which is the difference in air pressure between the Indian and Pacific Oceans. In turn, the strength of the Leeuwin Current has been shown to have a major influence on western rock lobster catches and a number of other WA marine species (Caputi *et al.*, 1996)

2.3.2 Economic Environment

The need to increase the live trade has altered some fishing practices but has increased the profitability of the fishery with the average price of lobsters having increased greatly over this period. The catch is exported either live or frozen, as whole cooked or whole raw lobsters to Taiwan, Japan, and Hong Kong/China or processed into frozen raw tails for the United States.
Small quantities of live and whole cooked lobster are now penetrating the European market.
The USA was once the sole market for WA lobster with product being sold as frozen tails, but the focus shifted dramatically to whole frozen and live trade to the Asian region in the 1990s. However, with the very large catch in 1998/99 and the record breaking catch of 1999/2000, the US tail market again became important as processors sought to distribute product to maintain returns.
A symbol of good fortune and happiness in Japan, and highly prized for weddings or other ceremonial occasions, a small red lobster in perfect condition will fetch top prices.
There is a small local market, mainly for whole cooked lobster.

2.3.3 Social Environment

The fishery has had considerable impact on regional WA. It operates out of a large number of ports along the central coast of WA. The 600 or so vessels usually have a crew of 2 or 3

(a skipper and one or two deckhands), thus there are typically about 2000 people directly employed by this fishery. In addition there are around 6000 people employed by the lobster processing sector and the associated support and service industries.

Along with playing a role in the generation of significant levels of income and employment, for many coastal communities, much of the infrastructure associated with their ports, and in many cases the towns themselves, has been created as a result of this fishery. Consequently this fishery forms an important part of the culture of many small communities.

ATTACHMENT 5

MODERATE RISK INFORMATION GAPS

Component	Sub-components	Items	Hazardous Event and Potential Impacts	Information Gaps
Indirect impacts on biological communities	Removal of/damage to organisms- impact on overall environment	Fishing	Sea-lion pups potentially becoming entangled in pots / Potential change to population.	No information gaps were identified during the workshop
Indirect impacts on biological communities	Removal of/damage to organisms- impact on overall environment	Physical Impact on coral and other habitats	Contact of pots with coral / Potential change to coral abundance.	• Potential change to coral
Indirect impacts on biological communities	Removal of/damage to organisms- impact on overall environment	Fishing	Leatherback turtles potentially becoming entangled in rope / Potential change to population.	• Turtle attraction to ropes • Entanglement resulting in reduction in turtle population
Indirect impacts on biological communities	Indirect impacts on biological communities - other impacts on overall environment	Water Quality	Dumping of domestic waste into ocean at Abrolhos Is / Potential reduction in ocean environment quality.	No information gaps were identified during the workshop

The above table lists the information gaps that were specifically identified for the moderate risks during the workshop. However, there were additional gaps identified during the development of recommendations (see Attachments 2)