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Western Rock Lobster Ecological Risk Assessment

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Executive Summary

An ecological risk assessment (ERA) was undertaken in 2005 in support of MSC re-certification of the commercial Western Rock Lobster (WRL) fishery. Following the 2005 ERA, the certifying body—Scientific Certification Systems Inc (SCS)—advised that an improved ERA was needed for meeting the requirements of MSC re-certification.

In particular, SCS required re-assessment of the ecological hazards identified in the 2005 ERA, ranked by at least one person as 'moderate' risk or above, using the 'Ecological Risk Assessment for Effect of Fishing' (ERAEF) methodology developed jointly by CSIRO Marine and Atmospheric Research, and the Australian Fisheries Management Authority (AFMA). This requirement is reflected in a formal condition of re-certification.

A workshop procedure was developed in consultation with CSIRO research scientists involved in the development of the ERAEF methodology, and proposed to SCS (as the certifying body) as an intermediate step to gain an improved understanding of ecological risk before proceeding to a Level 2 ERAEF analysis. It was agreed by the Department of Fisheries and the Western Australian Fishing Industry Council (WAFIC) to adopt this alternative approach, with the aim of carrying any hazards still assessed as 'moderate' risk or above in this 2007 ERA to the Level 2 ERAEF analysis.

A workshop procedure was distributed widely to all stakeholders in November 2006 whilst canvassing the availability of independent experts for proposed workshop dates. Based on the availability of technical experts and stakeholders, numerous technical documents were distributed on CD-ROM six weeks prior to the workshop date (2-3 April 2007), and made available to all stakeholders on the WAFIC website four weeks in advance of the workshop.

The ERA undertaken on 2-3 April 2007 resulted in detailed outcomes which were documented in the risk assessment workshop record and communicated to all participants. All of the 15 'moderate' risk hazards on the agenda were assessed using a consultative and structured workshop procedure. Consensus was reached on the expert judgements of a Technical Panel in this qualitative ERA.

Eleven of the 15 hazards were ranked 'low' or 'negligible' risk under present circumstances. Ongoing performance monitoring of the fishery and management controls should be used to confirm that the risk rankings do not increase.

The ERA of the Western Rock Lobster fishery revealed four 'moderate' risks. Risk management actions are in progress for three of the moderate risks (refer to Recommendations 1 and 2 below). One of the moderate risks to a by-catch species was subject to further assessment under a Level 2 ERAEF analysis, which yielded further information to characterise risk and propose management actions (Recommendations 3, 4 and 5).

The suggested risk management actions are documented for consideration by the Western Australian Department of Fisheries and WAFIC. For each of the four moderate risks under existing management controls, the following recommendations were made:

Recommendation 1:	No further risk assessment of fishery efficiency gains to the target species is recommended at the present time, pending a commitment of WRL fishery managers to improve estimates of efficiency gains and take them into account in the management of the fishery. An ERAEF Level 2 assessment would not be expected to add value to the management of this hazard, as it would not provide any additional information that might change the recommended action.

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 EcoSRG 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.

Recommendation 3:	No further risk assessment of bait band entrapment hazards to the by-catch species *Carcharhinus obscurus* (Dusky whaler shark) is recommended in the short term.

Recommendation 4:	Alternatives to bait bands, to avoid the use of materials that can entangle *C. obscurus* and other by-catch species, should be investigated as a matter of improving environmental management of the Western Rock Lobster fishery. If the bait band hazard is eliminated, no other specific actions would need to be taken by the Western Rock Lobster fishery to avoid impacts to this species.

Recommendation 5:	If bait bands continue to be taken to sea by the Western Rock Lobster fishery, on-going stock assessments of *C. obscurus* should consider the threat of mortality due to bait band interactions, and investigate methods for collecting data to monitor any increased mortality with a high level of confidence.

It is important to note that the interaction of bait bands with *C. obscurus* can be attributed to a number of fisheries which utilise bait bands aboard vessels, not solely the Western Rock Lobster fishery. If this risk is considered unacceptable, management actions to reduce or eliminate the exposure of marine fauna to bait bands should apply to all users of the marine environment.

Introduction

The Western Australian Rock Lobster (*Panulirus cygnus*) fishery was the first in the world to gain certification as a 'well-managed and sustainable fishery' by the Marine Stewardship Council (MSC) in 2000. It has since been re-certified for a period of five years, commencing in November 2006.[1] Re-certification of the fishery is subject to conditions which include improved ecological risk assessment (ERA) practices.

An ERA was undertaken in 2005 (Dept Fisheries 2005) in support of MSC re-certification of the commercial Western Rock Lobster (WRL) fishery. Following the 2005 ERA, the certifying body—Scientific Certification Systems Inc (SCS)—advised that an improved ERA was needed for meeting the requirements of MSC re-certification. In particular, SCS required re-assessment of the ecological hazards identified in the 2005 ERA, ranked by at least one person as 'moderate' risk or above, using a more rigorous risk assessment methodology. This requirement is reflected in a formal condition of re-certification (SCS 2006a).

It was suggested by SCS that the 'Ecological Risk Assessment for Effect of Fishing' (ERAEF) methodology should be used, which was developed jointly by CSIRO Marine and Atmospheric Research, and the Australian Fisheries Management Authority (AFMA) (Hobday et al. 2007). The ERAEF methodology provides a hierarchical framework for a comprehensive assessment of the ecological risks arising from fishing, with impacts assessed against five ecological components: target species; by-product and by-catch species; threatened, endangered and protected (TEP) species; habitats; and (ecological) communities. ERAEF also provides an explicit approach to uncertainty in assessment of ecological risks from fishing.

The Western Australian Department of Fisheries, on behalf of the Western Australian Fishing Industry Council, engaged E-Systems Pty Limited on the recommendation of CSIRO Marine and Atmospheric Research to undertake preparations for and facilitate the required ERA. Mr Richard Stoklosa of E-Systems was previously engaged by CSIRO to perform a peer review of the ERAEF methodology during its development, and has a detailed understanding of its practical use (Stoklosa 2003).

This document is the report of the 2-3 April 2007 Western Rock Lobster Ecological Risk Assessment, prepared by Richard Stoklosa of E-Systems on behalf of the Western Australian Department of Fisheries and Western Australian Fishing Industry Council (WAFIC). The expected outcome of this 2007 ERA was to provide transparent and confident classification of risks associated with the activities of the Western Rock Lobster fishery, and to identify management strategies to control risk where necessary. One of the moderate risks to a by-catch species was subject to further assessment under a Level 2 ERAEF analysis, which yielded further information to characterise risk and propose management actions

Selection of the assessment method

Prior to embarking on re-assessment of the fishery, E-Systems recommended a review of the possible ERA approaches that could be used to obtain explicit assessment outcomes and meet the requirements of MSC re-certification. A requirement of any ERA approach selected for this project was to ensure consistency with the Australian/New Zealand Standard for risk management (AS/NZS 4360 2004). Substantial effort had been previously undertaken in the 2005 ERA (Dept Fisheries 2005), and reviewed with a view to identify shortcomings and opportunities for improvement (Burgman 2005). A clear objective of re-assessment was to elicit more confident judgements of risk.

[1] Refer to the MSC website: http://www.msc.org/html/content_1277.htm, accessed 15 May 2007.

The proposition of re-assessing the fishery, addressing the necessary improvements identified by Burgman (2005) and SCS (2006a) was investigated. Selection of the ERA assessment method was subject to consultation with the Department of Fisheries, WAFIC and CSIRO Marine and Atmospheric Research.

ERAEF Methodology

The direct use of the intensive ERAEF methodology was considered, where a qualitative and highly structured Delphi method could be undertaken to determine which, if any, of the hazards from the 2005 ERA would require assessment using the ERAEF methodology. Background on the ERAEF methodology and the rationale for the adopted method is presented here.

The ERAEF methodology is a hierarchical approach, which proceeds through four stages of analysis:

- Scoping;
- An expert judgement-based Level 1 analysis described as 'Scale, Intensity and Consequence Analysis' (SICA);
- An empirically-based Level 2 analysis described as 'Productivity-Susceptibility Analysis' (PSA); and
- A deterministic model-based Level 3 analysis.

The hierarchical approach provides a way of screening hazards, with increasing time and attention paid only to those hazards that are not eliminated as 'acceptably low risk' at lower levels in the analysis. Risk management responses may be considered at any level in the hierarchy to eliminate hazards or reduce risk.

A review of the 2005 ERA noted that some 27 hazards received a risk ranking of 'moderate' or higher by at least one of up to 13 'voting' experts who participated in the workshop. The advice of SCS was to subject the 27 hazards to a Level 2 Productivity-Susceptibility Analysis (PSA) under the ERAEF methodology (inferring that 'moderate' or higher risks from the 2005 ERA are being taken to be similar to the medium, high or extreme risk levels defined in the ERAEF methodology).

It is noted that the Level 2 ERAEF methodology is currently described to address the potential ecological threats from activities related to the fishery being assessed. While external hazards are assessed at Level 1, Level 2 is not designed to consider hazards associated with threats external to the subject fishing activities (eg. recreational fishing impacts to the target species, introduction of diseases or pathogens in bait, climate change). As such, some of the 27 hazards identified in the 2005 ERA would not progress to Level 2 PSA assessment using the ERAEF methodology. The set of 27 hazards ranked as 'moderate' or above in the 2005 ERA was transparently categorised in the language of activities and ecological components of the ERAEF, to identify hazards that are relevant to continued Level 2 assessment for MSC certification under the ERAEF methodology. Of the 27 hazards, 15 were potential candidates for Level 2 ERAEF assessment as explained to stakeholders in November 2006.

The 15 potential hazards eligible for ERAEF Level 2 analysis are listed in Table 1, with reference to the 'hazard number' assigned in the 2005 ERA. Table 1 distinguishes between internal and external threats, and identifies the relevant ecological component for each hazard. These hazards were specifically considered in the subject ERA.

It is also noted from the hierarchical approach of the ERAEF that for medium, high or extreme risks identified from the Level 1 SICA assessment (substituted here by the outcomes of the 2005 ERA), that there are two possible responses: Level 2 PSA assessment; or a risk management response and re-assessment of the hazard, adopting the guidance contained in AS/NZS 4360 (2004). Consideration of risk management options early in a hierarchical risk assessment process is a common and recommended

practice, to eliminate or otherwise reduce the risk of hazards to an acceptable level, obviating the need for more rigorous risk analysis which does not in itself contribute to risk management. Remedial action is not, however, limited to high risk activities. It should not be precluded for less serious risks that cannot be classified with certainty, where appropriate remedial action may be recommended as a precautionary measure.

Table 1. Hazards from the 2005 ERA relevant to ERAEF Level 2 analysis.

2005 ERA Ref No.	Hazard identified in the 2005 ERA	Internal or external threat	Ecological component	Direct capture or other interaction
3	Efficiency changes	Internal	Target species	Direct capture
4	Mortality, productivity loss from handling	Internal	Target species	Direct capture
7	Octopus	Internal	By-catch species	Direct capture
8	Scalefish and sharks	Internal	By-catch species	Direct capture
10	Whales	Internal	TEP species	Direct capture
12	Sea lions	Internal	TEP species	Direct capture
14	Sea turtles	Internal	TEP species	Direct capture
19	Abrolhos ecosystem	Internal	Community	Direct capture
20	Leeuwin – Naturaliste	Internal	Community	Direct capture
21	Central west coast – shallow	Internal	Community	Direct capture
22	Central west coast – deep	Internal	Community	Direct capture
23	Kalbarri – Big Bank	Internal	Community	Direct capture
25	Benthic biota	Internal	Habitat	Direct capture
30	Marine issues – Abrolhos water quality	External	Community	Other interaction
32	Bait bands – Dusky whalers	Internal	By-catch species	Other interaction

Alternative methodology

In planning for an improved ERA to address the MSC conditions for re-certification in 2006, it was noted that the 2005 ERA had been reviewed and a number of weaknesses in the adopted workshop process had been identified (Burgman 2005). It was observed that the risk analysis conducted in the 2005 ERA was frustrated by a wide range of expert judgment, leading to extraordinary variations in the level of risk expressed for each hazard (Dept Fisheries 2005). For example, two of the hazards assessed were judged to vary from 'low' to 'extreme', with up to 12 experts choosing risk levels across the entire scale of risk. A contributing factor for this result was a lack of sufficient time and organisation of technical documents available to inform experts. Such a result is interpreted as an example of incertitude and perhaps frustration on the part of the workshop participants, where personal beliefs and values were (understandably) likely to dominate judgements in the absence of adequate technical information and a clearly articulated assessment process.

It was reported by the Department of Fisheries that there had been a number of management actions implemented since the 2005 ERA, which were relevant to many of the 15 hazards eligible for re-assessment. In view of the opportunity to gain an improved understanding of risk with an improved ERA process and full consideration of recently adopted management measures, E-Systems recommended a highly structured approach for a follow-up ERA that would address the previous shortcomings. The objective of this April 2007 ERA was to prepare for and undertake more confident risk analysis, before committing to an intensive and perhaps unnecessary Level 2 ERAEF analysis for all of the 15 hazards which were candidates for re-assessment.

A workshop procedure was developed in consultation with the CSIRO scientists involved in the development of the ERAEF methodology (E-Systems 2005), and proposed to SCS (as the certifying body) as an intermediate step to gain an improved understanding of ecological risk before proceeding to the Level 2 ERAEF analysis. It was agreed by the Department of Fisheries and the Western Australian Fishing Industry Council (WAFIC) to adopt this alternative approach, with the aim of carrying any hazards still assessed as 'moderate' risk or above in this 2007 ERA to the Level 2 ERAEF analysis.

The Workshop Procedure was distributed widely to all stakeholders in November 2006 whilst canvassing the availability of independent experts for proposed workshop dates. Based on the availability of technical experts and stakeholders, numerous technical documents were distributed on CD-ROM six weeks prior to the workshop date (2-3 April 2007), and made available to all stakeholders on the WAFIC website four weeks in advance of the workshop.

The Western Australian Rock Lobster fishery[2]

Target species

The Western Rock Lobster occurs off the western coast of Australia, with the post-larval stages inhabiting the continental shelf from 1 to 200 meters in depth. The highest densities occur in waters less than 60 m in depth (Kailola et al. 1993).

The species, *Panulirus cygnus*, is a spiny lobster with long antennae. The anterodorsal aspect of the carapace bears 2 distinct, smooth supraorbital spines and behind them are 2 rows of 4–8 smaller spines. Each abdominal segment has a transverse groove. The older juveniles and adult lobsters (except 'whites') assume a reddish-purple colour with each moult. The carapace is uniformly coloured without obvious spots and markings, although the abdomen is spotted dorsally and laterally. Each walking leg has a broad, pale longitudinal stripe on its dorsal surface.

Life history

The life cycle of the western rock lobster includes a long (approximately nine month) oceanic larval phase during which mortality is especially high during El Niño events. Hatching of eggs occurs in summer (mostly December and January) on the outer continental shelf. The larvae disperse up to 1500 km offshore spending the better part of the year in the South-eastern Indian Ocean. The larvae then return to the continental shelf from about July onwards and metamorphose into the final 'puerulus' larval stage which moves onshore and settles in shallow reefs in less than 30m of water (Kailola et al. 1993; Phillips and Pearce 1997). Juveniles remain on shallow coastal reefs for three to six years before recruiting to the fishery (Philips et al. 1991).

Adults mate between July and December and females carry the spermatophores until eggs are spawned between August and January. Depending upon the female's size, 100 000 to 1 million eggs are spawned. These eggs are carried on the underside of the female's abdomen until hatched, which may take up to ten weeks depending on the water temperature.

The size at which lobsters reach sexual maturity has been assessed only for females and varies with location and growth rate. Generally females are sexually mature at approximately five to six years of age, when their carapace length measures 90–95 mm. The sex ratio is usually 1:1.

Growth rates vary considerably along the coast. In general, pueruli settle at approximately 8 mm carapace length. One year after settlement, juveniles are about 2.5 cm in carapace length. Studies have

[2] Reproduced from SCS 2006b, and Dept Fisheries 2005.

shown three-year-old juvenile lobsters of 3.9 to 5.5 cm carapace length, four-year-olds between 5.6 and 6.8 cm carapace length, and five-year-old and older animals with a carapace length greater than 6.9 cm.

P. cygnus are omnivorous and feed at night. Their diet changes according to moult stage, season and habitat. Post-moult lobsters prefer epiphytic coralline algae (eg. *Corallina* species, *Metagonolithon* species) and inter-moult forms prefer molluscan items. Adults eat similar but larger food to that of juveniles (eg. epiphytic coralline algae, molluscs, small crustaceans, polychaete worms and sipunculids).

Predators include, but are not limited to, reef fish, sharks and octopus (*Octopus* species).

Fishery description

The commercial fishery for western rock lobster is the most valuable single species wild capture fishery in Australia (worth between $A200 and $A400 million annually) and usually represents about 20 percent of the total value of Australia's fisheries.

This fishery also supports a significant recreational fishery with about 42 000 rock lobster licenses issued in 2005/06 and around 80 percent of these licenses used to catch 200 to 400 tonnes (approximately two to four percent of the total commercial and recreational catch). The license entitles fishers to use two pots and/or dive for rock lobster and keep up to eight lobsters per day.

As one of the first managed fisheries in Western Australia, data have been kept on the Western Australia rock lobster fishery since the early 1900s. The rock lobster fishery was declared limited entry in March 1963 when license and pot numbers were frozen. Since 1963, boat numbers have declined from 836 to 491 (as of January 2007). The commercial catch has varied between 8 000 and 14 500 t over the last 20 years mostly due to natural fluctuations in annual recruitment. The settlement of puerulus (one year old lobsters) is used to predict recruitment levels, and therefore catches three to four years ahead.

The current management package employs several measures to pursue the legislative objectives, at the heart of which is resource sustainability. The rock lobster management package is widely recognized as meeting this objective, but the extent to which some other fisheries management objectives are pursued has been a matter of debate. An overall cap on effort, a Total Allowable Effort (TAE), is imposed by limiting the capacity of the fishery to a total number of usable pots. Relatively liberal transferability provisions allow market forces to determine the most efficient use of licenses and available entitlement (pots). This system of management is known as an Individually Transferable Effort (ITE) system.

Western rock lobsters are distributed from Augusta on the South coast of Western Australia up to Exmouth, north of Shark Bay (Figure 1). The fishery is divided into three access zones. This distributes effort across the fishery, rather than permitting the fleet to concentrate effort on areas of seasonally high productivity, thereby avoiding higher than acceptable exploitation rates. Zonal management also enables management controls aimed at addressing zone specific issues. For example, there are currently different maximum size restrictions in the northern and southern regions of the fishery. A form of zonal management known as "closed areas" has been used in a number of instances. Rottnest and Quobba Point are closed to commercial fishing, and there are Fish Habitat Fish Protection Areas at Cottesloe, Yallingup and Lancelin Island. Other closed areas exist under the Marine Park management system administered by the Department of Environment and Conservation (DEC) (formerly known as the Department for Conservation and Land Management, or CALM).

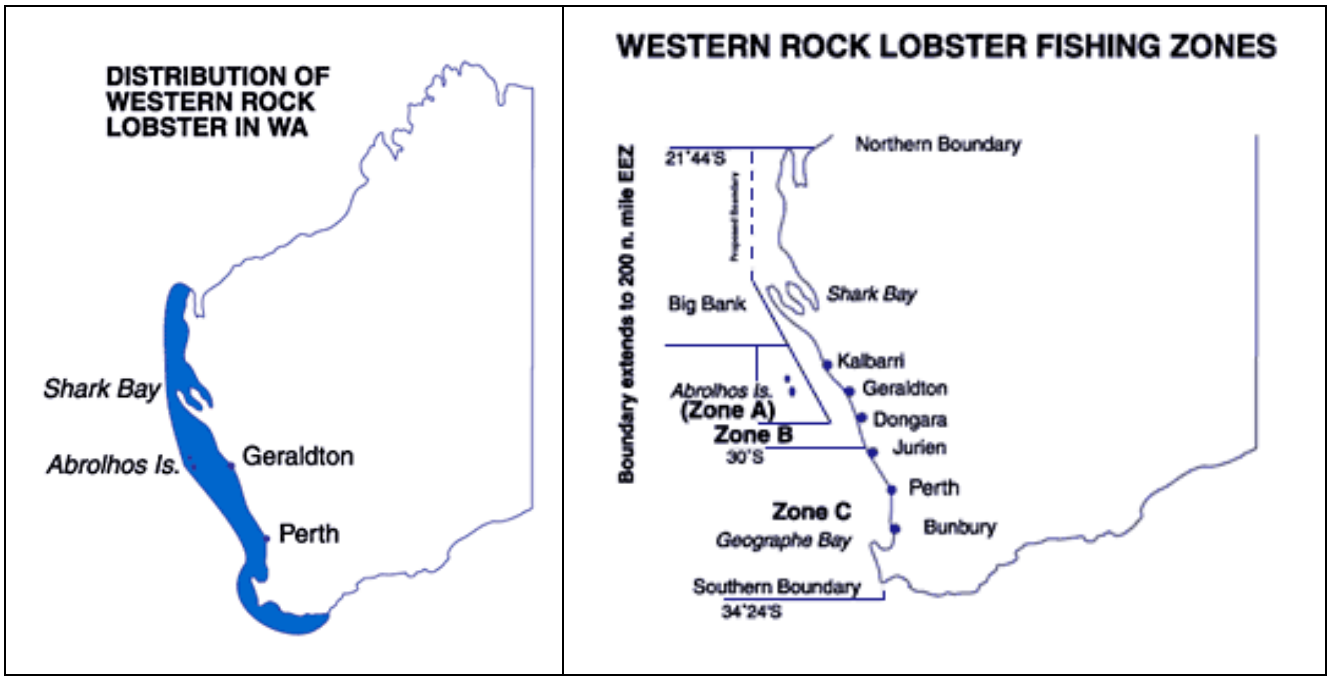

Figure 1. Distribution of Western rock lobster and lobster fishing zones in Western Australia.

Other management tools of note are those of a biological nature. Specifically, harvesting excludes females in breeding condition, and animals outside the limits of minimum and maximum carapace length. Gear restrictions that constrain the design and construction of the pots, including the requirement for escape gaps, also play a significant role in controlling exploitation rates.

Other resources for information regarding the management for the Western rock lobster fishery may be found at:

Western Australian Department of Fisheries	http://www.fish.wa.gov.au/sec/com/fisheries/WCRockLobster.php?0206, accessed 15 May 2007.
Western Australian Fishing Industry Council Inc.	http://www.wafic.org.au/fishing_industry/management.phtml, accessed 15 May 2007.
Western Rock Lobster Council	http://www.rocklobsterwa.com/, accessed 15 May 2007.
Western Rock Lobster Development Association	http://www.western-rock-lobster.com/index.htm, accessed 15 May 2007.

Fisheries management legislation

The Government of Western Australia operates under the Westminster system in which the responsible Minister makes executive decisions. Insofar as the administration of fisheries in Western Australia is concerned, the relevant executive decision maker is the Minister for Fisheries. The Department of Fisheries is established under the *Public Sector Management Act 1994* and is the department principally responsible for assisting the Minister for Fisheries in administering the following acts:

- *Fish Resources Management Act 1994 (FRMA)*;

- *Pearling Act 1990*;
- *Fisheries Adjustment Schemes Act 1987*;
- *Fishing and Related Industries Compensation (Marine Reserves) Act 1997*; and
- *Fishing Industry Promotion Training and Management Levy Act 1994*.

Up-to-date versions of these acts can be accessed online at the Department of Fisheries website, at www.fish.wa.gov.au. Of particular relevance to the management of fish resources is the *Fish Resources Management Act 1994* (FRMA). Section 3 of the FRMA establishes that:

> *The objects of the Act are to conserve, develop and share the fish resources of the State for the benefit of present and future generations.*

The fish resources that fall under the jurisdiction of the FRMA are described in an agreement between the Commonwealth and State Governments—the Offshore Constitutional Settlement. This agreement and explanation of it is contained within *Fisheries Management Paper No.77, Offshore Constitutional Settlement 199*5. Under the FRMA, there is a division of power between the Minister for Fisheries and the statutory office of the Executive Director of the Department of Fisheries. In broad terms, the Minister for Fisheries establishes the legal and policy framework for fisheries management, while the Executive Director (and staff) carries out the day-to-day administration of these frameworks.

Advice to the Minister

To assist the Minister for Fisheries in managing the State's fish resources, the FRMA makes provision, under Part 4, for the establishment of Advisory Committees. For the Western Australia rock lobster fishery resource the relevant advisory committee is the Rock Lobster Industry Advisory Committee (RLIAC). However, the Minister is not limited to seeking advice only from RLIAC and can, for example, seek advice directly from stakeholders, the Department of Fisheries or Parliamentary colleagues.

RLIAC is one of three statutory advisory committees established under the FRMA. The FRMA specifically and explicitly establishes RLIAC's composition (including the chairperson), functions, constitution and proceedings.

Section 29 of the FRMA specifies that there are 14 membership positions on RLIAC comprising of an independent chairperson, the Executive Director, commercial rock lobster fishers, a recreational rock lobster fisher and processing/marketers of rock lobster. In addition to the formal membership, RLIAC has a number of permanent observers who participate in the process at the direction of the Chairperson. Representatives from the Conservation Council of Western Australia and the Western Rock Lobster Council (a recently formed group of fishers seeking to give special attention to the oversight of the lobster fishery) are permanent observers while a senior member of the Minister's staff also attends meetings.

Section 30 of the FRMA states that:

> *(1) The functions of the Advisory Committee [RLIAC] are—*
>
> *a. to identify issues that affect rock lobster fishing;*
>
> *b. to advise the Minister on matters relating to the management, protection and development of rock lobster fisheries; and*
>
> *c. to advise the Minister on matters relating to rock lobster fisheries on which the advice of the Advisory Committee is sought by the Minister.*
>
> *(2) The Advisory Committee [RLIAC] may do all things necessary or convenient to be done for or in connection with the performance of its functions.*

To provide additional non-legislative guidance for the operation of RLIAC, and other advisory committees, the Minister for Fisheries issued *Fisheries Management Guide No.3, A guide for Management and Ministerial Advisory Committees (MACs) and the conduct of meetings issued by the Minister for Fisheries*, as published in January 2003 by the Department of Fisheries. This Guide covers all critical operational aspects for advisory committees such as RLIAC. For example, the guide covers the role of members and observers, procedural matters, disclosure of interests and executive support for advisory committees.

In a manner consistent with Fisheries Management Guide No. 3, RLIAC has established a number of sub-committees to assist it. Collectively these subcommittees cover strategic management, cost recovery finance, stock sustainability research and development, compliance and marketing issues.

In addition to its longstanding sub-committees, RLIAC recently established two Scientific Reference Groups (SRGs) responsible for ensuring that RLIAC is provided with advice on how to ensure the western rock lobster resource is managed in a manner that is consistent with the principles of ecosystem based management (EBM). These include an SRG on the effects of lobster fishing on ecosystem functions, and an SRG on the effects of lobster fishing on Sea Lions in or adjacent to fishing areas.

All these subordinates of RLIAC have compositions and terms of reference set down by RLIAC and each subordinate reports directly to RLIAC and operates in a manner that is consistent with Fisheries Management Guide No. 3.

Traditionally, the focus of management, and therefore consultative processes, has been the commercial sector. However, the management and RLIAC processes have evolved to more explicitly recognize and include other stakeholders—in particular the recreational and conservation sectors—through including formal observers to RLIAC meetings, as well as discussing the inclusion of additional members with ecological expertise.

Discussion with stakeholders occurs through a variety of forums, but regular and well-known features of the RLIAC process include the annual coastal tour and stakeholder meetings held three to four times in a twelve-month period. The coastal tour (spanning a number of days) is a forum with rock lobster stakeholders, including conservation representation, coordinated and organized by RLIAC. The tour is open to the public and held in October each year and visits three major rock lobster ports between Fremantle and Geraldton. This forum is widely recognized by rock lobster stakeholders as a mechanism for receiving the most up-to-date scientific advice on the status of the fishery within an ESD framework and discussing new and ongoing management issues in the context of the three-year planning process. Background material and the program for the upcoming coastal tour can be viewed and downloaded from www.fish.wa.gov.au around late-September each year.

In recent years, RLIAC's consultation and communication with stakeholders has been further enhanced by conducting half day 'stakeholder meetings' prior to a meeting of RLIAC itself. Held quarterly, these stakeholder meetings provide regular opportunities for all rock lobster stakeholders to have direct input into the RLIAC process throughout the year.

RLIAC communication and engagement with stakeholders on the assessment of the annual technical report is through a variety of media:

- RLIAC News, published quarterly;
- www.rocklobsterwa.com;
- Scheduled RLIAC meetings;
- Scheduled Joint Stakeholder meetings;
- Annual RLIAC coastal tour and accompanying background documentation and reports; and
- RLIAC Executive Officer.

One of the purposes of these communication and consultation processes is to ensure stakeholders and the community more generally have access to relevant information, reports and advice that shape the advice RLIAC provides to the Minister. For example, reports from the Scientific Reference Groups are available through a variety of means. By making information available and by providing for a discussion and exchange of ideas, RLIAC encourages input from stakeholders and the community into the management process.

Management powers

As the primary and statutory source of advice on all matters relevant to the management of the Western rock lobster resource and use of it, RLIAC has an extensive network of expert advisers across its various subordinate committees, reference groups and processes that also provide broader opportunities for RLIAC to engage directly with stakeholders.

As the recipient of much advice from RLIAC on management issues, the Minister requires legislative power to turn knowledge and advice into action. Parts 5 and 6 of the FRMA deal with the general regulation of fisheries through the use of orders and regulations and the specific management of fisheries via the declaration or amendment of fisheries management plans. Principally, the Minister for Fisheries manages the western rock lobster resource by exercising powers provided under Parts 5 and 6 of the FRMA on the advice of the RLIAC. The administration of these arrangements becomes the responsibility of the Executive Director and the Department of Fisheries more generally.

For the Western rock lobster resource there is a fisheries management plan determined by the Minister for Fisheries that limits the right to fish commercially for Western rock lobster to those who hold an appropriate license issued only by the Executive Director. The management plan establishes the area and sub-areas (zones) of the fishery, the capacity, permissible gear type, open and closed seasons, and rules for transferring licenses or parts of licenses. The management plan can be viewed online at www.fish.wa.gov.au.

In addition to the management plan there are orders determined by the Minister that (amongst other things) manage access to special areas within the overall boundaries of the fishery. For example there is an order that generally prohibits commercial fishing in waters immediately surrounding Rottnest Island off the Perth metropolitan coast.

To complement the management plan and various orders there is a body of regulations approved by the Minister and determined by the Governor that apply specifically to Western rock lobsters. In particular these regulations deal with the specifics of the sizes of lobsters that cannot be taken, the protection of lobsters in breeding condition, the dimensions of approved rock lobster fishing gear, bait types that cannot be used, and the requirement to hold a recreational fishing license to fish recreationally for Western rock lobster. A process is currently underway to make the collection of orders and regulations available online.

To assist RLIAC and its subordinate committees and reference groups in developing management advice for the Minister, a fisheries management 'decision rules framework' for the Western rock lobster fishery has been developed.

Sources of management funding

The costs of managing (including conducting research for management of) the Western Australia Rock Lobster Fishery are met from a variety of sources, including in particular significant contributions each financial year from the:

- West Coast Rock Lobster industry through an established cost recovery process;
- State government;

- Fisheries Research and Development Corporation;
- Industry Development Unit; and
- Development and Better Interests Fund.

Consultation and workshop participants

A consultative and inclusive process was developed for the 2007 ERA, to ensure that all stakeholders were given early access to the workshop procedure (Stoklosa 2006) and the technical documents that were assembled to underpin the assessment of the hazards that were assessed. Substantial effort was made to seek nominations for a cross-section of experts who could provide high quality analysis of technical documentation and perform a qualitative risk analysis.

A Stakeholder Working Group and a Technical Panel of subject matter experts were proposed for the ERA workshop. The Stakeholder Working Group comprised a wide range of stakeholders.

Persons having management roles and non-technical officers of organisations were recognised as non-participating observers within the Stakeholder Working Group. The rationale for making this distinction was to enable a free exchange of technical views in the workshop, without real or perceived pressures for subordinates of management officers to adopt a particular technical position.

The workshop organiser and facilitator was Richard Stoklosa of E-Systems, on behalf of the Department of Fisheries and WAFIC. Preparation and conduct of the workshop was strictly guided by the workshop procedure distributed to all stakeholders in November 2006 (Stoklosa 2006).

The composition and roles of the Stakeholder Working Group and the Technical Panel are elaborated below. Stakeholders were notified of the workshop date (2-3 April 2007) six weeks in advance.

Stakeholder Working Group

A Stakeholder Working Group was invited by WAFIC to participate in the ERA workshop, including those involved in the previous 2005 ERA and others identified as having an interest in the proceedings. Stakeholders included individuals, organisations, companies, government agencies and research scientists having an interest and/or technical expertise. WAFIC identified a list of stakeholders who have expressed an interest in the MSC certification process for the WRL fishery, so that nominated participants could be informed of preparations for the workshop and be invited to attend.

The Stakeholder Working Group received summary information from the 2005 ERA and the proposed workshop procedure (Stoklosa 2006), with updated information on technical documents and management actions that were considered in the 2007 ERA to re-assess risk. There was an opportunity for any member of the Stakeholder Working Group to propose other published information to WAFIC for review by all participants prior to the workshop.

The number of 'observers' (non-participating management officers and non-technical officers) invited to the workshop was limited, to allow for efficient consideration of technical issues by participants, whilst ensuring that all stakeholder views were appropriately represented. However, special efforts were made to invite non-participating observers from special interest groups and SCS.

The Stakeholder Working Group was given the opportunity to review and discuss new technical information that had become available since the 2005 ERA, and previously available information that may not have been given full consideration in the 2005 ERA.

Stakeholders represented the Department of Fisheries, Department of Environment and Conservation, WAFIC, Western Rock Lobster Council, and the RLIAC. Some stakeholders attending the workshop expressed disappointment that non-government organisations declined invitations or were otherwise unavailable, in view of early notification of the workshop date and prior indications of their availability.

Technical Panel

A Technical Panel was convened for the 2007 ERA with the support of a range of stakeholders, as a subset of the Stakeholder Working Group. The Technical Panel encompassed a range of scientific disciplines relevant to the fishery assessment, with a balanced representation of government, industry, non-government organisation and independent conservation specialists.

Although there is no formula to obtain a 'perfect' mix of expert representation, the goal was to represent the range of stakeholder interests with persons who demonstrate recognised experience and qualifications in the subject matter, and have the capacity to provide high quality technical expertise for risk analysis. Stakeholders were given the opportunity to nominate appropriately qualified scientists for participation in the Technical Panel. Non-government organisations declined to nominate experts to the Technical Panel during the four months preceding the 2007 ERA; however, the names of eminently qualified persons nominated to the Technical Panel were communicated to all stakeholders far in advance of the workshop.

The persons serving on the Technical Panel were:

Dr. Russ Babcock	Leader, Coastal Systems and Biodiversity CSIRO Marine and Atmospheric Research, Brisbane
Dr. Colin Buxton	Director, Tasmanian Aquaculture and Fisheries Institute University of Tasmania
Dr. Nick Caputi	Supervising Scientist, Invertebrates Western Australian Department of Fisheries
Dr. Rob Harcourt	Director of Marine Science, Marine Mammal Research Group Macquarie University, Sydney
Dr. Neil Loneragan	Director, Centre for Fish and Fisheries Research Murdoch University, Perth
Dr. Chris Simpson	Program Leader, Marine Science Program Western Australian Department of Environment and Conservation

The Technical Panel's role in the workshop was to participate in the discussion of the 15 hazards identified in the 2005 ERA, and to re-assess the risk level for these hazards under existing circumstances and fisheries management controls. Re-assessment was based on full consideration of published technical information and the management actions formally adopted by the WRL fishery or committed to by the government.

The Technical Panel also re-assessed the treated risk level for new or alternative management actions that were suggested by the Stakeholder Working Group. The re-assessment of treated risk was an important feature of the 2007 ERA—to identify potential risk management responses that might reduce risk to low levels, prior to embarking on a more sophisticated Level 2 PSA assessment under the ERAEF methodology.

ERA workshop proceedings

A workshop agenda was distributed to all participants and is presented in Attachment 1. All persons attending the workshop were invited to introduce themselves and area of expertise or interest. The agenda and workshop procedure (Stoklosa 2006) was reviewed and adopted by all participants, noting that the agenda would be flexible to accommodate the time availability of participants with specific expertise over the two day period. A full list of participants and observers who were present on the workshop dates is presented in Attachment 2.

The starting point for the workshop was the information contained in the 2005 ERA and the substantial set of background documents that were provided to the Technical Panel and one non-government organisation expressing their interest in attending (WWF), six weeks prior to the workshop date. The background documents were posted on the WAFIC website four weeks prior to the workshop date as announced to all stakeholders. An inventory of the background documents is presented in Attachment 3 for reference. Although information and hazards identified in the 2005 ERA were the starting point for the subject workshop, there was no attempt made to reconcile or compare workshop results because the present ERA was organised and structured differently to overcome stated difficulties and limitations of the earlier effort (Burgman 2005).

During the workshop, the recording of workshop proceedings in a structured risk assessment template was digitally projected, to enable all workshop participants to observe the information that was captured from the discussions. All participants had the opportunity to clarify the technical record during the workshop to ensure accuracy.

Clarification of risk analysis criteria

Consequence and likelihood definitions

The qualitative descriptions of consequence and likelihood categories for the risk analysis were largely adopted for the workshop procedure (Stoklosa 2006), to ensure that the interpretation of the risk levels were consistent with the 2005 ERA. However, it was essential for workshop participants to engage in a detailed discussion of the consequence and likelihood definitions to ensure that they were stated in clear and unambiguous terms.

Separate consequence category definitions were proposed in the workshop procedure for each ecological component: target species, by-catch species, TEP species, habitat, and community.

Substantial discussion of the consequence and likelihood category definitions for each of the ecological components occurred, to enable a common understanding of their meanings for stakeholders and the Technical Panellists. At the request of workshop participants, the author of the source document for these definitions (Fletcher et al. 2002) presented an update of the use of the consequence and likelihood criteria, and contributed to the discussion. A number of fishing interaction scenarios were postulated and discussed, to scrutinise the definitions and exercise the group's understanding of their application.

Following this lengthy review, some minor changes were suggested to clarify two of the consequence category definitions for community-level hazards. All of the other definitions were adopted by the workshop participants for risk analysis. The clarifications to the consequence and likelihood tables were distributed to all participants before proceeding to the assessment of hazards on the workshop agenda. The consequence tables are reproduced here as Table 2 through Table 6 for each ecological component, incorporating the clarification to community categories (Table 6), otherwise un-changed from the workshop procedure (Stoklosa 2006). The likelihood table is reproduced as Table 7.

Table 2. Consequence categories for target species.

Category	Rating	Description of consequences to target species
Negligible	0	Insignificant impacts to populations. Unlikely to be measurable against background variability for this population.
Minor	1	Possibly detectable, but minimal or acceptable impact on population size and none on dynamics.
Moderate	2	Full exploitation rate, but long-term recruitment/dynamics not adversely impacted.
Severe	3	Affecting recruitment levels of stocks, or their capacity to increase.
Major	4	Likely to cause local extinctions, if continued in longer term. Probably requiring listing of species in an appropriate category of the endangered species list (eg IUCN category).
Catastrophic	5	Local extinctions are imminent/immediate.

Table 3. Consequence categories for by-catch and by-product species.

Category	Rating	Description of consequences to by-catch and by-product species
Negligible	0	Area where fishing occurs is negligible compared to where the relevant stock of the species resides (eg less than one percent).
Minor	1	Take in this fishery is small (less than ten percent), compared to the total take by all fisheries. The risks to these species are covered explicitly elsewhere by management prescriptions and/or legislation.
Moderate	2	Relative area of, or susceptibility to capture is suspected to be less than 50 percent, and species do not have vulnerable life history traits.
Severe	3	No information is available on the relative area or susceptibility to capture, or on the vulnerability of life history traits of this species. Relative levels of capture/susceptibility are suspected or known to be greater than 50 percent, and species should be examined explicitly.
Major	4	Once a consequence exceeds the 'severe' category, it should be examined using Table 2.
Catastrophic	5	Once a consequence exceeds the 'severe' category, it should be examined using Table 2.

Table 4. Consequence categories for TEP species.

Category	Rating	Description of consequences to TEP species
Negligible	0	Almost none are impacted.
Minor	1	Some are impacted, but there is no impact on stock.
Moderate	2	Levels of impact are at the maximum acceptable level.
Severe	3	Once a consequence exceeds the 'moderate' category, it should be examined using Table 2.
Major	4	Once a consequence exceeds the 'moderate' category, it should be examined using Table 2.
Catastrophic	5	Once a consequence exceeds the 'moderate' category, it should be examined using Table 2.

Table 5. Consequence categories for habitats.

Category	Rating	Description of consequences to habitats
Negligible	0	Insignificant impacts to habitat or populations, probably not measurable. Activity only occurs in very small areas of the habitat, or the impact on the habitats from the activity is unlikely to be measurable against background variability. *(For example, activities that affect <<1% of habitat area, or if operating on a larger area, have virtually no direct impact)*
Minor	1	Measurable impacts on habitats, but these are very localised compared to local habitat area. *(For example, impacts affecting <5% of the habitat area)*
Moderate	2	There are likely to be more widespread impacts on the habitat, but the levels are still acceptable given the area affected, the types of impact occurring, and the recovery capacity of the habitat. *(For example, impact on non-fragile habitats may be up to 50%—but for more fragile habitats, the percentage area affected may need to be <20%, and for critical habitats <5%)*
Severe	3	The level of impact on habitats may be larger than is sensible to ensure that the habitat will not be able to recover adequately, or it will result in substantial loss of function. *(For example, the activity makes a significant impact in the area affected, and >25-50% of habitat is being affected—for critical habitats <10%)*
Major	4	Habitat is affected which may endanger its long-term survival and result in severe changes to ecosystem function. *(For example, it may equate to 70-90% of the habitat being affected or removed by the activity—for more fragile habitats >30%, and for critical habitats 10-20%)*
Catastrophic	5	Effectively the entire habitat is in danger of being affected or removed in a major way. *(For example, >90% of the habitat area being affected—for fragile habitats >50%, and for critical habitats >30%)*

Table 6. Consequence categories for communities (from 'ecosystem/trophic levels' consequence table in 2005 ERA).

Category	Rating	Description of consequences to ecological communities
Negligible	0	General consequences: Insignificant impacts on habitat or populations, unlikely to be measurable against background variability. Ecosystem consequences: Interactions may be occurring, but it is unlikely that there would be any change outside of natural variation.
Minor	1	Ecosystem consequences: Only minor changes in the relative abundance of other constituents. No change in function (captured species do not play a keystone role).
Moderate	2	Ecosystem consequences: Measurable (moderate) changes to ecosystem components without there being a major change in function (eg no loss of components).
Severe	3	Ecosystem consequences: Ecosystem function altered measurably and some function or components are locally missing/declining/increasing outside of historical range, and/or have allowed/facilitated the appearance of new species. Recovery measured in years.
Major	4	Ecosystem consequences: A major change to ecosystem structure and function (eg different dynamics now occur with different species/groups now the major targets of capture). Recovery measured in years to decades.
Catastrophic	5	Ecosystem consequences: Total collapse of ecosystem processes. Recovery period may be greater than decades.

Table 7. Likelihood categories for risk analysis.

Category	Rating	Description
Remote	1	Never heard of, but not impossible.
Rare	2	May occur in exceptional circumstances.
Unlikely	3	Uncommon, but has been known to occur elsewhere.
Possible	4	Some evidence to suggest this is possible here.
Occasional	5	May occur.
Likely	6	Expected to occur.

Risk classification

Using the reference panel judgments of consequence and likelihood categories, the risk is ranked as the product of the two ratings, as illustrated in the risk matrix in Figure 1. The risk matrix is used to rank risk in one of five levels, consistent with the adopted ESD Reporting Framework (Fletcher et al. 2002).

Although the risk matrix depicts a 'risk score' of zero to 30, it is based on a strictly qualitative risk analysis. The risk scores are used as a convenient means of classifying risk in five levels (negligible to extreme), but should not be interpreted in quantitative terms. An explanation of the required management response and reporting requirements for each risk level is summarized in Table 8.

		Consequence category					
		Negligible (0)	Minor (1)	Moderate (2)	Severe (3)	Major (4)	Catastrophic (5)
Likelihood category	Remote (1)	0	1	2	3	4	5
	Rare (2)	0	2	4	6	8	10
	Unlikely (3)	0	3	6	9	12	15
	Possible (4)	0	4	8	12	16	20
	Occasional (5)	0	5	10	15	20	25
	Likely (6)	0	6	12	18	24	30

Figure 1. Risk classification matrix.

Table 8. Risk rankings and expected action.

Risk ranking	Qualitative risk score	Management response	Reporting requirements
Negligible	0	None required.	Short justification only.
Low	1–6	No specific response required.	Full justification needed.
Moderate	7–12	Specific management needed.	Full performance report.
High	13–18	Possible increases to management activities needed.	Full performance report.
Extreme	>18	Likely additional management activities needed.	Full performance report.

Hazard description

Each hazard previously identified in the 2005 ERA was re-assessed based on a thorough review and discussion of technical documents and any commitments to risk management measures. After risk assessments of the WRL fishery in 2002 and 2005, it was expected that a comprehensive identification of hazards had been completed. Workshop participants were given an opportunity to nominate any new hazards not previously considered, and ultimately endorsed the list of 15 hazards on the workshop agenda (Table 1) without suggesting further hazards for consideration.

A member of the Technical Panel or Stakeholder Working Group was invited to introduce each hazard and familiarise themselves with all of its associated technical documentation. Each hazard was introduced to enable all participants to discuss the circumstances and applicable management regime. The person nominated to introduce each hazard was noted on the workshop agenda (Attachment 1). In the case of the benthic habitat hazard (2005 ERA Hazard No. 25), Dr Chris Simpson of the Western Australian Department of Environment and Conservation prepared and distributed a proposed approach for considering habitat values for risk analysis, which was discussed and adopted by workshop participants (presented in Attachment 4).

To augment the introduction of the hazards on the workshop agenda, WAFIC read aloud two e-mail comments from WWF and DEH representatives who did not attend the workshop, so that the group would be informed of the technical issues raised by these stakeholders in absentia. As such, the two issues raised were not overlooked in the workshop discussions. However, the widely distributed workshop procedure required the active participation of stakeholders present at the workshop to transparently debate the issues in a structured assessment framework. Written submissions were not put on the record by the facilitator, to avoid marginalising stakeholders who did not object to the workshop procedure, and who might have otherwise made written submissions.

Risk assessment

Following the introduction of each hazard and clarification of the causes and effects of the interaction, an 'interaction scenario' was discussed by workshop participants and recorded in the risk assessment template. Existing risk management controls were identified for each hazard to assist with the risk analysis part of the assessment. The completed risk assessment record for all hazards considered in the ERA is presented in Attachment 5. Only the Technical Panel contributed to the judgments made in the risk analysis, with input from the Stakeholder Working Group.

Some of the 15 hazards were assessed at more than one level, to distinguish between shallow and deep interactions (Hazard No. 23: Kalbarri–Big Bank community), or different TEP species (Hazard No. 10: Southern Right Whale, Humpback Whale). In the case of benthic biota (Hazard No. 25), eight different interaction scenarios were identified, based on the type of sea floor habitat and water depth (shallow, deep). These distinctions were made to ensure that the risk analysis focused on very specific interactions rather than attempting to make judgments about broad scenario descriptions that could be interpreted different ways.

Risk analysis

The risk analysis undertaken for each hazard scenario utilised the consequence categories defined in Table 2 through Table 6 and the likelihood categories defined in Table 7. It relied on expert judgment, in this case the Technical Panel, to make qualitative estimates of the consequences of a hazard for the ecological component identified in the interaction scenario, and the likelihood of those consequences eventuating. Judgments were based on expert knowledge, technical documentation and data.

The Technical Panel was instructed by the facilitator to seek consensus in their judgments of consequences and likelihood whenever possible, without losing any individual differences of opinion. It

was made clear that the range of judgments of Technical Panellists would be recorded in the event that consensus could not be achieved.

Although the Delphi technique for eliciting expert judgment was invented with consensus in mind, a number of sources of disagreement and incertitude appear to have compromised this intent in the 2005 ERA. In the case of this 2007 ERA, consensus was achieved in the risk analysis of all hazards.

Four elements of the approach appeared to be necessary to achieve consensus:

1. The organisation and early distribution of technical documents;

2. The rigorous and structured risk assessment procedure that was developed in consultation with CSIRO and widely distributed to workshop participants well in advance;

3. The effort spent at the start of this workshop to review and clarify risk analysis definitions, avoiding semantic disagreement; and

4. The substantial workshop time dedicated to informed debate and technical understanding.

One hazard (2005 ERA Hazard No. 3) was judged to have an imprecise likelihood ('unlikely' to 'rare', as shown in Attachment 5); however, this was a consensus judgment based on inadequate data and not a difference of opinion among Technical Panellists.

Of the 15 hazards assessed, the four hazards listed in Table 9 were ranked 'moderate' risk (refer to Attachment 5). All of the other hazards were analysed and classified as 'low' or 'negligible' risk by the Technical Panel under existing management controls.

Table 9. Hazards ranked moderate risk, based on existing management controls.

Hazard No.	Hazard description	Ecological component	Risk ranking (existing controls)	Reason for moderate risk
3	Efficiency changes	Target species	Moderate to low	Acknowledged uncertainty in the estimates of industry efficiency gains.
22	Central west coast, deep	Community	Moderate	Paucity of data from deep water.
23	Kalbarri–Big Bank, deep	Community	Moderate	Paucity of data from deep water.
32	Bait bands: Dusky whalers	By-catch species	Moderate	Age of Dusky whaler maturity is older than previously thought, and reporting is not systematic. The critical component of the stock is the adult population.

The record of the risk analysis, detailing the existing risk management responses for each hazard, the consequence and likelihood ratings, and the risk ranking for existing management controls is presented in Attachment 5.

Risk treatment

For interactions which resulted in higher levels of risk, particularly for moderate risk as there were no 'high' or 'extreme' risks identified in the workshop, participants were asked to identify planned commitments for remedial action, or suggest new risk treatment measures which might reduce the consequences and/or likelihood rating. These are recorded in Attachment 5 for each hazard.

Suggested risk treatment measures (beyond those already planned) are recorded as important advice to WAFIC and the Department of Fisheries for consideration, but may not necessarily be adopted by the fishing industry or government to manage risk in the WRL fishery. The risk analysis was nevertheless repeated to show the 'treated risk' by the Technical Panel, as a reflection of the residual level of risk if the risk treatment measures were in fact adopted.

In the case of the four hazards ranked moderate risk under existing management controls, risk treatment was shown to reduce the risk ranking of some of the hazards, as summarised in Table 10.

Table 10. Results of suggested risk treatment for hazards ranked moderate risk.

Hazard No.	Hazard description	Ecological component	Planned or suggested remedial action	Risk ranking (treated risk)	Remarks
3	Efficiency changes	Target species	Contemplating offsetting efficiency gains with effort reductions. Improve the estimate of the efficiency gains in the fishery.	Low	Opinion expressed that no specific new management response is needed—ongoing management is appropriate for mitigating this hazard.
22	Central west coast, deep	Community	Planned workshop in August 2007 with international experts and the WRL Ecological Scientific Reference Group, to review deepwater research, and to develop ongoing project proposals including the possible use of fished and unfished areas. WA Marine Science Institution (WAMSI) projects. Research to begin informing management decisions, beginning about 2008 (as expressed in MSC timetable).	(not re-assessed)	Moderate risk under existing management controls.
23	Kalbarri–Big Bank, deep	Community	Same as for Central west coast, deep.	(not re-assessed)	Moderate risk under existing management controls.
32	Bait bands: Dusky whalers	By-catch species	Zero tolerance of bait bands by the rock lobster fishery.	No risk	Suggested elimination of bait bands eliminates hazard.

Risk management

Risk management of the WRL fishery involves standardised fishing practices and fishing gear, industry standards and codes of practice, legislation, and research and monitoring of management effectiveness. The MSC Principles and Criteria for Sustainable Fishing set out the standards for the certification program.

MSC Principle 2 for sustainable fishing states:

> *Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.*

The assessment of the WRL fishery by the certifying body (SCS 2006b) identified some cases where scores for meeting specific criteria under MSC Principle 2 were below the minimum score of 80 for the WRL fishery (on a maximum scale of 100). There are three assessment criteria that have been addressed by this ERA for managing risk (numbered as per the SCS assessment criteria established for the WRL fishery):

> *2.1.4.1 The impacts of the fishery on ecosystem structure, function, biological diversity, productivity, and habitat structure are within acceptable levels of impact and there has been an assessment of risks.*
>
> *2.1.4.2 Management objectives and fishing practices are set in terms of impact identification and avoidance/reduction.*
>
> *2.2.1.4 The impacts of the fishery on protected, endangered, threatened, or icon species do not exceed acceptable levels.*

The first two assessment criteria (2.1.4.1 and 2.1.4.2) have been addressed through the process of conducting the subject ERA and the results of the assessment, as documented in this report. The limitations and weaknesses of the previous ERAs conducted for this fishery have been reviewed and remediated in this 2007 ERA. The ERA procedure was subject to consultation with CSIRO Marine and Atmospheric Research[3], incorporating helpful suggestions, and provided to stakeholders well in advance of the workshop. The workshop facilitator consulted with virtually all of the workshop participants, Technical Panellists, and a WWF representative prior to the workshop, to review the workshop procedure and discuss questions posed by stakeholders.

The third assessment criteria (2.2.1.4) has been addressed by the analysis contained in the ERA, and in the case of sea lion interactions reflects the required use of sea lion exclusion devices (SLEDs). The fishery has committed to performance monitoring of SLEDs to confirm their effectiveness, as noted in the record of the workshop (Attachment 5). Planned effectiveness monitoring includes underwater video observation of SLED performance, ongoing studies to delineate the foraging range and water depth of vulnerable juveniles, and compliance monitoring of the use of SLEDs within the identified SLED management zone. These commitments and the assessment of risk also address SCS assessment criteria 2.2.2.1, regarding the fishery's management practices to avoid impacts to TEP species.

Discussion of ERA workshop results

All but four of the hazards assessed in the ERA were ranked as 'negligible' or 'low' risk. The four hazards ranked 'moderate' risk (Table 9) were re-assessed with consideration for risk treatment measures documented in the workshop record (Table 10).

Negligible and low risk hazards under existing management controls

Eleven of the 15 hazards on the ERA agenda were ranked 'negligible' or 'low'. Notwithstanding the 'low' risk ranking, planned commitments for remedial action were noted for some of these hazards, most notably Hazard No. 12, avoidance of Sea lion interactions with rock lobster pots through the mandatory use of SLEDs. Commitments for monitoring the performance of SLEDs, and ongoing studies to delineate the range and depth of foraging juvenilles are documented in the record of the workshop (Attachment 5).

[3] Dr Alistair Hobday, CSIRO Marine and Atmospheric Research, personal communication, September–November 2006.

Some additional suggestions for managing the risks to whales and sea turtles (TEP species), even though these were ranked 'low' risk, were recorded as advice to the Department of Fisheries and WAFIC (refer to Hazard Nos. 10 and 14, respectively).

Ongoing performance monitoring of the fishery should confirm that these risks remain negligible to low. In the event that circumstances of the fishery change or performance monitoring detects an unexpected change, these hazards should be re-assessed.

Moderate risk hazards under existing management controls

Hazard No. 3, Efficiency changes

The potential risk to the target species is considered to be 'low', if efficiency gains are offset with effort reductions. Alternatively, improved estimates of the efficiency gains in the fishery may provide information to allow experts to rank this a 'low' risk without further mitigation.

The Technical Panel and Stakeholder Working Group expressed the opinion that no specific new management response is needed. Ongoing management is considered appropriate for mitigating this hazard.

Recommendation 1:	No further risk assessment of fishery efficiency gains to the target species is recommended at the present time, pending a commitment of WRL fishery managers to improve estimates of efficiency gains and take them into account in the management of the fishery. An ERAEF Level 2 assessment would not be expected to add value to the management of this hazard, as it would not provide any additional information that might change the recommended action.

Hazard Nos. 22 and 23, Central west coast and Kalbarri–Big Bank, deep

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 (EcoSRG) has made investigations into deep water 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 EcoSRG. 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 deep water 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 EcoSRG 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.

Hazard No. 32, Bait bands, Dusky whalers

The risk to the Dusky whaler shark (*Carcharhinus obscurus*, originally described as *Squalus obscurus* LeSueur, 1818), a by-catch species, relates to their high age at maturity and low fecundity. Females reach maturity at about 30 years of age. The critical component of the stock is the adult population, with the potential for rapid decline as a result of exposure to a number of commercial fishing activities (eg. bait bands, demersal gillnets, demersal longlines), and illegal fishing activities. It has been estimated that a one to two percent annual mortality rate from fishing activities, applied to Dusky whaler sharks over ten years of age, makes the species vulnerable to decline in Western Australia (McAuley et al. 2007). The one to two percent annual mortality rate, from all sources, represents a small number of mature adult animals.

The view expressed by the Technical Panel was that the exploitation of the fishery is not consistent with the scientific belief that the population is at risk of collapse as a result of adult mortalities. The only suggested remedial action was to eliminate bait bands from fishing vessels, with a zero tolerance of bait bands by the WRL fishery. If this was to occur, the hazard from the WRL fishery would be eliminated.

Interactions with other legal and illegal fishing activities beyond the scope of this ERA are being addressed through a number of new regulations (eg. commercial protection, maximum size limits, improved demersal gillnet/longline effort controls, gear restrictions, area closure).

To better characterise the threat of bait bands to the Dusky whaler shark, a Level 2 PSA analysis was undertaken by E-Systems subsequent to the ERA workshop, with assistance from specialists at the WA Department of Fisheries and CSIRO Marine and Atmospheric Research, Hobart.

ERAEF Level 2 PSA for the Dusky whaler shark

Under the ERAEF methodology (Hobday et al. 2007), all by-catch species would normally be considered in a Level 2 PSA analysis. However, it is not considered necessary to undertake an ERAEF Level 2 assessment for all by-catch species in the fished area, as no other by-catch species were identified as 'moderate' or higher risk under existing management controls.

Productivity attributes

A Level 2 PSA analysis was undertaken for only the Dusky whaler, using the species productivity attributes listed in Table 11. The seven attributes selected for the Level 2 PSA analysis are considered to be representative of species productivity and supported by scientific evidence.

Table 11. Productivity attributes and scores for the Dusky whaler shark. The score can range from 1 (high productivity) to 3 (low productivity). Allocation of the score is based on the data, and reference to the categories for low/medium/high productivity from Hobday et al. 2007.

Productivity attribute type	Data for Dusky whaler shark (*C. obscurus*)	Score	Source
Age at maturity – minimum, female	27 years	3	McAuley et al. (2005, 2007).
Maximum age – maximum, female	55 years	3	McAuley et al. (2005, 2007).
Fecundity	4-6 offspring per breeding female (every second or third year)	3	McAuley et al. (2005, 2007).
Maximum size – maximum, female	422 cm	3	Derived by R. McAuley, WA Department of Fisheries (personal communication) using length regression, 95% L_∞, referring to von Bertalanffy growth curve parameters.
Size at maturity – minimum, female	292 cm	3	McAuley et al. (2005, 2007).
Reproductive strategy	Live birth	3	McAuley et al. (2005, 2007).
Trophic level	3.73	3	Fishbase.
Productivity total score		**3.00**	Using methods and spreadsheets from Hobday et al. (2007).

It is notable that the productivity total score is the maximum of the productivity scoring range of 1.00 to 3.00. The productivity score of 3.00 for the Dusky whaler means that it is considered to be on the least productive limit of the scale. Low productivity species are the most vulnerable to sustainability of the stock because they are the least resilient to by-catch mortality. The productivity analysis is consistent with the scientific view that the Dusky whaler has one of the lowest population growth rates among shark (McAuley et al. 2005, 2007), and that its exploitation should be conducted with extreme caution and under close monitoring (http://www.fao.org/fi/website/FIRetrieveAction.do?dom=species&fid=2811, accessed 19 October 2007).

Susceptibility to bait band entanglement

Dusky whaler susceptibility to entanglement in bait bands was assessed with respect to:

- 'Availability', or the overlap of the Western Rock Lobster fishery with the spatial distribution of the Western Australian population of the Dusky shark;
- The 'encounterability' of the species with bait bands—that is, the likelihood that individuals will encounter bait bands within the area of their geographic range;
- The 'selectivity' of bait bands to entangle Dusky sharks, based on the size of bait bands with respect to the size of individuals encountering bait bands; and
- The likelihood of post-entanglement mortality.

The susceptibility of the Dusky whaler to entanglement with bait bands is summarised in Table 12.

The number of bait bands estimated to be loaded onto vessels targeting Western Rock Lobster is based on an average of 10 million kilograms (10,000 tonnes) of bait used per annum. Bait is packed in 20 kg cartons, having an average of two bait bands securing each carton. Two bait bands per carton yields an estimate of 1 million bait bands per annum. It was noted in the 2007 ERA Workshop that about one percent of all bait bands loaded onto fishing vessels are lost at sea, and it could be estimated that less than ten percent of those are in an 'uncut' condition (still forming a ring that could entrap animals). These figures predict that about 1,000 uncut bait bands are lost at sea each year. It is not known how many Dusky whalers interact with bait bands, or what percentage survives interaction.

This is a State fishery, and therefore the susceptibility analysis of the Dusky whaler to the hazard of bait bands that may be associated with their use in the Western Rock Lobster fishery is considered only with respect to the Western Australian population of the Dusky whaler. The Western Australian population is highly migratory, but limited in range to the Western coastal region of Australia at depths up to 200m near the edge of the continental shelf (Esperance to Cape Leveque). The Western population evidently does not interact with populations of the species found in other (Eastern) regions of Australian waters or elsewhere (R. McAuley, Department of Fisheries, personal communication, 2007).

Table 12. Susceptibility scores for the Western population of the Dusky whaler shark, with respect to bait band entanglement. The score can range from 1 (low susceptibility) to 3 (high susceptibility). Allocation of the score is based on the data, and reference to the categories for low/medium/high productivity from Hobday et al. 2007.

Susceptibility to bait band entanglement	Susceptibility data	Score	Source
Availability	Range overlap = 0.18 (within overlap range of 0.10 to 0.30 for an availability score of '2')	2	R. Brown, WA Dept of Fisheries (personal communication, 2007). Based on total Wester Rock Lobster commercial fishing zones (66,000 square kilometres), compared to the geographic distribution of the Western population of the Dusky whaler (370,500 square kilometres) – as calculated by GIS specialists.
Encounterability	Score based on adult habitat of species distributed throughout the depth range of fishery operations (0-400m). Generally considered a demersal species, but migrates vertically (probably in response to prey availability).	3	Hobday et al. (2007) for worldwide distribution of Dusky whaler. Confirmed by R. McAuley for Western population of Dusky whaler (personal communication, 2007).
	No data available to test a proposition that entanglement occurs near the surface, due to attraction of species to bait bands with discarded bait.		If Dusky sharks only encountered bait bands at shallow depth (<110m), the bathymetry-based score would be reduced to perhaps '2' (R. McAuley, personal communication, 2007).
Selectivity	Bait band diameter of 35 to 41 cm used as a proxy for 'mesh size', which is compared to the average size at maturity of 273 cm (for species >2 times mesh size, the selectivity score is '3')	3	Bait band diameter estimated by R. Brown, WA Dept of Fisheries (personal communication, 2007). Based on measurements of bait bands supplied with bait sourced from New Zealand. Average size at maturity from McAuley et al. (2005, 2007).
Post-capture mortality	In the absence of data, the post-capture mortality of all species is assigned a score of '3'.	3	Hobday et al. (2007).
			It is estimated that about 1,000 uncut bait bands are lost in the Western Rock Lobster fishery each year. However, relatively few mortalities of marine species are recorded. If 2/3 of all species which 'encounter' bait bands survive, then the post-capture mortality score would be reduced to '1'.
Selectivity total score		**2.33**	Using methods and spreadsheets from Hobday et al. (2007).

PSA graphs

The result of the Level 2 PSA for the Dusky whaler shark is shown in Figure 2. This result is taken from Tables 11 and 12 (productivity=3.00, susceptibility=2.33). The shaded arrow in Figure 2 shows the general direction of increasing risk (increasing susceptibility and decreasing productivity corresponds to increasing risk). Further consultation with stakeholders would be needed to agree on an accepted segmentation of risk levels in the PSA graph, but is not considered necessary for the assessment of this single by-catch species.

Although discrete low/medium/high risk levels have not been endorsed, it is clear that the productivity of the Dusky whaler is at the very 'low' end of the scale, and the susceptibility to bait bands is at the upper end of the scale.

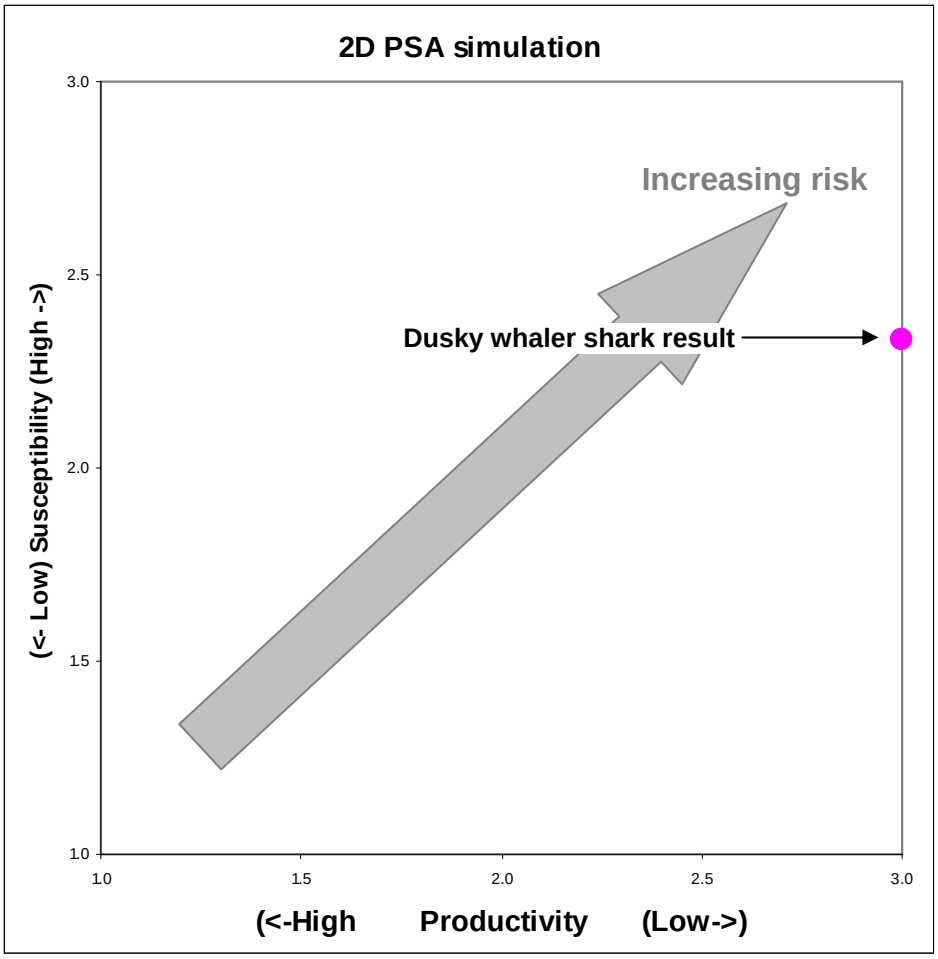

Figure 2. PSA result for bait band hazards to the Dusky whaler shark as a by-catch species (using methods and tools developed by Hobday et al. 2007).

Management of the species as an exploited fishery (excluding adults), or management of bait bands to prevent mortality due to entanglement does not change the productivity score of 3.00 in this analysis. However, the default values of susceptibility scores that were based on the lack of data allow us to consider the sensitivity analysis shown in Figure 3. The three points shown below the 'Dusky whaler shark result' show how the PSA result changes, if we can justify lower scores for encounterability and post-capture mortality.

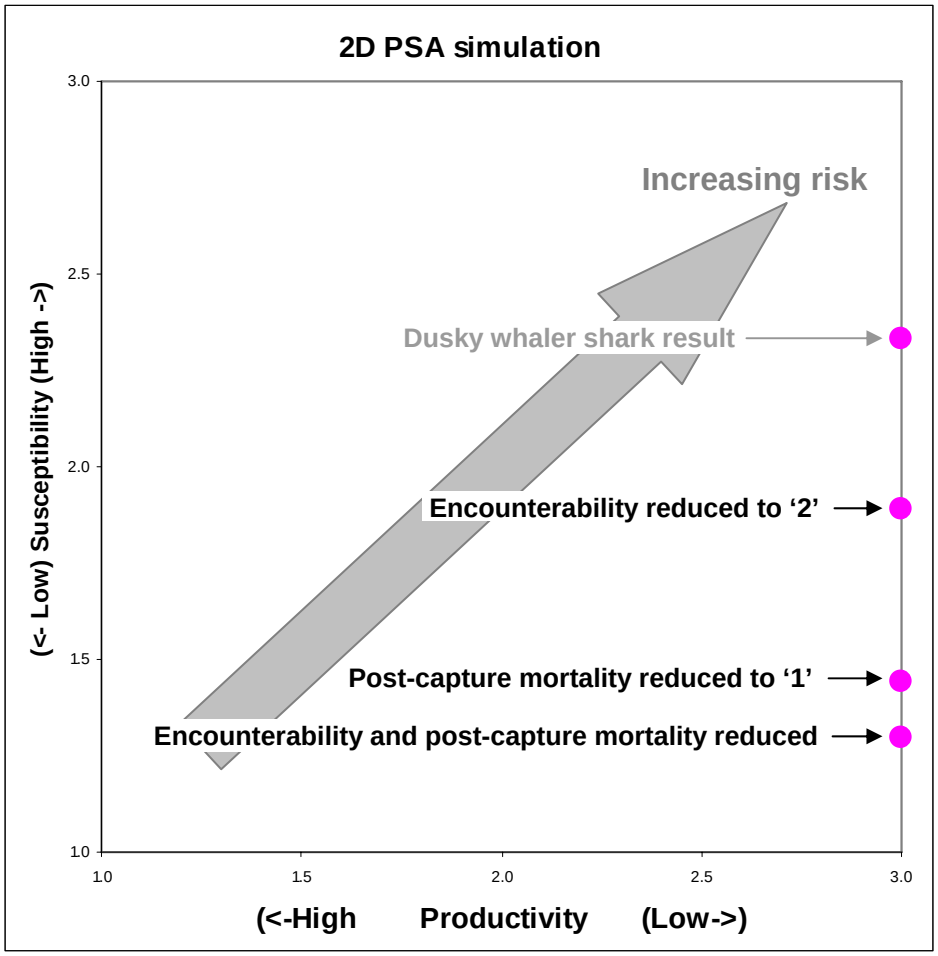

Figure 3. Sensitivity analysis of the PSA result, if lower encounterability and post-capture mortality scores can be justified (using methods and tools developed by Hobday et al. 2007).

Even if lower encounterability and post-capture mortality scores can be justified, the PSA results point to the sustainability of this by-catch species as being particularly vulnerable to increased mortality.

Discussion of ERAEF Level 2 PSA results

It is not known whether the Western Rock Lobster fishery is the source of the bait bands which have been reported to entangle Dusky whalers, although the fishery is implicated as the biggest user of bait bands with around 1 million taken aboard vessels on cartons of bait each year, and an estimated 1,000 uncut bait bands lost at sea. A Bait Band Code of Conduct exists to make fishery workers aware of the hazard of bait bands to marine species. Mortality of Dusky whalers from bait band entanglement has not been reported by the fishing industry in the last couple of years. It cannot be determined *a priori* whether this represents a decline in the reporting rate or a reduction in the number of entanglements. In any event, such reports would be likely to represent a fraction of animals that had been recently entangled.

This Level 2 PSA analysis has not considered the potential impact to stocks of Dusky whaler shark due to its exploitation by commercial longline and demersal gillnet fisheries targeting this species in Western Australia, as the impact of other fisheries was beyond the scope of this 2007 ERA. Although smaller animals are captured and retained by the shark fisheries, reduction in stocks leads to fewer animals reaching maturity (at least 17 years for males and 27 years for females).

McAuley et al. (2005) have assessed the stocks of the Dusky whaler shark, and arrived at the conclusion:

> *'…the rates of age-specific fishing mortality experienced by sharks released as neonates in 1994 and 1995 were probably sustainable, as long as there was negligible additional fishing mortality (less than 1-2% yr^{-1}) outside the demersal gillnet and longline fisheries. The lower estimate of the sustainable level of external fishing mortality is in keeping with recent analyses of dusky shark CPUE data from the demersal gillnet and longline fisheries, which indicate that the breeding stock of dusky sharks has been in decline for some years and is leading to a reduction in recruitment.'*

It is not known if the potential entanglement of Dusky whaler shark in bait bands is resulting in additional mortality to the species of 1-2% per year; or if the combined effect from Western Rock Lobster fishing activities, recreational fishing activities, illegal fishing activities, and variations in natural mortality rates is resulting in an unsustainable additional mortality. This could be assessed with a Level 3 ERAEF approach using deterministic modelling techniques; however, a Level 3 approach is considered a less desirable alternative to the recommendations below.

Recommendation 3:	No further risk assessment of bait band entrapment hazards to the by-catch species *Carcharhinus obscurus* (Dusky whaler shark) is recommended in the short term.

Recommendation 4:	Alternatives to bait bands, to avoid the use of materials that can entangle *C. obscurus* and other by-catch species, should be investigated as a matter of improving environmental management of the Western Rock Lobster fishery. If the bait band hazard is eliminated, no other specific actions would need to be taken by the Western Rock Lobster fishery to avoid impacts to this species.

Recommendation 5:	If bait bands continue to be taken to sea by the Western Rock Lobster fishery, on-going stock assessments of *C. obscurus* should consider the threat of mortality due to bait band interactions, and investigate methods for collecting data to monitor any increased mortality with a high level of confidence.

Conclusion

The ERA undertaken on 2-3 April 2007 resulted in the outcomes documented in the risk assessment workshop record presented here as Attachment 5. All of the 15 hazards on the agenda were assessed using a consultative and structured workshop procedure, addressing the requirements of SCS as the certifying body for MSC re-certification of the fishery. Consensus was reached on the expert judgements of the Technical Panel in this qualitative ERA.

Eleven of the 15 hazards were ranked 'low' or 'negligible' risk under present circumstances. Ongoing performance monitoring of the fishery and management controls should be used to confirm that the risk rankings do not increase.

The ERA of the Western Rock Lobster fishery revealed four 'moderate' risks. One of these moderate risks was subjected to an ERAEF Level 2 PSA to further characterise risk to a by-catch species. Risk management actions are in progress or have been suggested for each of the moderate risks. The suggested risk management actions are documented for consideration by the Western Australian Department of Fisheries and WAFIC.

The potential mortality of *Carcharhinus obscurus* (Dusky whaler shark) from bait bands taken to sea on rock lobster fishing vessels represents a moderate risk that cannot be managed—only eliminated by prohibiting bait bands from vessels, or developing an alternative bait band that cannot harm marine animals. In the event that fisheries managers do not adopt this prevention strategy, the interaction of *C. obscurus* with bait bands should be monitored as part of on-going stock assessments to contribute to the sustainability of this species.

It is important to note that the interaction of bait bands with *C. obscurus* can be attributed to a number of fisheries which utilise bait bands aboard vessels, not solely the Western Rock Lobster fishery. If this risk is considered unacceptable, management actions to reduce or eliminate the exposure of marine fauna to bait bands should apply to all users of the marine environment.

References

AS/NZS 4360 (2004). *Risk Management*, Standards Australia/Standards New Zealand.

Burgman, M. (2005). *MSC Workshop for the Western Rock Lobster fishery stakeholders—Summary report for the Western Australian Fishing Industry Council, 24 November 2005, Fremantle* (University of Melbourne).

Fletcher, W.J., J. Chesson, M Fisher, K.J. Sainsbury, T. Hundloe, A. Smith and B. Whitworth (2002). *National ESD reporting framework for Australian fisheries: The 'how to' guide for wild capture fisheries.* FRDC Project 2000/145, Canberra.

Hobday, A.J., A. Smith, H. Webb, R. Daley, S. Wayte, C. Bulman, J. Dowdney, A. Williams, M. Sporcic, J. Dambacher, M. Fuller, and T. Walker (2007). *Ecological Risk Assessment for the Effects of Fishing: Methodology*, Report R04/1072 for the Australian Fisheries Management Authority, Canberra (CSIRO Marine and Atmospheric Research: Hobart, Tasmania, Australia.).

Kailoloa, P.J., M.J. Williams, P.C. Stewart, R.E. Reichelt, A. McNee, and C. Grieve (1993). *Australian Fisheries Resources*, Bureau of Resource Sciences, Department of Primary Industries and Energy, and Fisheries Research and Development Corporation, Canberra.

McAuley, R., R. Lenanton, J. Chidlow, R. Allison, and E. Heist (2005). *Biology and stock assessment of the thickskin (sandbar) shark,* Carcharhinus plumbeus*, in Western Australia and further refinement of the dusky shark,* Carcharhinus obscurus*, stock assessment*, Final FRDC Report – Project 2000/134, Fisheries Research Report No. 151, Department of Fisheries, Western Australia, 132p.

McAuley, R.B., C.A. Simpfendorfer, and N.G. Hall (2007). *A method for evaluating the impacts of fishing mortality and stochastic influences on the demography of two long-lived shark stocks*, ICES Journal of Marine Science (64).

Phillips, B.F. and A.C. Pearce (1997). *Spiny lobster recruitment off Western Australia*, Bulletin of Marine Science (61): 21-41.

Phillips, B.F. et al. (1991). *The Leeuwin Current: an Influence on the Coastal Climate and Marine Life of Western Australia*, Roy. Soc. of Western Australia, Perth.

Scientific Certification Systems (2006a). *Western rock lobster fishery, Compliance report on final Corrective Action Requests from 2005 MSC final surveillance report*, 28 February 2006.
Available at http://www.msc.org/assets/docs/WARL/WRL_FinalCARs_28Feb06.pdf, accessed 15 May 2007.

Scientific Certification Systems (2006b). *MSC Assessment, The Western Australia Rock Lobster Fishery*, Final Report, 12 December 2006.
Available at http://www.msc.org/assets/docs/WARL/WRLreass_FinalPubCertRep.pdf, accessed 15 May 2007.

Stoklosa, R. (2003). *Review of CSIRO Risk Assessment Methodology: Ecological Risk Assessment for the Effects of Fishing*, E-Systems Pty Ltd, Hobart, in Hobday, A., A. Smith and I. Stobutski 2004, *Ecological Risk Assessment for Australian Commonwealth Fisheries, Final Report Stage 1, Hazard Identification and Preliminary Risk Assessment*, Australian Fisheries Management Authority, Report No. R01/0934 (CSIRO Marine Research, Hobart).
Available at http://www.afma.gov.au/environment/eco_based/eras/docs/era_report_only.pdf, accessed 15 May 2007.

Stoklosa, R. (2006). *Ecological Risk Assessment Western Rock Lobster Fishery—Re-assessment of Hazards from the 2005 ERA for AFMA/CSIRO ERAEF Level 2 Analysis*, Rev. 0, unpublished specification prepared for the Western Australian Fishing Industry Council, November 2006 (E-Systems Pty Limited, Hobart).

Western Australian Department of Fisheries (2005). *Western Rock Lobster Fishery Ecological Risk Assessment 2005 Report*, Fisheries Management Paper No. 203, Perth (University of Melbourne).

Attachment 1

Agenda

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Agenda

Date	2-3 April 2007
Location	Western Australian Fisheries and Marine Research Laboratories Conference Room 3, 1st Floor 39 Northside Drive Hillarys, Western Australia (08) 9203-0111
Facilitator	Richard Stoklosa, E-Systems
Purpose	**Ecological Risk Assessment of the Western Rock Lobster Fishery,** **Re-assessment of 2005 ERA Hazards Ranked 'Moderate' and Above**

Monday, 2 April

09:00	Welcome and introductions	Richard Stoklosa
09:10	Opening remarks by WAFIC	
09:15	Adoption of workshop agenda and procedure	Richard Stoklosa
09:40	Clarification of consequence/likelihood scoring criteria	Stakeholders
10:30	Morning tea	
10:45	Hazard No. 3 – Efficiency changes (target species)	Intro by Nick Caputi
11:30	Hazard No. 4 – Leg loss from handling (target species)	Intro by John Fitzhardinge
12:00	Hazard No. 32 – Bait bands—Dusky whalers (bycatch species)	Intro by Rory McAuley
12:00	Hazard No. 8 – Scalefish and sharks (bycatch species)	Intro by Steve Newman
12:30	Lunch break	
13:15	Hazard No. 14 – Sea turtles (TEP species)	Intro by Bob Prince
13:40	Hazard No. 12 – Sea lions (TEP species)	Intro by Lorraine Hitch
14:00	Hazard No. 10 – Whales (TEP species)	Intro by Doug Coughran
14:20	Hazard No. 21 – Central west coast, shallow (community)	Intro by Russ Babcock
15:00	Hazard No. 22 – Central west coast, deep (community)	Intro by Colin Buxton
15:30	Afternoon tea	
15:50	Hazard No. 23 – Kalbarri, Big Bank (community)	Intro by Neil Loneragan
16:20	Hazard No. 20 -- Leeuwin-Naturaliste (community)	Intro by Colin Buxton
17:00	Review workshop progress and conclude first day	Richard Stoklosa

Tuesday, 3 April

09:00	Review of agenda	Richard Stoklosa
09:10	Hazard No. 7 – Octopus (bycatch species)	Intro by Lindsay Joll
09:30	Hazard No. 19 – Abrolhos (community)	Intro by Richard Campbell
10:00	Hazard No. 30 – Marine water quality issues (community)	Intro by Alice Hurlbatt
10:30	Morning tea	
10:45	Hazard No. 25 – Benthic biota (habitat)	Intro by Chris Simpson
11:15	Quality assurance review of assessment	
11:40	Advice to WAFIC on MSC Conditions of Certification	
12:30	Lunch break	
13:15	Overview of AFMA/CSIRO ERAEF Methodology	Richard Stoklosa
13:45	Level 2 ecological risk assessment of community-level hazards	
14:30	Level 2 ecological risk assessment of habitat-level hazards	
15:15	Closing remarks by WAFIC	
15:30	Review forward plan and conclude workshop	Richard Stoklosa

Attachment 2

Workshop Participants

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Western Rock Lobster Ecological Risk Assessment
Workshop Participants, 2 April 2007

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Workshop Participants, 3 April 2007

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Attachment 3

Inventory of Technical Documents

Inventory of Technical Documents for April 2007 ERA (pdf files)

The first level of the inventory is the folder name (numbered sequentially, in bold typeface, by subject). Under each folder name is a list of technical documents available as pdf files.

01 Technical document references

1.1 Consolidated update of ERA references 14 December 2006

1.2 ERA references, 2005

1.3 Reference list for 2005 ERA

02 ESD audit report, EMS and progress reports

2.1 Summary of DEH and EMS documents

2.2 Final ESD audit report for DEH, March 2006

2.3 Western Rock Lobster EMS, Amended March 2005

2.4 Quarterly EMS progress report, February 2005

03 WAFIC action plans to meet conditions

3.1 WAFIC action plans to meet conditions of re-certification, Final November 2006

04 Handling undersize lobsters, escape

4.1 Summary of handling undersize lobsters documents

4.2 Leg loss from handling, escape gap research, December 2006

4.3 Handling undersize lobster education—RLIAC Newsletter, September 2006

05 Leeuwin-Naturaliste region reports, closures

5.1 Summary of Leeuwin-Naturaliste documents

5.2 Leeuwin-Naturaliste activity in the Capes region, May 2004

5.3 Web link to Capes closure notice

5.4 Rock lobster potting closures, gazetted November 2005

06 Abrolhos Islands reports

6.1 Abrolhos Islands fishery summary

6.2 Summary of Abrolhos Islands documents

6.3 Abrolhos Islands waste management strategy implementation, August 2006

6.4 Abrolhos Islands waste management coordinator's report, 2006

6.5 Abrolhos Islands visitor data—2002 through 2006

6.6 Abrolhos Islands habitat assessment, Volume 1, 2002

6.7 Abrolhos Islands habitat assessment, Volume 2, 2002

07 Fishing efficiency, stock assessment

7.1 Summary of fishing efficiency documents

7.2 Fishing efficiency changes, update December 2006

7.3 RLIAC fishing efficiency phone survey data, 2006

7.4 Terms of reference—stock assessment review, February 2006

08 West coast ecology reports

8.1 Summary of west coast ecology reports

8.2 Central west coast—shallow water ecology progress, update December 2006

8.3 FRDC R&D funding application, 2004

8.4a Deep water ecosystem project milestone progress report, February 2005

8.4b Deep water ecosystem project milestone progress report, June 2005

8.4c Deep water ecosystem project milestone progress report, December 2005

8.4d Deep water ecosystem project milestone progress report, September 2006

8.5 SRFME shallow water ecosystem research executive summary, 2005
(see also folder 11, SRFME Report and DIVE program)

8.6 Rottnest lobster productivity research

09 Threatened, Endangered and Protected (TEP) species reports

9.1 Summary of TEP species reports

9.2a Minister's press release regarding SLEDs, October 2006

9.2b SLED regulations, November 2006

9.2c RLIAC Newsletter—implementation of SLEDs, September 2006

9.2d SLED pamphlet, September 2006

9.2e SLED poster, 2006

9.3 Video monitoring of SLED performance—MSC response, September 2006

9.4 Sea lion movement project, November 2006

9.5 Whale entanglement avoidance DVD announcement, October 2006

9.6 WWF media release—Sea lion pups rescued by SLEDs, October 2006

9.7 Leatherback turtle paper and occurrence table

10 Bycatch species reports

10.1 Summary of bycatch species documents

10.2 Octopus bycatch update, 2006

10.3 Status report for shark fisheries, September 2005

10.4 Media release-new protection for sharks, rays and skates, November 2006

10.5 WAFIC action plan—bait handling and bait bands Code of Practise

11 SRFME Report and DIVE Program

11.1 SRFME interim report, 2005

11.2 SRFME DIVE Program folder

Attachment 4

Benthic Habitat Analysis

WESTERN ROCK LOBSTER FISHERY
ECOLOGICAL RISK ASSESSMENT WORKSHOP
2-3 April 2007

HAZARD NUMBER 25: BENTHIC HABITATS

APPROACH

1. **Identify dominant and critical benthic habitats in each 'bioregion'**
   See Table 1

2. **Identify potential direct threats of WRL fishery to benthic habitats**
   Potting, jet boats, moorings, waste disposal, litter, removal?, jetties

3. **Identify major threat/s based on biological intensity, spatial and temporal scales**
   Potting

4. **Identify sensitivity of different benthic habitats to WRL potting in each 'bioregion'**
   See Table 2

5. **Identify spatial and temporal overlap of WRL potting and benthic habitats in each 'bioregion'**
   See Table 3

6. **Apply consequence and likelihood criteria to determine risk in each 'bioregion'**
   Risk is the degree of spatial and/or temporal overlap of potting on sensitive habitats

TABLE 1: DOMINANT AND CRITICAL MARINE BENTHIC HABITATS OF THE WRL FISHERY

IMCRA Bioregion	Dominant habitats	Critical[1] Habitats
Abrolhos Islands	•Coral reef (subtidal) •Coral reef (intertidal) •Macroalgae-dominated limestone reef •Sand (unvegetated) •Mangrove	• Coral reef?
Central West Coast[2] (shallow: <30 m depth)	•Seagrass •Macroalgae-dominated limestone reef •Sand (unvegetated)	• Seagrass
Central West Coast (incl. Big Bank?) (deep: >30 m depth)	•Macroalgae-dominated limestone reef •Filter-feeder dominated reef? •Sand (unvegetated)	•Macroalgae-dominated limestone reef? •Filter-feeder dominated reef?
Leeuwin-Naturaliste[3]	•Seagrass •Macroalgae-dominated limestone reef •Macroalgae-dominated granite reef •Filter-feeder dominated reef? •Sand (unvegetated)	•Seagrass •Filter-feeder dominated reef?

[1] Critical = ecologically important (e.g. fish nursery area)
[2] Central West Coast: Kalbarri to Perth
[3] Leeuwin-Naturaliste: Perth to Windy Harbour including 'Capes' region

TABLE 2: SENSITIVITY OF MARINE BENTHIC HABITATS TO POTTING IMPACTS OF WRL FISHING (H= high; M= moderate; L= low)

IMCRA Bioregion	Dominant habitats		Critical[4] Habitats	
Abrolhos Islands	•Coral reef (subtidal) •Coral reef (intertidal) •Macroalgae-dominated limestone reef •Sand (unvegetated) •Mangrove	H H L L L	• Coral reef	H
Central West Coast[5] (shallow: <30 m depth)	•Seagrass •Macroalgae-dominated limestone reef •Sand (unvegetated)	M L L	• Seagrass	M
Central West Coast (Incl. Big Bank) (deep: >30 m depth)	•Macroalgae-dominated limestone reef •Filter-feeder dominated reef? •Sand (unvegetated)	L H? L	• Macroalgae-dominated limestone reef • Filter-feeder dominated reef?	L H
Leeuwin-Naturaliste[6]	•Seagrass •Macroalgae-dominated limestone reef •Macroalgae-dominated granite reef •Filter-feeder dominated reef? •Sand (unvegetated)	M L L H? L	• Seagrass • Filter-feeder dominated reef?	M H?

[4] Critical = ecologically important (e.g. fish nursery area)
[5] Central West Coast: Kalbarri to Perth
[6] Leeuwin-Naturaliste: Perth to Windy Harbour including 'Capes' region

TABLE 3: SPATIAL AND TEMPORAL OVERLAP OF POTTING IN RELATION TO MARINE BENTHIC HABITATS (H= high; M= moderate; L= low)

IMCRA Bioregion	Dominant habitats		Sensitive habitats		Critical[7] Habitats	
Abrolhos Islands	•Coral reef (subtidal) •Coral reef (intertidal) •Macroalgae-dominated limestone reef •Sand (unvegetated) •Mangrove	L L H L L	• Coral reef (subtidal) • Coral reef (intertidal)	L L	• Coral reef	L
Central West Coast[8] (shallow: <30 m depth)	•Seagrass •Macroalgae-dominated limestone reef •Sand (unvegetated)	L H L	• Seagrass	L	• Seagrass	L
Central West Coast (Incl. Big Bank) (deep: >30 m depth)	•Macroalgae-dominated limestone reef •Filter-feeder dominated reef? •Sand (unvegetated)	H M? L?	• Filter-feeder dominated reef?	L?	• Macroalgae-dominated limestone reef? • Filter-feeder dominated reef?	H M?
Leeuwin-Naturaliste[9]	•Seagrass •Macroalgae-dominated limestone reef •Macroalgae-dominated granite reef •Filter-feeder dominated reef? •Sand (unvegetated)	L L? L? M? L	• Seagrass • Filter-feeder dominated reef?	L M?	• Seagrass • Filter-feeder dominated reef?	L M?

[7] Critical = ecologically important (e.g. fish nursery area)
[8] Central West Coast: Kalbarri to Perth
[9] Leeuwin-Naturaliste: Perth to Windy Harbour including 'Capes' region

TABLE 4: CONSEQUENCE CATEGORIES FOR MARINE HABITAT TYPES[10]

Category	Rating	Description of consequence	Major	Sensitive	Critical
Negligible	0	Insignificant impacts to habitat, probably not measurable. Activity only occurs in very small areas of the habitat, or the impacts on the habitats from the activities unlikely to be measurable against background variability	<< 1	0	0
Minor	1	Measurable impacts on habitats, but these are very localized compared to habitat area	<5	0	0
Moderate	2	There are likely to be more widespread impacts on the habitat, but the levels are still acceptable given the area affected, the types of impact occurring, and the recovery capacity of the habitat	<50	<20	<5
Severe	3	The level of impact on habitats may be larger to ensure that the habitat will not be ale to recover adequately, or it will result in substantial loss of function	>50-70	.25-50	<10
Major	4	Habitat is affected which may endanger its long-term survival and result in severe changes to ecosystem function	>70-90	>30	>10
Catastrophic	5	Effectively the entire habitat is in danger of being affected or removed in a major way	>90	>50	>30

[10] Should consider EPA Benthic Primary Producer Guidelines

Attachment 5

ERA Workshop Record

Western Rock Lobster Ecological Risk Assessment, referring to hazards identified in the 2005 ERA
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2005 ERA Ref No.	Hazards identified in the 2005 ERA	Cause	Effect	Interaction scenario	Existing risk management responses	AFMA/CSIRO ERAEF Attributes			Existing risk			Planned commitments for remedial action (date to be implemented)	Suggested remedial action for consideration	Treated Risk			Remarks
						Internal or external threat	Ecological component	Direct capture or other interaction	Consequences	Likelihood	Risk Ranking			Consequences	Likelihood	Risk Ranking	
2005 ERA 'Group A'																	
3	Efficiency changes	Increase in the size of fishing vessels, fish-finding technology and fishing patterns.	Higher catch efficiency, local depletion of larger concentrations of the target species and breeding stock. Fishing of residual stocks inshore.	Reduction in breeding stock below a target level (below 1980's level of breeding stock)..	Depletion analysis to measure efficiency increase and exploitation rate on an annual basis, presented to management committee. Stock assessment review in 2007 (N Hall to complete April 2007, workshopped in July 2007 with international panel). Review of harvest strategy on breeding stock, exploitation rate. Eighteen percent of pots removed in 1993/94 season. In 2005/06 season, fifteen percent equivalent effort reduction in northern zone and five percent in southern areas. Management strategy overrides the potential consequences of	Internal	Target species	Direct capture	Severe	Unlikely to rare (reflects uncertainty in the efficiency change)	Moderate to low		Contemplating offsetting efficiency with effort reductions. Opinion expressed that no speciifc new management response is needed -- ongoing management is appropriate for mitigating this hazard. Improve the estimate of the efficiency gains in the fishery.	Severe	Rare	Low	
21	Central west coast - shallow	Change to population size structure and abundance	Possible change to community structure and function (predator/prey relationships). Possible loss of ecosystem resilience.	Loss of large animals from the shallow water environment leads to long term ecological consequences.	Deep water research project may reveal information on predator/prey relationships. Sanctuary zone study at Jurien Bay to look at community structure of lobsters in shallow water. Jurien Bay ecosystem study to model interactions of species in the community using tagging and tracking of lobsters and fish and diets. Trophodynamic modelling study to help understand the ecosystem effects of fishing (particularly lobsters). Fished versus unfished areas offer the best possibility of determining what effect reducing rock lobster abundance has on the community.	Internal	Community	Direct capture	Severe	Rare	Low						Shallow water 30 - 80% of fishery depending on location. Undersize in shallow water comprises a large proportion of the total population of lobsters in shallow water. Rock lobster important species in community, can have local depletion. Impact of removal of lobsters from shallow water likely to be small as approximately legal size move offshore as in the migration of the whites. Rottnest Island research indicates that further research on removal of lobsters from shallow water communities needs to be undertaken, in more representative areas of the fishery. Research in the 1980's at Dongara indicated they have an effect on benthic communities. Does not seem to be severe impact of removing lobsters by fishing. Three years of study has not revealed any obvious change in community structure relating to lobster fishing. The proportion of legal size rock lobster in shallow water is <10% of total shallow water rock lobster biomass. Risk analysis is based on preliminary findings of the research over the first three years.
22	Central west coast - deep	Capture has unknown trophic relationships with respect to migrating whites.	Changes to species relative abundance in the region.	No change from the opinions expressed in the 2005 ERA.	FRDC project to investigate deep water ecology. Marine Futures (NHT) project undertaking habitat mapping and biodiversity sampling at Abrolhos, Jurien, Rottnest and Capes areas.	Internal	Community	Direct capture	Moderate	Possible	Moderate	Planned workshop in August with international experts and the rock lobster Eco SRG to review deepwater research projects, and to develop an ongoing project proposal including the possible use of fished and unfished areas. WA Marine Science Institution (WAMSI) projects. Research to begin informing management decisions beginning about 2008 (as expressed in MSC timetable).					Paucity of data from deep water, and proportion of legal size/large lobsters in deep water has been made a research priority by the Scientific Reference Group. Comparison of fishing intensity (looking for a low to high abundance gradient) to detect changes. Focused on detailed habitat mapping, lobster denisty and size/structure, diet, effect on habitat on catchability, foraging range, behaviour, etc. Subject of three year FRDC project (ongoing).
2005 ERA 'Group B'																	

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2005 ERA Ref No.	Hazards identified in the 2005 ERA	Cause	Effect	Interaction scenario	Existing risk management responses	AFMA/CSIRO ERAEF Attributes			Existing risk			Planned commitments for remedial action (date to be implemented)	Suggested remedial action for consideration	Treated Risk			Remarks
						Internal or external threat	Ecological component	Direct capture or other interaction	Consequences	Likelihood	Risk Ranking			Consequences	Likelihood	Risk Ranking	
7	Octopus	Retention of species for sale to processors with increasing marketability.	Depletion of octopus stocks (short lifespan and highly variable recruitment). Tetricus species are most commonly captured in pots (95%). About 3.5 octopus per 100 pot lifts.	Capture of octopus impacting on sustainablity of octopus population.		Internal	Bycatch species	Direct capture	Minor	Unlikely	Low						Distribution very similar to lobster fishery. Octopus catch rates have increased slightly since the 1990's. Octopus is major prey of sealions.
14	Sea turtles	Collision of leatherback turtles with fishing vessels or entanglement in pot lines.	Mortality of individuals (1-2 annually reported).		Interaction reports from fishery. Code of practice for whale entanglement. Capes region code of conduct. DVD - how to reduce marine interactions.	Internal	TEP	Direct capture	Minor	Unlikely	Low		Better reporting. Follow up logbooks.				A study to understand whether the fishery is having impact on stock is worthy of investigation.
23	Kalbarri - Big Bank	Capture has some impact on the ecosystem of the region.	Depletion of species abundance in the region.	The hazard cannot be distinguished from the hazard identified for the Central West Coast shallow and deep water situation (2005 ERA Hazard Nos. 21 and 22).	Special management area, to prevent conflict among fishing vessels (congestion).	Internal	Community	Direct capture	Severe (shallow) Moderate (deep)	Rare (shallow) Possible (deep)	Low (shallow) Moderate (deep)	Planned workshop in August with international experts and the rock lobster Eco SRG to review deepwater research projects, and to develop an ongoing project proposal including the possible use of fished and unfished areas. WA Marine Science					Refer to remarks for 2005 ERA Hazard Nos. 21 and 22 above.
32	Bait bands: dusky whalers	Discarding of bait bands by fishermen. Dusky whalers distribution is in the southwest for juveniles, adult sharks much further north to Ningaloo. Adult migration thought to be on the shelf. Anecdotal view that sharks are attracted to fishing vessels. 500,000 bait bands go on board vessels annually. About one percent are discarded. Source of some bands are non-rock lobster fishery vessels.	Mortality of dusky whalers (shark species), which take 30 years to mature and have low fecundity. Potential for rapid decline in stock numbers and listing as an endangered species (with additional pressure from illegal fishing activities). 2000-2003, 37 Dusky whaler mortalities observed to be entagled with bait bands, but not necessarily cause of mortality (observed in demersal gillnet and demersal longline). 1-2% mortality annually estimated from all sources (equates to a small number of adult animals).	Bait bands (persistent material) are contributing to the mortality to adult Dusky whalers. The number of entangled animals are unknown.	Bait Handling Code of Conduct -- disposal of bait and rubbish.	Internal	Bycatch species	Other interaction	Severe	Unlikely	Moderate		Zero tolerance of bait bands by the rock lobster fishery.	(none)	(no interaction)	—	Age of Dusky whaler maturity is older than previously thought (~30 yrs instead of ~20 years). Reporting is not systematic, but no mortalities reported last couple of years. WAFIC Board will proceed with initiative to prohibit bait bands with the MInister. Problematic for fishermen in Abrolhos Islands. Bait bands are observed in the Abrolhos with entanglement of pinnipeds. Demersal gillnet fishery targets juveniles. Adult mortality is estimated at about 100 individuals per year (introduced size limits have probably reduced mortality by half. Loss of adults as a result of rock lobster bait bands is not known. Critical component of the stock is the adult population. Sharks and rays are protected with respect to commercial fishing only (since June 2006). View expressed that exploitation of the fishery is not consistent with the scientific view that the population is at risk of collapse as a result of adult mortalities.
2005 ERA 'Group C'																	
19	Abrolhos ecosystem	Removal of lobsters from the region. Only a small proportion of lobsters are available for capture, and only during a short period (3.5 months).	Depletion of species abundance in the region.	Considered to be similar situation to West Coast shallow.		Internal	Community	Direct capture	Severe	Rare	Low						Greater abundance of undersize lobsters compared to mainland coast. Biomass removal is therefore significantly lower than mainland coast. Females mature at smaller size. Consistent removal of legal size lobsters. Three and a half month fishing season. Coral community, shallow water.
20	Leeuwin - Naturaliste	A pulse in recruitment.	Peaks in abundance are observed in this region, leading to higher level of fishing effort when this occurs.	Disproportionate impact on the environment. Removal of 'standing stock'.	Eighteen small scale areas closed to fishing permanently (commercial and recreational pot fishing), which is considered a response to social risk, not ecological risk.	Internal	Community	Direct capture	Minor	Rare	Low						Large increase of fishing vessels in the region prompted a question about the potential impacts to the community structure/function. Area exhibits historically low recruitment. Risk is related to how the fishery is managed (200-250 boats in the southern region), with respect to settlement and recruitment. Social interactions (and conflict) were significant with other users of the marine environment. There is no unique hazard associated with the Leeuwin-Naturaliste region that should be considered here.

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						Internal or external threat	Ecological component	Direct capture or other interaction	Consequences	Likelihood	Risk Ranking			Consequences	Likelihood	Risk Ranking	
4	Mortality and loss of productivity from handling.	Inappropriate handling of lobsters. Larger female, setose and undersize lobsters repeatedly caught and handled.	Appendage loss. Displacement of animals during discarding.	Reduced productivity and increased mortality. Reduced egg production. (10% in deep water, more frequent in shallow water???)	Two year education study in 1980s. Requirement to return setose animals increases handling. Escape gaps in pots to avoid undersize lobsters. Number of pot lifts have declined - lowest in 35 years.	Internal	Target species	Direct capture	Minor	Likely	Low		Increase gap size on pots to reduce capture of undersize animals. Recommence education programs for handling. Enforcement of the 'five minute rule'.				
25	Benthic biota	Pot sets and lifts. Anchoring of boats.	Mechanical damage to benthic habitat.	Shallow water interaction of pots with benthic habitat. Limestone		Internal	Habitat	Direct capture	Minor	Unlikely	Low						Pot footprint (size) is very small when compared to areal extent of habitat types.
25	Benthic biota	Pot sets and lifts. Anchoring of boats.	Mechanical damage to benthic habitat.	Shallow water interaction of pots with benthic habitat. Coral		Internal	Habitat	Direct capture	Minor	Unlikely	Low						Anecdotal opinion expressed that comparison of benthic habitat damage from storm damage appears to be very significant when compared to the mechanical damage of pot sets and lifts.
25	Benthic biota	Pot sets and lifts. Anchoring of boats.	Mechanical damage to benthic habitat. Seagrass interaction is infrequent.	Shallow water interaction of pots with benthic habitat. Seagrass		Internal	Habitat	Direct capture	Minor	Rare	Low						
25	Benthic biota	Pot sets and lifts. Anchoring of boats.	Mechanical damage to benthic habitat.	Deep water interaction of pots with benthic habitat. Limestone		Internal	Habitat	Direct capture	Moderate	Unlikely	Low						
25	Benthic biota	Pot sets and lifts. Anchoring of boats.	Mechanical damage to benthic habitat.	Deep water interaction of pots with benthic habitat. Coral		Internal	Habitat	Direct capture	Moderate	Unlikely	Low						

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						Internal or external threat	Ecological component	Direct capture or other interaction	Consequences	Likelihood	Risk Ranking			Consequences	Likelihood	Risk Ranking	
25	Benthic biota	Pot sets and lifts. Anchoring of boats.	Mechanical damage to benthic habitat. Seagrass interaction is infrequent.	Deep water interaction of pots with benthic habitat. Seagrass		Internal	Habitat	Direct capture	Moderate	Rare	Low						
25	Benthic biota	Pot sets and lifts. Anchoring of boats.	Mechanical damage to benthic habitat (infauna).	Deep water soft sediments.		Internal	Habitat	Direct capture	Negligible	Rare	Negligible						
25	Benthic biota	Pot sets and lifts. Anchoring of boats.	Mechanical damage to benthic habitat (filter feeding organisms).	Deep water hard bottom.		Internal	Habitat	Direct capture	Minor	Rare	Low						Impact of pots and recovery rates of filter-feeding benthos is unknown and worthy of investigation.
10	Whales (ecological)	Entanglement in gear. An important contributing factor is excess rope floating on the surface of the sea where whales are present.	45 incidents of capture since 1992 for all fisheries (7 out of 9 by lobster fishers in 2006, one mortality source unknown). Migration overlaps end and start of lobster season. Effect of mortality has different impact on different species. Small effective population size of Southern Right Whale (SRW) are more vulnerable.	Impact on whale population recovery	Disentanglement policy and incident response. Code of practice identifying what to do, safety. Mandatory reporting under EPBC and catch and effort statistics (CAES). Outreach education program for fishers using DEC and WRLC DVD.	Internal	TEP	Direct capture	Minor (SRW) Minor (Humpback)	Unlikely Unlikely	Low Low		More efficient fewer numbers of pots would reduce risk of entanglements.				Southern Right Whale has minimal spatial overlap with the fishery.
30	Marine issues - Abrolhos water quality	Potential for human occupation of Abrolhos Islands to cause an elevated level of nutrients and domestic waste discharged to the sea.	Impact on marine biodiversity at the Abrolhos Islands from elevated nutrients, and physical damage to corals from pots and vessel activities.	Increased nutrient loading in surrounding waters.	Security of tenure to encourage implementation of long term management practices (waste). Water sampling program for nutrients and bacteria. Treatment of sewage prior to discharge. Returning household and fishing activity waste to mainland instead of incineration for non-paper waste (bait bands, plastic, waste oil, oil filters, etc).	External	Community	Other interaction	Negligible	Unlikely	Negligible	DEC Waste Management Strategy (Draft).					Background sources of nutrients are seabirds, plant decay on beaches. Waste Management Plan includes three year sampling program. Maceration of food scraps prior to discharge and disposal at night to avoid attracting seabirds.
8	Scalefish and sharks	Bald chin groper, Break sea cod, Western wirrah are major species captured and generally kept. Port Jackson shark, Wobbegong shark, eels, and Leather jacket exceed a catch rate of 0.1/100 pot lifts.	Impacts to Break sea cod population are being considered, but no data available as yet.	The rock lobster catch of Break sea cod if significant compared to fin fish fishery, but no particular concerns have been articulated with respect to the fishery.	Moon closures in rock lobster fishery (reduces scalefish capture in pots).	Internal	Bycatch species	Direct capture	Minor	Remote	Negligible		Expand detail of bycatch retention/return recording in logbooks.				About 75% of fish captured in pots are returned to the sea. Eight tonnes of Break sea cod retained bycatch (40% of recreational fishery take). The management of the fin fish fishery will reportedly maintain a sustainable population through regulation. Reduce effort in fishery presumed to reduce bycatch species take. Nine and a half million pot lifts estimated next season, on downward trend. Proportion of 'stick pots' is about 10-20%.

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						Internal or external threat	Ecological component	Direct capture or other interaction	Consequences	Likelihood	Risk Ranking			Consequences	Likelihood	Risk Ranking	
12	Sea lions (managed)	Small pups attracted to pots to take bait or rock lobsters.	Drowning of pups from about 5-24 months of age. The historically reported rate of interactions is 10 pup deaths per season, or about 8% of the pup count (regarded in 2005 ERA as the minimum mortality estimate).	Exclusion of sea lions from pots with implementation of SLEDs results in a significant reduction in drowning (none recorded to date). Assumption is that additional data will not reveal any change to SLED performance.	Scientific Reference Group advice for gear changes to prevent capture of sealions. Sealion exclusion devices (SLEDs) introduced in the 2006 fishing season (mandatory). SLEDs trialled in commercial fishery to validate design.	Internal	TEP	Direct capture	Minor	Unlikely	Low	Studies ongoing with regard to foraging range of juveniles. Management strategy to be checked to ensure that SLED requirements are correct for depth and range of vulnerable juveniles. Continue to monitor efficacy of SLEDs via underwater video. Compliance validation of the use of SLEDs within the SLED management zone. Research underway to investigate the interaction of sea lions with rock lobster pots in the vicinity of the Abrolhos Islands. However, there is no current evidence that sea lions are entering pots in the Abrolhos (tiny remnant population).					Breeding on 18 month cycle, about 60 pups per colony. Recovery of impacted colonies reportedly unsuccessful. SLEDs introduced in water depths less than 20 metres, within 30 kilometers of breeding range, where juveniles are considered to be most vulnerable. High level of SLED compliance observed to date. No reports of sea lion mortality this fishing season, following introduction of SLEDs. Video observations of SLED trials suggest that they are very effective.
2005 ERA 'Group D'																	
(hazards were judged to be lower than 'moderate risk', and not re-assessed here																	