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Western Rock Lobster
Ecological Effects of Fishing Research Plan

Developed by the Ecological Effects of Fishing Scientific Reference Group

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Government of **Western Australia**
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Fish for the future

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Western Rock Lobster Ecological Effects of Fishing Research Plan

Developed by

The Ecological Effects of Fishing Scientific Reference Group

Background

The commercial West Coast Rock Lobster Fishery (WCRLF) targets the western rock lobster (WRL), *Panulirus cygnus*, averaging approximately 10,000 tonnes of lobsters each year. Currently approximately 450 to 500 boats operate in the Fishery in waters ranging from 5 m to 200 m depth adjacent to the Western Australian coast and stretching from Cape Leeuwin in the south to Shark Bay in the north. The Fishery is managed by the Department of Fisheries (DoF) in Western Australia, using an input control system designed to constrain exploitation/fishing effort and deliver sustainable catches. The annual value of the catch is estimated at between AUD $200 - $300 million.

In March 2000 the WCRLF became the first Fishery in the world to be certified by the Marine Stewardship Council (MSC) as a well managed and sustainable fishery. The status of the rock lobster stocks, the fishery's impact on the ecosystem and its management systems were independently assessed by a team of experts contracted to, Scientific Certifications Systems Inc (SCS) of Oakland California, which undertook the certification on behalf of the MSC. The fishery successfully underwent its second five-year assessment by SCS in November 2006 and was has been recertified until November 2011.

The process to obtain MSC certification involved a number of key components, two of which were the development and implementation of an Ecological Risk Assessment[1] (ERA) and an Environmental Management Strategy[2] (EMS). The development of these two documents involved a number of processes including public, stakeholder and expert consideration and comment.

The ERA reports were based on a risk assessment workshop of stakeholders that produced a register of the main potential ecological hazards that arise from the various activities carried out by the fishery. A subsequent workshop of scientific experts provided a risk ranking on all the hazards identified. The EMS was developed, using the ERA documents and comments from the peer reviewers, as a reference point from which continuous improvement of the fisheries management arrangements and a better understanding of related environmental/ecological processes could proceed. The EMS has in place objectives, actions, targets and management actions to deal with the hazards identified as risks.

The Ecological Effects of Fishing Research Plan (the plan) has been developed to address knowledge gaps identified by the ERA processes and the Ecological Effects of Fishing

[1] ERAs were conducted in Feb 2001, Feb 2005 and in April 2007.
[2] The first EMS covered the period July 2002 to July 2006 and is currently (Sept 08) undergoing revision and updating.

Scientific Reference Group. See Appendix A for the sections of the February 2005 and April 2007 ERAs that are relevant to the ecological effects of fishing.

Establishment of the Ecological Effects of Fishing Scientific Reference Group

In addition to its longstanding sub-committees[3] the Rock Lobster Industry Advisory Committee (RLIAC) established the Ecological Effects of Fishing Scientific Reference Group (Eco SRG or SRG), which held its inaugural meeting on 5 and 7 August 2003. The Eco SRG has been responsible for providing RLIAC with independent ecological advice to ensure the western rock lobster resource is managed in a manner that is consistent with the national principles of Ecologically Sustainable Development (ESD) and ecosystem based management.

The Eco SRG has a composition and terms of reference (Appendix B) that are set down by RLIAC and it reports directly to RLIAC. The Eco SRG also operates in a manner that is consistent with *Fisheries Management Guide No. 3*[4].

History of the Development of the Research Plan

2003

At its inaugural meeting on the 5th and 7th August 2003 (Attachment 1 report of meeting) the Eco SRG identified that there was a general lack of knowledge / information on the interaction of the WCRLF with the deepwater ecosystem and therefore it was necessary for initial research to focus on identifying and observing ecosystem patterns before attempting to research ecosystem processes (Attachment 1). The Eco SRG considered observing ecosystem patterns to be the important first step for all forms of ecosystem research whether based on gradients in effect (caused by different densities of lobsters) or fished versus unfished areas. Without first undertaking this basic research there would be no scientific guidance on which to base the design of future studies comparing fished and unfished fished areas. For example, what size the closed areas should be, the levels of replication required and what should be used as potential response variables.

The Eco SRG produced a strategic research framework (Attachment 2) to help develop a more detailed research plan to improve the information base to enable a more robust scientific assessment of the ecosystem effects of rock lobster fishing, i.e. the effects of large scale lobster biomass removal in deepwater (>30m)[5]. The goal of the research plan was to provide an overview of the research that would be required to test the null hypothesis that:

> *Removal of western rock lobsters on a scale experienced in Western Australia does not have a significant or irreversible effect on the ecosystem.*

Based on its strategic research framework the Eco SRG recommended that an operational plan of research be developed and implemented to establish the necessary understanding of the critical natural history elements that would be necessary to address the null

[3] RLIAC subcommittees – Research and Development; Finance; Market Research; Compliance and Education; Finance Working Group; Sea Lion SRG; Eco SRG and Management Steering Committee.
[4] A guide for Management and Ministerial Advisory Committees (MACs) and the conduct of meetings issued by the Minister for Fisheries.
[5] The Eco SRG decided the research plan should concentrate on the impact of lobster removal in deepwater, as it was likely to be more significant because the biomass of undersize animals was much less than in shallow water and the SRFME projects were investigating the shallow water impacts.

hypothesis. The key elements of the operational plan included four points with associated focus questions and action plans to answer them (see Attachment 1 for full details):

1. Habitat mapping

Focus questions to be addressed

- What habitats do lobsters utilise?
- Is there a pattern in the habitat type that is related to lobster density and / or size structure?

Action Plan

1. Produce a broad scale habitat map by collating information from existing data bases e.g. fishers' GPS, seismic surveys, etc.
2. Review existing benthic habitat and seabed data for the shelf waters between Mandurah and Kalbarri.
3. Conduct broad large-scale rapid assessment protocols in waters between Mandurah and Kalbarri to determine areas of interest.
4. Choose a minimum of three representative transects with replicates at each location.
5. Conduct detailed habitat mapping of chosen sites that include:
   - acoustic survey of hard structure and associated groundtruthing of epifauna and infauna 'habitat' using video techniques; and
   - limited grab sampling to later determine infaunal composition and sediment type.

Addressing these questions would provide information on the distribution and density of lobsters of different sizes relative to benthic habitats[6] and prey resources.

2. Size structure and density of lobsters

Focus questions to be addressed

- What is the current size structure and density of lobsters in the chosen sites?
- Is potting an appropriate measure of abundance and size structure of the population (selectivity of pots)?
- What is/are the relationship(s) between pot catch rates and size composition?
- What is/are the impact(s) of habitat on catchability?
- What is the degree of movement (foraging/home range) of lobsters and is it size dependent?

Action plan

1. Use a range of methods to estimate selectivity and catchability (depletion experiments using different fishing gear (e.g. pots with larger necks or tangle nets) and multiple tagging.
2. Use video to observe localised lobster behaviour with habitat types and interaction with baited pots.
3. Using existing catch records and environmental data assess the influence of climate variation on catchability at sites.
4. Use existing length based fishery models to investigate possible size compositions for unfished stocks.

This information would be used to relate lobster density (and size structure) to fisheries data to facilitate the scaling up of information from specific study sites to the fishery. It would also be combined with information collected in "1" above to determine relationships between habitat and lobster size and density.

[6] The SRG defined the term "habitat" in this context to include the physical (e.g., rocks and sand waves) and biological (e.g. sponge gardens, emergent bivalves) features on the seafloor that provide structural complexity (on > 1m spatial scale) and are likely to act as surrogate variables enabling broad-scale rapid assessment of benthic communities.

3. Trophic Dynamics

Focus questions to be addressed

- What is the size dependent diet of lobsters in the chosen sites?
- What are the trophic dynamics of lobsters in these regions?
- Are there relationships between lobster size-structure compositions and prey density and composition?

Action plan

1. Conduct carbon and nitrogen isotope analysis of lobsters to provide information on diets, trophic relationship and whether the basis of lobster diets is plant, animal, detritus or a combination.
2. Conduct gut analysis studies to examine diets and compare with long-term trophic source both on a seasonal and inter-annual basis.
3. Conduct aquarium tests to investigate relationship(s) between lobster size and prey size.

This information would be used to assess whether large lobsters exploit a different range of food resources than smaller individuals.

4. Lobster behaviour

Focus question to be addressed

- What size and sex specific behaviours are relevant to the issue of sustainability of the resource?

Action plan

1. Observe behaviour of small lobster in areas where there is an absence of large lobster, then seed some of those areas with large lobsters and observe any changes in behaviour / abundance of small lobsters.
2. Use video techniques to observe lobster behaviour.

This information would be used to assess interactions between different sized lobsters and determine the relevant space and time scales for manipulative studies.

2004

The research plan was further developed at the SRG's second meeting on 14th May 2004 (Attachment 3 report of meeting) and a conceptual model was also developed (Appendix C) to show how the research process would evolve and develop knowledge that was directly applicable to testing the null hypothesis. The proposed research approach was to try and find a "meaningful gradient" in biological assemblage structure across sites that were otherwise indistinguishable based on physical attributes, which could be associated with differences in rock lobster densities. The examination of gradients was to be structured in such a way that it took into account both physical and biological habitat structure. The starting point was the data from sites identified during the fishery Independent Breeding Stock Survey (IBSS, i.e. independent egg production field surveys) conducted annually by DoF in 40 to 60m along the west coast (Jurien Bay in particular) and more detailed habitat mapping studies. The SRG noted however, that pattern focussed studies, which did not require areas to be closed to fishing, assumed that gradients in effect could be found, however, if they could not the only recourse would be to use fished versus unfished areas comparisons.

The Department of Fisheries' project "*The effects of western rock lobster fishing on the deepwater ecosystem off the west coast of Western Australia*" (FRDC[7] funded project #

[7] FRDC – Fisheries Research and Development Corporation http://www.frdc.com.au/

2004/049) was developed using the Eco SRG's research framework. It commenced in July 2004 and was completed in July 2007. A summary of the objectives of the project is provided at Appendix D, along with a table of complementary research projects[8].

2005
At its third meeting on 3rd February 2005 (Attachment 4 report of meeting) the Eco SRG received detailed briefings on the SRFME[9] shallow and the DoF deepwater water ecology projects. The SRG redrafted its research plan and it was circulated out of session to all members for final comment. A copy of the final draft that was to have been signed off at the SRG's 2006 meeting is provided at Attachment 5.

2006
The Eco SRG did not meet during 2006 and the draft research plan was not signed off.

2007
See the report of the Eco SRG meeting of 10th August 2007 at Attachment 6.

Status of the Eco SRG's strategic research plan

The Eco SRG had not formally endorsed the draft of the original research plan for the effects of rock lobster fishing that was developed and circulated in 2005. Since then FRDC Project 2004/049 had collected a lot of new information that was being processed for the final report to FRDC[10]. In view of these considerations, the SRG decided that the plan should be redrafted based on the discussion that would take place at the meeting and then re-submitted to them for review and comment.

The Eco SRG reviewed the results of FRDC Project 2004/049 and noted that the project had been successful in obtaining baseline information on rock lobster ecology in deepwater (the draft Non Technical Summary of the report on the project is provided at Appendix E[11]). However, it was clear that the gradients identified during the course of the project were confounded by habitat differences and consequently could not be used to evaluate the effects of fishing, as originally proposed by the SRG. The SRG concluded that future research on the ecological effects of rock lobster fishing, would require a comparison of areas open and closed to fishing (i.e. as per the conceptual model / decision making process developed at the May 2004 meeting – Appendix C).

Development of a research plan for the new DoF effects of fishing project

At its August 2007 meeting, the Eco SRG discussed and development a research plan for a new DoF project, funded by FRDC, to investigate the ecological effects of fishing using fished and unfished area comparisons. The SRG made the following recommendations for the project:

- as per the first DoF project (FRDC funded project # 2004/049), the new research project should be carried out in deepwater (>30m), as this was the area likely to show the most significant ecological impacts due to removal of legal size lobsters by the fishery (see further discussion on this point at Attachment 6 and see Attachment 7 for

[8] The table describes other key projects already funded or planned and relevant milestones that the Eco SRG regarded as important for the research plan to deliver against its objective and purpose.
[9] SRFME – Strategic Research Fund for the Marine Environment http://www.srfme.org.au/
[10] A draft of the final report was sent to FRDC in September 2008.
[11] The complete report will be provided to members as soon as it becomes available.

information provided on specific issues raised by SRG members regarding the new project – including information on rock lobster length frequency by depth); and
- experimental sites needed to be replicated (see discussion Attachment 6);

At the meeting the SRG also:
- developed site selection criteria;
- recommend the development of methodologies using macro algae and macro invertebrates indicators to detect indirect habitat-level changes in communities;
- recommend the continued investigation of lobster trophic pathways to detect direct changes in communities via the prey items in lobster diets;
- recommend the development of a framework for a conceptual model to help identify the ecosystem parameters that would need to be monitored;
- developed project objectives; and
- listed the potential benefits of the project.

Site Selection Criteria

A set of site selection criteria that would need to be satisfied in the selection of potential research areas open and closed (to all fishing) was developed. The site would need to:

1. be representative in terms of lobster demographics, *i.e.* have the potential for high adult biomass (relative to undersize biomass), as indicated by good or high catch rates of mature lobster;
2. be central to and generally representative of the fishery (*e.g.* region between Lancelin and Dongara);
3. have optimal accessibility – needs to be as close to shore/a 'port' as practical while satisfying other criteria;
4. be representative of lobster habitat based on information obtained from previous habitat mapping (structure and function);
5. have replicates of closed areas in different locations;
6. be in an optimum location for enforcing compliance of the closure;
7. meet the following size of site-criteria:
    a. complementary to the size of the lobster's foraging area;
    b. large enough to allow measurements of indicator responses (both up/down the lobster food web, e.g. predators of lobster and key prey for lobster;
    c. must encompass representative habitats; and
8. minimise the relative level of economic loss to industry.

The use of these criteria should facilitate site selection and help answer inshore/offshore/depth questions.

Methodologies

The Eco SRG suggested that macro algae and macro invertebrates should be monitored and compared at fished and unfished sites, as it should be feasible to detect indirect habitat-level changes in these communities. If no change in these indicators were observed, given adequate sampling of appropriate variables over sufficient space and time, then it would be unlikely that there were significant ecosystem effects. However, it was also recognised that it would be necessary to continue investigation of lobster trophic

pathways, as it may not be possible to detect, or understand any large scale changes without more detailed data on the composition of the rock lobster's prey communities.

Conceptual model development

The development of a conceptual model to help identify the ecosystem parameters that need to be monitored, should be one of the first objectives of the new project. The sampling methods will depend on the ecosystem parameters that are selected for monitoring. Prior knowledge of the nature of the data to be collected will also help inform the level of sampling required to detect responses in the taxa targeted for monitoring. The SRG recommended that Dr Jeff Dambacher of CSIRO, or another suitably qualified qualitative modeller, be approached to help develop the conceptual model.

Project objectives

1. Develop a conceptual/qualitative model for the main components affecting lobsters and their ecosystem in deep waters.
2. Identification and assessment of areas to be closed to fishing and those acting as controls. Assessment will include examination of habitat and lobster catch rates.
3. Measurement of the distribution and abundance of lobsters, major habitat forming taxa and taxa identified by conceptual modelling as high priorities for monitoring.
4. An increased understanding of the dynamic role of lobsters in key ecosystem processes. This should include more work on interactions of habitat and biogeochemical processes. Techniques such as acoustic tagging and isotope analysis should be included.
5. Development of a long-term monitoring plan for the research areas, with secure funding.

The SRG noted that there would need to be a coordinated effort to bring the information from the new DoF project together and integrate it with other projects through the use of ecological modelling, e.g. Ecopath. Some integration of the existing data and information will be achieved through Western Australian Marine Science Institute (WAMSI) Project 4.3 on trophic interactions and ecosystem modelling[12].

Project benefits

A research area(s) of suitable size and location that was closed to fishing would enable the types of ecological research (e.g. the effects of fishing) needed to satisfy the requirements for MSC recertification to be undertaken. Furthermore, it is likely that closed areas along the west coast will be an output of the Commonwealth's bioregional marine planning initiative and the proposed project would allow the western rock lobster industry to provide a high level of scientific input into the planning process.

The information from this project would significantly enhance the DoF's ability to manage the rock lobster stocks in the best possible way, to meet its ESD obligations and to ensure the long-term sustainability of the fishery.

The Eco SRG recognised that the acceptance of the project by industry and the community generally would require its benefits to be clearly articulated (Attachment 6, Table 2. pgs

[12]More information on WAMSI Project 4.3 can be found at http://www.wamsi.org.au/research/nodes/node4

13/14). It was anticipated that the benefits would be part of the need/outcomes statement of the new project proposal.

Current Status of the New DoF Effects of Fishing Research Project

The new DoF effects of fishing research project, *Assessing the ecological impact of the Western Rock lobster fishery in fished and unfished area*, was developed based on the research framework produced by the Eco SRG and was circulated to SRG members for comment. The project was revised in light of the comments received from the SRG and the WA FRAB[13] and a successful application for FRDC funding was subsequently made (Attachment 8 – FRDC application). The project officially commence on 1 January 09. An brief outline of the proposed work schedule is provided at Appendix F.

[13] FRAB – Fisheries Research Advisory Body.

APPENDIX A

February 2005 Ecological Risk Assessment

Hazard identification and risk ranking

6.4.1c Central West – Deep (page 64)

This region experiences the largest potential change in size structure and relative abundance of large lobsters (the abundance of lobsters in this region is replenished each year during the annual whites migration). Furthermore, because we don't yet know the trophic relationships in this region, it is possible (L4) that the removals may be making some identifiable changes to species relative abundance (C2) in this region. There is, however, no suggestion that different species now exist in this location compared to previous years, an outcome that would suggest severe impacts may have occurred. Thus, this was considered by most of the group to be a moderate risk (Figure 6.30d). The deepwater work currently underway may assist in either confirming or adjusting this risk by the next review when further information on this section of the fishery will be available.

For full details of the risk assessment of the effect of fishing on the general ecology see Western Rock Lobster Fishery Ecological Risk Assessment 2005 Report July 2005, Section 6.4 General environment, page 51 to 64, by Professor Mark Burgman, School of Botany, University of Melbourne, Australia, 3010, at:
http://www.fish.wa.gov.au/docs/op/op025/index.php?0706

April 2007 Ecological Risk Assessment

Hazard identification and risk ranking

Hazard # 22 and 23, Central west coast and Kalbarri–Big Bank, deepwater

The risk to deep-water communities is the potential for changes in the relative abundance of species in these regions. The fishery is currently managing this risk with a Fisheries Research and Development Corporation (FRDC) research project to investigate deep water ecology, and a Marine Futures (Natural Heritage Trust) project to undertake habitat mapping and biodiversity sampling at the Abrolhos Islands, Jurien, Rottnest and Capes areas. The Western Rock Lobster Effects of Fishing on the Ecosystem Scientific Reference Group (Eco SRG) has made investigations into deepwater ecology a research priority due to a lack of data.

The following commitments have been made to address the data gaps in deep water ecology, with research to begin informing management decisions beginning about 2008 as expressed in the MSC Action Plan timetable to address this issue:

- A workshop was undertaken following the 2007 ERA Workshop with international experts and the Eco SRG. The agenda included a review of deepwater research, and developed ongoing project proposals using fished and unfished areas.
- The Western Australian Marine Science Institution (WAMSI) is developing research projects to inform the scientific understanding of deepwater ecology in the areas of interest.

In view of the research priority to develop information to inform fishery management in this region, no other information is currently available to better inform fishery management. This hazard should be re-assessed when the results of research activities become available.

It is noted that the ERAEF Level 2 methodology does not currently address community-level ecological components (Hobday et al. 2007, and personal communication with the author). As such, there is no prospect for a Level 2 assessment of these hazards at the present time.

Recommendation 2:	No further risk assessment of hazards to the central west coast or Kalbarri–Big Bank deep-water ecological communities is recommended in the short term. The hazards of fishing activity interactions with deep-water ecological communities has been assessed in an Eco SRG workshop (August 2007, chairman's report in preparation), which recommended ongoing research of fished and unfished areas. If new information becomes available as a result of future research, the risk level should be reviewed and validated by the WA Department of Fisheries and WAFIC in consultation with independent experts.

For full details of the risk assessment of the effect of fishing on the general ecology see Western Rock Lobster Fishery Ecological Risk Assessment April 2007, by Richard Stocklosa of E-Systems Pty Limited, 205 Davey Street, Hobart, Tasmania 7000, at: http://fishnet/ics-wpd/exec/icswppro.dll?AC=GET_RECORD&XC=http://fishnet/ics-wpd/exec/icswppro.dll&BU=http%3A%2F%2Ffishnet%2Flibrary%2FREFsearch_3&TN=referenc&SN=AUTO12124&SE=1045&RN=84&MR=20&TR=0&TX=1000&ES=0&CS=1&XP=&RF=WebDisplayTable&EF=&DF=A_REPORT&RL=1&EL=0&DL=1&NP=1&ID=PUBLIC&MF=CSEngMsg.ini&MQ=QUERY_ALL_WEB&TI=1&DT=&ST=0&IR=17436&NR=0&NB=4&SV=0&BG=&FG=&QS=&OEX=ISO-8859-1&OEH=ISO-8859-1

APPENDIX B

Terms of Reference and Composition of Ecological Effects of Fishing Scientific Reference Group

Terms of Reference

The Ecological Effects of Fishing Scientific Reference Group (Eco SRG) as required, annually and in a strategic way every five years, to provide advice on:

- the ecological effects of removing lobster biomass;
- how to improve our measurement and assessment of the risk to the environment from the removal lobster biomass; and
- the experimental designs / techniques that are necessary to gather data for analysis to address these questions.

The Eco SRG as required, annually and in a strategic way every five years, will perform the following functions:

- an assessment of known and recently identified risks and review established projects against milestones and objectives;
- seek formal input from the ESD steering committee with regard to the status of existing risks and the identification of new risks;
- provide the ESD Steering Committee with its justification for risk ratings for a new risk or an already identified risk; and
- be a source of advice when changed circumstances may influence risk ratings.

Composition

• Independent Chair	Ron Edwards (RLIAC Chairman)
• Executive Officer	Tim Bray (RLIAC Executive Officer)
• Simon Thrush	Principal Scientist Marine Benthic Ecology – New Zealand National Institute of Water & Atmospheric Research
• Andrew Heyward	Australian Institute of Marine Science
• Russ Babcock	Strategic Research Fund for the Marine Environment
• Colin Buxton	Director – Tasmanian Aquaculture & Fisheries Institute, University of Tasmania
• Chris Simpson	Department of Conservation and Land Management
• TBA	Director Research, Department of Fisheries
• Neil Loneragan	Chair in Fisheries Science, Biological Sciences, Murdoch University

Operational requirements

- The Eco SRG reports directly to RLIAC with a copy of its report sent to the ESD Steering Committee.
- Eco SRG reports are to be made available to the Minister for Fisheries as part of RLIAC advice.

- Eco SRG members are to formally sign off (signature or email confirmation) on every report before it is forwarded to RLIAC and the Chairman to ensure any dissenting views are explicitly recorded in the report.
- In all other matters the Eco SRG is to operate in a manner that is consistent with *Fisheries Management Guide No. 3*.

Process for amending terms of reference or composition

Responsibility for amending the Eco SRG's terms of reference or composition rests with RLIAC. Should RLIAC decide to alter either the terms of reference or composition then it should document the justification in its advice to the Minister for Fisheries.

RLIAC should seek input from rock lobster stakeholders and the Department of Fisheries prior to amending the terms of reference or composition.

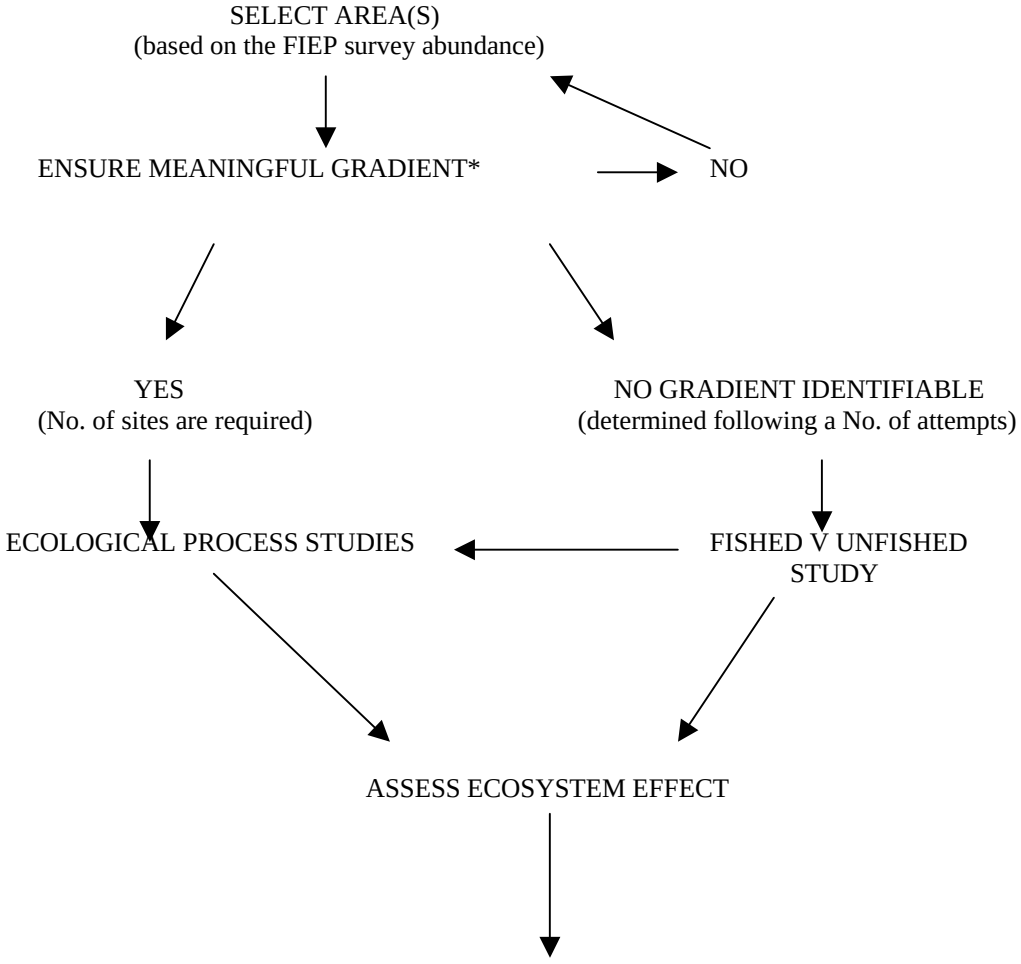
APPENDIX C

(Extracted from Eco SRG meeting report of 14 May 2004 – Attachment 3, Figure 1, p10.)

Conceptual Model for the Research Plan

To assist in establishing a collective understanding of the approach that is to be at the heart of the Research Plan, the Eco SRG developed a conceptual model as to how the process would evolve and develop knowledge that is directly applicable to testing the hypothesis. The results of the research will be used to answer the threshold question contained within the ongoing requirements of the Department of Environment and Heritage and MSC certification. This model is illustrated in Figure 1 below.

Figure 1. The Eco SRG's conceptual model of a research plan to determine the effect of rock lobster fishing on the ecosystem. Note that management responses can occur throughout the process as information is fed into the risk assessment and evaluation process through the SRG.



*The task of finding a meaningful gradient is encapsulated here in a single component of the conceptual model, but is actually a complex iterative task. Ideally, or ultimately, a "meaningful gradient" will be defined as a meaningful gradient in biological assemblage structure across sites that are otherwise undistinguishable based on physical attributes. Thus the examination of gradients will need to be structured in such a way that it takes into account both physical and biological habitat structure. It is recognized that fully meeting these criteria will only be possible by the ongoing incorporation of data from initial examinations of sites identified by FIEP and more detailed habitat mapping studies.

APPENDIX D

Objectives of the DoF Effects Fishing FRDC Project 2004/049

(Extracted from the draft Effects of Fishing Research Plan 2005, Attachment 5, pgs 11 and 12. Note: The project was completed in July 2007.)
The effect of western rock lobster fishing on the deepwater ecosystems off the west coast of Western Australia.
Department of Fisheries Western Australia
Principal Investigator: Dr Lynda Bell-Chambers

There is a need to collect basic ecological information to determine if changes in lobster density and size structure due to fishing, has caused significant changes in habitat structure and benthic community composition in deep water. This will provide information on the level of ecosystem impact of removing lobsters from deep-water habitats to improve the assessment of risk to the ecosystem to ensure that the western rock lobster fishery maintains MSC certification and complies with DEH requirements for export permits. However, the SRG recognised that research needs to occur in a structured manner and has highlighted the need for research proposals which sit within the strategic framework which they have devised.

The SRG recognises that the provision of a strategic framework and related scientific research will ultimately allow management of deep-water stocks in a more sophisticated ecosystem-based manner.

If removal of western rock lobster biomass, by the deepwater fishery, has resulted in detectable changes in the ecosystem, management options such as reduction in the fishing effort, minimum size changes and area closures, will be considered by RLIAC to reduce the removal of biomass from areas of the deepwater fishery. This FRDC funded research project is focused primary on the question " what is the effect of lobster biomass removal on the ecosystem?"

The objectives of the project are:

1. To identify gradients in the density/size distribution of western rock lobster to enable selection of representative areas.

The focus of this objective is to use existing data, from both the Department of Fisheries and other sources, to compile a comprehensive database on the abundance and distribution of rock lobsters and the associated habitat types. This objective is primarily a desktop study to use existing data to identify areas, within the scope of the rock lobster fishery, where gradients in lobster density and/or size structure can be investigated.

2. To assess the deep-water catchability of western rock lobsters and its relationship with population abundance and size structure.

The focus of this objective is to be able to calibrate commercial and research catch rates and determine the actual size structure and density of lobsters in selected locations, examine the influence of gear type on providing an accurate representation of the population.

3. To identify the relationship between the deep-water habitat and the density/size

distribution of western rock lobster to enable a preliminary evaluation of the impact of lobster biomass removal in the deep-water

The focus of this objective is to investigate the pattern in the relationship between gradients in the abundance and size distribution of lobsters and their corresponding deep-water habitat. The aim is to collect additional biological data to identify if habitat characteristics, physical or biological, are correlated with high or low lobster abundance.

APPENDIX E

Non Technical Summary – *The effect of western rock lobster fishing on the deepwater ecosystems of the west coast of Western Australia*. FRDC Project 2004/049

Department of Fisheries Western Australia
Principal Investigator: Dr Lynda Bell-Chambers

NON TECHNICAL SUMMARY:

Outcomes achieved to date

This study has resulted in the collection of biological, population and habitat data that improves our understanding of the role of western rock lobster in the deepwater ecosystem. The relationship between western rock lobster size and abundance and habitat variables established in this study is important for the effective management of the fishery in an ecosystem based fisheries management (EBFM) framework. For fisheries managers this information has application in two main areas. Firstly, it enables the examination of the spatial distribution of lobster abundance and size by habitat type and in combination with fine resolution fishing effort data may allow the assessment of standing biomass and harvest rate. Secondly, it provides invaluable information for the design and implementation of marine protected areas as a tool for research and species conservation. For researchers this study provides an assessment of different techniques to assess the benthic habitat of deepwater ecosystems that has previously been a costly exercise requiring specialised equipment. For industry this information is the first step in the process of assessing the impact of lobster biomass removal in the deepwater and provides detailed information for the ecological risk assessment (ERA) process required to meet Department of Water Resources, Heritage and Arts (DEWHA) regulations and maintain marine stewardship certification (MSC).

Similarly, depletion estimates for western rock lobster in shallow and deep water at the Abrolhos can be used to improve the stock assessments by using length-based models that will lead to a more robust assessment of the management of the fishery that will be of benefit to fisheries managers and industry alike. The Results confirm a high level of pot saturation at the Abrolhos, particularly in shallow water. This result suggests that there may be some economic benefit from further pot reductions in shallow waters at the Abrolhos Islands and these are currently being examined for the 2008/09 season.

The western rock lobster fishery was awarded Marine Stewardship Council (MSC) certification as a well-managed fishery in 2000 and has since been successfully re-certified in 2006. It was the first fishery in the world to receive this certification, which was awarded after an extensive review of the sustainability of the fishery and its impact on the marine environment. This certification largely reflects the significant data available on the shallow (<40 m) water ecology of lobsters and the impact of fishing and biomass removal. However, there remains a knowledge gap with respect to the deep-water ecology of western rock lobsters. Most western rock lobster undertake a substantial offshore migration as they approach sexual maturity which coincides with the size at which they reach legal minimum size and are targeted by the commercial and recreational fishery.

This study seeks to fill in some of the knowledge gaps to assist with answering the question “what is the effect of lobster biomass removal on the ecosystem?”.

The benthic biota of deepwater ecosystems (35-75 m) was classified using towed video and diver sampling at Dongara, Jurien and Lancelin. While differences in sponge/algal assemblages and macro invertebrate community composition were detected between study locations, a direct link between sponge/algal assemblage structure and macro invertebrate community composition could not be established. Macro invertebrates are important prey items for western rock lobsters, therefore differences in macro invertebrate community composition will have implications for prey available to western rock lobsters. The two methods used to classify assemblage structure were also compared. Both methods of classifying assemblage structure yielded similar outcomes, suggesting a single method of classifying habitat can be employed in future studies to determine assemblage structure.

Two components of this report were focused on examining the relationship between the abundance and size of western rock lobster and the habitats in which they are found. In the first component the relationship between lobster abundance and size, from the annual western rock lobster independent breeding stock survey (IBSS), and habitat variables were quantified using towed video transects at Dongara, Jurien and Lancelin. All three locations vary both with respect to the composition of habitats and the abundance and size of lobster, with Dongara being significantly different from the other two sites. The largest lobsters were found at Dongara while the highest abundance of lobsters was at Lancelin. In addition, lobsters vary both qualitatively and quantitatively with habitat. Qualitative characteristics of the benthos rather than the density of a particular habitat type determined lobster size.

In the second component western rock lobster size and abundance data was derived from the annual western rock lobster independent breeding stock survey at the five subregions of the IBSS at Jurien. Two habitat datasets were used: (1) a towed video survey to derive benthic habitat data and (2) a full coverage habitat map derived from a multi-beam hydroacoustic survey and towed video. Abundance and size of lobsters varied significantly across the five subregions of the IBSS at Jurien. Habitat classification from both towed video and the habitat map indicated that subregions also varied significantly in habitat composition. Multivariate statistical techniques show a strong association between western rock lobster abundance and size and habitat types with 74% of the variation being explained by the combination of *Ecklonia* and sponges.

Both components of the study illustrated that low numbers of larger lobsters are present in areas associated with sponge and high numbers of smaller lobsters are present in more structurally complex *Ecklonia* dominated habitats.

We used stable isotope analysis and gut content analysis to determine the diet and trophic position of western rock lobsters at three locations (Dongara, Jurien and Lancelin). Lobsters were primarily carnivorous, and no consistent differences in diet were detected with varying lobster size, sex or among locations. The main components of the diet were bait (from the fishery) and small crustaceans such as crabs and amphipods/isopods. Foliose red algae, bivalves, gastropods and sponges were minor contributors to diet. The diet of lobsters in deepwater differed to results of previous studies of lobsters from shallow water ecosystems. Coralline algae and molluscs are important prey in studies of lobsters from shallow water but were minor components of the diet. These differences are likely to reflect differences in food availability between these systems and potentially,

differences in choice of prey by lobsters that inhabit deeper water. Given the high contribution of bait to lobster diet, bait is likely to be subsidising lobster production in deep coastal ecosystems during the fishing season.

A desk top study was conducted to examine changes in the catchability of western rock lobster. The Abrolhos Islands region was used to examine catchability dynamics between shallow (< 20 fm) and deep (>= 20 fm) water western rock lobster using the DeLury depletion model. This region was chosen as a significant decline in CPUE due to fishing in a relatively short period (3.5 months) occurs in this location. As a result of the high exploitation and the large number of pots operating in a relatively restricted area, the catchability of rock lobsters in shallow water was significantly increased by the 18% pot reduction in 1993/94. This study indicates that the increase is confined to the shallow water component of the fishery. This indicates that there is a significant level of pot saturation occurring in the shallow waters of the Abrolhos. This result suggests that there may be some economic benefit from further pot reductions in shallow waters at the Abrolhos Islands and these are currently being examined for the 2008/09 season.

APPENDIX F

The proposed work schedule for the new DoF effects of fishing research project, *Assessing the ecological impact of the Western Rock lobster fishery in fished and unfished areas*

Department of Fisheries Western Australia
Principal Investigator: Dr Lynda Bell-Chambers

See Attachment 8, FRDC application 2007, for details of the project, which officially commences on 1 January 2009.
Proposed work schedule:

- Oct 2008 – In conjunction with the Independent Breeding Stock Survey (IBSS), an area of approx 7.5 nm x 2.5 nm around 30 degree south latitude (just north of Jurien Bay on the border of B and C zones) will be potted to obtain an indication of lobster abundances in and around the proposed research site that will be closed to fishing. The outer zones of the Jurien IBSS areas will also be sampled as possible control sites. The results will be reported to the RLIAC working group that has been established to negotiate and make recommendations on the research sites that will be closed to fishing.
- Nov - Dec 2008 – Suitable sampling methodologies will continue to be appraised.
- Feb - Mar 2009 – UWA[14] will undertake a 'Marine Futures' style habitat mapping survey over the proposed research areas.
- Feb - Mar 2009 – An independent review of sampling methodologies, etc to take place.
- May 2009 – First official benthic sampling of proposed research areas by video and still cameras, etc, using RV *Naturaliste*.
- June 2009 – Finalise negotiations concerning size and locations of research areas with industry.
- Oct 2009 – In conjunction with DoF's Independent Breeding Stock Survey (IBSS) potting will be undertaken in the proposed closed area and Jurien IBSS control areas.
- June 2010 – At the end of the rock lobster fishing season (30 June) the research area will be closed to all fishing.

[14] UWA – University of Western Australia.