



PARKS VICTORIA TECHNICAL SERIES

NUMBER 33

Identification of threats to natural values in Victoria's Marine National Parks and Marine Sanctuaries

*Janet M. Carey, Mark A. Burgman, Anthony Boxshall,
Ruth Beilin, Louisa Flander, Phil Pegler and Andrea K. White*

October 2007

© Parks Victoria

All rights reserved. This document is subject to the Copyright Act 1968, no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form, or by any means, electronic, mechanical, photocopying or otherwise without the prior permission of the publisher.

First published 2007

Published by Parks Victoria
Level 10, 535 Bourke Street, Melbourne Victoria 3000

Opinions expressed by the Authors of this publication are not necessarily those of Parks Victoria, unless expressly stated. Parks Victoria and all persons involved in the preparation and distribution of this publication do not accept any responsibility for the accuracy of any of the opinions or information contained in the publication.

Authors:

Janet M. Carey – University of Melbourne
Mark A. Burgman – University of Melbourne
Anthony Boxshall – Parks Victoria
Ruth Beilin – University of Melbourne
Louisa Flander – University of Melbourne
Phil Pegler – Parks Victoria
Andrea White – Parks Victoria

National Library of Australia
Cataloguing-in-publication data

Includes bibliography.
ISSN 1448-4935

Citation

Carey, J.M., Burgman, M.A., Boxshall, A., Beilin, R., Flander, L., Pegler, P. and White, A.K. (2007). *Identification of threats to natural values in Victoria's Marine National Parks and Marine Sanctuaries*. Parks Victoria Technical Series No.33. Parks Victoria, Melbourne.



Printed on environmentally friendly paper

Parks Victoria Technical Paper Series No. 33

Identification of threats to natural values in Victoria's Marine National Parks and Marine Sanctuaries

Jan M. Carey, University of Melbourne
Mark A. Burgman, University of Melbourne
Anthony Boxshall, Parks Victoria
Ruth Beilin, University of Melbourne
Louisa Flander, University of Melbourne
Phil Pegler, Parks Victoria
Andrea White, Parks Victoria

October 2007



EXECUTIVE SUMMARY

The declaration in 2002 of a complete system of marine national parks and marine sanctuaries in Victoria created imperatives for robust, scientifically defensible approaches to identifying threats to valued ecological attributes of the parks, setting management priorities and developing monitoring systems. We developed an inclusive and transparent protocol to provide the opportunity for stakeholder involvement in the identification of valued attributes within the parks, as well as in the assessment of associated risks. Sixteen workshops were held at various locations across the state, between July 2004 and February 2006, with a total of 206 stakeholders participating.

Over 500 hazards were identified, each defined in terms of a threat to a nominated natural value at a specific park or sanctuary. Some hazards such as the poaching of commercially valuable species, were common to many parks across the state. Others were location-specific, for example, the trampling of mangrove flats and saltmarsh by hard-hoofed animals such as cattle and sheep. While many hazards involved predictable, tangible threats such as poaching, pollution, invasive species and disturbance by park visitors, the approach also identified a number of less obvious threats including governance issues and the ecological knowledge-base for the parks. Collectively, water quality issues were prominent among stakeholder concerns. Slightly more than half of the contaminant threats to water quality originate in adjacent catchments. Of those not arising from terrestrial sources, 58% referred to oil or fuel contamination from maritime activities.

The workshops consistently identified threats not previously considered by Parks Victoria in its internal assessments. Half were threats to ecological values on a wider scale than the parks alone, for example, catchment-based issues of water quality and sediment transport. A further 27% of the new threats referred to governance issues and 16% to the ecological knowledge-base of the parks.

Parks Victoria used information generated in the risk assessment workshops as a direct input to the management planning process that coincided with the workshops. In some cases the output from workshops was used to refocus sections of the management plans on certain threats or include more discussion of possible management responses. The information on threats and values also informed the marine research strategy being developed during 2006-2007. It has allowed a detailed analysis and prioritization of the research gaps in each park, as well as more broadly across the state.

CONTENTS

EXECUTIVE SUMMARY	2
1.0 INTRODUCTION.....	4
2.0 THE WORKSHOPS	5
2.1 Discovery Bay Marine National Park	7
2.2 Twelve Apostles Marine National Park, The Arches and Merri Marine Sanctuaries.....	14
2.3 Marengo Reefs Marine Sanctuary	24
2.4 Point Addis Marine National Park, Eagle Rock Marine Sanctuary & Point Danger Marine Sanctuary	36
2.5 Barwon Bluff Marine Sanctuary	47
2.6 Port Phillip Heads Marine National Park.....	58
2.7 Point Cooke Marine Sanctuary	68
2.8 Jawbone Marine Sanctuary	78
2.9 Ricketts Point Marine Sanctuary.....	87
2.10 Mushroom Reef Marine Sanctuary	98
2.11 Westernport 1: Churchill Island Marine National Park	109
2.12 Westernport 2: Yaringa and French Island Marine National Parks.....	118
2.13 Bunurong Marine National Park.....	129
2.14 Wilsons Promontory and Corner Inlet Marine National Parks.....	137
2.15 Ninety Mile Beach Marine National Park	148
2.16 East Gippsland Marine National Parks and Sanctuary	157
REFERENCES.....	166

1.0 Introduction

A program of ecological risk assessment has been undertaken for Victoria's marine protected areas. Workshops were carried out between July 2004 and February 2006, and included participants from various shareholder groups including staff from Parks Victoria, the Department of Sustainability and Environment and the Department of Primary Industry, representatives from commercial and recreational fisheries groups, Indigenous representatives, field naturalists, marine scientists, catchment management professionals, environmental and social scientists, members of friends groups, professional and recreational divers, and local government representatives. A full list of participants for each workshop is included in Appendix 1.

The objectives of the workshop were:

- To identify potential threats to valued attributes of the park;
- To rank the importance of hazards using subjective assessments of likelihood and consequence;
- To develop a register of major hazards; and
- To outline conceptual models for selected hazards.

2.0 The workshops

The first step of the elicitation process on the workshop day was to conduct an unstructured brainstorming session to elicit concerns from participants. The time frame to be considered in the risk assessment was 10 years, chosen because it is the intended life span of management plans for the park. Each participant was asked to identify threats of particular concern to them, together with the natural attributes of the sanctuary that they valued and that were potentially affected by those threats. This strategy reflected a focus on single hazards, where a hazard was defined by both a threat and a value which could be affected by that threat. This process resulted in an initial list of hazards.

To prompt a fuller consideration of hazards, and to identify values or threats that may have been overlooked, participants were provided with a list of natural values specific to the park or sanctuary (Appendix 2). This list was compiled from the Marine and Coastal Estuarine Investigation (ECC 2000) and the Marine Natural Values Study (Plummer et al. 2003). In addition to this the participants were provided with a generic list of potential threats to marine systems (Appendix 2).

Combined in a hazard matrix, these two lists generate a large number of hazards for consideration. Participants were asked to consider the possible combinations of value and threat; then add to the previous list of hazards if they wished. This structured brainstorming process resulted in a number of additional hazards being identified as of a particular concern to at least one workshop participant.

As individual hazards were nominated, some were discussed in detail to enhance participants' understanding and to minimize differences in interpretation.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored at least one vote were included in the risk register.

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into groups of three or four people. Each group was as mixed as possible in terms of the interests and experiences of its members. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). The results of the group assessments were entered into software designed to record, score and rank hazards. Participants were asked to record any instances in which their assessments differed from that of the other group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between the groups was indicated by the Spearman's rank correlation coefficient; where positive one indicates perfect agreement in the rank order of hazards for two groups, negative one denotes exactly reversed rank orders and values around zero indicate a basically random pattern. Individual hazards with high levels of disagreement were then discussed in detail.

Following the discussion of selected hazards, groups were offered the opportunity to change likelihood and consequence scores if they wished. Any changes were entered in the ranking software and the risks (Appendix 4) and ranks recalculated.

The risk posed by each hazard was recorded in the risk register, where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented for each workshop.

2.1 Discovery Bay Marine National Park

An ecological risk assessment for the Discovery Bay Marine National Park was undertaken in a workshop setting at Portland on 9th March 2005. The seven workshop participants included Parks Victoria staff and members of the local community with an interest in the marine environment (Appendix 1).

It was generally agreed that because of its exposure and remoteness, the park was subject to fewer threats than many of the other parks and sanctuaries in the Victorian system.

The unstructured brainstorming resulted in an initial list of 9 hazards (Table 2.1.1). Participants were then provided with a list of 7 natural values specific to the sanctuary, together with a generic list of 141 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 987 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 9 hazards being identified as of particular concern to at least one workshop participant (Table 2.1.2).

Table 2.1.1 Initial list of hazards from unstructured brainstorming session, for Discovery Bay Marine National Park.

Initial definition	Subsequent definition if refined
Poaching of abalone near Blacks Beach resulting in decreased abalone populations <i>in the park</i>	
Lack of clear communication of the purpose of the park, resulting in loss of community support and <i>consequently</i> , impacts on <i>park</i> habitats and communities	
Marine pests introduced via ballast water affecting the <i>species</i> composition of <i>park</i> communities	
Illegal fishing on the edge of the park by licenced fishers, resulting in a decrease in rock lobster populations <i>in the park</i>	
General community apathy eventually affecting <i>park</i> habitats, communities and processes	
Lack of ecological knowledge affecting <i>park</i> habitats, communities and processes	
Lack of monitoring and research into impacts on park, resulting lack of effective management <i>with subsequent</i> effects on <i>park</i> habitats, communities and processes	
Oil spill sufficient to trigger an AMSA response affecting intertidal and subtidal <i>habitats and communities in the park</i> , and fish, mammals and birds <i>that use the park</i>	

Diminished public supervision of park (i.e. no large <i>human population living beside and constantly overlooking the park</i>) resulting in decreased abalone populations <i>in the park (due to failure to report poaching)</i>	
--	--

Table 2.1.2. Additional hazards from structured brainstorming session, Discovery Bay Marine National Park.

Initial definition	Subsequent definition if refined
Increased sea temperature due to global warming impacting on intertidal <i>and subtidal</i> reef communities <i>in the park</i>	
Sea-sourced litter from shipping or fishing affecting fish, birds or seals <i>that use the park</i>	Later split into component hazards: Sea-sourced litter from shipping affecting fish Sea-sourced litter from shipping affecting birds Sea-sourced litter from shipping affecting seals Sea-sourced litter from fishing affecting fish Sea-sourced litter from fishing affecting birds Sea-sourced litter from fishing affecting seals
Industrial discharges from Portland <i>Aluminium</i> smelter or Pivot (<i>Incitec Pivot Ltd - fertiliser manufacturer</i>) affecting <i>park</i> habitats, communities and processes	
Sewage discharge into Nelson Bay affecting <i>park</i> habitats, communities and processes	
Opening of Swan Lake (<i>by either natural or artificial means</i>) resulting in nutrients and herbicides from forestry and farming affecting <i>park</i> water quality and <i>park</i> habitats, communities and processes	
Erosion of cliff tops (cleared of natural vegetation) adjacent to park introducing sediments into the park resulting in smothering of benthos and reduced light for algal growth	
Contamination of groundwater <i>with nutrients</i> from farming practices affecting algae and seastars on intertidal reefs <i>in the park</i>	
Seismic testing adjacent to the park affecting pelagic species, food chains and <i>demersal</i> fish <i>in the park</i>	
Exotic species introduced via aquaculture affecting the ecological integrity of <i>park</i> populations	

Participants were then asked to select a subset of hazards deemed to be of most concern. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored at least one vote were included in the risk register (Table 2.1.3). At this stage, the sea-sourced litter hazards effectively reverted to their original form (Table 2.1.2). The original wording had been altered

to specify separate sources of litter and separate target species, with the expectation that different scores for likelihood and consequence might be appropriate for different combinations of threat and value (i.e. litter source and target species). However, it was the original wording of the hazard which received two votes.

Table 2.1.3 Risk register, Discovery Bay MNP. E=extreme, H=high, M=moderate, L=low.

Hazard	Likelihood	Consequence	Risk score	Level of Risk
Poaching of abalone near Blacks Beach resulting in decreased abalone populations <i>in the park</i>	3 - 4	3 - 4	9 - 16	H - E
Lack of clear communication of the purpose of the park , resulting in loss of community support and <i>consequently</i> , impacts on park habitats and communities	2 - 3	1 - 2	2 - 6	L - M
Illegal fishing on the edge of the park by licenced fishers, resulting in a decrease in rock lobster populations <i>in the park</i>	3 - 4	2 - 3	6 - 12	M - H
Lack of ecological knowledge affecting <i>park</i> habitats, communities and processes	2 - 4	2 - 4	6 - 16	M - E
Lack of monitoring and research into impacts on park, resulting lack of effective management with <i>subsequent</i> effects on park habitats, communities and processes	2 - 4	3 - 4	6 - 12	M - H
Oil spill sufficient to trigger an AMSA response affecting intertidal and subtidal habitats and communities <i>in the park</i> , and fish, mammals and birds <i>that use th park</i>	1	3 - 4	3 - 4	M - H
Increased sea temperature due to global warming impacting on intertidal <i>and subtidal</i> reef communities <i>in the park</i>	1 - 2	3 - 4	3 - 8	M - H
Sea-sourced litter from shipping or fishing affecting fish, birds or seals <i>that use the park</i>	3 - 4	1 - 3	3 - 12	L - H
Seismic testing adjacent to the park affecting pelagic species, food chains and <i>demersal</i> fish <i>in the park</i>	1 - 3	2 - 3	2 - 9	L - H
Exotic species introduced via aquaculture affecting the ecological integrity of <i>park</i> populations	1	4	4	H

Note: Level of Risk is based on Likelihood and Consequence in accordance with AS4360 Appendix E

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). The results of the group assessments were entered into software designed to record, score and rank hazards. Participants were asked to record any instances in which their assessments differed from that of the other group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between the groups was indicated by Spearman's rank correlation coefficient, where positive one indicates perfect agreement in the rank order of hazards for two groups, negative one denotes exactly reversed rank orders and values around zero indicate a basically random pattern. In this case, the coefficient was +0.35 indicating a moderate level of disagreement between the two groups. Individual hazards with high levels of disagreement were then discussed in detail (see points (i) to (vi) below).

(i) Lack of clear communication of the purpose of the park, resulting in loss of community support and consequently, impacts on park habitats and communities

It was suggested that Parks Victoria may not have clearly identified the role of the park, what values are to be protected, and how the general public may be involved.

(ii) Lack of ecological knowledge affecting *park* habitats, communities and processes

This hazard represented long-term concerns for park values. There was also an immediate difficulty at the workshop, with a lack of data and knowledge hampering the identification of values and the scoring of likelihoods and consequences. There was general agreement that this was a major concern.

(iii) Increased sea temperature due to global warming impacting on intertidal *and subtidal* reef communities *in the park*

It was noted that long-term increases in sea temperature may generate new and currently unforeseen impacts, as well as the more obvious ones (e.g. geographic shifts in species distributions). While global warming is clearly not an issue that can be managed by Parks Victoria, there is a need for the agency to recognise the trend and manage the park accordingly.

(iv) Lack of monitoring and research into impacts on park, resulting lack of effective management with subsequent effects on park habitats, communities and processes

It was generally agreed that Discovery Bay has been the subject of less monitoring and research than many other parts of the Victorian coast.

(v) Illegal fishing on the edge of the park by licensed fishers, resulting in a decrease in rock lobster populations in the park

Discussion of this hazard prompted the development of a conceptual model identifying the different types of fishing that take place in and around the park (Figure 2.1.1)

(vi) Sea-sourced litter from shipping or fishing affecting **fish, birds or seals** *that use the park*

While acknowledging that likelihood of sea-sourced litter entering the park was high, one group felt the likelihood of that litter having a substantial effect on fish, birds and seals was much lower.

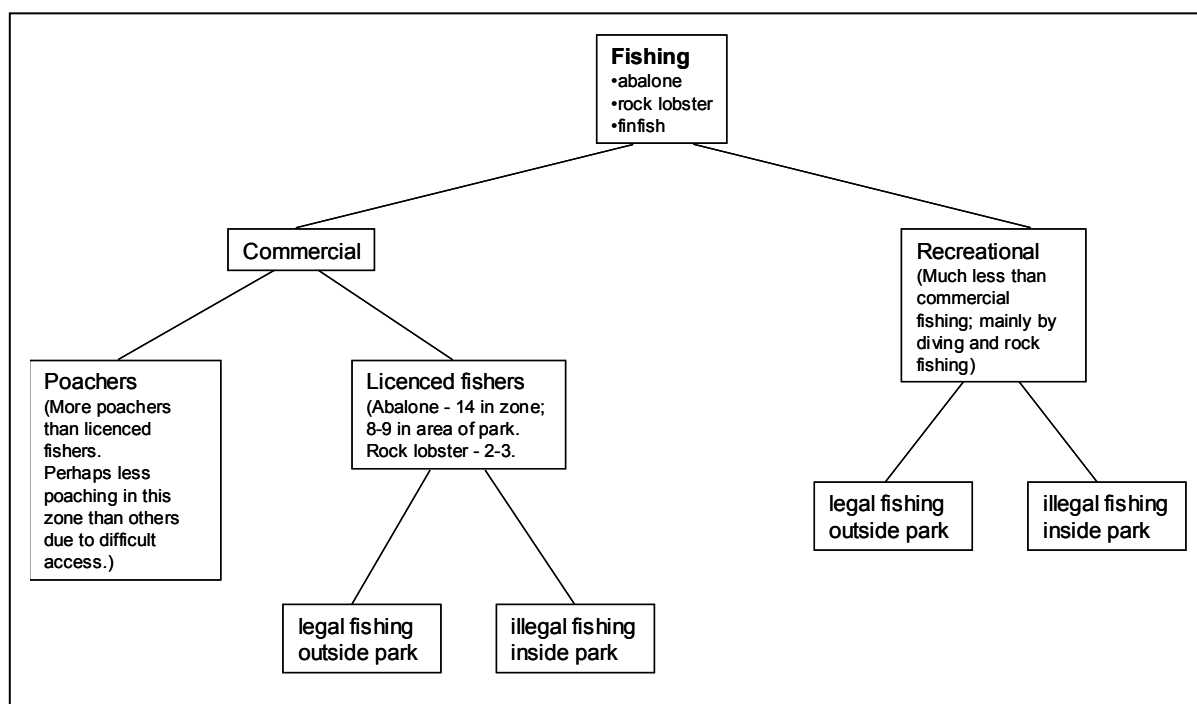


Figure 2.1.1 Conceptual model identifying the different types of fishing that take place in and around the Discovery Bay MNP.

Following the discussion of selected hazards, groups were offered the opportunity to change likelihood and consequence scores if they wished. Any changes were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in a moderate increase in agreement between the groups, with the correlation rising from +0.35 to +0.46.

The risk posed by each hazard was recorded in the risk register (Table 2.1.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 2.1.2 and 2.1.3. The hazards of greatest concern identified in the Discovery Bay workshop had a maximum risk score of 16 out of a possible 25. Those hazards were:

- **Poaching** of abalone **near Blacks Beach** resulting in decreased **abalone populations in the park**
- **Lack of ecological knowledge** affecting **park habitats, communities and processes**

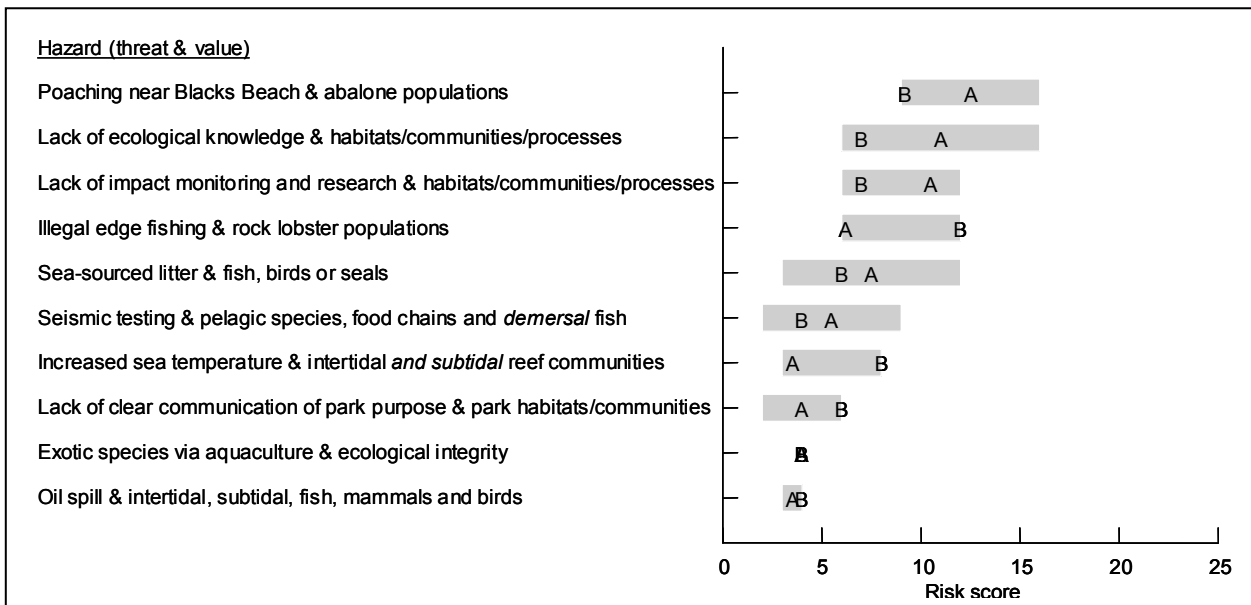


Figure 2.1.2 Summary of major risks to Discovery Bay MNP, with hazards ordered firstly by maximum risk score, then by minimum risk score, and finally by the highest median score among the groups of participants.

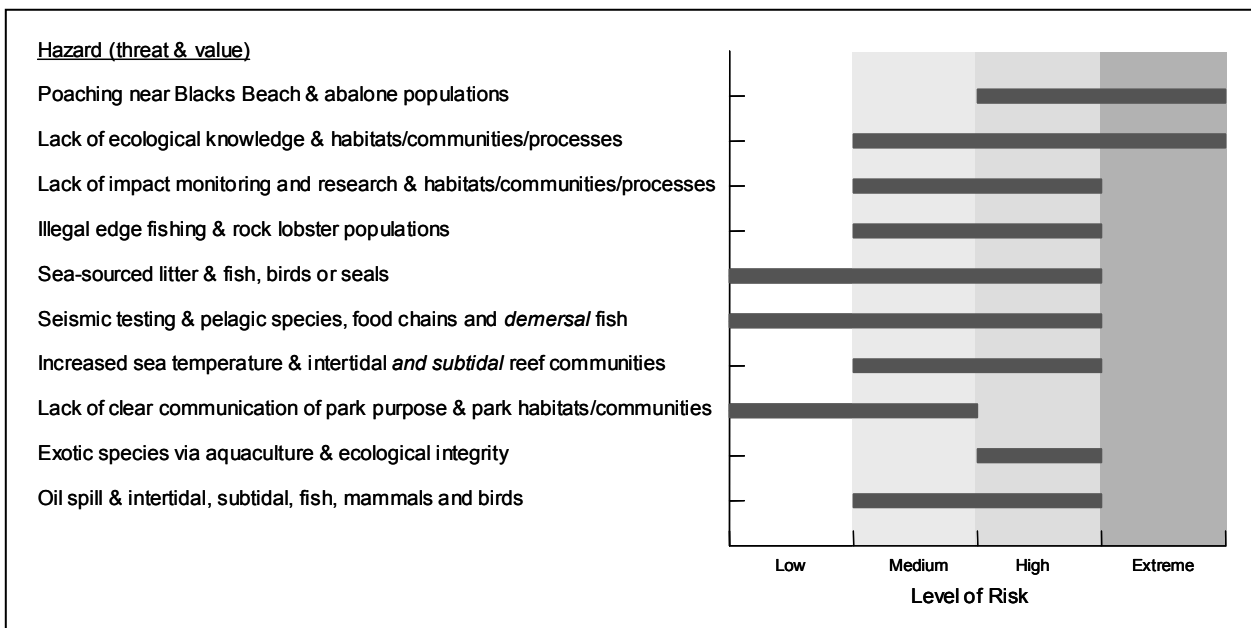


Figure 2.1.3 Hazards in Discovery Bay MNP, showing level of risk based on likelihood and consequence in accordance with AS 4360 Appendix E.

2.1.1 Comparison with other Parks Victoria Reports

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2004) flagged 7 threats out of 51 as posing either an extreme or high risk to the Discovery Bay MNP (Table 2.1.4). Four of these threats (oil pollution, abalone and rock lobster poaching, and litter from vessels) were also of major concern to workshop participants. While not among the extreme or high risk threats for the park, exotic species were considered in the internal assessment. However, the only recognised source of such species was ballast water, whereas in the workshop, aquaculture was the source of most concern.

Table 2.1.4 Risk priorities for major threats of concern to Discovery Bay MNP. Drawn from an internal Parks Victoria risk assessment (Parks Victoria 2004).

Threat	Priority
Oil pollution	Extreme
Cetacean stranding	High
Commercial quantity abalone poaching	High
Commercial quantity rock lobster poaching	High
Litter - from vessel	High
Non-compliance with zoning restrictions (pending management plan)	High
Vandalism - environmental	High

Five of the risk register hazards incorporated threats not specifically considered in the internal assessment:

- **Lack of clear communication** of the **purpose** of the **park**, resulting in loss of community support and *consequently*, impacts on **park habitats and communities**
- **Lack of ecological knowledge** affecting *park habitats, communities and processes*
- **Lack of monitoring and research** into **impacts** on park, resulting lack of effective management with *subsequent* effects on *park habitats, communities and processes*
- **Increased sea temperature** due to global warming impacting on **intertidal and subtidal reef communities** *in the park*
- **Seismic testing** adjacent to the park affecting **pelagic species, food chains and demersal fish** *in the park*

2.2 Twelve Apostles Marine National Park, The Arches and Merri Marine Sanctuaries

An ecological risk assessment for the Twelve Apostles Marine National Park, the Arches Marine Sanctuary and Merri Marine Sanctuary was undertaken in a workshop setting at Warrnambool on 18th August 2004. The 12 workshop participants (Appendix 1) included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park. The risk assessment was designed to consider the park and the two sanctuaries collectively, but with scope to restrict individual hazards to specific protected areas.

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Participants were then provided with a list of 17 natural values specific to the park or sanctuaries, together with a generic list of 89 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 1513 possible hazards for consideration. The combined process of unstructured and structured brainstorming resulted in an initial list of 34 hazards, eight of which were concerned with specific reserves (Table 2.2.1).

To minimize differences in interpretation among the participants, some hazards were more tightly defined at this stage (Table 2.2.1).

- It was agreed that seismic testing may affect the echolocation abilities of larger vertebrates such as whales and dolphins and may thus disrupt feeding activity. There was also concern for smaller vertebrates less able to leave the immediate area, and for invertebrate organisms where potential effects are unknown, but these organisms were not included in the revised definition of the hazard.
- Marine debris from beyond the parks was taken to include both lost fishing gear and general litter such as discarded plastic items. Litter from terrestrial sources was listed separately.
- It was agreed that there is a general correlation between development around the Merri MS and reduced water quality in the sanctuary (Figure. 2.2.1), but there was debate about exactly what the term "development" covered. Some participants felt it referred to urban development, while others assumed it encompassed all activities in the catchment that could affect water quality. The latter definition was accepted, and it was recognized that the term would then include thermal inputs and both licensed and unlicensed discharges.

Table 2.2.1 Hazards of concern nominated by participants for Twelve Apostles MNP, the Arches MS and Merri MS.

Initial definition of hazard	Subsequent definition, if hazard refined
Impact of change in indigenous practices on marine biodiversity	
Terrestrial pest animals affecting intertidal fauna and penguins	
Lack of knowledge affecting marine habitats and communities	
"Island-based" management focus affecting marine habitats and communities	
External management complexity (e.g. common boundary of Twelve Apostles MNP with Federal MPA) <i>affecting marine communities and habitats</i>	
Anchoring damaging habitat at the Arches MS	
Seismic testing affecting marine habitats and communities	Seismic testing affecting larger (<i>marine</i>) vertebrates
1) Oil spills from offshore <i>platforms</i> affecting all three parks 2) Oil spills from (<i>commercial?</i>) shipping affecting all three parks	Two hazards combined as follows: Oil spills from offshore <i>platforms</i> or shipping affecting seabirds and intertidal habitats and communities
Marine debris from elsewhere (<i>i.e. beyond parks</i>) resulting in smothering <i>of</i> , entanglement <i>with</i> , or ingestion <i>by marine organisms</i>	
Developments around Merri MS affecting marine communities and habitats	
Edge effects around parks, <i>leading to impacts on marine communities and habitats</i> particularly in small parks such as Merri and the Arches MSs	
Urban and catchment runoff and outfall <i>discharges</i> into Merri MS impacting on its general ecology	Urban and catchment runoff and outfall <i>discharges</i> direct into Merri MS, impacting on its general ecology
Illegal fishing impacting on fish populations and habitats	
Pest plants and animals from recreational boating, ballast <i>water discharge</i> , agriculture, shipping and industry	Pest plants and animals from recreational boating, ballast <i>water discharge</i> , agriculture, shipping and industry, displacing local species
Trampling and collecting in intertidal region of Merri MS <i>affecting populations and habitats</i>	
Human interactions (e.g. whale watching) affecting whales and penguins	
Litter, anchoring, oil spillage and groundings from recreational boating <i>affecting marine communities and habitats</i>	

Alienation of indigenous cultural values and perspectives impacting on management of marine biodiversity	
Pesticides from coastal pest plant management (e.g. spurge) <i>affecting marine organisms</i>	
Diseases introduced by aquaculture <i>affecting marine organisms</i>	
Artificial opening of river mouths producing silt plumes resulting in fish kills and sedimentation	
Government influence on management affecting marine communities and habitats	
Rupturing of oil/gas pipelines affecting marine communities and habitats	
Technology creep (i.e. better oil/gas extraction/exploration methods, exploitation of new resources, new ways of accessing resources via bioprospecting, aquaculture etc.) <i>affecting marine communities and habitats</i>	
Terrestrial events/activities such as floods, fires, droughts, nutrients, extractions, affecting water quality	
Global warming producing changes in sea level or sea temperature	
Litter from land or sea (other than from recreational boating) affecting the marine environment	Land-based litter affecting the marine environment
Deliberate harassment of wildlife affecting penguins at Merri MS	
Genetic impacts from aquaculture affecting the integrity of <i>local marine</i> populations	
Equipment/delayed access for emergency response affecting communities and habitats at Twelve Apostles MNP and the Arches MS	
Lost fishing gear impacting charismatic megafauna	
Funding for management affecting marine communities and habitats	
Noise and emissions from helicopters <i>affecting marine organisms</i>	

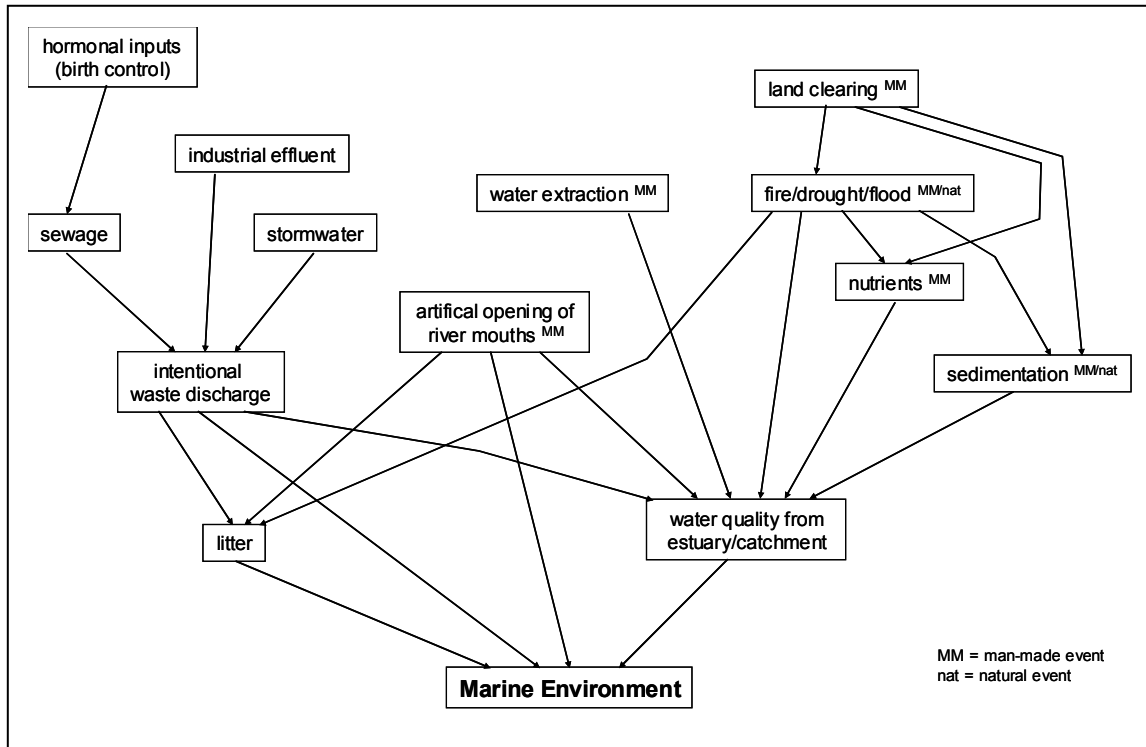


Figure 2.2.1 Conceptual model of terrestrial activities/events with potential to affect water quality in the Merri Marine Sanctuary.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern for the next stage of the risk assessment. Participants were invited to vote for their preferred two hazards, and this process produced the 17 hazards listed in Table 2.

Table 2.2.2 Risk register for Twelve Apostles MNP, the Arches MS and Merri MS.

Bounds represent the range of opinion among the four groups of participants. (L = low risk, M = moderate risk, H = high risk, E = extreme risk)

Hazard	Likelihood	Consequence	Risk Score	Level of Risk
Lack of knowledge affecting marine habitats and communities	4 - 5	3 - 4	12 - 20	H - E
“Island-based” management focus affecting marine habitats and communities	4 - 5	3 - 4	12 - 20	H - E
External management complexity (e.g. common boundary of Twelve Apostles MNP with Federal MPA) <i>affecting marine communities and habitats</i>	2 - 5	2 - 3	4 - 15	L - E
Seismic testing affecting larger (<i>marine</i>) vertebrates	3 - 5	2 - 4	8 - 20	H - E
Oil spills from offshore <i>platforms</i> or shipping affecting seabirds and intertidal habitats and communities	4 - 5	3 - 5	12 - 25	H - E
Marine debris from elsewhere (<i>i.e. beyond parks</i>) resulting in smothering of, entanglement with, or ingestion by marine organisms	3 - 5	1 - 4	4 - 20	M - E
Developments around Merri MS affecting marine communities and habitats	4 - 5	3 - 4	12 - 16	H - E
Edge effects around parks, <i>leading to impacts</i> on <i>marine communities and habitats</i> particularly in small parks such as Merri and the Arches MSs	4 - 5	2 - 4	8 - 20	H - E
Urban and catchment runoff and outfall <i>discharges</i> direct into Merri MS , impacting on its general ecology	4 - 5	3 - 4	15 - 20	E
Pest plants and animals from recreational boating, ballast <i>water discharge</i> , agriculture, shipping and industry, displacing local species	3 - 5	1 - 5	5 - 25	H - E
Alienation of indigenous cultural values and perspectives impacting on management of marine biodiversity	4 - 5	1 - 3	4 - 12	M - H
Artificial opening of river mouths producing silt plumes resulting in fish kills and sedimentation	3 - 5	2 - 3	6 - 15	M - E
Government influence on management affecting marine communities and habitats	5	1 - 3	5 - 15	H - E
Technology creep (i.e. better oil/gas extraction/exploration methods, exploitation of new resources, new ways of accessing resources via bioprospecting, aquaculture etc.) <i>affecting marine communities and habitats</i>	4 - 5	1 - 4	5 - 16	H - E
Terrestrial events/activities such as floods, fires, droughts, nutrients, (<i>water</i>) extractions, affecting water quality	4 - 5	1 - 5	5 - 25	H - E
Land-based litter affecting the marine environment	3 - 5	1 - 4	5 - 20	M - E
Funding for management affecting marine communities and habitats	4 - 5	3 - 4	12 - 20	H - E

Note: level of risk is based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were

divided into four groups of two or three people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so. Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from -0.04 to +0.45, with a median of +0.27, indicating a moderate level of disagreement among the groups. Hazards with high levels of disagreement were then discussed in detail (see below).

i) **Oil spills** from offshore platforms or shipping affecting **seabirds and intertidal habitats and communities**

Differences of opinion on the oil spill hazard were largely about the likelihood of a spill occurring, which in turn was dependent on the source and size of possible spills.

ii) **Edge effects** around parks, leading to impacts on marine communities and habitats particularly in small parks such as **Merri and the Arches MSs**

Edge effects were generally taken to relate to fishing. Smaller reserves tend to have a greater boundary length relative to their area (depending on configuration), so are generally of more concern than larger reserves. It was pointed out that at least one small reserve (in New Zealand) has nonetheless shown increases in both size and number of mobile species such as fish.

iii) **Pest plants and animals** from recreational boating, ballast water discharge, agriculture, shipping and industry, **displacing local species**

Discussion of the likelihood of marine pests displacing local species in the next ten years drew on previous experiences in Victoria (where several species have established in the past but there is little evidence to date for displacement of local species?). This was contrasted with the presumably high potential for so far unknown species to establish. With its high level of endemism, Victoria was seen as potentially very susceptible to invasion.

It was generally agreed that the consequences of any new pest species would vary with the characteristics of the species, i.e. with their ability to initially establish, to reproduce and spread, and to out-compete local species.

Lack of knowledge of existing pest species and their impacts was seen as a major difficulty in the scoring of this hazard.

iv) **Funding for management** affecting marine communities and habitats

It was agreed that the definition of this hazard excluded funding for research even if management-related, and that it referred specifically to government funding. Participants tended to be precautionary in their scoring of this hazard. They perceived a need for groups to be able to access funds for the running of specific projects, but acknowledged that funding is not the sole solution to the problem of effectively managing the parks.

During the above discussion, it was recognised that lack of knowledge was a major issue, with flow-on effects to other hazards. Several specific knowledge gaps were identified as being of general concern to participants and affecting their ability to evaluate the risk to populations, communities and habitats within the parks posed by the following threats:

- artificial opening of river mouths
- adjacent seismic testing
- past indigenous fishing practices
- technology creep
- edge fishing

Participants tended to be reluctant to be specific about values associated with each potential threat. It was later suggested that this may have been due to:

- lack of detailed knowledge of marine populations, communities and habitats
- the broad nature of many of the potential threats

There was some concern expressed by several participants that issues relating to Merri MS were sufficiently different to those of the other two reserves as to warrant separate consideration.

Following the discussion of selected hazards, some changes were made to likelihoods and consequences by some groups. These were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in a substantial increase in agreement among groups, with the median correlation rising from +0.27 to +0.48.

The risk posed by each hazard was recorded in the risk register (Table 2.2.2), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards is presented in Figures 2.2.2 and 2.2.3.

The top three hazards identified in this workshop were:

- **Oil spills** from offshore *platforms* or shipping affecting **seabirds** and **intertidal habitats and communities**
- **Terrestrial events**/activities such as floods, fires, droughts, nutrients, (*water*) extractions, affecting **water quality**
- **Pest plants and animals** from recreational boating, ballast *water discharge*, agriculture, shipping and industry, **displacing local species**

The oil spill hazard was clearly the one of most concern to workshop participants, as demonstrated by the median scores of the groups ranging from 15 to 25, and the narrow range of scores compared to the terrestrial event and pest hazards (Figure 2.2.2).

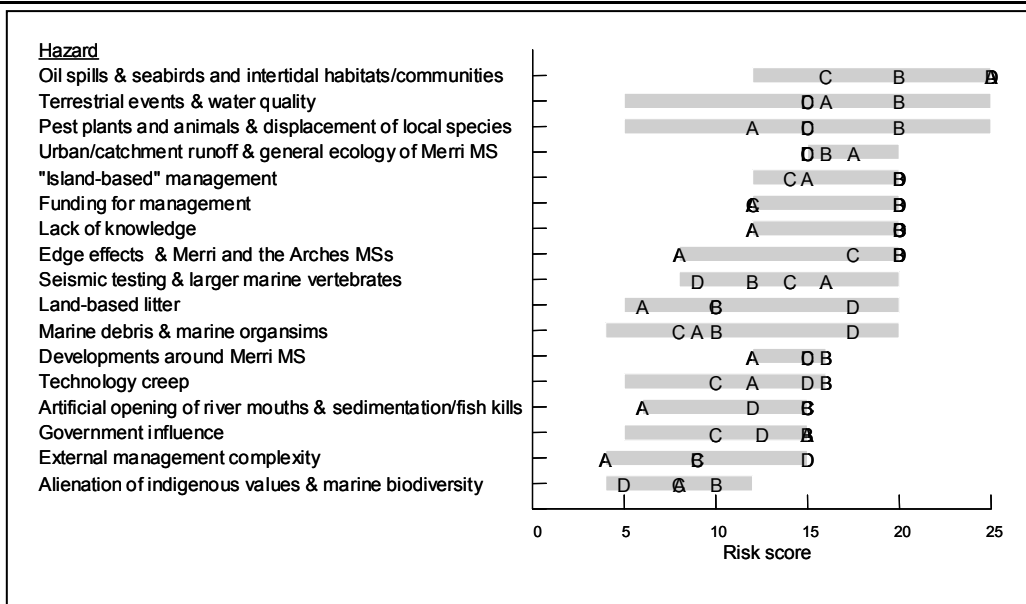


Figure 2.2.2 Summary of major risks for Twelve Apostles MNP, the Arches MS and Merri MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the four groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the four groups.

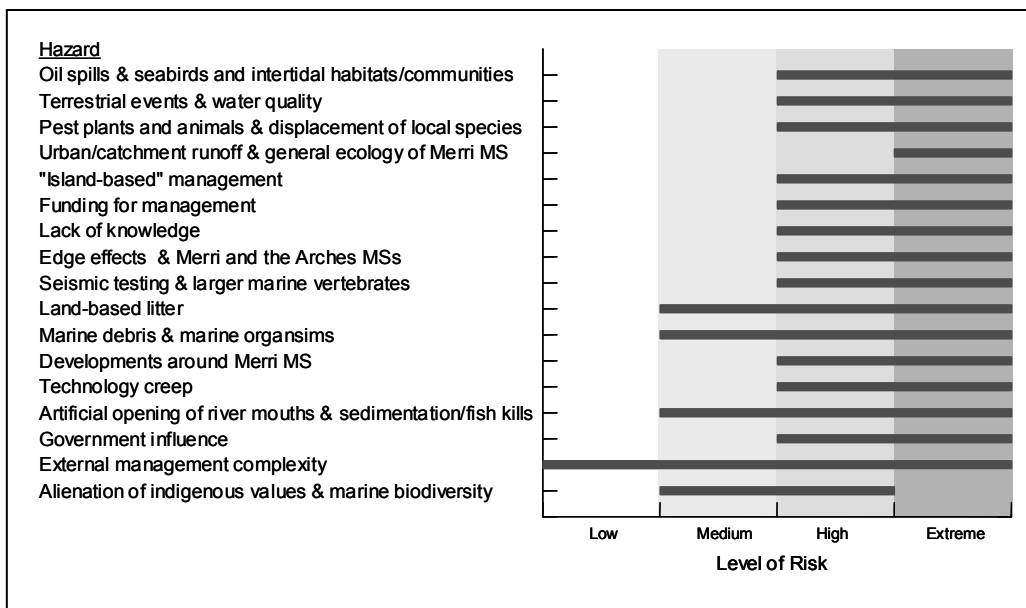


Figure 2.2.3 Hazards ordered as in Figure 2.2.2, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

2.2.2 Additional Concerns

The following additional concerns were raised outside the workshop setting, but are of relevance to the risk assessment:

- Visible plastic litter is not the only concern; shredded plastics may do more damage.
- Lack of community education about existing knowledge
- Likely increases in the local human population
- Housing development along the Merri system without wetland protection
- Proposed irrigation of the golf course with wastewater.
- Dredging: in the 1980s, dredged material was dumped in what is now the Merri MS. Further dredging may release *contaminants* currently bound in the sediments.
- Lack of enforcement to prevent dogs entering the Merri MS.
- Genetic integrity: both translocation of species and genetic mutations (e.g. the “aquarium strain of *Caulerpa taxifolia*) are important aspects to the maintenance of wild populations of native species.
- The aquarium industry should be addressed as a possible source of exotic species.

2.2.3 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2004) flagged 7 threats out of 51 as posing either an extreme or a high risk to the park or sanctuaries (Table 3). Only two of the seven, oil pollution and litter from vessel, are matched by similar entries in the workshop risk register (Table 2). Non-compliance with zoning restrictions (Table 3) could well encompass the illegal fishing hazard raised in the workshop (Table 1) but the latter was not considered by workshop participants to be of sufficient concern for promotion to the risk register. Cetaceans (Table 3) were considered as a potentially impacted value in three of the lesser workshop hazards, namely seismic testing, human interactions affecting whales and penguins, and lost fishing gear (Table 1). Although dogs (Table 2.2.3) were not raised as a potential threat at the workshop, they were of concern to a potential participant unable to attend.

Table 2.2.3 Risk priorities for threats of major concern to the Twelve Apostles MNP, the Arches MS or Merri MS. Drawn from an internal Parks Victoria risk assessment (Parks Victoria 2004).

Threat	Twelve Apostles MNP	The Arches MS	Merri MS
Oil pollution	Extreme	Moderate	Extreme
Non-compliance with zoning restrictions (pending management plan)	High	Low	Extreme
Cetacean stranding	High	High	High
Vandalism - environmental	High	High	High
Commercial quantity abalone poaching	High	High	Moderate
Litter - from vessel	High	High	Moderate
Dogs	Low	Low	High

Of the 15 hazards in the workshop risk register that do not match high or extreme risks from the internal assessment (Table 3), at least partially comparable threats for 6 do appear in the internal assessment but with risks rated as only moderate or low (Parks Victoria 2004). However, the following nine threats from the workshop register had no equivalent in the internal assessment:

- **Lack of knowledge** affecting marine habitats and communities
- **“Island-based” management** focus affecting marine habitats and communities
- **External management complexity** (e.g. common boundary of Twelve Apostles MNP with Federal MPA) affecting marine communities and habitats
- **Alienation of indigenous cultural values** and perspectives impacting on management of **marine biodiversity**
- **Artificial opening of river mouths** producing silt plumes resulting in **fish kills and sedimentation**
- **Government influence** on management affecting marine communities and habitats
- **Technology creep** (i.e. better oil/gas extraction/exploration methods, exploitation of new resources, new ways of accessing resources via bioprospecting, aquaculture etc.) affecting marine communities and habitats
- **Terrestrial events/activities** such as floods, fires, droughts, nutrients, (water) extractions, affecting **water quality**
- **Funding for management** affecting marine communities and habitats

2.3 Marengo Reefs Marine Sanctuary

An ecological risk assessment for the Marengo Reefs Marine Sanctuary was undertaken in a workshop setting at Apollo Bay on 2nd March 2005. The 13 workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the sanctuary (Appendix 1).

Areas of fully exposed reef above high water mark were included in the assessment because they are, atypically, part of the sanctuary. It was noted that the habitat map of the Marine Natural Values Study (Plummer *et al.* 2003) does not show the intertidal area on the inner reef, nor the fully exposed part of the outer reef. Inconsistencies in the naming of the reefs by various sources (e.g. Parks Victoria, Royal Australian Navy charts, and common usage) were also noted.

Each participant was asked to identify threats of particular concern to them, and the natural attributes of the sanctuary that they valued and that were potentially affected by those threats, and resulted in an initial list of 14 hazards (Table 2.3.1).

As individual hazards were nominated, some were discussed in detail to enhance participants' understanding and to minimize differences in interpretation. Lines of reasoning concerning particular threats or values are recorded below:

- In relation to the nearby sewage treatment plant, it was reported that on one occasion, *E. coli* readings taken by the EPA had been the second worst in the state. This event had clearly engendered a lack of faith in plant operations in the minds of some participants, and there were also concerns with future plans in relation to Skenes Creek.
- Seals regularly use Little Henty Reef as a haul out area. It was noted that there are no regulations covering interaction with seals in the sanctuary, as there are in Port Phillip Bay. However, Parks Victoria is able to impose controls on licenced tour operators within the sanctuary. One participant reported seeing no difference in numbers of commercial and non-commercial boats around the reef, and suggested that advisory signs at the boat ramp might help inform individual boat owners. Another participant reported that seals typically move off the reef when people approach within about 30 m.
- Recreational divers may inadvertently damage reef assemblages, for example, by holding on to algae to maintain their position in surge conditions. Deliberate removal of biota from the sanctuary is of course, not permitted.
- With regard to the small size of the sanctuary, it was suggested that this would not be problem were the uses of surrounding areas compatible with the goals of the sanctuary. However, were a buffer zone to be created outside the sanctuary, it may be seen by some as a further encroachment of their freedom to indulge in their chosen activities.
- For oil spills, it was decided to separate different categories of vessel because of potential differences in sizes and frequencies of spills. Small spills from recreational vessels were believed to occur fairly frequently, whereas very large spills from commercial shipping occur rarely. Commercial fishers such as cray fishers might fall somewhere in between for both size and frequency of spills. It was also noted that wildlife carers are now better prepared and organised to cope with the effects of a spill on species such as penguins.
- The proximity of an airfield was believed to increase the likelihood of a plane or helicopter crash nearby, perhaps somewhere behind the township of Apollo Bay.
- The sanctuary was reported to be used by birds for feeding and roosting, but as part of the general shore line, rather than as a focal site. While the reef might be used more by

penguins than some other species, it was not thought to be sufficiently sheltered to allow breeding of these or other birds. Terns which use the sanctuary are believed to breed at the Twelve Apostles or possibly at Deen Maar Island (Lady Julia Percy Island).

- Marine pests were believed to be an important threat because of the nature of the coast and because of the small size of the sanctuary, the latter making it less robust to environmental disturbances. The movement of commercial fishing vessels to and from Tasmanian ports was seen as heightening the threat of introductions.
- Increasing quantities of nutrients flowing to sea in the vicinity of the sanctuary were of concern to workshop participants in the light of increasing development in the surrounding area. One cited an instance in 2004 when after heavy rain, the entire bay (Mounts Bay?) was discoloured by runoff. Another reported that since the commissioning of a stormwater outfall, rocks in the immediate area have become black and slippery. This was presumed to be due to a high nutrient load and the mixing of freshwater and seawater. The slippery surface has led to an increased number of accidents among people walking on the rocks. It was reported that some foreshore outfalls are to be upgraded to allow faster dispersal of wastewater in future.

Table 2.3.1 Initial list of hazards from unstructured brainstorming session, Marengo Reefs MS.

Initial definition	Subsequent definition if refined
Land-based litter, especially plastics, affecting seals, birds and penguins	Individual items of land-based litter, especially plastics, affecting seals, birds and penguins
Divers or snorkellers taking abalone, crayfish and resident fish and thereby affecting the size distribution of these species <i>within the sanctuary</i> .	Divers or snorkellers illegally taking edible species such as abalone, crayfish and resident fish and thereby affecting the size distribution of these species <i>within the sanctuary</i> .
Failure of the <i>nearby</i> sewage treatment plant affecting algal communities.	
Trampling on the reef affecting the intertidal community.	
Commercial tour groups or other organised groups of human visitors on the reef disturbing seals.	
Recreational divers damaging or removing <i>sanctuary</i> flora and fauna.	
Small size of the sanctuary affecting management decisions and resourcing, <i>with flow-on effects to habitats and communities in the sanctuary</i> .	
Oil spill from small recreational boats in the sanctuary with localised effects on flora and fauna.	
Oil spill from commercial fishing boat running aground in the sanctuary, with sanctuary-wide effects on flora and fauna.	
Oil spill from commercial shipping with sanctuary-wide effects on flora and fauna.	
Aircraft crash on/near sanctuary affecting sanctuary flora and fauna.	

Noise from and/or the physical presence of humans disturbing roosting or feeding birds in the sanctuary.	
Establishment of marine pests disrupting (e.g. by competition, predation) ecological processes in the sanctuary.	
Nutrient increase in the sanctuary as a result of increased human population causing changes in community composition in the sanctuary.	

To prompt a fuller consideration of hazards, and to identify values or threats that may have been overlooked, participants were provided with a list of 3 natural values specific to the sanctuary, together with a generic list of 135 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 405 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 24 hazards being identified as of particular concern to at least one workshop participant (Table 2.3.2).

Table 2.3.2 Additional hazards from structured brainstorming session, Marengo Reefs MS.

Initial definition	Subsequent definition if refined
<i>Legal</i> fishing in areas surrounding the sanctuary resulting in reduced populations of fin fish in the sanctuary.	
Seismic testing resulting in damage to sanctuary invertebrates.	
Aggregated land-based litter discharged via stormwater affecting marine mammals, birds and fish <i>in the sanctuary</i> .	
Anchor damage to sanctuary habitats and large sessile organisms.	
Propellers causing <i>physical</i> damage to the reef structure, to algae or to seals <i>in the sanctuary</i> .	
Propellers resulting in increased turbidity and thus affecting marine algae and filter feeders in the sanctuary.	
Personal water craft disturbing (noise) or striking birds, seals or fish. Small boat operations through the Gap (between the high points of Little Henty Reef) damaging intertidal algae and invertebrates (i.e. wash from boats).	Combined in single hazard: Small boat operation in the Gap (between the high points of Little Henty Reef) or personal water craft disturbing or damaging birds, seals, fish, intertidal algae and invertebrates.
Lack of public awareness of the existence of a marine sanctuary leading to damage to or disturbance of sanctuary flora and fauna.	

Lack of clear boundary marks resulting in damage to or disturbance of sanctuary flora and fauna.	
Increased quantity of sediment resulting from land practices around the estuary and discharged via the river affecting algae and filter feeders in the sanctuary.	
Lack of community support for the sanctuary resulting in decreased resourcing and thus affecting the sustainability of sanctuary communities.	
Herbicides/pesticides from the proposed golf course killing or accumulating in sanctuary species.	
Sea-based litter (including lost fishing gear) affecting marine mammals, birds or fish (by ingestion or entanglement)	
Active fishing gear (i.e. not lost or discarded) resulting in entanglement of marine mammals.	
Human disturbance to natural values of the sanctuary with cultural significance.	
Shooting of seals.	
Coastal infrastructure development causing increased sedimentation in the sanctuary and thus affecting benthos and filter feeders in the sanctuary. Coastal infrastructure development causing increased turbidity and thus affecting algae in the sanctuary.	Combined in a single hazard: Coastal infrastructure development causing increased sedimentation or turbidity in the sanctuary and thus affecting benthos, filter feeders or algae in the sanctuary.
Increasing freshwater outputs from shore causing changes to algal community composition in the sanctuary.	
Vessel wrecked on the reef resulting in physical damage to sanctuary habitats and communities.	
Global warming resulting in increased sea temperature and thus causing changes to species composition in the sanctuary.	
Bacterial contamination from dog droppings (via stormwater runoff) resulting in changes to species composition in the sanctuary.	
Lack of ecological knowledge <i>leading to inappropriate/ineffective management and consequently</i> affecting sanctuary species and communities.	

- While the hazard of legal fishing in areas surrounding the sanctuary referred specifically to fin fish, there was also some concern for species used as bait. It was reported that the Bass yabby (*Trypaea australiensis*) is no longer as abundant on the beach as it had been in the past. There was also concern for the effect that widespread use of pots and lines might have on any monitoring program designed to monitor the effects of the sanctuary.

- With regard to seismic testing, it was noted that there is a large area of potential interest for seismic exploration offshore of the sanctuary. The relative lack of information on the effects of seismic testing on marine biota was of concern to participants.
- Personal water craft were thought to be present in increasing numbers around the sanctuary, and their operators perceived to often act without due regard to regulations. It was suggested that being naturally inquisitive, seals may sometimes venture too close to both PWCs and small boats.
- Small boats have frequently been observed travelling fast through the Gap between the high points of Little Henty reef. The Gap may be used as a shortcut back to calmer water when the sea is rough, and there was concern from some participants that both noise and wash from the boats may disturb or damage sanctuary biota. However, another participant suggested that waves generated by passing boats would be smaller than those due to natural wave action. It was also reported that killer whales and humpback whales pass through the Gap. (Note: the Marine Natural Values Study (Plummer *et al.* 2003) shows the 10 m depth contour passing through the middle of the reef, and reports sightings of the Southern Right Whale on the edge of the sanctuary.)
- It was suggested that a lack of public awareness of the sanctuary, particularly by interstate visitors, may be linked to the lack of signage identifying both the boundaries of the sanctuary and whether activities such as shore fishing are permitted. In spite of this link, the public awareness and boundary marking hazards were treated separately because they were seen to require different management responses.
- The effects of sediments of terrestrial origin were thought to be greatest on the inshore side of the reef, which is in shallower water and is less steep than the seaward side. Fewer species are seen on the inshore side of the reef. There was some question over whether artificial opening of the river mouth would result in more or less impact on the sanctuary, and it was suggested that the timing of any such opening should take into account wind and current conditions.
- Concerns with lack of community support for the sanctuary considered different groups of people within the community, for example, locals versus tourists.
- Pesticides or herbicides applied on land were reported to have affected marine and estuarine systems in Tasmania, where spraying of a forest area resulted in the loss of oysters.
- Litter originating from the sea, including lost fishing gear, is a recognised problem for marine mammals, birds and fish. It was reported that a full set of fishing nets could be lost during a storm. At Marengo Reefs MS, entanglement of seals was seen as the major issue. Another concern was fishing gear which had been deployed on the sanctuary boundary, but was subsequently damaged and then drifted into the sanctuary, obstructing the passage of seabirds, whales and larger fish (through the Gap?).
- There was some discussion over the likelihood of natural attributes with indigenous cultural significance existing within the sanctuary. It was suggested that some such attributes may exist, but that areas adjacent to the sanctuary may be valued more highly. One participant suggested that such cultural values were likely to be non-physical in nature. (Note: the Kooyang Sea Country Plan (Smyth & Bahrdt 2004) indicates that indigenous cultural values and ecological attributes are closely interwoven.)
- The shooting of seals is no longer as great a problem as it once was, one participant attributing some of the change in local attitude to a sculpture outside the information centre. It was noted that the shooting of seals was one motivation for the creation of and support for the sanctuary.

- Coastal infrastructure development raised concerns with increased sedimentation and turbidity in the sanctuary. Indirectly, development in the Apollo Bay Boat Harbour about 2 km north of the sanctuary was also a concern. The harbour supports the only seagrass beds in the region. These in turn support a variety of fish, some of which may eventually inhabit the sanctuary, thus impacts on fish populations in the harbour may have consequences for the sanctuary. It was pointed out that development of a marina might also result in increased occurrence of other threats, such as the grounding of boats in the sanctuary. In the past, two boats have run aground in the sanctuary, and considerable damage was done to the reef and its biota while refloating them.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored two or more votes were included in the risk register (Table 2.3.3). Some tightening of the definitions of a few hazards was also undertaken at this stage.

Table 2.3.3 Risk register, Marengo Reefs MS.

Hazard	Likelihood	Consequence	Risk score	Level of Risk
Divers or snorkellers illegally taking edible species such as abalone, crayfish and resident fish and thereby affecting the size distribution of these species <i>within the sanctuary</i> .	4 - 5	3 - 5	12 - 25	H - E
Failure of the <i>nearby</i> sewage treatment plant affecting algal communities.	1 - 2	1 - 4	1 - 8	L - H
Commercial tour groups or other organised groups of human visitors on the reef disturbing seals .	4 - 5	2 - 5	10 - 25	H - E
Recreational divers damaging or removing <i>sanctuary</i> flora and fauna.	3 - 4	2	6 - 8	M - H
Small size of the sanctuary affecting management decisions and resourcing, <i>with flow-on effects to habitats and communities</i> in the sanctuary.	3 - 5	2 - 4	6 - 20	M - E
Establishment of marine pests disrupting (e.g. by competition, predation) ecological processes in the sanctuary.	2 - 4	3 - 5	9 - 16	H - E
Nutrient increase in the sanctuary as a result of increased human population causing changes in community composition in the sanctuary.	3 - 5	3 - 5	9 - 25	H - E
Fishing in areas surrounding the sanctuary resulting in reduced populations of fin fish in the sanctuary.	4 - 5	3 - 4	12 - 20	H - E
Aggregated land-based litter <i>discharged to the sea</i> via stormwater affecting marine mammals, birds and fish <i>in the sanctuary</i> .	3 - 5	2 - 3	6 - 15	M - E

Small boat operation in the Gap (<i>between the high points of Little Henty Reef</i>) or personal water craft disturbing or damaging birds, seals, fish, intertidal algae and invertebrates .	4 - 5	2 - 3	8 - 15	H - E
Lack of public awareness of the existence of a marine sanctuary leading to damage to or disturbance of sanctuary flora and fauna .	3 - 4	2 - 4	8 - 16	H - E
Lack of clear boundary marks resulting in damage to or disturbance of sanctuary flora and fauna .	3 - 5	3 - 4	9 - 20	H - E
Increased quantity of sediment resulting from land practices around the estuary and discharged via the river affecting algae and filter feeders in the sanctuary.	3 - 5	3 - 4	9 - 20	H - E
Sea-based litter (including lost fishing gear) affecting marine mammals, birds or fish (<i>by ingestion or entanglement</i>)	2 - 4	2 - 3	4 - 12	L - H
Coastal infrastructure development causing increased sedimentation or turbidity in the sanctuary and thus affecting benthos, filter feeders or algae in the sanctuary.	3 - 5	3 - 5	9 - 25	H - E
Lack of ecological knowledge <i>leading to inappropriate/ineffective management and consequently</i> affecting sanctuary species and communities .	2 - 5	2 - 4	4 - 20	L - E

Note: Level of Risk is based on Likelihood and Consequence in accordance with AS4360 Appendix E

The subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into four groups of two or three people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from -0.08 to +0.71, with a median of +0.35, indicating a moderate level of disagreement overall among the groups. Individual hazards with high levels of disagreement were then discussed in detail (see below).

(i) **Lack of ecological knowledge** *leading to inappropriate/ineffective management and consequently* affecting sanctuary **species and communities**.

There was general agreement among the groups that ecological knowledge was both desirable but currently lacking. However, there was debate about whether the lack of knowledge would in fact lead to important impacts on the sanctuary. Were there any

example of research which had brought about different management decisions than would otherwise have been the case?

The importance of monitoring was highlighted. Sub-optimal management decisions may have been made in the past, but without monitoring, there is no way to identify such events. It was noted that funding may be easier to obtain for on-ground management than for research to inform that management. This problem seen as not confined to the park management agency, but to also exist in other agencies such as catchment management authorities.

A comparison was made between lack of knowledge and other more tangible threats such as an oil spill. Which would be easier to deal with? It was also noted that a lack of knowledge does not negate the need for decision-making.

(ii) Lack of clear boundary marks resulting in damage to or disturbance of sanctuary **flora and fauna**.

Apparently many boat users initially thought the sanctuary rather larger than it actually is, leading them to leave what was effectively a buffer zone around the sanctuary. However, as GPS has become more common in small boats (and the park boundaries can be more readily identified), there is an increasing trend of fishing right up to the park boundary. One participant suggested that poachers and divers are particularly likely to operate close to the boundary. However, substantial fines should make the risk not worth while for licenced commercial fishers.

The effects of such boundary fishing might be expected to vary with the type of fish involved. That is, whether they are pelagic species and may thus be expected to move in and out of the sanctuary, or territorial reef dwellers such as wrasse. It was suggested that most fishing did not target reef-dwelling species, but that even so, some impact on such species might be expected.

It was noted that the sanctuary is a small but ecologically complex area with a high public profile. It invokes passionate responses in people.

(iii) Recreational divers damaging or removing *sanctuary* **flora and fauna**.

One group recognised high use of the sanctuary by divers, but believed the consequences to sanctuary biota from such use would be low.

There was some concern that usage by divers may increase substantially should a proposed marina development go ahead. An alternative view was that, if managed effectively, more divers could be a positive influence for the sanctuary by enhancing its reputation as a desirable dive site.

Education of park users and an enforcement presence were noted as being important to minimise impacts in the sanctuary.

(iv) Sea-based litter (including lost fishing gear) affecting **marine mammals, birds or fish** (*by ingestion or entanglement*)

One view of this hazard was that any effect of sea-based litter such as fishing gear would typically involve a small number of individuals, and thus would not have lasting population-wide effects. In addition, the threat tends to be visible and localised, and are thus likely to be noticed and dealt with by people concerned for the sanctuary and its biota.

A group that scored this hazard more highly for likelihood did so in the light of the longer-term ghost-fishing effects of lost nets and pots, believing that such litter would be less noticeable, and thus less likely to be cleaned up.

(v) Establishment of **marine pests** disrupting (e.g. by competition, predation) **ecological processes** in the sanctuary.

One point of view was that if pest species have not already established in the sanctuary, they are unlikely to do so in the next ten years. The opposing view was that increasing popularity of the sanctuary, increasing shipping traffic passing by, and the sanctuary's slightly sheltered location make the establishment of a pest species more likely in future. Commercial fishing vessels are tending to go further afield which may also aid the spread of marine pests. In addition, other environmental impacts such as changes in nutrient concentrations may make the sanctuary ecosystem more susceptible to invasion.

The Northern Pacific seastar *Asterias amurensis* and the European shore crab *Carcinus maenas*, also known as the "green meanie", were two species mentioned by participants. The former is notable for having spread beyond major ports, to other locations along the Victorian coast.

(vi) **Nutrient increase** in the sanctuary as a result of increased human population causing changes in **community composition** in the sanctuary.

One hope with this hazard was that increased regulation would control the flow of nutrients to the sea. However, other groups were not confident that either regulation or technology would provide adequate controls to ensure the health of the sanctuary.

Local concerns in relation to an increasing human population include a proposal by the golf club, the expected timing and volumes of stormwater, and the ability of the sewage treatment works to treat wastewater to an adequate standard for reuse.

(vii) **Failure of the nearby sewage treatment plant affecting algal communities.**

Discussion of this hazard reflected different degrees of faith in the regulatory environment under which the plant would operate in future.

At various times throughout the post-ranking discussion, there appeared to be some confusion as to the correct approach to scoring the hazards. In this workshop, likelihood was to be scored as the likelihood of defined consequences eventuating as a result of the threat, not just the likelihood of the threat occurring.

Following the lengthy discussion of selected hazards, some changes were made to likelihood and consequence scores. These were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in a modest increase in agreement among groups. While the median correlation increased from +0.35 to +0.44, the

minimum and maximum correlation coefficients rose only slightly, to +0.03 and +0.73 respectively.

The risk posed by each hazard was recorded in the risk register (Table 2.3.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 2.3.1 and 2.3.2. The hazards of greatest concern identified in the Marengo Reefs workshop were:

- **Divers or snorkellers** illegally taking **edible species** such as abalone, crayfish and resident fish and thereby affecting the size distribution of these species *within the sanctuary*.
- Commercial tour groups or other organised **groups of human visitors** on the reef disturbing **seals**.
- **Coastal infrastructure** development causing increased sedimentation or turbidity in the sanctuary and thus affecting **benthos, filter feeders or algae** in the sanctuary.
- **Nutrient increase** in the sanctuary as a result of increased human population causing changes in **community composition** in the sanctuary.

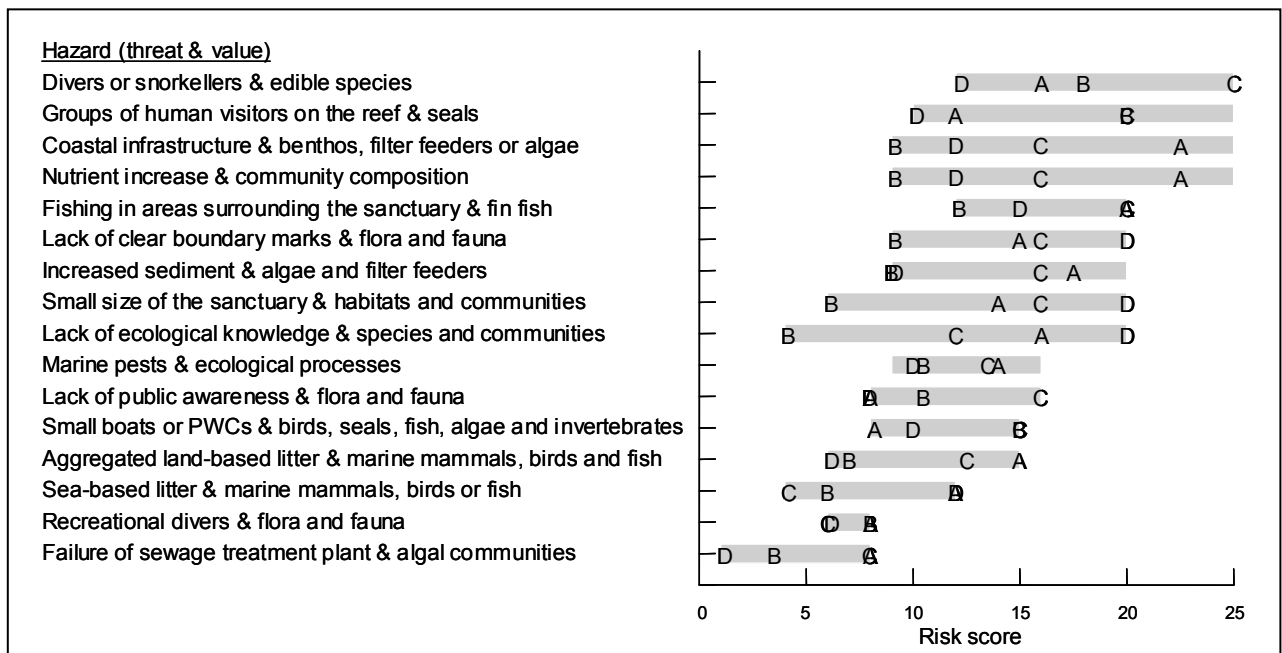


Figure 2.3.1 Summary of major risks to Marengo Reefs MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the four groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the four groups.

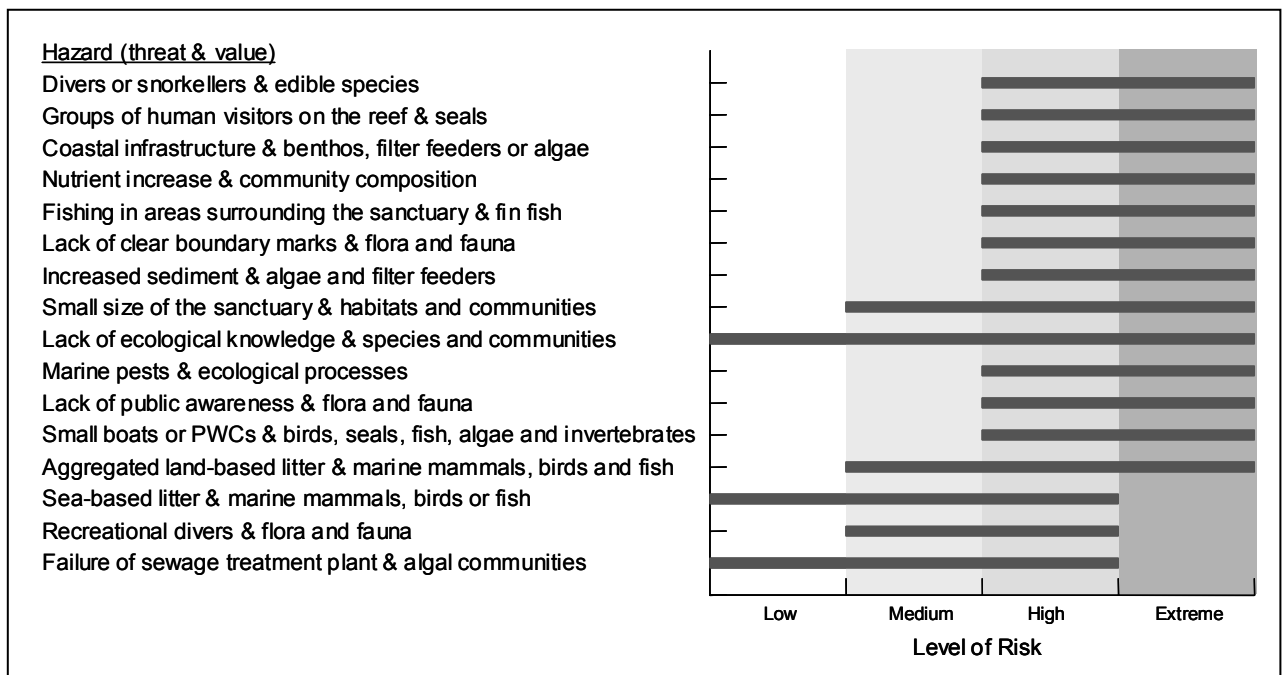


Figure 2.3.2 Hazards ordered as in Fig. 1, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E.

2.2.1 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2004) flagged 8 threats out of 51 as posing either an extreme or high risk to the Marengo Reefs MS (Table 2.3.4). There is little correspondence between these high risk threats and hazards listed in the workshop risk register. There is some similarity between wildlife harassment and groups disturbing seals, but the former was defined as specifically intentional, whereas the latter was not necessarily so.

Table 2.3.4 Risk priorities for major threats of concern to Marengo Reefs MS. Drawn from an internal Parks Victoria risk assessment (Parks Victoria 2004).

Threat	Priority
Oil pollution	Extreme
Cetacean stranding	High
Commercial quantity abalone poaching	High
Intentional wildlife harassment	High
Intentional wildlife harassment (commercial tour operators)	High
Non-compliance with zoning restrictions (pending management plan)	High
Speed	High
Vandalism - environmental	High

Five of the risk register hazards incorporated threats not considered in the internal assessment:

- **Failure of the nearby sewage treatment plant** affecting **algal communities**.
- **Small size of the sanctuary** affecting management decisions and resourcing, *with flow-on effects to habitats and communities* in the sanctuary.
- **Lack of public awareness** of the existence of a marine sanctuary leading to damage to or disturbance of sanctuary **flora and fauna**.
- **Increased quantity of sediment** resulting from land practices around the estuary and discharged via the river affecting **algae and filter feeders** in the sanctuary.
- **Lack of ecological knowledge** *leading to inappropriate/ineffective management and consequently* affecting sanctuary **species and communities**.

Threats associated with the remaining risk register hazards rated low or medium priority in the internal assessment.

2.4 Point Addis Marine National Park, Eagle Rock Marine Sanctuary & Point Danger Marine Sanctuary

An ecological risk assessment for the Point Addis Marine National Park, Eagle Rock Marine Sanctuary and Point Danger Marine Sanctuary was undertaken in a workshop setting at Anglesea on 11th August 2004. The 14 workshop participants (Appendix 1) included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park and sanctuaries.

The risk assessment was designed to consider the park and the two sanctuaries collectively, but with scope to restrict individual hazards to specific protected areas.

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants and resulted in an initial list of 14 hazards, two of which concerned specific reserves (Table 2.4.1).

Participants were then provided with a list of 15 natural values specific to the park or sanctuaries, together with a generic list of 84 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 1260 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 15 hazards being identified as of particular concern to at least one workshop participant (Table 2.4.2).

To minimize differences in interpretation among the participants, some hazards were more tightly defined at this stage (Tables 2.4.1 & 2.4.2). This process involved clarifying the value at risk, and the nature of threat affecting that value, to the extent that a measurable endpoint may have been identified.

Table 2.4.1 Hazards of concern initially nominated by participants for Point Addis MNP, Eagle Rock MS and Point Danger MS

Initial definition of hazard	Subsequent definition, if redefined
Tourism on the shore-side of parks.	
Marine pests displacing local species.	New and emerging marine pests, including pathogens, displacing local species and causing ecological change.
Pollution from land.	
Pollution from sea.	Moderate (<i>i.e. not major spill from shipwreck</i>) oil pollution from sea, either deliberate or accidental, having sublethal effects on biota in more than 5% of a park.
Uncoordinated, unsupervised or uninformed access to intertidal platforms.	Trampling and disturbance to intertidal platforms causing greater than natural variability in communities.
Increased nutrients and heavy metals from sewage outfall affecting seagrass and reef at Point Addis MNP and Eagle Rock MS.	Increased nutrients and heavy metals from sewage outfall causing any loss of seagrass or reef (<i>biota</i>) at Point Addis MNP and Eagle Rock MS.

Parks Victoria Technical Series No. 33 Threats to Victoria's Marine Protected areas

VEAC review/new Otway (<i>terrestrial</i>) NP shifting focus from MNPs and MSs.	
Divers feeding fish, anchoring their boats or otherwise causing damage to habitats.	
High acidity flush from Anglesea River causing kill kills at Point Addis MNP.	
Lack of flexibility in management (e.g. ability to respond to new hazards such as <i>new</i> recreational activities) and lack of coordination among multiple agencies (<i>resulting in impacts on environmental values</i>).	
Lack of knowledge about hydrology, habitats, population dynamics including recruitment, geomorphology and sand movement <i>resulting in impacts on environmental values</i> .	Lack of ecological knowledge about hydrology, habitats, population dynamics including recruitment, geomorphology and sand movement, and fisheries management leading to less effective management of communities and habitats.
Physical damage, pollution or cleanup impacts of a shipwreck sufficient to invoke an AMSA response.	Physical damage, pollution or cleanup impacts of a shipwreck sufficient to invoke an AMSA response, and resulting in any impacts on the parks.
Sea level rise from climate change affecting intertidal habitats.	
Stranding of whales (<i>or dolphins?</i>) and their impacts on existing park fauna.	

Table 2.4.2 Additions to hazard list for Point Addis MNP, Eagle Rock MS and Point Danger MS, after considering pre-workshop lists of threats.

Initial definition of hazard	Subsequent definition, if hazard refined
Plastic litter causing the death of organisms.	
Increased shore-based development stemming from a desire to access the coast, leading to increases in the human population, stormwater, sewage, litter, small boating and management costs, and decreased visual amenity	Split into two hazards, other components of the original being covered elsewhere: 1) Increased shore-based development leading to increases in small boating activity which may cause physical damage to habitats and communities greater than that caused naturally. 2) Increased shore-based development leading to increased cost of management <i>and consequent effects on park communities and habitats</i> .
Increased sedimentation from rivers leading to decreased photosynthesis and increased smothering (<i>of biota</i>).	

Freshwater from outfalls and estuaries (the latter due to increased mechanical opening) affecting intertidal biota.	Man-made discharges of freshwater/stormwater from outfalls and estuaries (the latter due to increased mechanical opening) leading to changes in subtidal communities greater than natural variation.
Increased (<i>numbers of</i>) structures (e.g. groynes) affecting longshore drift at Point Danger.	
Off-site fisheries management resulting in ecological change in MNPs, both directly and indirectly through changed human behaviour.	
Directional drilling in oil/gas exploration <i>leading to habitat damage</i> .	
Noise pollution from seismic exploration, boating, shipping, navigation, aircraft etc. affecting the behaviour and physiology of valued organisms such as penguins, hooded plovers, white-faced herons and terns in MNPs.	
Dogs, horses and vehicles affecting birds and seals at Point Addis MNP and Eagle Rock MS.	Dogs, horses and vehicles reducing viability of populations of birds and seals at Point Addis MNP and Eagle Rock MS.
Increasing numbers of native fauna resulting in ecological change. (<i>cf. koalas</i>)	
Anchoring of large vessels and oils rigs causing damage to benthos at Point Addis MNP.	
<i>Exotic species in ballast water discharge from passing shipping (given proximity of shipping channel) displacing local species and causing ecological change.</i>	
Plastic and other litter from sea or land leading to injury or death of resident or transient organisms.	Plastic and other litter from sea or land leading to injury or death of resident or transient organisms and thus reduced community viability.
Illegal harvesting.	Illegal harvesting (organised poaching) of abalone leading to decreased population viability and flow-on effects to other organisms.

A detailed discussion of the effects of trampling on intertidal rock platforms resulted in a conceptual model of the different groups of people who may be involved (Figure 2.4.1). It was noted that the level of understanding of possible impacts varied substantially within groups. For example, among surfers and fishers, local residents were believed to have a good understanding of local rules relating to the park and sanctuaries, while visitors from Melbourne were perceived as less knowledgeable in this regard.

It was also observed that people visiting rock platforms were often happy to remain on designated pathways to reach the shore, but once there, tended to ramble about with little attention to where they walked or what damage they may do. The ways in which an increasing human population may affect the marine parks were also discussed at length

(Figure 2.4.2). Increases were seen as having a multiplying effect on existing hazards such as sewage discharge, boating activity and littering.

The future of the existing sewage outfall at Anglesea was discussed. Workshop participants understood the treatment plant to be capable of tertiary treatment, but to routinely discharge waste treated only to secondary level. (Note: Wastewater from the Anglesea treatment plant routinely undergoes sand filtration and ultraviolet disinfection, which are both forms of tertiary treatment, but is not subjected to chemical dosing for additional removal of nutrients. (R. MacKenzie, Barwon Water. pers. comm.) Barwon Water is currently investigating options to accommodate increased sewage inflows from Aireys Inlet, including construction of a pipeline to the Anglesea plant and the use of recycled water by Alcoa.

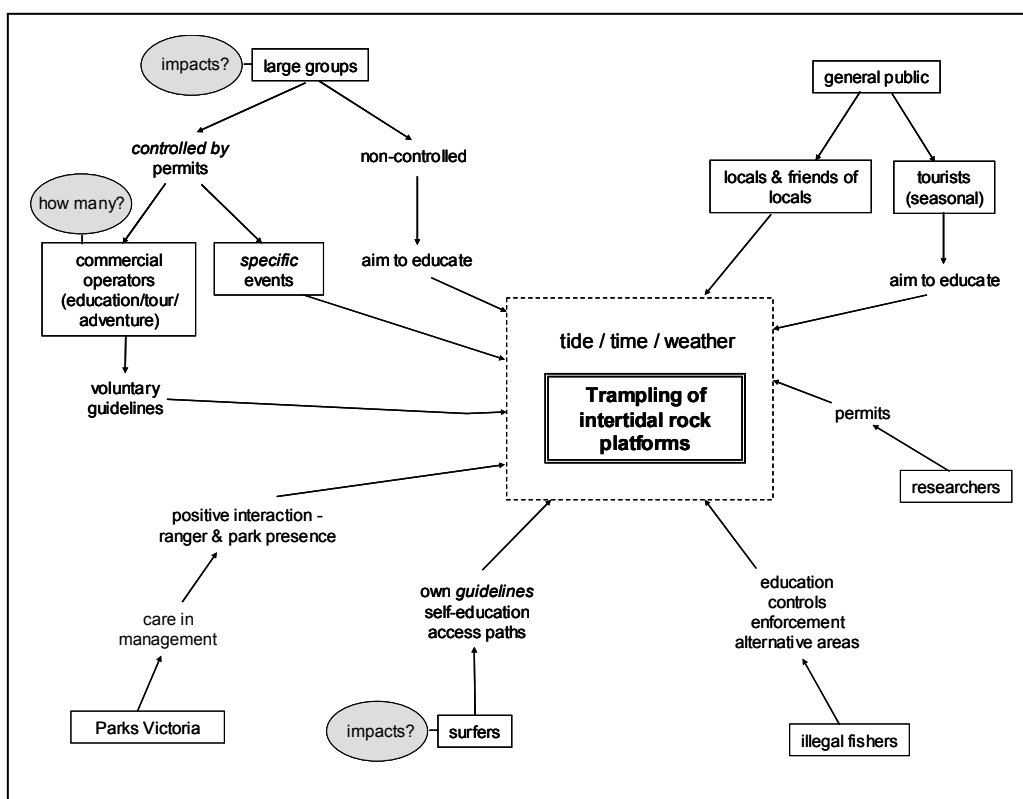


Figure 2.4.1 Groups of people who may trample on intertidal rock platforms.

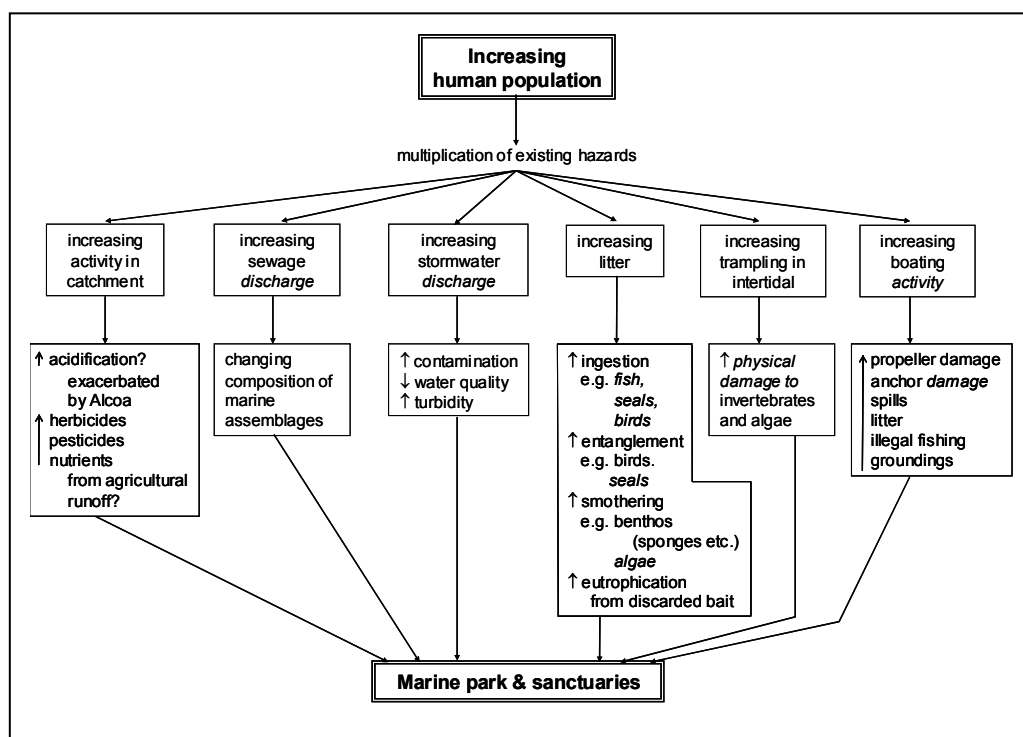


Figure 2.4.2 Pathways by which an increasing human population may affect the park and sanctuaries.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern for the next stage of the risk assessment. Participants were invited to vote for their preferred two hazards, and this process produced the hazards listed in Table 2.4.3.

Table 2.4.3 Risk register for Point Addis MNP, Eagle Rock MS and Point Danger MS.

Bounds represent the range of opinion among the four groups of participants. (L = low risk, M = moderate risk, H = high risk, E = extreme risk).

Hazard	Likelihood	Consequence	Risk Score	Level of Risk
New and emerging marine pests , including pathogens, displacing local species and causing ecological change	3 - 5	1 - 5	3 - 25	H - E
Moderate (i.e. not major spill from shipwreck) oil pollution from sea, either deliberate or accidental, having sublethal effects on biota in more than 5% of a park	3 - 5	2 - 3	6 - 15	M - E
Trampling and disturbance to intertidal platforms causing greater than natural variability in communities	4 - 5	2 - 4	8 - 20	H - E
Increased nutrients and heavy metals from sewage outfall causing any loss of seagrass or reef (biota) at Point Addis MNP and Eagle Rock MS	3 - 5	3 - 4	9 - 20	H - E
Lack of ecological knowledge about hydrology, habitats, population dynamics including recruitment,	4 - 5	1 - 5	5 - 25	H - E

geomorphology and sand movement, and fisheries management leading to less effective management of communities and habitats				
Physical damage, pollution or cleanup impacts of a shipwreck sufficient to invoke an AMSA response , and resulting in any impacts on the parks	1 - 3	3 - 5	4 - 15	M - E
Increased shore-based development leading to increased cost of management and consequent effects on park communities and habitats.	2 - 5	1 - 4	3 - 16	L - E
Increased shore-based development leading to increases in small boating activity which may cause physical damage to habitats and communities greater than that caused naturally	2 - 5	1 - 4	2 - 20	L - E
Man-made discharges of freshwater/stormwater (fw component only) from outfalls and estuaries (the latter due to increased mechanical opening) leading to changes in subtidal communities greater than natural variation	3 - 4	1 - 4	4 - 16	M - E
Dogs, horses and vehicles reducing viability of populations of birds and seals at Point Addis MNP and Eagle Rock MS	2 - 5	2 - 4	6 - 15	M - E
Plastic and other litter from sea or land leading to injury or death of resident or transient organisms and thus reduced community viability	2 - 5	3 - 4	6 - 15	M - E
Illegal harvesting (organised poaching) of abalone leading to decreased population viability and flow-on effects to other organisms	3 - 5	3 - 4	12 - 20	H - E

Note: level of risk is based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

The next step in the assessment process was to select a subset of hazards deemed to be of most concern for the next stage of the risk assessment. Participants were invited to vote for their preferred two hazards, and this process produced the hazards listed in Table 2.4.3.

Table 2.4.3 Risk register for Point Addis MNP, Eagle Rock MS and Point Danger MS.

Bounds represent the range of opinion among the four groups of participants. (L = low risk, M = moderate risk, H = high risk, E = extreme risk)

Hazard	Likelihood	Consequence	Risk Score	Level of Risk
New and emerging marine pests , including pathogens, displacing local species and causing ecological change	3 - 5	1 - 5	3 - 25	H - E
Moderate (i.e. not major spill from shipwreck) oil pollution from sea, either deliberate or accidental, having sublethal effects on biota in more than 5% of a park	3 - 5	2 - 3	6 - 15	M - E
Trampling and disturbance to intertidal platforms causing greater than natural variability in communities	4 - 5	2 - 4	8 - 20	H - E
Increased nutrients and heavy metals from sewage outfall causing any loss of seagrass or reef (<i>biota</i>) at Point Addis MNP and Eagle Rock MS	3 - 5	3 - 4	9 - 20	H - E

Lack of ecological knowledge about hydrology, habitats, population dynamics including recruitment, geomorphology and sand movement, and fisheries management leading to less effective management of communities and habitats	4 - 5	1 - 5	5 - 25	H - E
Physical damage, pollution or cleanup impacts of a shipwreck sufficient to invoke an AMSA response , and resulting in any impacts on the parks	1 - 3	3 - 5	4 - 15	M - E
Increased shore-based development leading to increased cost of management and consequent effects on park communities and habitats.	2 - 5	1 - 4	3 - 16	L - E
Increased shore-based development leading to increases in small boating activity which may cause physical damage to habitats and communities greater than that caused naturally	2 - 5	1 - 4	2 - 20	L - E
Man-made discharges of freshwater/stormwater (fw component only) from outfalls and estuaries (the latter due to increased mechanical opening) leading to changes in subtidal communities greater than natural variation	3 - 4	1 - 4	4 - 16	M - E
Dogs, horses and vehicles reducing viability of populations of birds and seals at Point Addis MNP and Eagle Rock MS	2 - 5	2 - 4	6 - 15	M - E
Plastic and other litter from sea or land leading to injury or death of resident or transient organisms and thus reduced community viability	2 - 5	3 - 4	6 - 15	M - E
Illegal harvesting (organised poaching) of abalone leading to decreased population viability and flow-on effects to other organisms	3 - 5	3 - 4	12 - 20	H - E

Note: level of risk is based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into four groups of three or four people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from +0.39 to +0.82, with a median of +0.67. While these indicated a considerable degree of agreement among the groups, the correlations were nonetheless used as a starting point for a discussion of differences in ranks for particular hazards (see below).

(i) Increased shore-based development leading to **increased cost of management** and consequent effects on park communities and habitats

Scores for this hazard initially ranged from 2 to 5 for likelihood and 1 to 4 for consequence. It was pointed out by a group scoring consequence relatively low, that the severity of the consequences would vary with the detail of the reduced resourcing. The group that scored more highly though with less certainty, believed that resources would generally be found where major ecological issues were involved, except if costs were prohibitive. This group also questioned the flexibility of the overall level of resourcing. When scoring likelihood, the first group considered an average level of resourcing rather than that available for specific projects.

(ii) Increased **nutrients and heavy metals from sewage** outfall causing any loss of seagrass or reef (biota) at Point Addis MNP and Eagle Rock MS

The difference in opinion over likelihood (3 versus 5) stemmed from the belief of one group that changes due to increased nutrients would probably be positive, i.e. causing gains in biota rather than losses. This was countered by one of the higher-scoring groups pointing out that they currently saw no increases in seagrass or reef biota that they would attribute to increased nutrients.

Discussion of this hazard did not specifically address heavy metals.

(iii) **Man-made discharges of freshwater**/stormwater (fw component only) from outfalls and estuaries (the latter due to increased mechanical opening) leading to changes in subtidal communities greater than natural variation

One group scored 5 for likelihood, arguing that the threat of freshwater already exists in the parks. (See comment below on approaches to scoring) Other groups believed that freshwater inputs were not close enough to the parks to affect the subtidal communities.

(iv) **Dogs, horses and vehicles** reducing viability of populations of birds and seals at Point Addis MNP and Eagle Rock MS

Consequences of dogs and horses disturbing or injuring birds and seals were initially believed to be relatively minor, but the possibility of diseases or parasites being introduced by these animals resulted in elevation of consequence scores by two of the four groups.

During the discussion of these hazards, it became evident that one group was scoring likelihoods as the chance of the threat occurring, not the chance of it affecting the specified value. Another group, with participants who had some experience of risk assessment in the context of occupational health and safety issues, noted that the second approach was the more helpful in the assigning of scores.

Following this discussion of selected hazards, some changes were made to likelihoods and consequences by some groups. These were then entered in the ranking software and the risks (Appendix 4) and ranks recalculated. Contrary to expectations based on other risk assessments (Burgman 2001), the net result of the changes was a decrease in the level of agreement among groups over that of the first round, the median decreasing from +0.67 to +0.48 (range: +0.31 to +0.62). Clearly some of the initial agreement on the hazards had been the product of differences in interpretation of the hazards, and also to some extent, differences in the approach to scoring.

The risk posed by each hazard was recorded in the risk register (Table 2.4.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range

of opinion among the groups of participants. A priority order of the hazards is presented in Figures 2.4.3 and 2.4.4.

The top three hazards identified in this workshop were:

- **Lack of ecological knowledge** about hydrology, habitats, population dynamics including recruitment, geomorphology and sand movement, and fisheries management leading to less effective management of communities and habitats.
- **New and emerging marine pests**, including pathogens, displacing local species and causing ecological change.
- Illegal harvesting (**organised poaching**) of **abalone** leading to decreased population viability and flow-on effects to other organisms.

Uncertainty surrounding the first two was considerable (Figure 2.4.3), and in both cases this was largely attributable to information gaps. In the case of ecological knowledge, the deficiency referred to how that lack of knowledge might manifest itself in park communities and habitats. For marine pests, the initial difficulty lay in predicting what species may establish in or near the parks in the next 10 years.

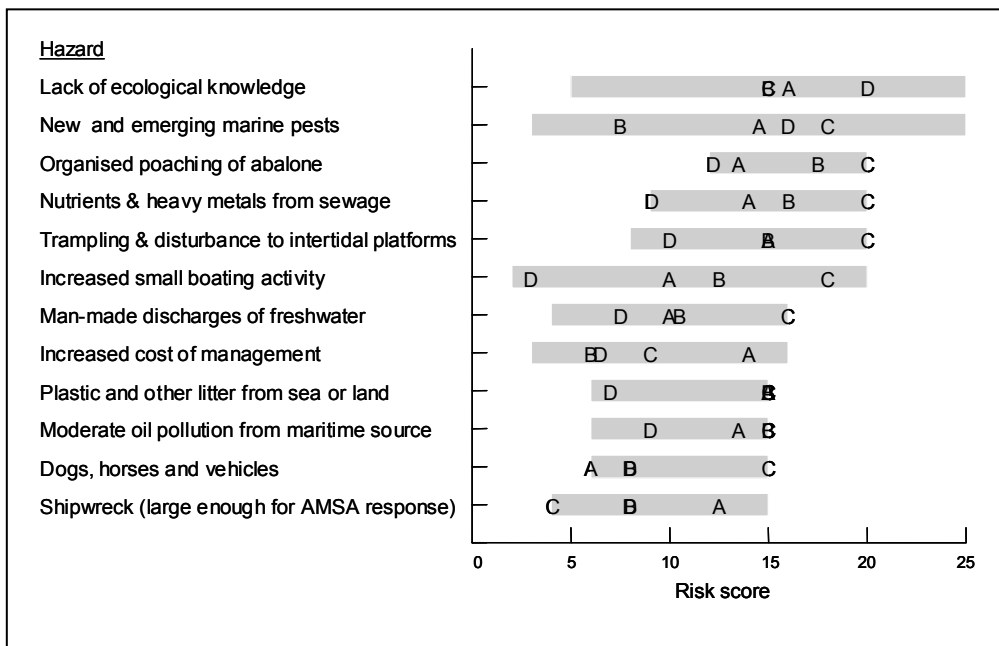


Figure 2.4.3 Summary of major risks to Point Addis MNP, Eagle Rock MS and Point Danger MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the four groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register (Table 3). Letters represent the median scores of the four groups.

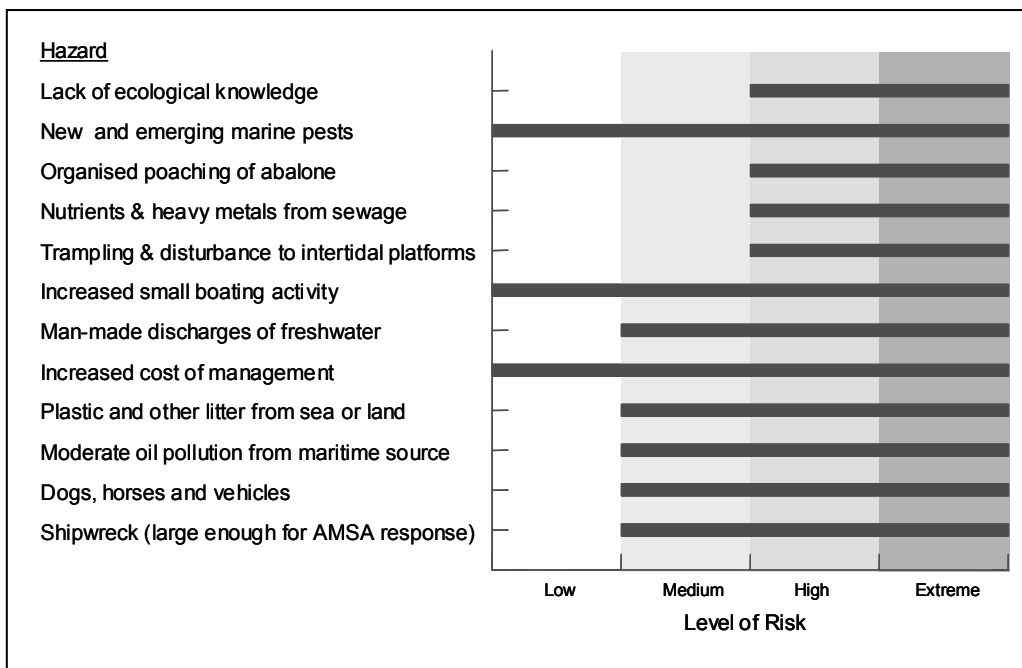


Figure 2.4.4 Hazards ordered as in Fig. 3, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

2.4.1 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2004) flagged eight threats out of 51 as posing either an extreme or a high risk to the Surf Coast park or sanctuaries (Table 4). Only two of the eight, oil pollution and abalone poaching, are matched by similar entries in the workshop risk register (Table 3). One further threat, cetacean stranding, was raised in the workshop (Table 1) but was not considered of sufficient concern by the workshop participants to warrant inclusion in the ranking exercise. Of the remaining ten hazards in the workshop risk register, comparable threats for seven appear in the internal assessment rated as moderate or low risks.

The following three threats from the workshop register had no equivalent in the internal assessment:

- lack of ecological knowledge
- nutrients and heavy metals from sewage outfalls
- trampling and disturbance to intertidal platforms

Table 2.4.4 Risk priorities for threats of major concern to Surf Coast marine national park and sanctuaries. Drawn from an internal Parks Victoria risk assessment (Parks Victoria 2004).

Threat	Point Addis MNP	Eagle Rock MS	Point Danger MS
Oil pollution	Extreme	Extreme	Extreme
Non-compliance with zoning restrictions (pending management plan)	High	High	High
Cetacean stranding	High	High	High
Commercial quantity abalone poaching	High	High	High
Speed (of recreational boats and/or small commercial vessels?)	High	High	High
Vandalism - environmental	High	High	High
Intentional wildlife harassment	High	High	High
Intentional wildlife harassment (commercial tour operators)	High	High	High

2.5 Barwon Bluff Marine Sanctuary

An ecological risk assessment for the Barwon Bluff Marine Sanctuary was undertaken in a workshop setting at Barwon Heads on 5th November 2004. The 16 workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park (Appendix 1).

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify threats of particular concern to them, and the natural attributes of the sanctuary they valued which were potentially affected by those threats, and resulted in an initial list of 24 hazards (Table 2.5.1).

Participants were then provided with a list of 5 natural values specific to the sanctuary, together with a generic list of 121 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 605 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 8 hazards being identified as of particular concern to at least one workshop participant (Table 2.5.2).

Table 2.5.1 Initial list of hazards from unstructured brainstorming session, Barwon Bluff MS.

Initial definition	Subsequent definition if refined
Trampling in intertidal zone resulting in decreased abundance and diversity of organisms.	
Increasing nutrients from the Barwon River resulting in changes to ecological processes.	
Increasing human population and thus increasing pressure on the intertidal community resulting in a change in <i>ecological</i> condition.	
Increasing numbers of organised education groups resulting in <i>increased</i> removal and trampling and thus decreased biodiversity.	
Slumping of cliffs resulting in changes to intertidal habitat.	
Lack of accurate baseline data leading to uninformed management and thus threatening the <i>maintenance of</i> biodiversity.	
Incidental marine pollution from recreational boats (<i>e.g. minor oil/petrol discharges, litter</i>) resulting in damage to plant and animal communities.	
Marine pollution from commercial shipping (<i>e.g. bilge water, domestic effluent</i>) resulting in damage to plant and animal communities.	
Introduced species outcompeting indigenous species.	

Re-introduction of supposedly local species resulting in a change to species composition.	
Insufficient information (<i>i.e. indicating the existence of the sanctuary, but not why it is important</i>) stimulating vandalism, and thus resulting in damage to rockpool biota.	
<i>The presence of land-based litter resulting in entanglement in, ingestion by, or smothering of marine organisms.</i>	
Lack of resourcing resulting in lack of (<i>insufficient?</i>) management (research, enforcement and education) and thus changes in species composition.	
Intrusive or excessive signage from multiple agencies resulting in reduced landscape/seascape values.	
Lack of environmental etiquette on the part of sanctuary visitors (e.g. not returning rocks to original position) resulting in damage to intertidal biota.	
Poaching or <i>other forms of extraction</i> , and vandalism, resulting in reduced abundances of <i>organisms</i> .	
Lack of appreciation of natural values leading to damage to habitats or organisms.	
Sewage from Black Rock outfall leading to increased nutrients <i>in the sanctuary</i> and consequently <i>excessive</i> algal growth, resulting in a change in species composition.	
Oils spills negatively impacting intertidal birds and shallow subtidal communities.	
Dogs disturbing birds, damaging their nests, and damaging other organisms.	
Horses trampling intertidal soft-sediment communities, including birds such as the hooded plover.	
Litter, freshwater, oils etc from stormwater discharges affecting intertidal and shallow subtidal organisms.	Later split into two hazards: Litter, oils etc from stormwater discharges affecting intertidal and shallow subtidal organisms. Freshwater from stormwater discharges affecting intertidal and shallow subtidal organisms.
Coastal/catchment infrastructure affecting the frequency and extent of natural sand movement.	Later split into two hazards: Coastal infrastructure affecting the frequency and extent of natural sand movement. Catchment infrastructure affecting the frequency and extent of natural sand movement.
Coastal/catchment infrastructure affecting the frequency and extent of flood events.	

Table 2.5.2 Additional hazards from structured brainstorming session, Barwon Bluff MS.

Initial definition	Subsequent definition if refined
Alienation of indigenous cultural values and management perspectives resulting in reduced understanding in the management of environmental values.	
Failure to document ecological change affecting intertidal and subtidal communities.	
Damage to habitats and contamination from dredging and disposal of spoil.	
Inappropriate off-site residential development leading to increased nutrient and other discharges, and resulting in loss of community values <i>within the sanctuary</i> .	
Construction of or failure of sewage pipelines across the Barwon River affecting ecological communities <i>within the sanctuary</i> .	
Global warming leading to increased <i>numbers of</i> storm events and resulting in changes to habitats and communities <i>within the sanctuary</i> .	
Water-based recreational activities (snorkelling, diving, surfing, jetskiing, etc) resulting in disturbance to wildlife.	
Ship groundings resulting in damage to habitats <i>within the sanctuary</i> .	

As individual hazards were considered, some were explored in detail to enhance participants' understanding and to minimize differences in interpretation. Discussions of visitor behaviour in the sanctuary identified links between the provision of information about natural values, a lack of appreciation of those values, and the potential for damage to habitats and organisms. The conceptual model shown in Figure 2.5.1 was not generated at the workshop, but does encapsulate the points raised.

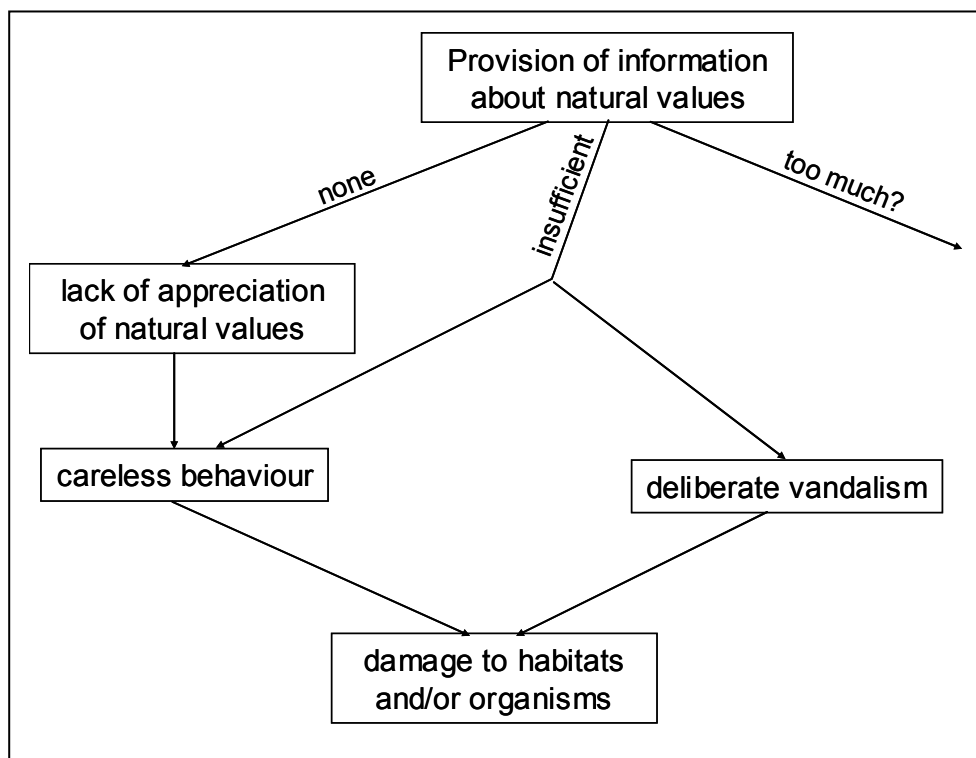


Fig. 2.5.1 The potential influence of information and attitudes on sanctuary organisms and habitats. This conceptual model was developed by the facilitator after the workshop, to encapsulate ideas discussed at the workshop.

Heat stress and burning of intertidal assemblages, changes in water temperature, the feeding of fish by tour operators, exploitation of fish populations, and the presence of hormones (in discharged wastewaters?) affecting fish populations were other issues briefly considered, but not formally nominated for listing in Tables 2.5.1 or 2.5.2.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern, for consideration in the next stage of the risk assessment. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected the participant's concerns. Hazards that scored two or more votes were included in the risk register (Table 2.5.3).

Table 2.5.3 Risk register, Barwon Bluff MS.

Hazard	Likelihood	Consequence	Risk score	Level of Risk
Trampling in intertidal zone resulting in decreased abundance and diversity of organisms.	4 - 5	3 - 4	12 - 20	H - E
Increasing nutrients from the Barwon River resulting in changes to ecological processes.	2 - 4	3 - 4	6 - 16	M - E
Increasing human population and thus increasing pressure on the intertidal community resulting in a change in ecological condition .	3 - 5	3 - 4	9 - 20	H - E
Increasing numbers of organised education groups resulting in <i>increased</i> removal and trampling and thus decreased biodiversity .	3 - 4	3 - 4	9 - 16	H - E
Lack of accurate baseline data leading to uninformed management and thus threatening the maintenance of biodiversity .	3 - 4	3 - 4	9 - 16	H - E
Marine pollution from commercial shipping (e.g. bilge water, domestic effluent) resulting in damage to plant and animal communities .	2 - 3	2 - 5	4 - 15	L - E
Introduced species outcompeting indigenous species.	2 - 4	3 - 5	8 - 16	H - E
Insufficient information (i.e. indicating the existence of the sanctuary, but not why it is important) stimulating vandalism , and thus resulting in damage to rockpool biota.	2 - 4	2 - 3	4 - 9	L - H
Lack of resourcing resulting in lack of (insufficient?) management (research, enforcement and education) and thus changes in species composition .	4 - 5	3 - 5	12 - 20	H - E
Lack of environmental etiquette on the part of sanctuary visitors (e.g. not returning rocks to original position) resulting in damage to intertidal biota .	3 - 4	2 - 3	8 - 12	H
Poaching or <i>other forms of</i> extraction, and vandalism , resulting in reduced abundances of organisms .	3 - 5	3 - 5	9 - 25	H - E
Lack of appreciation of natural values leading to damage to habitats or organisms.	3 - 5	2 - 3	6 - 15	M - E
Litter, oils etc from stormwater discharges affecting intertidal and shallow subtidal organisms.	2 - 4	2 - 3	6 - 9	M - H
Coastal infrastructure affecting the frequency and extent of natural sand movement .	1 - 2	2 - 4	2 - 8	L - H
Failure to document ecological change affecting intertidal and subtidal communities.	3 - 4	2 - 4	6 - 16	M - E
Water-based recreational activities (snorkelling, diving, surfing, jetskiing, etc) resulting in disturbance to wildlife .	4 - 5	2 - 4	8 - 20	H - E

Catchment infrastructure affecting the frequency and extent of natural sand movement .	1 - 3	2 - 4	3 - 9	L - H
Freshwater from stormwater discharges affecting intertidal and shallow subtidal organisms.	1 - 2	2 - 3	2 - 6	L - M

Note: Level of Risk is based on Likelihood and Consequence in accordance with AS4360 Appendix E.

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into four groups of four people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to note any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from +0.12 to +0.60, with a median of +0.45, indicating a moderate level of disagreement overall among the groups. Individual hazards with high levels of disagreement were then discussed in detail (see below).

(i) **Increasing human population** and thus increasing pressure on the intertidal community resulting in a change in **ecological condition**.

Two groups felt that an increasing human population, together with increasing popularity of the sanctuary, would result in increased damage from trampling. However, another group believed that the effects of an increasing population would be outweighed by greater (ecological) knowledge and a heightened sense of environmental ethics.

(ii) **Lack of accurate baseline data** leading to uninformed management and thus **threatening** the maintenance of **biodiversity**.

The group scoring this hazard highest saw a clear link between a lack of ability to define values at risk in the sanctuary, and the effective management of those values. Introduced pest species and intertidal trampling were identified as two management challenges, with differing levels of background data available. Another group believed that substantial amounts of baseline data already exist, and having additional data was unlikely to result in changes to management actions.

(iii) **Coastal infrastructure** affecting the frequency and extent of natural **sand movement**.

Early in discussions, all groups expressed concern about the distinction between coastal infrastructure and catchment infrastructure. This concern led to the splitting of the original coastal and catchment infrastructure hazard into separate hazards for scoring (Table 2.5.1).

For the coastal infrastructure hazard, one group was aware of sediment and debris collecting in the sanctuary at present, and thus scored this hazard higher than a group that believed sand movement was highly unlikely to occur on a scale sufficient to affect the

sanctuary. A third group which could see the potential for infrastructure changes to affect the sanctuary, scored relatively highly on consequence, but were less certain of the likelihood of such changes occurring.

(iv) **Failure to document ecological change** affecting intertidal and subtidal communities.

Two groups scored this hazard highly for consequence in the belief that lack of documentation of ecological change would inevitably lead to uninformed management decisions. However, a dissenting group believed that proclamation of the sanctuary has increased the likelihood of any changes being documented.

(v) **Litter, oils etc from stormwater** discharges affecting intertidal and shallow subtidal organisms.

As was the case for coastal and catchment infrastructure, discussion of the original stormwater hazard (Table 1) resulted in the freshwater component being considered separately to the oils and litter component. It was suggested that freshwater might be less likely than oils and litter to impact the natural values of the sanctuary.

An initial difference of opinion on the litter and oils hazard was removed when one group conceded that they had considered only the likelihood of the threat occurring, not the likelihood of its effect on organisms eventuating.

Following the discussion of selected hazards, groups were given the opportunity to change likelihood and consequence scores if they wished. The changes made were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The median correlation increased from 0.45 to 0.74, indicating considerably greater agreement among the groups on the ranking of hazards.

The risk posed by each hazard was recorded in the risk register (Table 2.5.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 2.5.2 and 2.5.3. Five hazards achieved a maximum risk score of 20 or higher in the Barwon Bluff workshop. These were:

- **Poaching** or *other forms of* extraction, and **vandalism**, resulting in **reduced abundances of organisms**.
- **Lack of resourcing** resulting in lack of (*insufficient?*) management (research, enforcement and education) and thus **changes in species composition**.
- **Trampling** in intertidal zone resulting in decreased **abundance and diversity of organisms**.
- **Increasing human population** and thus increasing pressure on the intertidal community resulting in a change in **ecological condition**.
- **Water-based recreational activities** (snorkelling, diving, surfing, jetskiing, etc) resulting in **disturbance to wildlife**.

Two other concerns raised during the workshop did not relate to ecological values, so were not properly the concern of this risk assessment, but are recorded here for the sake of completeness:

- Cliffs outside the sanctuary may pose a health and safety risk to people below on the beach.
- Non-licenced tour operators using the sanctuary may pose an economic risk to licenced operators by reducing the quality of the experience the latter are able to offer to sanctuary visitors.

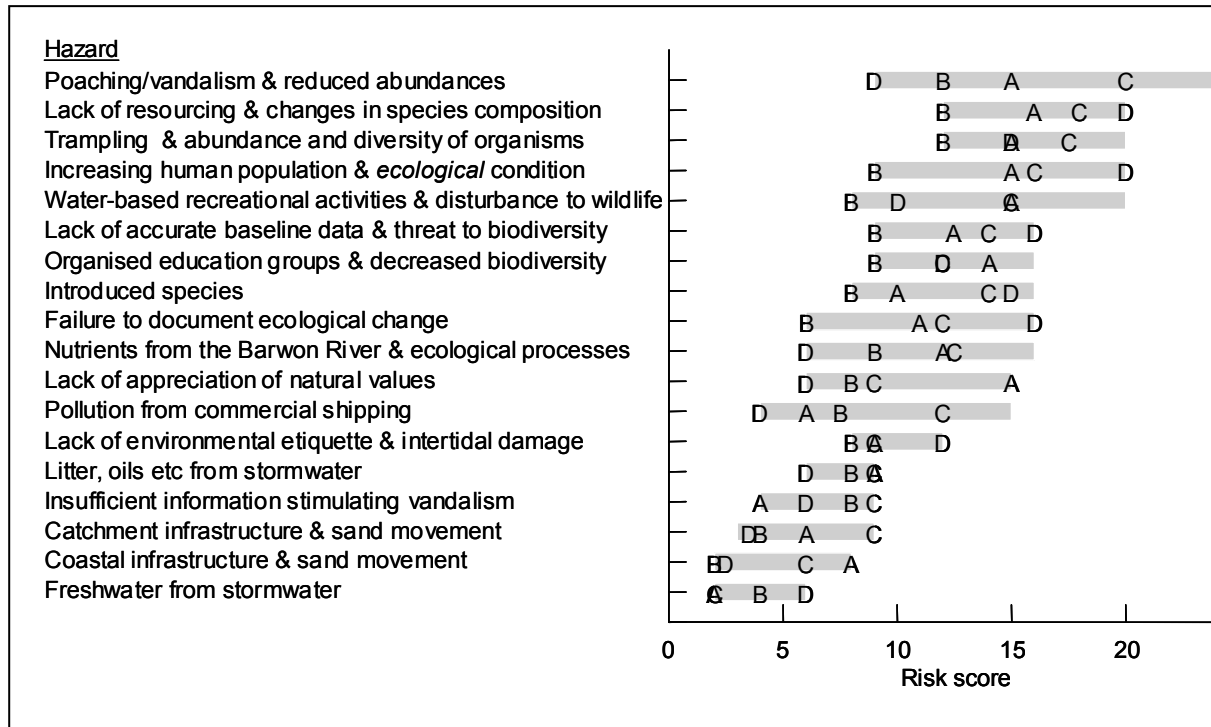


Figure 2.5.2 Summary of major risks to Barwon Bluff MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the four groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the four groups.

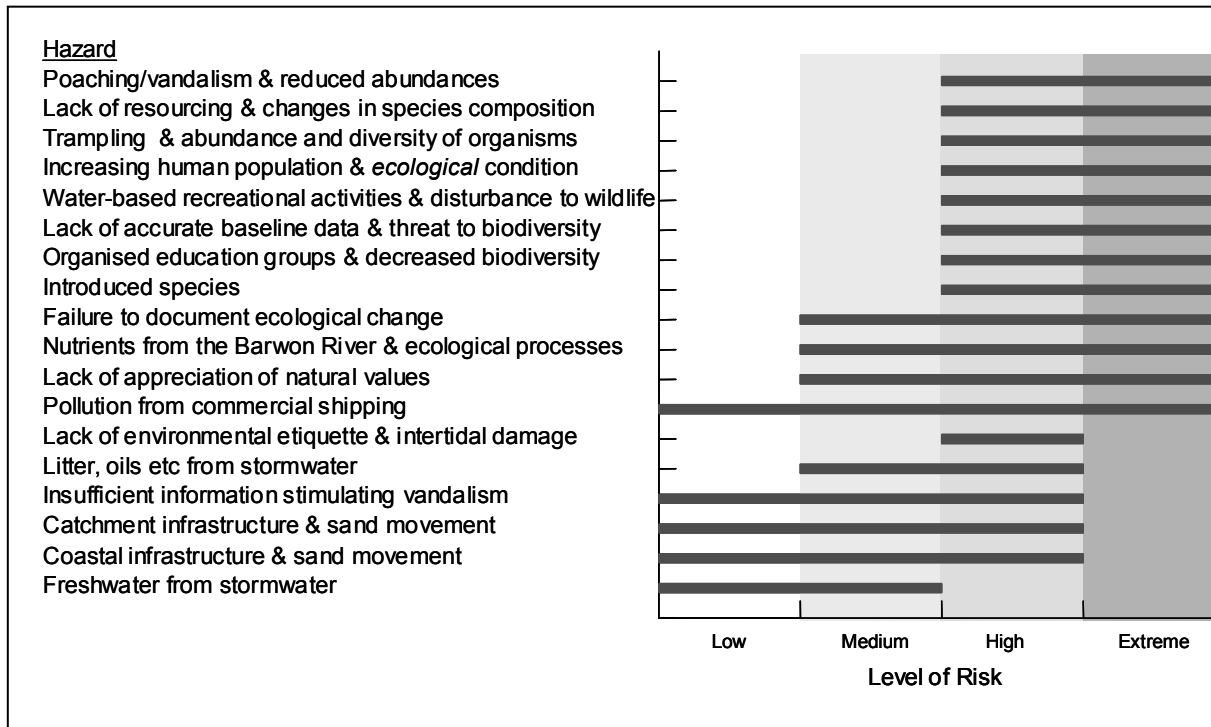


Figure 2.5.3 Hazards ordered as in Fig. 2, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E.

2.5.1 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2003) flagged 14 threats from a total of 16 considered, as posing high risks (Table 2.5.4). The majority of the high risk threats overlap to some extent with risk register hazards, the exceptions being dogs, commercial tourism operations, and possibly pollution from marine incidents (if the last is assumed to refer to major spills rather than small discharges).

Table 2.5.4 Threats posing high risks to values of Barwon Bluff MS. Drawn from an internal Parks Victoria assessment (Parks Victoria 2003).

Threat *	Risk Score
Habitat damage – Intertidal or Subtidal – trampling & anchoring	25
Recreational shellfish collection.	25
Spear fishing	25
Bait collection	20
Marine Exotics	20
Abalone theft (unlicensed)	20
Removal of material living/dead in National Park.	20
Recreational fishing	20
Commercial tourism operations outside permit conditions	15
Damage to signs and markers	15
Aquarium specimen collection	15
On shore litter	12
Pollution – Marine Incidents (oil / chemical or effluent waste incidents)	10
On shore dogs	10

* the context of the internal assessment indicates that these threats are considered as occurring within the sanctuary.

The workshop generated 13 hazards with no comparable threat in the internal assessment:

- Increasing **nutrients from the Barwon River** resulting in changes to **ecological processes**.
- **Increasing human population** and thus increasing pressure on the intertidal community resulting in a change in **ecological condition**.
- Increasing numbers of **organised education groups** resulting in *increased* removal and trampling and thus **decreased biodiversity**.
- **Lack of accurate baseline data** leading to uninformed management and thus **threatening** the *maintenance of biodiversity*. **Insufficient information** (*i.e. indicating the existence of the sanctuary, but not why it is important*) **stimulating vandalism**, and thus resulting in damage to rockpool biota.

- **Insufficient information** (*i.e. indicating the existence of the sanctuary, but not why it is important*) **stimulating vandalism**, and thus resulting in damage to rockpool biota.
- **Lack of resourcing** resulting in lack of (*insufficient?*) management (research, enforcement and education) and thus **changes in species composition**.
- **Lack of environmental etiquette** *on the part of sanctuary visitors (e.g. not returning rocks to original position)* resulting in **damage to intertidal** biota.
- **Lack of appreciation of natural values** leading to damage to habitats or organisms.
- **Coastal infrastructure** affecting the frequency and extent of natural **sand movement**.
- **Failure to document ecological change** affecting intertidal and subtidal communities.
- **Water-based recreational activities** (snorkelling, diving, surfing, jetskiing, etc) resulting in **disturbance to wildlife**.
- **Catchment infrastructure** affecting the frequency and extent of natural **sand movement**.
- **Freshwater from stormwater** discharges affecting intertidal and shallow subtidal organisms.

It is noteworthy that less than half of these newly-considered threats relate directly to issues of park management and visitor education. Four concern management issues on a wider scale than the marine sanctuary alone, while two more are matters of ecological knowledge, and one relates to resourcing of the park management agency.

2.6 Port Phillip Heads Marine National Park

An ecological risk assessment for the Port Phillip Heads Marine National Park was undertaken in a workshop setting at Queenscliff on 27th July 2004. The 21 workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park (Appendix 1).

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify two threats of concern and the thing that they valued that could be affected by that threat and resulted in an initial list of 20 hazards (Table 2.6.1).

Participants were then provided with a list of 24 natural values specific to the park and a generic list of 106 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate over 2500 possible hazards for consideration. Participants considered the combinations, and then added to their previous list of hazards. This structured brainstorming process resulted in an additional 13 hazards being identified as of particular concern to at least one workshop participant (Table 2.6.2).

To minimize differences in interpretation among the participants, some hazards were more tightly defined at this stage (Tables 2.6.1 & 2.6.2). This process involved clarifying the value at risk, and the nature of threat affecting that value, to the extent that a measurable endpoint may have been identified. In particular, there was considerable discussion about the criteria by which a species should be classified as an exotic. It was generally agreed that the term should include species that:

- are native to other countries or other biogeographic areas;
- displace existing local species; and
- precipitate large ecological change.

However, elements of uncertainty about classification as exotic remained:

- Should a species which may always have been present, but not detected previously be considered exotic? (observation uncertainty)
- Should the support given to prior distributions depend on whether the records were a personal observation or a formal scientific record? (observation reliability)
- Should a species within its natural range but not present previously be considered exotic? (distribution uncertainty)
- Must the effect of an exotic always be detrimental? Some participants argued that species with beneficial effects should not be classed as exotic. (effect uncertainty)

Table 2.6.1 Initial list of hazards from unstructured brainstorming session.

Initial definition	Subsequent definition if refined
Effects of sediment load from dredging on marine park values.	
Effects of sand movement from dredging on benthic biota.	
Water contamination from oil spills.	Water contamination from shore-based oil spills.
Nutrient loads from urban runoff causing algal blooms.	Nutrient loads from rural and urban runoff causing algal blooms.
Failure to document ecological change – lack of baseline and monitoring data.	
Ship grounding resulting in a major oil spill.	
Toxic loads from stormwater resulting in a loss of RAMSAR habitat.	
Recreational visitation in the intertidal at Swan Bay and Point Lonsdale.	Recreational visitation in the intertidal at Swan Bay and Point Lonsdale resulting in decreased ecological values.
Development.	Later deleted as being too broad and covered better by more tightly defined hazards.
Sediment load from dredging resulting in decreased park visitation. (i.e. poorer visibility leading to fewer divers)	
Lack of community awareness leading to inappropriate development and visitation.	Lack of community awareness leading to inappropriate behaviour, development and visitation.
Exotic species.	Exotic species displacing existing local species and precipitating large ecological change.
Marine livestock depletion.	Sediment loads from dredging resulting in loss of seagrass and thus loss of fauna.
Institutional inertia and accountability.	Later linked with hazard “failure to document ecological change”.
Loss of wetlands linked to Swan Bay as a result of incremental development.	
Reclaimed land.	Reclaimed land leading to loss of wetlands, which in turn affects erosion, filtration and birds.
Excavation for waterfront property.	Excavation for waterfront property leading to loss of wetlands, which in turn affects erosion, filtration and birds.
New groyne at Point Lonsdale affecting beach visitation.	
Dumping of dredged spoil near Mud Is.	Dumping of dredged spoil 10 km north of Mud Is in water more than 15 m deep, affecting seagrass and benthic fauna, and therefore wetland birds.
Emergency and primary medical services at risk from increasing/changing human population.	

Table 2.6.2 Additional hazards from structured brainstorming session.

Initial definition	Subsequent definition if refined
Rock cutting and falling in dredging operation.	
Resuspension of contaminated sediments due to dredging.	
Illegal fishing, poaching and collecting - seagrass, rocks, aquarium fish.	
Recreational vessels – divers, anchoring and pollution.	Recreational vessels – divers causing physical damage (to habitat and organisms), anchoring damaging seagrass and reef, and pollution (affects unspecified).
Loss of fish resources resulting in potential for increased competition among fishers.	Loss of fish resources due to presence of park, resulting in potential for increased competition among fishers and illegal fishing.
Terrorism – sinking of shipping at the Heads, causing economic and environmental damage.	
Sea level rise / change in temperature.	Sea level rise of 1 m / change in temperature.
Gas pipelines.	Rupture of gas pipelines leading to (unspecified outcomes)
Aquaculture leading to (release of) chemicals, disease, escapes (of cultured organisms) with consequences of (unspecified).	
Algal blooms resulting from increased nutrients.	Deleted from list: already listed in Table 1.
Ship grounding leading to chemical spills.	
Acid sulphate soils causing fish kills and acidification of wetlands.	
Planning decisions leading to changed hydrology and thus ecological values.	

The next step was to select a subset of hazards deemed to be of most concern by the workshop participants. Each participant nominated their preferred two hazards. The final subset (Table 2.6.3) consisted of the 12 hazards receiving the highest number of nominations.

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into six groups of three. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from -0.26 to +0.80, with a median of +0.24. This prompted a

discussion of the differences in ranks for particular hazards, and some substantive differences of opinion were identified (see below).

(i) Nutrient loads from rural and urban runoff causing algal blooms.

Two groups agreed on the severity of consequences for this hazard, but differed on the likelihood of an algal bloom occurring. One group believed this to be likely, while the other rated it as unlikely to occur because they understood that about 50% of water in Swan Bay is exchanged with each tidal cycle.

This hazard also demonstrated the importance of all participants sharing a common understanding of what the hazard entails. It became evident during the discussion that some groups believed it referred to blooms of phytoplankton, while others understood it to be mats of epiphytic macroalgae. The hazard was redefined, more precisely, as an unacceptably high concentration of phytoplankton cells.

(ii) Sediment load from dredging resulting in decreased visitation.

One group scored this hazard as being highly likely, while a second considered it to be very unlikely, not because they viewed the hazard itself as very unlikely to occur, but because they viewed the consequence as a social issue rather than an ecological one.

Extended discussion of this hazard and how the increased sediment load might influence visitation in the park produced the conceptual model shown in Figure 2.7.1. Implicit in the model was an assumption that disorganized visitation may have a substantial ecological cost, presumably in terms of damage to habitats or communities within the park. With the aid of the model, the nature of the hazard came to be understood by all participants, but clear value-based differences of opinion remained.

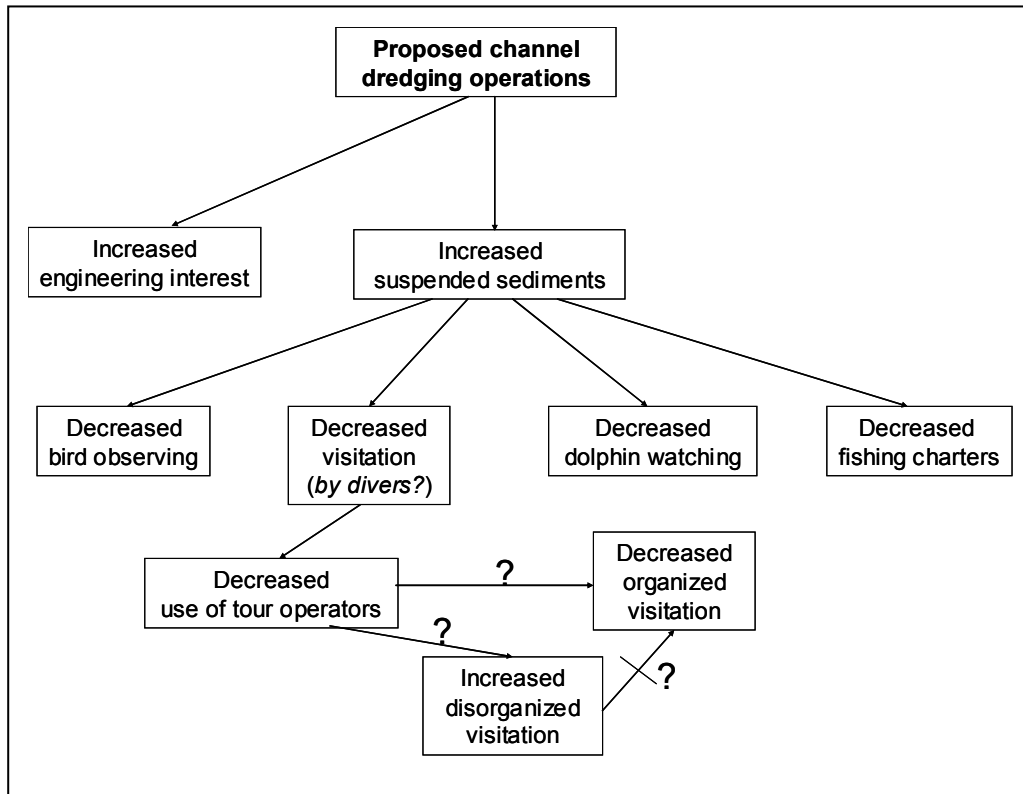


Figure 2.6.1 Conceptual model of how suspended sediment from the proposed channel dredging may affect park visitation.

The wider effects of an increased sediment load from dredging operations were also considered during the discussion (Fig. 2), addressing both suspended sediment in the water column and sediment settling to the seabed.

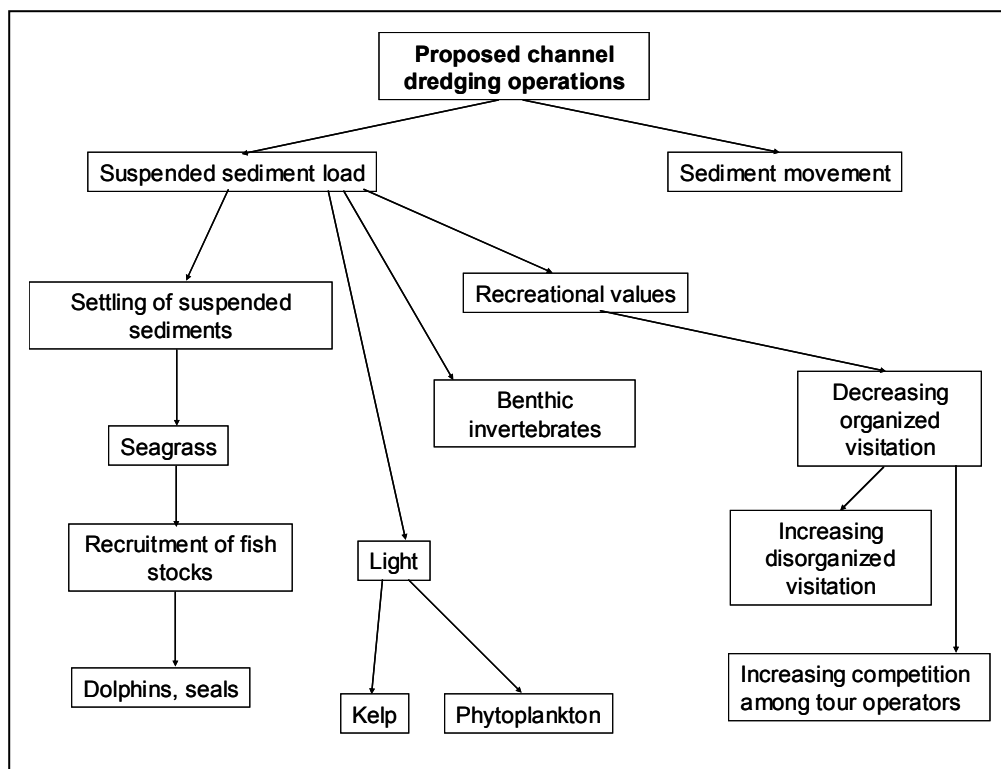


Figure 2.6.2 Conceptual model of pathways by which suspended sediment load from proposed channel dredging may affect the park.

(iii) Dumping of dredged spoil 10 km north of Mud Is in water more than 15 m deep, affecting seagrass and benthic fauna, and therefore wetland birds.

The likelihood of a widespread turbid plume resulting from the disposal of dredged material produced substantial difference of opinion. One view was that such an effect had been seen in a recent dredging operation and was likely to occur again, while the opposing view maintained that the previous plume was a result of the dredging process itself, rather than the disposal of spoil, and was therefore not indicative of the future effects of spoil disposal. It was also suggested that the plume which might eventuate would tend to be entrained in the shipping channel and suspended sediments that did eventually reach seagrass beds would be sufficiently dispersed as to have little impact. The differing views on plume movement were not resolved during the workshop, but pose a technical question amenable to mathematical modelling by relevant experts.

(iv) Exotic species displacing existing local species and precipitating large ecological change.

Following extensive discussion of the criteria by which species might be identified as exotic, the initial ranking exercise still produced a difference of opinion. This centred around whether or not most of the species that might invade Port Phillip Bay have already done so.

The final consensus appeared to be that new shipping routes were quite likely to be established in future, so there was a real possibility that new exotics might be introduced.

(v) Loss of wetlands linked to Swan Bay as a result of incremental development.

Most groups rated this as a hazard as of lesser importance than others, but one group considered the effects likely to occur because there are already developments planned for the area. This group was less certain about the severity of consequences, acknowledging that they would vary with the nature of the development and the planning controls imposed.

(vi) Lack of community awareness leading to inappropriate behaviour, development and visitation.

This was a top hazard for one group, but scored lower for all other groups. The group most concerned felt that it will be necessary to win over the general public at this early stage of park development in order to avoid long-term detrimental effects. Other groups felt that Parks Victoria has already done a great deal of work in this area, and thus scored the hazard rather lower.

Following this discussion of selected hazards, some changes were made to likelihoods and consequences by some groups. These were then entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The net result of the changes was an improvement in the level of agreement among groups over that of the first round, the median increasing from +0.24 to +0.45 (range: +0.14 to +0.80). The risk posed by each hazard was then recorded in the risk register (Table 2.6.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants.

Given the importance of retaining differences of opinion in a group-based risk assessment, there are several possible ways to order the hazards listed in Table 2.6.3 in terms of priority. Figure 2.6.3 shows a rank order based firstly on the maximum risk score among the six groups, then on the minimum score and lastly on the highest median score among the six groups. However, regardless of whether the order is based on maxima, means or medians, the top priority hazards identified in this workshop were:

- exotic species displacing existing local species and precipitating large ecological change.
- sediment load from dredging resulting in decreased park visitation. (i.e. poorer visibility leading to fewer divers).

Table 2.6.3 Risk register arising from hazard ranking exercise. Bounds represent the range of opinion among the six groups of participants. (L = low risk, M = moderate risk, H = high risk, E = extreme risk)

Hazard (Threat to Value)	Likelihood	Consequence	Risk score	Level of Risk
Effects of sand movement from dredging on benthic biota.	4 - 5	2 - 4	8 - 18	H - E
Nutrient loads from rural and urban runoff causing algal blooms.	1 - 4	3 - 4	4 - 12	M - H
Failure to document ecological change – lack of baseline and monitoring data.	2 - 4	3 - 5	6 - 19	M - E
Ship grounding resulting in a major oil spill.	1 - 3	4 - 5	4 - 12	M - E
Sediment load from dredging resulting in decreased park visitation. (i.e. poorer visibility leading to fewer divers)	4 - 5	2 - 5	10 - 20	H - E
Lack of community awareness leading to inappropriate behaviour, development and visitation.	2 - 4	2 - 4	6 - 13	M - H
Exotic species displacing existing local species and precipitating large ecological change.	2 - 5	4 - 5	8 - 25	H - E
Sediment loads from dredging resulting in loss of seagrass and thus loss of fauna.	2 - 5	2 - 4	4 - 16	L - E
Loss of wetlands linked to Swan Bay as a result of incremental development.	2 - 4	3 - 4	6 - 12	M - H
Dumping of dredged spoil 10 km north of Mud Is in water more than 15 m deep, affecting seagrass and benthic fauna, and therefore wetland birds.	2 - 5	2 - 4	4 - 19	L - E
Loss of fish resources due to presence of park, resulting in potential for increased competition among fishers and illegal fishing.	2 - 3	1 - 4	2 - 10	L - H
Planning decisions leading to changed hydrology and thus ecological values.	2 - 4	2 - 4	4 - 17	L - E

Note: One group did not score Likelihood and Consequence separately, therefore that group is not represented in the summary data for those variables, nor in the Level of Risk which is based on Likelihood and Consequence in accordance with AS4360 Appendix E (SA/SNZ 1999). However, their data is represented in the Risk Score summary.

Levels or categories of risk are shown for the hazards in Figure 2.6.4. These levels follow the Australian Standard (SA/SNZ 1999) and are based consideration of the likelihood and consequence separately, rather than on the risk score obtained by combining the two.

It was notable that hazards relating to the proposed channel deepening project of the Port of Melbourne Corporation were prominent among participant concerns, filling four of the top twelve places. This may be related to the Queenscliff workshop coinciding with the public exhibition of the Environmental Effects Statement for the project. Dredging-related hazards would presumably be of less concern in subsequent risk assessments when there was no longer an immediate possibility of extensive capital dredging near the park.

Comparison of the workshop risk register (Table 2.6.3) with risk assessments presented in the Regional Compliance Plan for the City and Bays region (Parks Victoria 2003) shows exotic species to have been a major concern in both assessments. However, there were also some differences in the top hazards. In the Compliance Plan, habitat damage by anchoring or trampling was the first or second ranked hazard for five of the six park components, with various forms of fishing or collecting of specimens also of major concern. Neither figured prominently at the workshop. Factors possibly contributing to these differences include:

- the broader range of participants in the workshop assessment (the Compliance Plan assessment was undertaken by staff from Parks Victoria and the Department of Primary Industry)
- the Compliance Plan pre-dating the recent high public profile of the channel deepening project

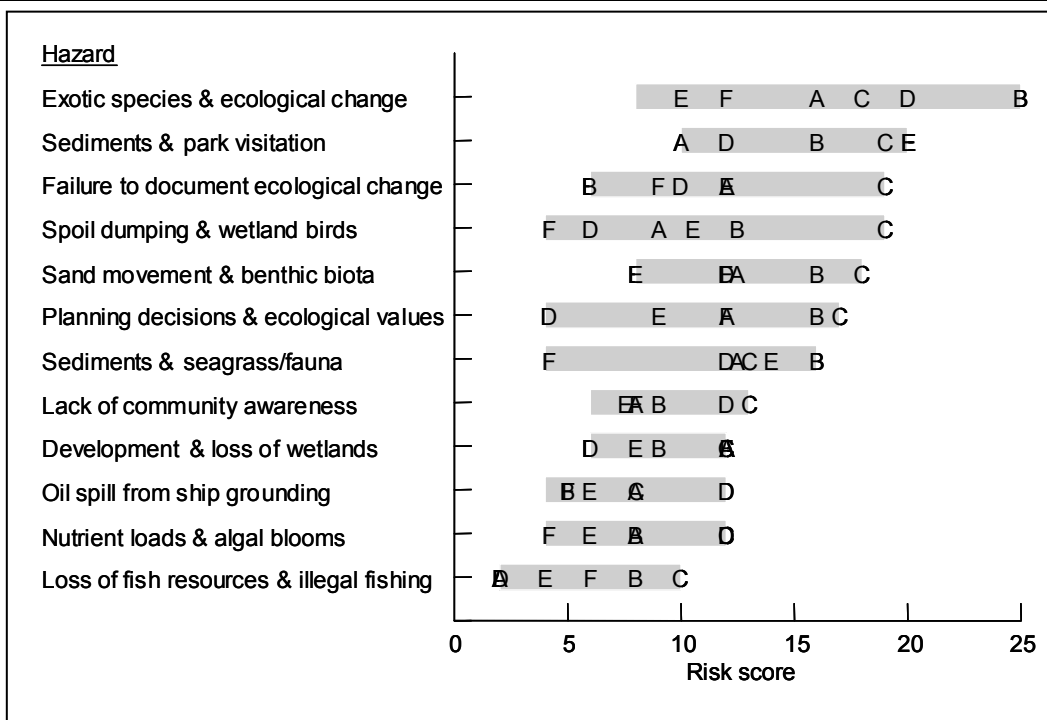


Figure 2.6.3 Summary of major risks to Port Phillip Heads MNP, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the six groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register (Table 2.6.3). Letters represent the median scores of the six groups.

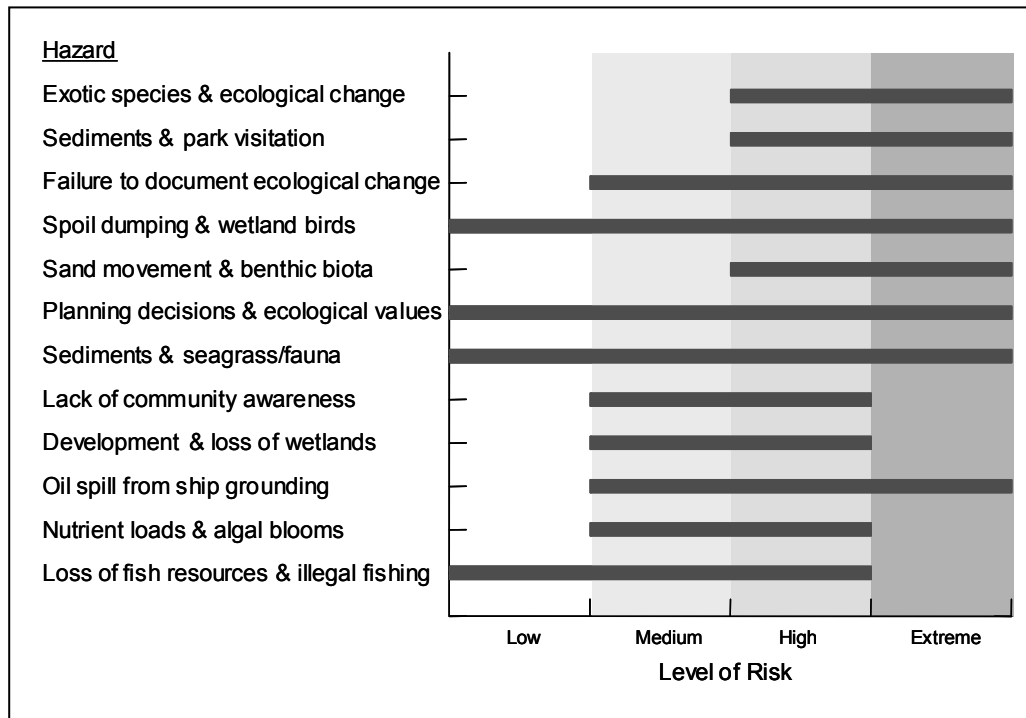


Figure 2.6.4 Hazards ordered as in Figure 2.6.3, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E.

2.7 Point Cooke Marine Sanctuary

An ecological risk assessment for the Point Cooke Marine Sanctuary was undertaken in a workshop setting at Werribee Park on 10th November 2004. The 15 workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park (Appendix 1).

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify threats of particular concern to them, and the natural attributes of the sanctuary they valued which were potentially affected by those threats and resulted in an initial list of 17 hazards (Table 2.7.1).

Participants were then provided with a list of 3 natural values specific to the sanctuary, together with a generic list of 124 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 372 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 10 hazards being identified as of particular concern to at least one workshop participant (Table 2.7.2).

Table 2.7.1 Initial list of hazards from unstructured brainstorming session, Point Cooke MS.

Initial definition	Subsequent definition if refined
Poaching (of abalone) or general collecting of species <i>leading to reduced populations of target species</i> .	Split into two hazards: Poaching of abalone leading to reduced populations. General collecting of species leading to reduced populations of target species.
Invasive species (Sabella) competing for space with <i>local</i> marine biota.	Split into four hazards: Invasive species competing with <i>local</i> marine biota. Fanworm Sabella competing for space with <i>local</i> marine biota. Northern Pacific seastar preying on <i>local</i> shellfish species. Seaweed Undaria excluding other <i>local</i> algal species.
Speed boat accidents causing physical damage to reefs or affecting water quality with oils and debris.	Split into two hazards: Speed boat accidents causing physical damage to reefs. Oil and debris from speed boat accidents affecting water quality.
Increasing human population leading to increasing trampling and resulting in damage to intertidal shellfish and seagrass.	

Increasing human population leading to increasing vandalism causing damage to intertidal reef.	
Increasing human population leading to increasing littering	
Human disturbance (boating/ <i>use of personal water craft/walking/horseriding</i>) of shorebirds, seabirds and waterfowl.	<p>Later split into four hazards:</p> <p>Boating activity disturbing shorebirds, seabirds and waterfowl.</p> <p><i>Use of personal water craft</i> disturbing shorebirds, seabirds and waterfowl.</p> <p>Walkers disturbing shorebirds, seabirds and waterfowl.</p> <p><i>Horseriding</i> disturbing shorebirds, seabirds and waterfowl.</p>
Dogs off-lead disturbing shorebirds and waders, leading to reduced reproduction and thus declining populations.	
Feral carnivores (foxes, cats) <i>preying on</i> shorebirds and waders, leading to reduced reproduction and thus declining bird populations.	
Increasing development leading to increasing runoff and thus increasing nutrient loads, resulting in changes to macroalgal species composition.	
Increasing development leading to increasing runoff and thus increasing nutrient loads, resulting in <i>phytoplankton</i> blooms with consequent reduction in light penetration and thus changes to macroalgal species composition.	
New marina development resulting in increased boating activity leading to physical damage to reefs, reduced fish populations and reduced water quality.	
Spill from commercial shipping, sufficient to invoke AMSA response, and affecting sanctuary biota.	
Current Port of Melbourne channel deepening project causing increased turbidity affecting plant <i>populations</i> , and the release of contaminants from sediments affecting fish and filter feeding organisms.	<p>Later split into two hazards:</p> <p>Current Port of Melbourne channel deepening project causing increased turbidity which reduces light penetration and has a smothering effect, and thus leads to reduced plant <i>populations</i>.</p> <p>Current Port of Melbourne channel deepening project causing the release of contaminants from sediments affecting fish and filter feeding organisms.</p>
Industrial spills or seepage into Skeleton Creek affecting biota in the sanctuary.	

Increasing isolation and fragmentation of <i>shorebird habitats</i> leading to reduced availability of alternative habitats for migratory shorebirds, <i>causing birds to seek destinations with a greater range of available habitats</i> .	
Groundwater seepage of pesticides and herbicides from market gardens affecting algae and invertebrates an the sanctuary.	

Table 2.7.2 Additional hazards from structured brainstorming session, Point Cooke MS.

Initial definition	Subsequent definition if refined
Rising sea level due to climate change leading to reduced shorebird habitat and reduced habitat value of rocky reef.	
Development at RAAF base leading to increased numbers of aircraft movements and thus increased pollution and increased numbers of crashes, with <i>detrimental</i> effects on sanctuary biota.	
Sewage discharge leading to increased nutrients and freshwater, resulting in changes to algal species composition, to shorebird populations and to marine biota.	
Flood events affecting the Western Treatment Plant and resulting in failures in chlorine storage and breaching of sewage ponds, leading to effects on sanctuary biota.	
Coastal erosion resulting in increased turbidity and decreased water quality.	
Ineffectiveness of seaward signs and boundary markers (too few/too far apart) resulting in illegal fishing in sanctuary and thus reduced populations of fish and abalone.	
Vehicle-related contaminants in stormwater affecting sanctuary biota.	
Ash and increased runoff from fire in neighbouring areas directly affecting shorebirds and affecting fish and other biota in the sanctuary via increased turbidity and decreased water quality.	
Failure to document ecological change leading to effects on sanctuary biota.	
Propeller scour and anchor damage affecting seagrass beds.	

As individual hazards were nominated, some were discussed in detail to enhance participants' understanding and to minimize differences in interpretation.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern for the next stage of the risk assessment. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored two or more votes were included in the risk register (Table 2.7.3).

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into four groups of three or four people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from -0.04 to +0.52, with a median of +0.29, indicating a moderate level of disagreement overall among the groups. Individual hazards with high levels of disagreement were then discussed in detail (see below).

(i) Increasing development leading to increasing runoff and thus increasing **nutrient loads**, resulting in changes to **macroalgal species composition**.

It was suggested that the human population in the vicinity of the park may increase four-fold over the next 15 years. One group believed that such development may ultimately affect algal species composition. An alternative view held that there had already been major development without such an affect occurring.

(ii) **Rising sea level** due to climate change leading to reduced **shorebird habitat** and reduced habitat value of **rocky reef**.

While one group believed that climate change has and will continue to occur within the 10 year time frame of the assessment, another group considered that no substantial change in climate would occur within that period. A third group acknowledged the change in climate, but felt that no impacts of such change were likely to be seen in the sanctuary within 10 years.

(iii) Current Port of Melbourne **channel deepening** project causing increased turbidity affecting **plant populations**, and the release of contaminants from sediments affecting **fish and filter feeding organisms**.

There was a genuine difference of opinion about the likelihood of impacts of the channel deepening project reaching as far afield as the Point Cooke Marine Sanctuary.

(iv) Industrial spills or seepage into Skeleton Creek affecting biota in the sanctuary.

In the view of one group, the presence of industry along Skeleton Creek has already led to impacts on sanctuary biota. They therefore consider it highly likely that more impacts will occur over the next 10 years. However, another group expected that better management by industry and tighter regulation will lead to a reduced likelihood of impacts in future.

(v) **Dogs** off-lead disturbing shorebirds and waders, leading to reduced reproduction and thus **declining populations**.

Increased numbers of pet dogs off-lead on the beach were seen by one group as inevitable with the increasing human population, with the likely consequence of impacts on shorebird populations.

(vi) Increasing human population leading to increasing **trampling** and resulting in **damage to intertidal shellfish and seagrass**.

This hazard prompted discussion of different ways in which an increasing human population might affect intertidal habitats and assemblages, other than via the runoff and nutrient pathway considered in Item I above. The conceptual model in Figure 2.7.1 summarises these more immediate effects in terms of trampling, litter and vandalism. Following the discussion, one group was prompted to increase the likelihood score they had previously assigned to this hazard.

Following the discussion of selected hazards, groups were given the opportunity to change likelihood and consequence scores if they wished. The changes were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in a marginal increase in agreement among groups. While the range of correlation coefficients was unchanged, the median rose slightly to +0.40.

The risk posed by each hazard was recorded in the risk register (Table 2.7.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 2.7.2 and 2.7.3. Only one hazard scored the maximum of 25 as its upper bound at the Point Cooke workshop:

- Invasive species competing for space with *local* marine biota.

Other hazards scoring highly were:

- **Poaching of abalone** leading to reduced populations;
- **Walkers disturbing** shorebirds, seabirds and waterfowl;
- Increasing development leading to increasing runoff and thus increasing **nutrient loads**, resulting in changes to **macroalgal species composition**; and
- **Rising sea level** due to climate change leading to reduced **shorebird habitat** and reduced habitat value of **rocky reef**.

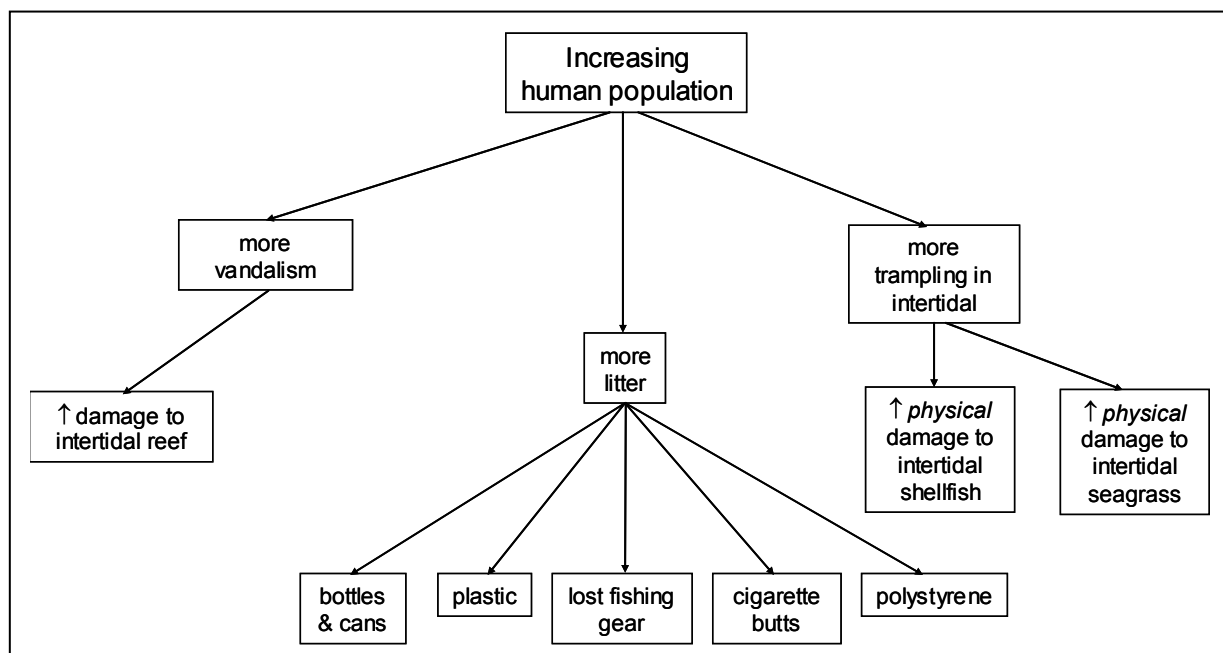


Figure 2.7.1 Pathways by which an increasing human population might affect intertidal habitats and assemblages.

Table 2.7.3 Risk register, Point Cooke MS.

Hazard	Likelihood	Consequence	Risk score	Level of Risk
Walkers disturbing shorebirds, seabirds and waterfowl.	5	2 - 4	10 - 20	H - E
Dogs off-lead disturbing shorebirds and waders, leading to reduced reproduction and thus declining populations.	2 - 4	2 - 4	4 - 16	L - E
Feral carnivores (foxes, cats) preying on shorebirds and waders, leading to reduced reproduction and thus declining bird populations.	4 - 5	2 - 3	8 - 15	H - E
Increasing development leading to increasing runoff and thus increasing nutrient loads , resulting in changes to macroalgal species composition .	3 - 5	3 - 4	9 - 20	H - E
Poaching of abalone leading to reduced populations.	5	3 - 4	15 - 20	E
General collecting of species leading to reduced populations of target species.	3 - 5	1 - 3	5 - 15	M - E
Invasive species competing for space with <i>local</i> marine biota.	5	3 - 5	15 - 25	E

Increasing human population leading to increasing trampling and resulting in damage to intertidal shellfish and seagrass .	3 - 5	2 - 3	6 - 15	M - E
Rising sea level due to climate change leading to reduced shorebird habitat and reduced habitat value of rocky reef .	1 - 5	1 - 4	4 - 20	H - E
Ineffectiveness of seaward signs and boundary markers (too few/too far apart) resulting in illegal fishing in sanctuary and thus reduced populations of fish and abalone.	2 - 5	1 - 4	2 - 20	L - E
Failure to document ecological change leading to effects on sanctuary biota.	3 - 4	1 - 5	4 - 20	M - E
Spill from commercial shipping , sufficient to invoke AMSA response, and affecting sanctuary biota.	1 - 3	3 - 5	5 - 9	H
Current Port of Melbourne channel deepening project causing increased turbidity affecting plant populations , and the release of contaminants from sediments affecting fish and filter feeding organisms .	2 - 4	2 - 4	6 - 16	M - E
Industrial spills or seepage into Skeleton Creek affecting biota in the sanctuary.	2 - 5	2 - 4	6 - 15	M - E
Groundwater seepage of pesticides and herbicides from market gardens affecting algae and invertebrates in the sanctuary.	2 - 3	3 - 4	6 - 12	M - E

Note: Level of Risk is based on Likelihood and Consequence in accordance with AS4360

Appendix E

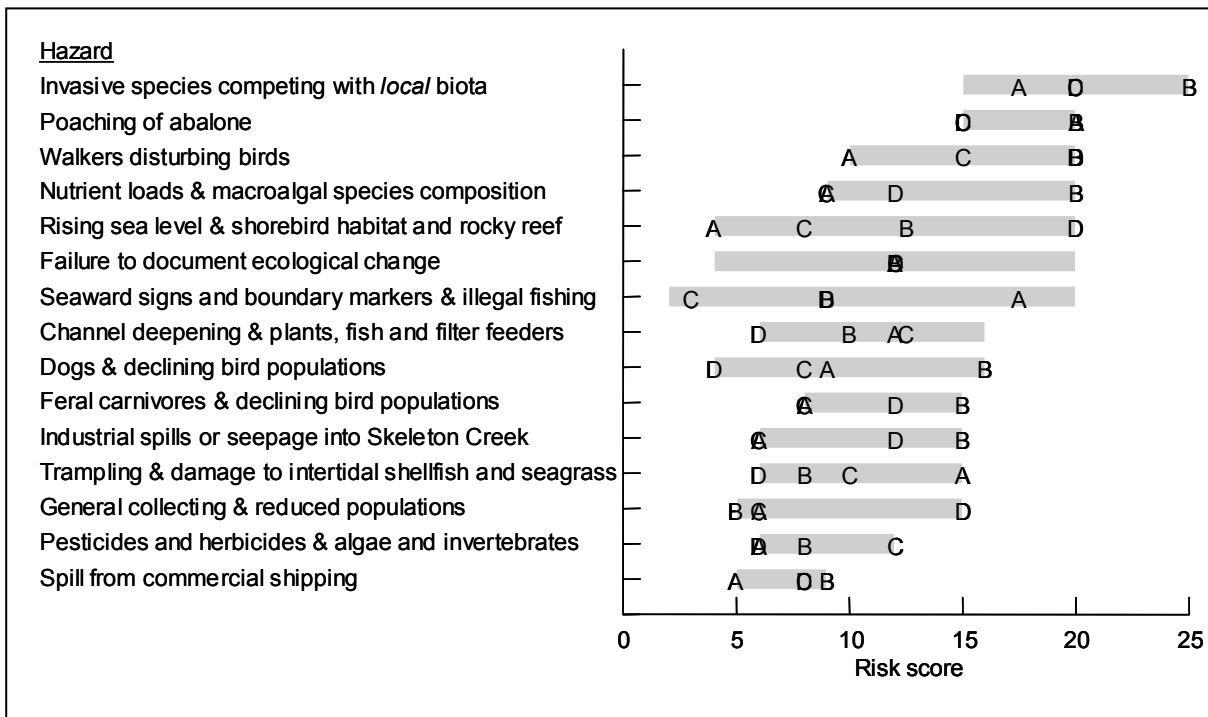


Figure 2.7.2 Summary of major risks to Point Cooke MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the four groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the four groups.

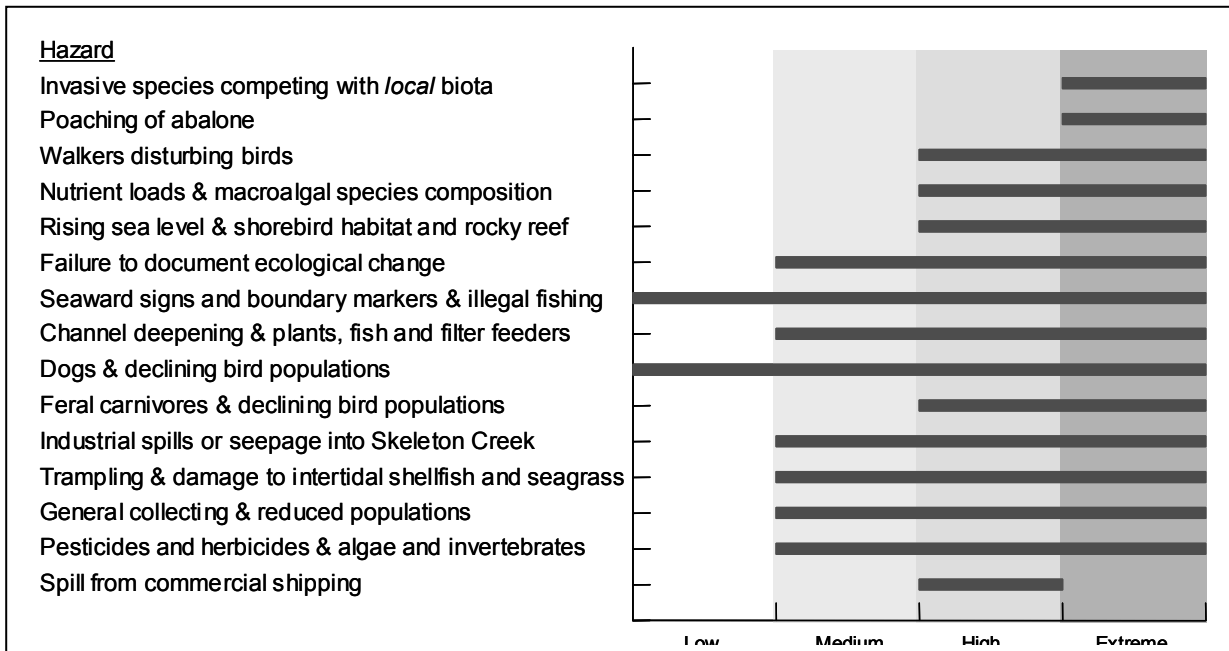


Figure 2.7.3 Hazards ordered as in Fig. 2, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E.

2.7.1 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2003) flagged 13 threats as high risk (Table 4) from a total of 23 considered. The top three threats appeared in the workshop risk register, while those concerning fishing and bait collection also overlapped the risk register to some extent. However litter, habitat damage, damage to signs and markers, and onshore fires were not considered as priorities by workshop participants. Note that cultural values were not explicitly considered in the workshop, but there is potential for specific attributes of the sanctuary to be regarded as valuable in both a cultural and an ecological sense.

Table 2.7.4 Threats posing high risk to values of Point Cooke Marine Sanctuary. Drawn from an internal Parks Victoria assessment (Parks Victoria 2003)

Threat	Risk Score
Recreational shellfish collection	25
Abalone theft	25
Marine exotics	20
Commercial fishing	20
Recreational fishing	20
Spear fishing	16
Recreational bait collection	16
On shore litter	16
Impacts to cultural values	16
Commercial bait collection	15
Onshore fires	15
Habitat damage – Intertidal or Subtidal – trampling & anchoring	12
Damage to signs and markers	12

The workshop generated 9 hazards with no comparable threat in the internal assessment:

- **Walkers disturbing shorebirds**, seabirds and waterfowl.
- **Feral carnivores** (foxes, cats) *preying on* shorebirds and waders, leading to reduced reproduction and thus **declining bird populations**.
- Increasing development leading to increasing runoff and thus increasing **nutrient loads**, resulting in changes to **macroalgal species composition**.
- **Rising sea level** due to climate change leading to reduced **shorebird habitat** and reduced habitat value of **rocky reef**.
- Ineffectiveness of **seaward signs and boundary markers** (too few/too far apart) resulting in **illegal fishing** in sanctuary and thus reduced populations of fish and abalone.
- **Failure to document ecological change** leading to effects on sanctuary biota.

- Current Port of Melbourne **channel deepening** project causing increased turbidity affecting **plant populations**, and the release of contaminants from sediments affecting **fish and filter feeding organisms**.
- **Industrial spills or seepage into Skeleton Creek** affecting biota in the sanctuary.
- Groundwater seepage of **pesticides and herbicides** from market gardens affecting **algae and invertebrates** an the sanctuary.

2.8 Jawbone Marine Sanctuary

An ecological risk assessment for the Jawbone Marine Sanctuary was undertaken in a workshop setting at Williamstown on 2nd February 2005. The 15 workshop participants included Parks Victoria staff, and community stakeholders who had expressed an interest in joining the Parks Victoria Advisory Group for the sanctuary (Appendix 1).

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify threats of particular concern to them, together with the natural attributes of the sanctuary that they valued and that were potentially affected by those threats. This resulted in an initial list of 15 hazards (Table 2.8.1).

Participants were then provided with a list of 5 natural values specific to the sanctuary, together with a generic list of 131 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 655 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 15 hazards being identified as of particular concern to at least one workshop participant (Table 2.8.2).

Table 2.8.1 Initial list of hazards from unstructured brainstorming session, Jawbone MS.

Initial definition	Subsequent definition if refined
Trampling of any mangroves on east side of sanctuary	
Heavy metal or petrochemical pollution from Kororoit Creek affecting biodiversity in the sanctuary	Split into two hazards: Continuous heavy metal or petrochemical pollution from Kororoit Creek affecting biodiversity in the sanctuary. Spills causing heavy metal or petrochemical pollution from Kororoit Creek affecting biodiversity in the sanctuary.
Dogs off-lead disturbing of migratory wading birds	
Stormwater containing freshwater, contaminants, litter and nutrients, discharging from the drain near the school, and affecting biodiversity in the sanctuary	
Fox predation on shore-feeding, roosting or breeding birds, affecting their population numbers.	
Commercial-scale poaching of shellfish (abalone and mussels) or finfish (by spearfishing or line fishing) causing reduction of populations to below sustainable limits	Commercial-scale poaching of shellfish (abalone and mussels) causing reduction of populations to below sustainable limits
Heavy metals from possible dredging at the mouth of Kororoit Creek accumulating in birds or shellfish.	

Sediments from possible dredging at the mouth of Kororoit Creek smothering seagrass, sponges, and other susceptible taxa.	
Litter from stormwater and other land-based sources affecting biodiversity in the sanctuary.	
Oil spill from shipping destroying all of the sanctuary's seagrass (< 5 ha)	
Recreational bait collection resulting in habitat disturbance and removal of invertebrates from intertidal sediments.	
Predation by domestic cats on shore-feeding birds, leading to decreased populations.	Predation by domestic cats on shorebirds in Reserve or MS, leading to decreased shorebird populations.
Unregulated school group access to sanctuary resulting in disturbance of any intertidal marine life.	
Introduction of new marine pests causing changes to ecological processes.	Introduction of marine pests new to MS, causing changes to ecological processes.
Disturbance by personal water craft to more than 20 migratory birds.	

Table 2.8.2 Additional hazards from structured brainstorming session, Jawbone MS.

Initial definition	Subsequent definition if refined
Contaminants in groundwater from former tannery and other industries, <i>leaching into the sanctuary and thus</i> affecting biodiversity in MS.	
Lack of environmental etiquette among general visitor population resulting in disturbance to intertidal areas of mangrove and saltmarsh.	
Major rain event after long dry period causing concentrated contaminants in lake to overflow into sanctuary, thus causing impacts on biodiversity in the western part of MS	
Global warming (extreme events / <i>changed</i> weather conditions) causing changes in ecological processes <i>in MS</i>	
Human-induced changes in water movement affecting distribution of <i>marine</i> flora <i>in MS</i>	
Sedimentation and reduced light penetration due to the PoMC Channel Deepening project, resulting in changes to algae and seagrass, with flow-on effects to <i>other marine biota</i>	
Increasing public access through the adjacent reserve resulting in trampling causing destruction or any damage in the intertidal zone	Increasing public access via informal tracks through the adjacent reserve, resulting in trampling causing destruction or any damage in the intertidal zone

Organised research/education groups removing flora or fauna, or damaging geological formations	
Access to the water (for snorkelling etc.) by organised groups and other recreational users, causing trampling damage to seagrass in MS	
Removal of artefacts resulting in loss or disturbance of biota	
Nearby operation of aircraft (helicopters & seaplanes) for training or testing purposes causing disturbance of waders and seabirds	
Contaminants from boats in nearby small boat harbour resulting in reduced health of marine life in MS	
Elevated levels of lead etc. from accumulated ammunition in the sediments (from former rifle range) resulting in bioaccumulation in MS biota beyond current levels	
Lack of information / knowledge of biota and indigenous values for <i>management of ecosystem</i> , resulting in <i>sub-optimal</i> management actions with <i>consequent</i> effects on biodiversity in MS	
Small size of sanctuary resulting in edge effects (concentration of activity) and leading to lack of effective protection for populations within MS	

As individual hazards were nominated, some were discussed in detail to enhance participants' understanding and to minimize differences in interpretation. There was concern about the accuracy of various maps of the sanctuary viewed during the workshop, in particular the habitat map from the Marine Natural Values Study (Plummer *et al.* 2003)

The next step in the assessment process was to select a subset of hazards deemed to be of most concern. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored two or more votes were included in the risk register (Table 2.8.3).

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into three groups of three or four people, four of the fifteen participants being unable to remain for the entire day. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from +0.07 to +0.23, indicating a low level of agreement overall

among the groups. Individual hazards with high levels of disagreement were then discussed in detail (see below).

(i) Heavy metal or petrochemical pollution from Kororoit Creek affecting biodiversity in the sanctuary.

The original wording of the Kororoit Creek pollution hazard did not specify the size or timing of the pollution event. Following disagreement over the scoring of this hazard, it was split into two, one hazard referring to continuous low-level pollution, the other to spills from industry.

(ii) **Commercial-scale poaching** of shellfish (**abalone and mussels**) causing reduction of populations to below sustainable limits.

The group scoring this hazard highly did so because poaching is already at an unsustainable level. There was also some confusion over target species, so the hazard definition was tightened to specifically exclude fin fish.

(iii) Predation by **domestic cats** on shorebirds in Reserve or MS, leading to decreased **shorebird populations**.

There was discussion of whether the birds at risk of predation in this hazard should be those actually within the sanctuary at the time, or whether those outside should be included because a drop in their population is likely to influence numbers found within the sanctuary.

The group who ranked this hazard lower than other groups did so because they believed that fewer domestic cats are now at liberty at night when predation would normally be highest. Another group took the view that cats do prowl the sanctuary every night, and thus scored this hazard somewhat higher.

There was a general consensus that more information was required to better rank this hazard.

(iv) Introduction of **marine pests new to MS**, causing changes to **ecological processes**.

Consequence scores for this hazard tended to be higher than those for likelihood.

(v) Increasing **public access via informal tracks** through the adjacent reserve, resulting in trampling causing destruction or any damage in the **intertidal zone**

Increasing access through the reserve to the intertidal zone was a concern to workshop participants. Beyond the informal tracks specified in the hazard, this concern also extended to formal tracks that might be constructed in the future.

(vi) **Lack of information / knowledge** of biota and indigenous values for *management of ecosystem*, resulting in *sub-optimal* management actions with *consequent* effects on **biodiversity in MS**

There was no dispute about the current lack of knowledge of sanctuary biota. Discussion centred on whether or not this lack might result in undesirable effects on biodiversity. The high scores from two groups were also associated with acknowledged uncertainty about the consequences of this hazard (Appendix 4).

Following the discussion of selected hazards, groups were given the opportunity to change likelihood and consequence scores if they wished. Any changes were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in considerable increase in agreement among some groups, with the maximum correlation coefficient rising from +0.23 to +0.59. The minimum value rose rather more modestly, from +0.07 to +0.18.

The risk posed by each hazard was recorded in the risk register (Table 2.8.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 2.8.1 and 2.8.2. The hazards of greatest concern identified in the Jawbone workshop were:

- Increasing **public access via informal tracks** through the adjacent reserve, resulting in trampling causing destruction or any damage in the **intertidal zone**
- **Commercial-scale poaching** of shellfish (**abalone and mussels**) causing reduction of populations to below sustainable limits
- **Lack of information / knowledge** of biota and indigenous values for *management of ecosystem*, resulting in *sub-optimal* management actions with *consequent* effects on **biodiversity in MS**

Unusually, there was one hazard about which there was complete agreement in scoring between groups, and no uncertainty evident in the scores of individual groups:

- Dogs off-lead disturbing of migratory wading birds.

Notably, the area near the school which is particularly popular with dog walkers was of minimal concern to workshop participants.

Table 2.8.3 Risk register, Jawbone MS

Hazard	Likelihood	Consequence	Risk score	Level of Risk *
Trampling of any mangroves on east side of sanctuary	3 - 4	3	9 - 12	H
Continuous heavy metal or petrochemical pollution from Kororoit Creek affecting biodiversity in the sanctuary.	4 - 5	1 - 3	5 - 15	H - E
Dogs off-lead disturbing of migratory wading birds	5	3	15	E
Stormwater containing freshwater, contaminants, litter and nutrients, discharging from the drain near the school , and affecting biodiversity in the sanctuary	3 - 5	3	9 - 15	H - E
Commercial-scale poaching of shellfish (abalone and mussels) causing reduction of populations to below sustainable limits	2 - 5	3 - 5	10 - 20	H - E
Predation by domestic cats on shorebirds in Reserve or MS, leading to decreased shorebird populations .	3 - 4	3	9 - 12	H
Introduction of marine pests new to MS, causing changes to ecological processes.	2 - 3	3 - 5	8 - 15	H - E
Major rain event after long dry period causing concentrated contaminants in lake to overflow into sanctuary, thus causing impacts on biodiversity in the western part of MS	1 - 3	2 - 3	2 - 9	L - H
Sedimentation and reduced light penetration due to the PoMC Channel Deepening project , resulting in changes to algae and seagrass , with flow-on effects to <i>other marine biota</i>	2 - 4	3 - 4	8 - 16	H - E
Increasing public access via informal tracks through the adjacent reserve, resulting in trampling causing destruction or any damage in the intertidal zone	4 - 5	3 - 4	12 - 20	H - E
Lack of information / knowledge of biota and indigenous values for <i>management of ecosystem</i> , resulting in <i>sub-optimal</i> management actions with <i>consequent</i> effects on biodiversity in MS	3 - 5	1 - 4	5 - 20	H - E
Small size of sanctuary resulting in edge effects (concentration of activity) and leading to lack of effective protection for populations within MS	3 - 4	2 - 4	6 - 16	M - E
Spills causing heavy metal or petrochemical pollution from Kororoit Creek affecting biodiversity in the sanctuary.	1 - 3	3 - 5	3 - 15	M - E

*Level of Risk is based on Likelihood and Consequence in accordance with AS4360 Appendix E

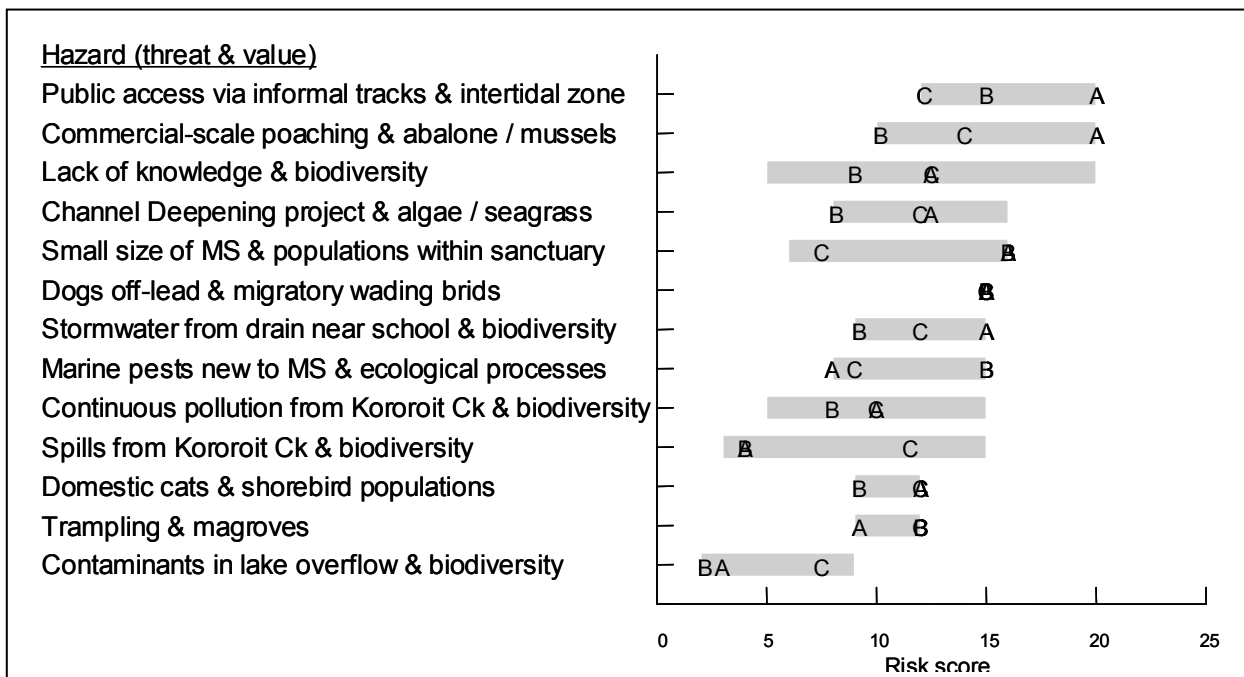


Figure 2.8.1 Summary of major risks to the Jawbone MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the three groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the three groups.

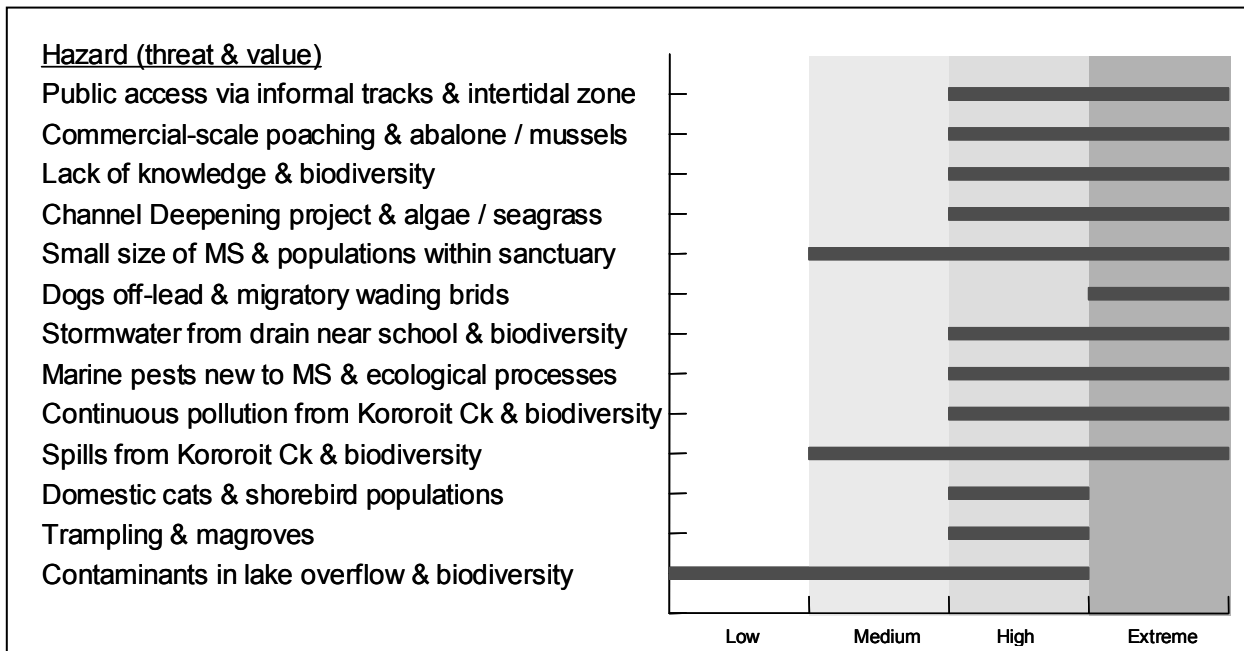


Figure 2.8.2 Hazards ordered as in Fig. 1, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E.

It was suggested that existing data may be available on the following hazards:

- Dogs off-lead disturbing of migratory wading birds.
- Contaminants in groundwater from former tannery and other industries, *leaching into the sanctuary and thus affecting biodiversity in MS*

It was generally felt that better assessment of the following hazards would have been possible if more information had been available at the workshop:

- Major rain event after long dry period causing concentrated contaminants in lake to overflow into sanctuary, thus causing impacts on biodiversity in the western part of MS
- Sedimentation and reduced light penetration due to the *PoMC* Channel Deepening project, resulting in changes to algae and seagrass, with flow-on effects to *other marine biota*

2.8.1 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2003) flagged 13 threats from a total of 23 considered, as posing high risks (Table 2.8.4). Four of the high risk threats (abalone theft, marine exotics, dogs and habitat damage) overlap with risk register hazards from the workshop.

Table 2.8.4 Threats posing high risks to values of the Jawbone MS. Drawn from an internal Parks Victoria assessment (Parks Victoria 2003).

Threat	Risk Score
Recreational shellfish collection	25
Abalone theft	25
Spear fishing	20
Aquarium specimen collection	20
Introduction or spread of Marine Exotics	20
Commercial Fishing (illegal fishing within MPAs by licensed fishers) inside boundaries	20
Recreational Fishing	20
Pollution – Marine Incidents (oil / chemical of effluent waste incidents)	20
Removal of living or dead material	20
On-shore dogs	16
Habitat damage - Intertidal or Subtidal	16
Bait collection - commercial	15
Bait collection - recreational	15

Eight of the risk register hazards (Table 3) involved the following threats that had not been assessed during the compliance planning process:

- Continuous heavy metal or petrochemical pollution from Kororoit Creek

Parks Victoria Technical Series No. 33 Threats to Victoria's Marine Protected areas

- Stormwater containing freshwater, contaminants, litter and nutrients, discharging from the drain near the school
- Predation by domestic cats
- Major rain event after long dry period causing concentrated contaminants in lake to overflow into sanctuary
- Sedimentation and reduced light penetration due to the PoMC Channel Deepening project
- Lack of information / knowledge of biota and indigenous values for management of ecosystem, resulting in sub-optimal management actions
- Small size of sanctuary resulting in edge effects (concentration of activity)
- Spills causing heavy metal or petrochemical pollution from Kororoit Creek

2.9 Ricketts Point Marine Sanctuary

An ecological risk assessment for the Ricketts Point Marine Sanctuary was undertaken in a workshop setting at Beaumaris on 22 September 2004. The 23 workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park (Appendix 1).

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify threats of particular concern to them, and the natural attributes of the sanctuary they valued which were potentially affected by those threats and resulted in an initial list of 24 hazards (Table 2.9.1).

Participants were then provided with a list of 6 natural values specific to the sanctuary, together with a generic list of 114 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 684 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 13 hazards being identified as of particular concern to at least one workshop participant (Table 2.9.2).

Table 2.9.1 Initial list of hazards from unstructured brainstorming session, Ricketts Point MS.

Initial definition	Subsequent definition if refined
Trampling by visitors affecting intertidal organisms	
Freshwater in stormwater discharges reducing salinity and thus affecting algae	
Shore-based litter resulting in entanglement, ingestion <i>or smothering of/by</i> animals	
Oil or chemical pollution from maritime sources affecting assemblages and habitats in the sanctuary	
Uninformed and excessive use of the sanctuary by visitor groups affecting intertidal assemblages	
New or existing marine pests outcompeting local species	
Abalone poaching affecting abalone populations in the sanctuary	
Dogs disturbing native shorebirds and seabirds, including migratory waders	Dogs not under effective control, disturbing (i.e. causing a change in behaviour of) native shorebirds and seabirds, including migratory waders
Nutrients from stormwater discharges affecting intertidal algae	

Increased turbidity and thus decreased light penetration, and the release of toxicants, both resulting from the Channel Deepening project, and affecting <i>sanctuary assemblages and habitats</i>	
Lack of environmental etiquette (e.g. <i>individuals trampling organisms, or neglecting to return rocks to their original position</i>) affecting intertidal sand and rock habitats and communities	
Lack of efficacy of signage (e.g. <i>in relation to walking of dogs</i>) affecting sanctuary assemblages and habitats	
Global warming leading to increased <i>frequency of storms</i> and thus increased erosion, resulting in damage or alteration to habitats	
Shifting of seaward boundary markers <i>of the sanctuary</i> resulting in inappropriate fishing pressure	
Lack of accessible knowledge <i>affecting management and consequently the functioning of organisms and the ecosystem of the sanctuary</i>	Lack of accessible ecological knowledge <i>affecting management and consequently the functioning of organisms and the ecosystem of the sanctuary</i>
Water-based activities (e.g. snorkelling) causing disturbance to habitats	Water-based recreational activities (e.g. snorkelling, boating, kite surfing) causing disturbance to habitats
Overflow from Fourth St sewage pumping station affecting water quality in the sanctuary	
Commercial fishing pressure (snapper, pike/snook, garfish and squid) around the sanctuary boundaries affecting fish populations	
Inappropriate boating behaviour (anchor <i>damage</i> , propeller scour etc.) affecting seagrass	
Acid rain <i>from industries</i> on western shores of Port Phillip Bay affecting calcareous organisms (<i>most likely to occur in the intertidal?</i>)	
Loss of local community support affecting sanctuary assemblages and habitats, and eventually the existence of the sanctuary	
Disturbance by researchers (collection, manipulation) affecting sanctuary assemblages and habitats	
Fragmentation of ecological processes (e.g. larval supply)	
Misguided action to deal with marine pests affecting local species (e.g. destruction of misidentified local species)	

Table 2.9.2 Additional hazards from structured brainstorming session, Ricketts Point MS.

Initial definition	Subsequent definition if refined
Coastal management practices adjacent in areas to the sanctuary (e.g. construction of groynes/seawalls, protection of roads, maintenance of carparks) affecting habitats (e.g. by altering longshore drift of sand)	
Lack of resourcing for sanctuary management affecting assemblages and habitats	Lack of consistent resourcing for sanctuary management (i.e. for Parks Victoria and Fisheries Victoria, with flow-on effects to Friends groups etc.) affecting assemblages and habitats
Contamination of groundwater <i>in surrounding urban area</i> affecting sanctuary assemblages and habitats	
Inappropriate use of recreational craft (presence, noise) disturbing roosting birds	
Industrial pollution in stormwater discharges affecting sanctuary assemblages and habitats	
Lack of coordinated management affecting <i>sanctuary assemblages and habitats</i>	
Ecological vandalism affecting sanctuary assemblages and habitats	
Bureaucratic timelines and inertia, and lack of co-ordination among multiple management agencies, affecting sanctuary assemblages and habitats	
Failure to document ecological change affecting sanctuary assemblages and habitats	
Unpredicted weather events affecting sanctuary assemblages and habitats (e.g. pulse discharge from Yarra River after storm event)	
Political influence in decision-making and resourcing affecting sanctuary assemblages and habitats	
Large vessels grounding and thus <i>damaging reefs in sanctuary</i>	
Change in water temperature (<i>due to global warming?</i>) affecting species composition and ecological processes	

As individual hazards were nominated, some were discussed in detail to enhance participants' understanding and to minimize differences in interpretation. A conceptual model was developed identifying different pathways by which exotic marine species might affect local species within the sanctuary (Figure 2.9.1).

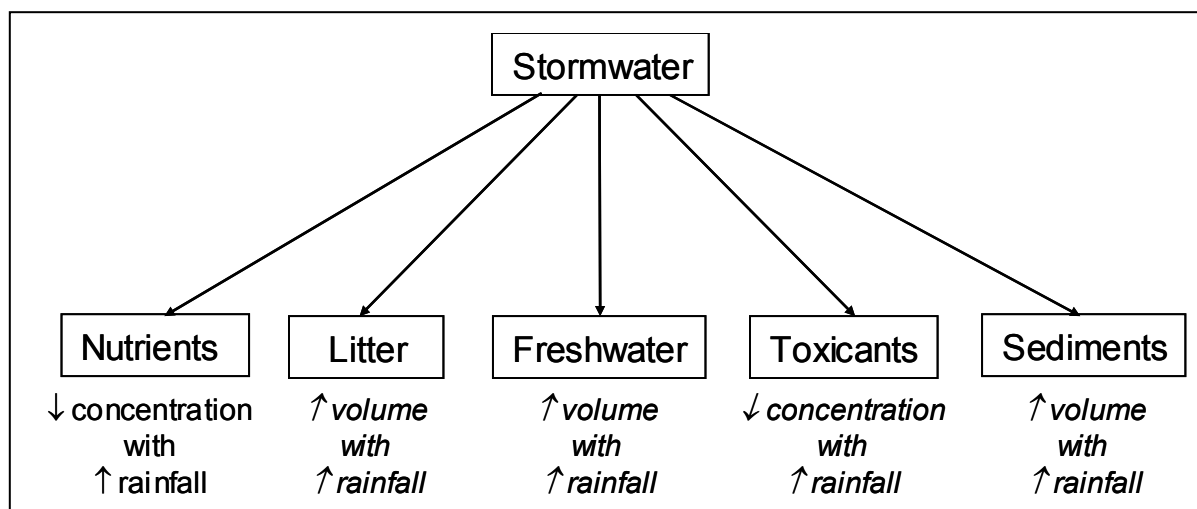


Figure 2.9.1 Conceptual model of pathways by which exotic species might affect native species within Ricketts Point MS.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern for the next stage of the risk assessment. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored three or more votes were included in the risk register (Table 2.9.3).

Table 2.9.3 Risk register, Ricketts Point MS.

Hazard	Likelihood	Consequence	Risk score	Level of Risk
Trampling by visitors affecting intertidal organisms	5	3 - 4	15 - 20	E
Uninformed and excessive use of the sanctuary by visitor groups affecting intertidal assemblages	4 - 5	3 - 4	15 - 20	E
New or existing marine pests outcompeting local species	3 - 5	3 - 5	12 - 25	E
Dogs not under effective control, disturbing (i.e. causing a change in behaviour of) native shorebirds and seabirds , including migratory waders	3 - 5	2 - 4	6 - 20	M - E
Nutrients from stormwater discharges affecting intertidal algae	3 - 5	2 - 4	6 - 20	M - E

Increased turbidity and thus decreased light penetration, and the release of toxigants , both resulting from the Channel Deepening project, and affecting <i>sanctuary assemblages and habitats</i>	2 - 4	2 - 5	4 - 20	L - E
Bureaucratic timelines and inertia , and lack of co-ordination among multiple management agencies, affecting sanctuary assemblages and habitats	2 - 4	2 - 4	4 - 16	L - E
Failure to document ecological change affecting sanctuary assemblages and habitats	2 - 4	2 - 4	4 - 16	L - E
Lack of environmental etiquette (e.g. <i>individuals trampling organisms, or neglecting to return rocks to their original position</i>) affecting intertidal sand and rock habitats and communities	4 - 5	2 - 4	8 - 20	H - E
Lack of accessible ecological knowledge affecting management and consequently the functioning of organisms and the ecosystem <i>of the sanctuary</i>	2 - 5	2 - 4	4 - 20	L - E
Water-based recreational activities (e.g. snorkelling, boating, kite surfing) causing disturbance to habitats	3 - 4	1 - 3	3 - 12	L - H
Coastal management practices in areas adjacent to the sanctuary (e.g. construction of groynes/seawalls, protection of roads, maintenance of carparks) affecting habitats (e.g. <i>by altering longshore drift of sand</i>)	2 - 5	3 - 4	8 - 16	H - E
Lack of consistent resourcing for sanctuary management (i.e. for Parks Victoria and Fisheries Victoria, with flow-on effects to Friends groups etc.) affecting assemblages and habitats	1 - 4	3 - 4	3 - 16	M - E
Loss of local community support affecting sanctuary assemblages and habitats, and eventually the existence of the sanctuary	2 - 3	2 - 3	4 - 9	L - H

Note: Level of Risk based on Likelihood and Consequence in accordance with AS4360 Appendix E (SA/SNZ 1999)

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into five groups of four to five people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from +0.05 to +0.63, with a median of +0.44, indicating a moderate level of disagreement overall among the groups. Individual hazards with high levels of disagreement were then discussed in detail (see below).

(i) **Lack of accessible ecological knowledge** affecting management and consequently the functioning of organisms and the ecosystem of the sanctuary

During the discussion of this hazard, it became evident that some participants (including the facilitator) were thinking specifically of ecological knowledge, while others were thinking in more general terms. However, tightening the definition for the second round of ranking failed to produce any changes in scores for this hazard. While it had received twice the number of votes needed for promotion to the risk register (i.e. it was clearly a hazard worth considering further), it was generally agreed that it was a difficult hazard to score with any confidence. This was reflected in the scores for likelihood and consequence, with four of the five groups giving ranges rather than point estimates (Appendix 4).

(ii) **Lack of consistent resourcing for sanctuary management** (i.e. for Parks Victoria and Fisheries Victoria, with flow-on effects to Friends groups etc.) affecting assemblages and habitats

The general issue for this hazard was possible changes in government initiatives and priorities that could affect the level of resourcing available for marine parks and sanctuaries. Tangible effects might include reduced signage around the sanctuary or reduced manpower to control poaching. Most groups believed this hazard to be likely or moderately likely to eventuate within the next ten years. The dissenting group thought that active community involvement with the sanctuary would ameliorate the affects of reduced resourcing, to the extent that it scored the likelihood as very unlikely.

(iii) **Nutrients from stormwater** discharges affecting **intertidal algae**

Initially one group scored this hazard as stormwater in its entirety, not just the nutrient component (Figure 2.9.2). Discussion made this misinterpretation of the definition evident, and the group modified their scores in the second round of ranking.

(iv) **Dogs** not under effective control, disturbing (i.e. causing a change in behaviour of) native **shorebirds and seabirds**, including migratory waders

Risk scores for this hazard ranged from 6 to 20 (Table 3). While this was not the largest range among hazards in the risk register, the issue of dogs and birds is a particularly controversial one for the sanctuary. Dogs are not permitted off-leash at any time on rock platforms or on the sandy beaches below high water mark (specifically MHHW), a lesser restriction than that applied in other Victorian marine parks and sanctuaries. Variable restrictions on dogs are in place in areas adjacent to the sanctuary and that are managed by the local council.

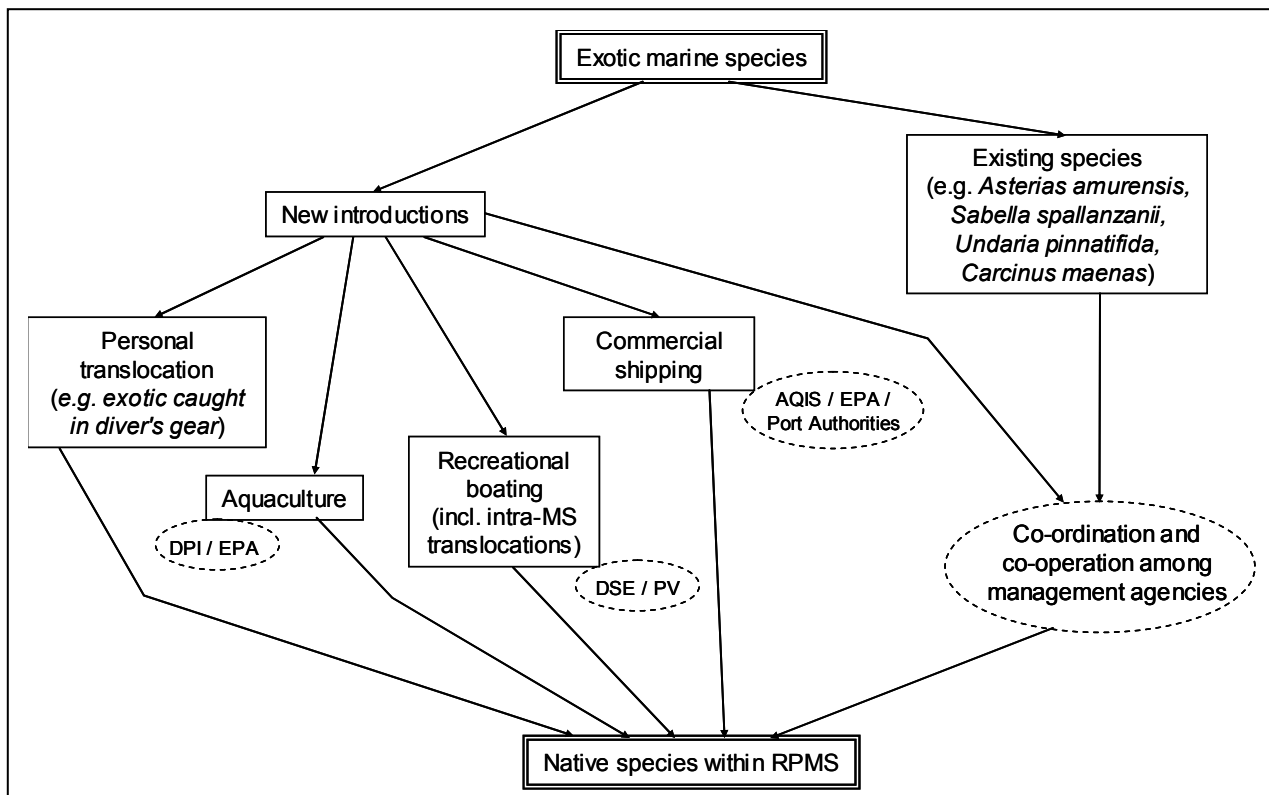


Figure 2.9.2 Components of stormwater which may affect sanctuary biota.

The definition of this hazard was progressively tightened during the course of the workshop (Table 1). Nonetheless, considerable linguistic uncertainty remained in relation to interpretation of the percentage-based definitions of likelihood (Appendix 3), and to the question of how many dogs and how many birds constituted a disturbance. These difficulties were not satisfactorily addressed during the workshop, and doubtless contributed to the wide range of risk scores. In spite of these difficulties, there was progress towards an improved understanding of the issues. It appeared that there may be a spatial component to the problem of disturbance (Fig. 3), perhaps confounded with birds becoming habituated to the presence of dogs over time. It was reported by one participant that few dogs venture onto the offshore rocky reefs, where there is a concern that roosting birds may be disturbed. Fewer birds appear to roost on the sandy areas close to or above the high water mark, so disturbance by dogs is less likely to occur in this area. Of course, the relative absence of birds from this area may itself be a long-term effect of disturbance by large numbers of humans and dogs.

It was agreed that data on the numbers of dogs and birds using the sanctuary and any interactions between them would have been helpful in assessing the risk of this hazard.

Following the discussion of selected hazards, groups were given the opportunity to change likelihood and consequence scores if they wished. The few changes made were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. Very little change in the overall level of agreement among groups was evident, with the median correlation increasing by only 0.04, and the maximum actually decreasing by 0.01.

The risk posed by each hazard was recorded in the risk register (Table 2.9.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 2.9.4 and 2.9.5. The three hazards of greatest concern identified in the Ricketts Point workshop, all unambiguously rated as having an extreme level of risk, were:

- New or existing **marine pests** outcompeting local species
- **Trampling** by visitors affecting **intertidal organisms**
- Uninformed and excessive use of the sanctuary by **visitor groups** affecting **intertidal assemblages**

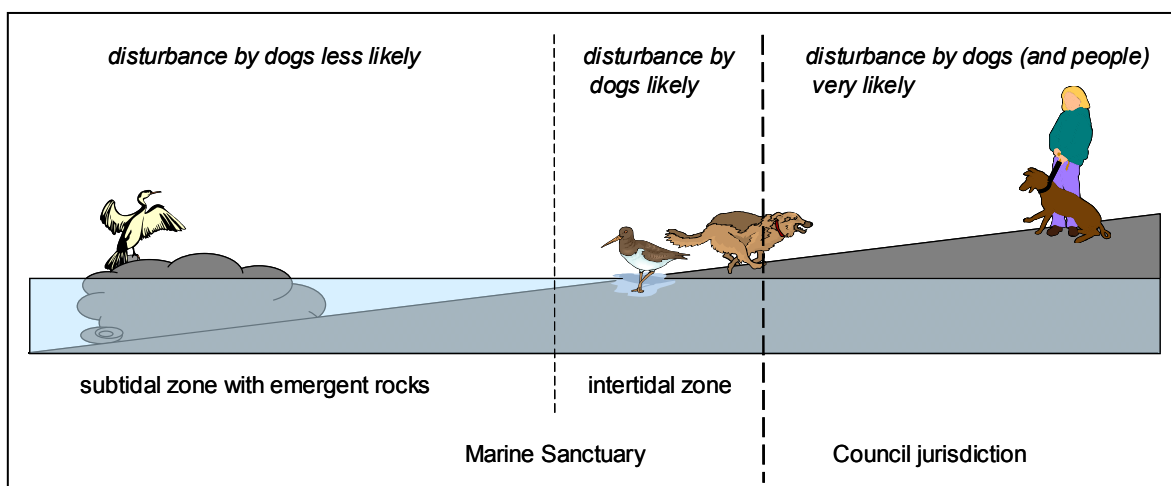


Figure 2.9.3 Possible zonation of disturbance of shorebirds and seabirds by dogs. Note that dogs in Ricketts Point MS are required to be on-leash at all times.

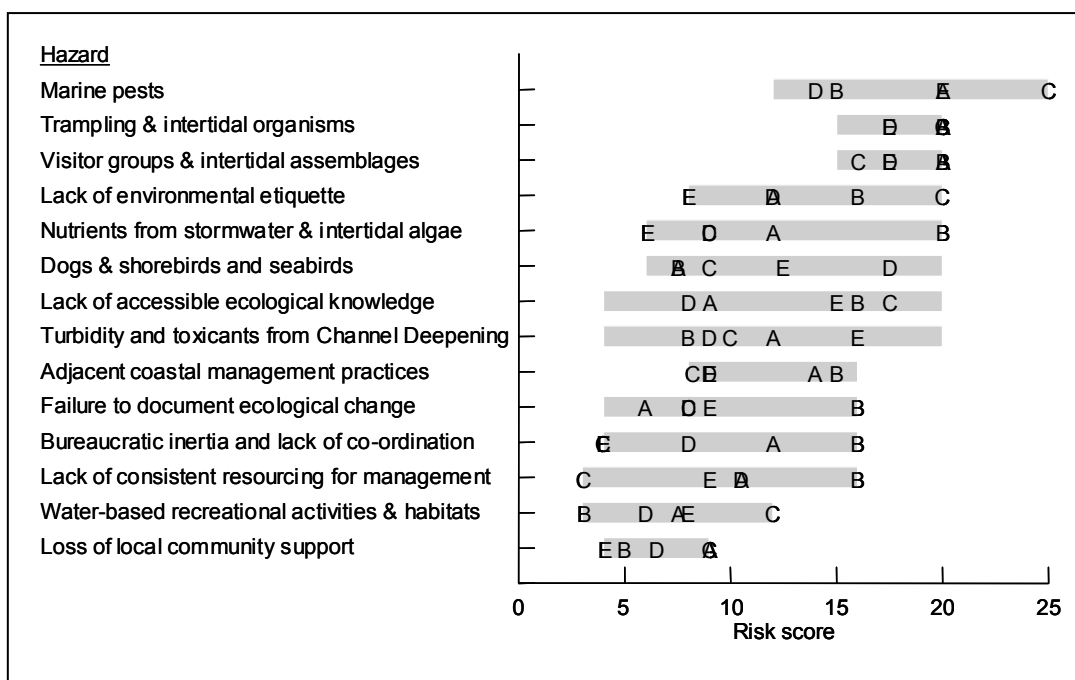


Figure 2.9.4 Summary of major risks to Ricketts Point MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the five groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the five groups.

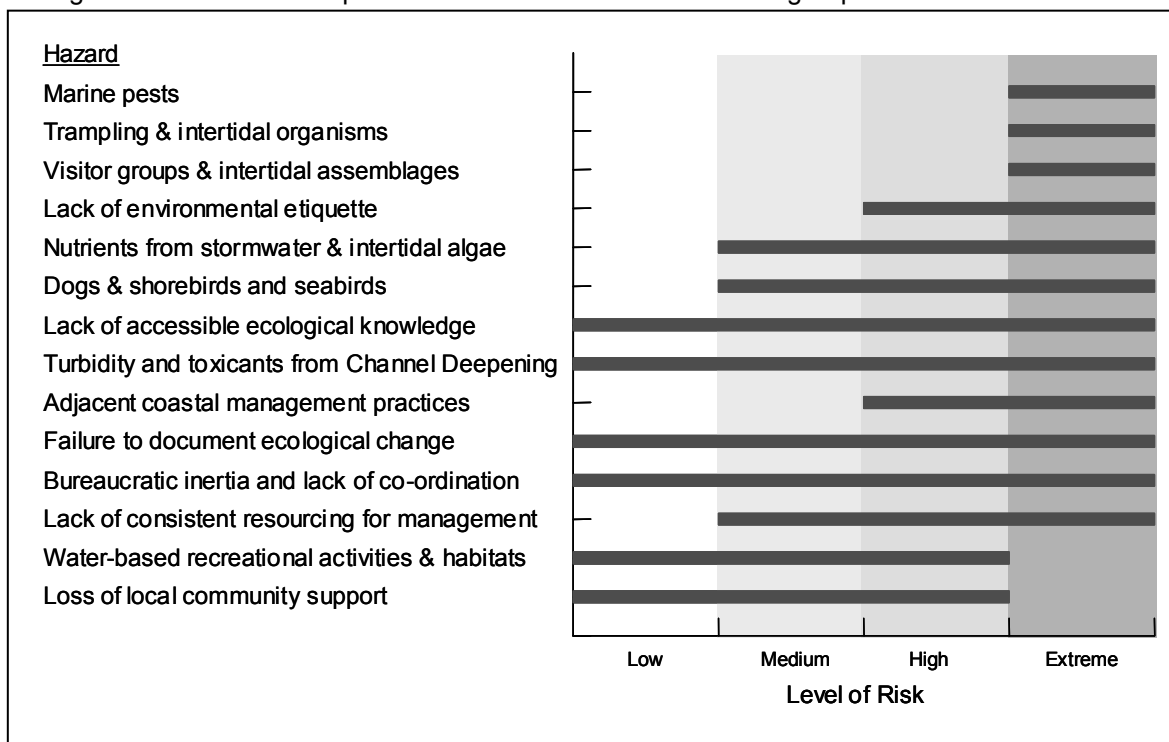


Figure 2.9.5 Hazards ordered as in Fig. 1, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

During the course of the workshop, information gaps were identified in relation to the following issues:

- contamination from ground water;
- acid rain *from industries on the western side of Port Phillip Bay*;
- local effects of global warming;
- fragmentation of ecological processes;
- the impact of nutrients from stormwater discharges;
- local impacts of the Channel Deepening project;
- the possible consequences stemming from lack of ecological knowledge; and
- the nature of interactions between dogs and sea/shorebirds in the sanctuary.

2.9.1 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2003) flagged 15 threats from a total of 22 considered, as posing high risks (Table 2.9.4). Two-thirds of the high risk threats overlap to some extent with hazards identified in the workshop, the exceptions being spear fishing, aquarium specimen collection, bait collection and unauthorised moorings. Of particular note is the complete lack of agreement between the top three threats in Table 2.9.4 and the top three hazards from the workshop (i.e. marine pests, trampling and visitor groups; Figures 2.9.4 & 2.9.5).

Table 2.9.4 Threats posing high risk to values of Ricketts Point Reef MS. Drawn from an internal Parks Victoria assessment (Parks Victoria 2003). High risk was defined as a risk score greater than 10.

Threat *	Risk Score
Recreational fishing	25
Recreational shellfish collection	25
Abalone theft	25
Marine exotics	20
Damage to signs and markers	20
Commercial fishing	20
Pollution – Marine Incidents (oil / chemical of effluent waste incidents)	16
Spear fishing	16
Aquarium specimen collection	16
On shore dogs	16
Habitat damage – Intertidal or Subtidal – trampling & anchoring	16
Removal of material - living or dead	15
Bait collection – recreational	15
Bait collection – commercial	15
Placing an unauthorised mooring	12

* the context of the internal assessment indicates that these threats are considered as occurring within the sanctuary.

The workshop produced seven hazards with no comparable threat in the internal assessment:

- **Nutrients from stormwater** discharges affecting **intertidal algae**
- Increased **turbidity** and thus decreased light penetration, and the release of **toxicants**, both resulting from the **Channel Deepening** project, and affecting *sanctuary assemblages and habitats*
- **Bureaucratic** timelines and **inertia, and lack of co-ordination** among multiple management agencies, affecting sanctuary assemblages and habitats
- **Failure to document ecological change** affecting sanctuary assemblages and habitats
- **Lack of accessible ecological knowledge** *affecting management and consequently the functioning of organisms and the ecosystem of the sanctuary*
- **Lack of consistent resourcing** for sanctuary **management** (i.e. for Parks Victoria and Fisheries Victoria, with flow-on effects to Friends groups etc.) affecting assemblages and habitats
- **Loss of local community support** affecting sanctuary assemblages and habitats, and eventually the existence of the sanctuary

The first two of these hazards relate to tangible threats (nutrients and turbidity/toxicants) not dissimilar in nature to those addressed during the compliance planning process. The remaining five, however, are indirect threats and quite different in nature. Three involve bureaucratic or social threats to the ecological values of the sanctuary, and two focus on our current lack of understanding of ecological matters.

2.10 Mushroom Reef Marine Sanctuary

An ecological risk assessment for the Mushroom Reef Marine Sanctuary was undertaken in a workshop setting at Flinders on 25th August 2004. The 17 workshop participants (Appendix 1) included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park.

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify two threats of particular concern to them, and the natural attributes of the sanctuary they valued which were potentially affected by those threats; this resulted in an initial list of 25 hazards (Table 2.10.1).

Participants were then provided with a list of 5 natural values specific to the sanctuary, together with a generic list of 92 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 460 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 13 hazards being identified as of particular concern to at least one workshop participant (Table 2.10.2).

Table 2.10.1 Hazards of concern initially nominated by participants for the Mushroom Reef MS.

Initial definition of hazard	Subsequent definition, if hazard refined
Impact of trampling on intertidal reef communities	
Pollution from terrestrial runoff affecting marine flora and fauna	
Effects of fishing on marine flora and fauna	Effects of illegal recreational fishing, including spearfishing, on marine flora and fauna
Individual/recreational fossicking effects on intertidal reef communities	
1) Fishing pressure on the edge of the sanctuary <i>affecting fish populations</i> . 2) Concentration of resources within the sanctuary encouraging extraction activities.	Two hazards combined: Concentration of resources within the sanctuary leading to <i>increased</i> fishing pressure on the edge of the sanctuary <i>affecting fish populations</i> .
Disturbance from fossicking, trampling and dogs affecting wading birds	
Sea-sourced pollution (oil, chemicals and ballast water) affecting marine communities	Sea-sourced pollution (oil and chemicals) affecting intertidal communities and transient megafauna
Physical damage to habitats and communities from vessel groundings	Physical damage to habitats and communities from grounding of vessels less than 10 m in length

Research and educational collections affecting subtidal and intertidal communities	Split into two hazards: 1) Research collecting, under permit, affecting subtidal and intertidal communities. 2) Educational collecting affecting subtidal and intertidal communities
Nutrients from sewage or fertilizers (golf course, farming) affecting marine communities	
Changes in sea level or sea temperature due to global warming affecting marine habitats and communities	Split into two hazards: 1) Changes in sea level due to global warming affecting marine habitats. 2) Changes in sea temperature due to global warming affecting marine communities.
Changing land uses affecting marine communities and habitats, either positively or negatively	
Potential infrastructure in adjacent National Park affecting marine habitats and communities	Potential infrastructure failures (e.g. in septic systems) in adjacent National Park affecting marine habitats and communities
Freshwater in plume from Boags Rocks affecting algal species composition	
New releases or translocations of exotic <i>marine</i> species affecting marine communities	
Changes in community composition resulting from man-made influences outside the sanctuary	Changes in community composition resulting from man-made influences (i.e. aquaculture) outside the sanctuary
Dog excrement causing bacterial contamination of habitats	
Land-based litter resulting in entanglement in or smothering of <i>marine organisms</i>	Land-based litter resulting in entanglement in, smothering of, or ingestion by <i>marine organisms</i>
Stray projectiles <i>from naval gunnery school</i> landing in sanctuary	
Carcasses (e.g. cattle) contaminating the sanctuary	
Catastrophic storm events affecting marine communities	
Geological events (e.g. earthquakes) affecting marine habitats and communities	
Natural petroleum seepage from Bass Strait affecting marine habitats and communities	
Terrestrial pest species (foxes, cats, rodents) affecting penguins and wading birds	

Table 2.10.2 Additional hazards after prompting with pre-prepared lists of possible values and potential threats

Initial definition of hazard	Subsequent definition, if hazard refined
Turbid plume from channel dredging in Port Phillip Bay affecting seagrass (<i>Amphibolis</i>)	
Microalgal bloom caused by channel dredging in Port Phillip Bay affecting filter feeding organisms	
Increased turbidity from Double Creek affecting seagrass beds	
Failure to document ecological change affecting marine habitats and communities	
Reduced protection on three <i>seaward</i> boundaries resulting in increased fishing pressure on species within the sanctuary	Reduced protection on three <i>seaward</i> boundaries resulting in increased recreational fishing pressure on species within the sanctuary
Shellfish poaching (abalone, sea urchins and crabs) leading to decreased populations of those species	
Licensed discharges to Double Creek affecting marine communities	
4WD vehicles causing damage to habitat	
Increased populations of resident pest species (e.g. green shore crab) affecting local <i>marine</i> species	
Discarding of dead fish bait leading to contamination of habitat and introduction of disease	
Native title claims over cobble paths leading to unspecified effects on sanctuary	
Lack of coordination among multiple management agencies affecting marine habitats and communities	Lack of coordination of everyday activities among multiple management agencies affecting marine habitats and communities
Anchoring of <i>boats</i> in sanctuary causing damage to habitat	

As individual hazards were nominated, some were discussed in detail to enhance participant's understanding and to minimize differences in interpretation. Lines of argument concerning particular threats or values are presented below:

- While the possibility of stray projectiles from the Naval Gunnery School landing in or near the sanctuary was acknowledged, it was generally accepted that the noise of artillery practice was something to which local species such as birds seem to have become accustomed.
- The nearby aquaculture operation farms only the locally-occurring blue mussel *Mytilus edulis*. Transfers of mussels or spat from Port Phillip Bay are regulated to reduce the likelihood of other species being introduced, with a requirement that they be immersed in

freshwater (Note: 2 hours immersion is required, followed by air-drying overnight (Anon. 2003)). Increases in mussel populations in the general area (i.e. beyond the mussel culture zone) have been noted since farming commenced.

-
- Turbidity from maintenance dredging of the South Channel in Port Phillip Bay was discussed. Could a turbid plume from Port Phillip Bay extend as far as Mushroom Reef? Would it combine with the sewage plume from the Boags Rocks outfall? How long would any such increased turbidity persist? Seagrass beds were perceived to be most at risk from this potential threat, with intertidal assemblages less so because of their more dynamic environment. Related concerns included:
 - (i) algal blooms being precipitated by dredging turbidity, particularly in summer when temperatures are elevated, and
 - (ii) nutrient enrichment in Port Phillip Bay, stemming from disturbance to in-sediment processes by dredging, and possibly affecting shellfish (*shellfish which may then be transferred to the Flinders mussel culture zone?*).
- Nutrient-rich discharges from chicken farms on the Mornington Peninsula are unlikely to pose a threat to Mushroom Reef, but there may be some changes relevant to the sanctuary when Flinders is sewerred in about 5 years time.
- The European shore crab *Carcinus maenas* is believed to displace local crab species, and to be present in the area (Note: While there are reports of major impacts of *C. maenas* overseas, there is little actually known about its impact on native species in Victoria since its introduction in the mid 1800s. There is a diversity of opinion on possible future impacts here (EPA 1996)). Workshop participants were not aware of any reports of either the Japanese kelp *Undaria pinnatifida* or the northern Pacific seastar *Asterias amurensis* in or near the sanctuary. (Note: Both are found in Port Phillip Bay (Campbell & Burridge 1998, Cohen et al. 2000), and in 2004, *A. amurensis* was detected at Inverloch (DSE 2004), some 60 km to the east of Mushroom Reef)
- It was suggested that the cobble causeway leading to the raised area of Mushroom Reef may be man-made, designed by the local indigenous inhabitants to act as a fish trap. There may also be a midden nearby, which would lend support to this interpretation of the causeway's origin.
- Management agencies and other organisations with responsibilities in and around the sanctuary include Parks Victoria, Bass Park Trust, Mornington Peninsula Shire Council, Dept of Sustainability and Environment, Fisheries Victoria (DPI), Toll WesternPort (managers of the Port of Hastings), and the Royal Australian Navy. With so many agencies, there is considerable potential for lack of co-ordination, especially in the case of an incident such as an oil spill, where the basic responsibilities may change.
- The extensive area of intertidal reef within the sanctuary does not negate the potential for anchor damage from small boats. While the rock itself is less prone to damage, the assemblages of plants and animals remain susceptible.
- The eastern side of Mushroom Reef tends to suffer more human trampling than the western side, largely because it is somewhat drier. One participant reported observing a decline in both abundance and diversity of organisms over the last ten years, particularly invertebrates such as seastars, crabs and sea urchins. Abalone are now virtually absent from the sanctuary. Possible strategies for addressing human pressures on the reef were

considered (Fig. 1), including the trade-offs involved in dispersing impacts across the reef (i.e. reduced impact but spread over a greater area).

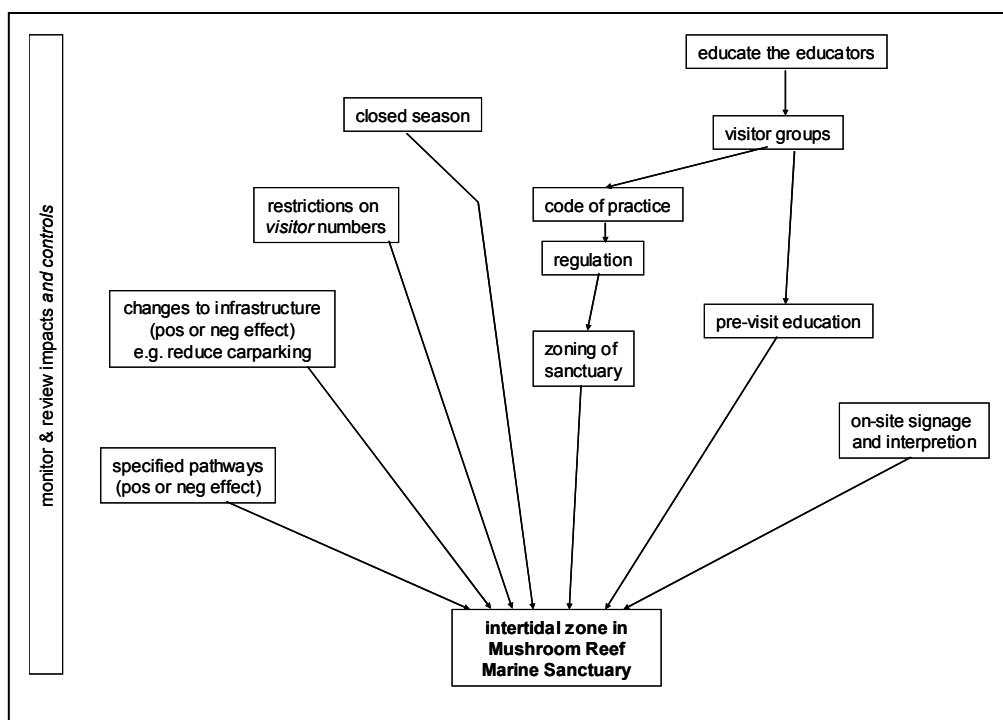


Figure 2.10.1 Conceptual model of strategies to address human pressures on the intertidal zone of Mushroom Reef MS.

- Long-term changes in bird populations and behaviour were also reported by participants:
 - i) Twenty years ago, sooty oystercatchers *Haematopus fuliginosus* and ruddy turnstones *Arenaria interpres* could be seen feeding on the reef that is now in the sanctuary, and at the mouth of Double Creek; they now feed in different areas.
 - ii) There are now increased numbers of the kelp gull *Larus dominicanus* in the area, a species expanding its range worldwide, and previously noted as critically endangered in Victoria. (Note: *L. dominicanus* may have arrived in Australia in the 1940s, and is increasing in numbers here. This is believed to be a natural process of range extension. To date, there is only a single breeding colony known in Victoria, near Phillip Island. (Viridans 2005))
- Jet skis were noted as disturbing birds, but there was a suggestion that fish may not be similarly affected. Jet skis are subject to the same regulations that apply to other types of recreational powerboat.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern for the next stage of the risk assessment. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored two or more votes were included in the risk register (Table 2.10.3).

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into four

groups of three or four people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from +0.14 to +0.66, with a median of +0.41, indicating a moderate level of disagreement overall among the groups. Individual hazards with high levels of disagreement were then discussed in detail (see below).

(i) Reduced protection on three seaward boundaries resulting in increased recreational fishing pressure on **species** within the sanctuary

This hazard was seen as highly likely to eventuate by one group on the evidence that poaching and illegal fishing currently occur, presumably indicative of a willingness to extract resources regardless of regulations. (Note: fishing just outside the sanctuary boundary would not constitute illegal fishing) On the basis of the same evidence, a second group concluded that there was little scope for fishing pressure to increase beyond its present level, and thus rated this hazard as highly unlikely. The first group rated the consequences as moderate to major, while conceding that more information on the nature of the consequences was really required. The second group considered the consequences to be insignificant. A third group specifically considering recreational fishing agreed with the insignificant rating for consequence because they have observed that many recreational fishers catch only a few fish.

Some territorial species such as damselfish, may have disappeared from reefs in the sanctuary since its declaration.

While the seaward boundaries of the sanctuary are not as readily apparent as the landward one, any encroachment could be easily observed from the top of the beach, enhancing the ability to deal with offenders. Furthermore, the area is exposed to the south and subject to swell, making it less popular for small boats than other more protected areas.

(ii) Lack of coordination of everyday activities among multiple **management** agencies affecting **marine habitats and communities**

Disagreement over this hazard was largely related to its likelihood. The highest score resulted from consideration of the indirect effects possible from the large number of agencies with local responsibilities. The lowest likelihood was due to the adjacent land being part of the Mornington Peninsula National Park and thus managed by the same agency as the marine sanctuary.

(iii) Effects of illegal recreational fishing, including spearfishing, on marine flora and fauna

Once again, disagreement related to likelihood rather than consequence. The evidence of existing illegal fishing led to high scores, while relative inaccessibility for boats and a view that the effects of spearfishing were overstated resulted in the lower scores for likelihood.

(iv) Freshwater in plume from Boags Rocks affecting algal species composition

While three groups believed this hazard was likely or highly likely to eventuate, one group scored likelihood much lower. While the participants were well informed as to the effects of freshwater on algal species composition, there was also a need to know more about the movement of the plume, and also what might happen if the discharge is reduced (in volume?). This was not resolved at the workshop.

(v) New releases or translocations of **exotic marine species** affecting **marine communities**

Differences of opinion revolved around the contrasting positions of no problem with exotic species in the sanctuary being apparent at the moment, and what might happen as a result of the current high levels of boating and diving activity together with the likely increases in activity over the next 10 years. Of particular concern were boat movements between the sanctuary and the bay (Port Phillip Bay?) and the sanctuary and Flinders Pier.

(vi) **Land-based litter** resulting in entanglement in, smothering of, or ingestion by **marine organisms**

One group initially scored higher on consequence than the other three groups as a result of focussing on individual animals such as birds or seals. The remaining groups considered population level effects either solely or in addition to individual effects.

(vii) **Educational collecting** affecting **subtidal and intertidal communities**

Mushroom Reef has a history as a popular location for the educational activities of schools and universities. Participants did not expect that use to change with the declaration of the sanctuary, and recognised that past use may have already modified the reef environment. They saw a clear potential for improvement in the condition of the sanctuary with park rangers educating visitors and influencing their behaviour.

The group scoring this hazard low for both likelihood and consequence believed that teachers would be aware of the existence of the sanctuary and the restrictions that status placed on visitors. Other groups had reservations about the abilities of teachers to adequately control their students.

Following the discussion of selected hazards, some changes were made to likelihood and consequence scores. These were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in a moderate increase in agreement among groups. While the median correlation was unchanged, the minimum correlation coefficient rose from +0.14 to +0.28, and the maximum rose from +0.66 to +0.72.

The risk posed by each hazard was recorded in the risk register (Table 3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 2.10.2 and 1.10.3. The top hazard identified in the Mushroom Reef workshop was:

- **Freshwater** in the plume **from Boags Rocks** affecting **algal species composition**.

- There was however, a great deal of uncertainty surrounding this hazard in the minds of the participants, as demonstrated by the very large range of risk scores (Figure 2.10.2). Three further hazards scored highly, but with minimal difference of opinion among the groups (Fig. 2). Individual/recreational **fossicking** effects on **intertidal reef communities**.
- **Shellfish poaching (abalone, sea urchins and crabs)** leading to decreased populations of those species.
- Impact of **trampling** on **intertidal reef communities**.

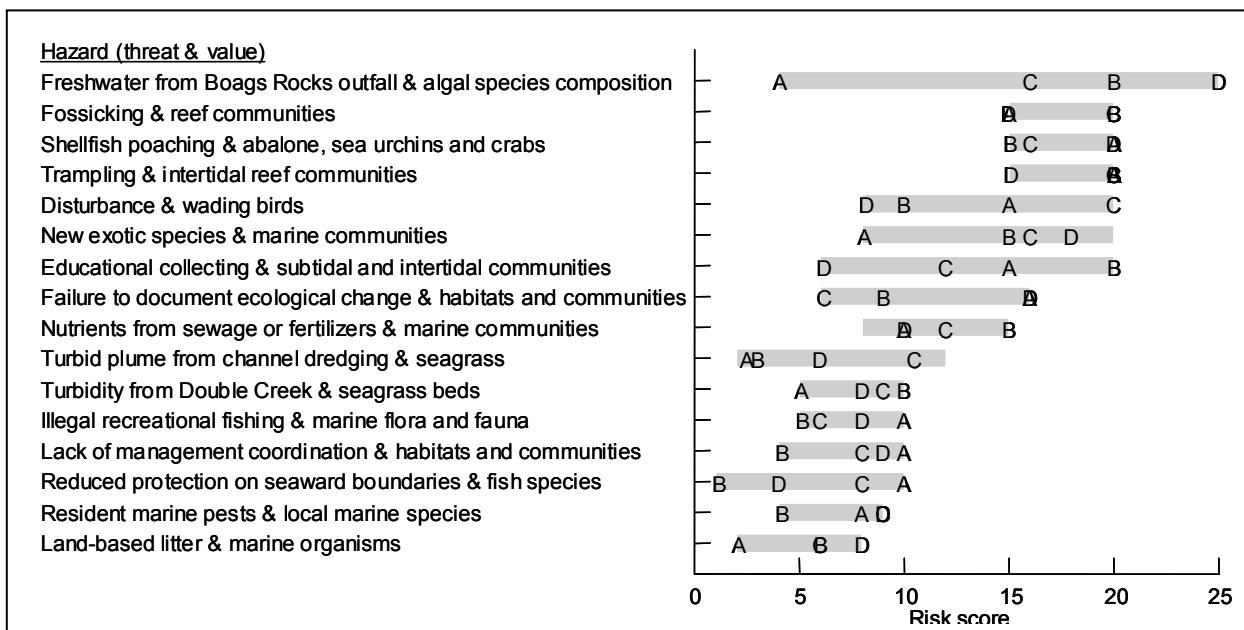


Figure 2.10.2 Summary of major risks to Mushroom Reef MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the four groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the four groups.

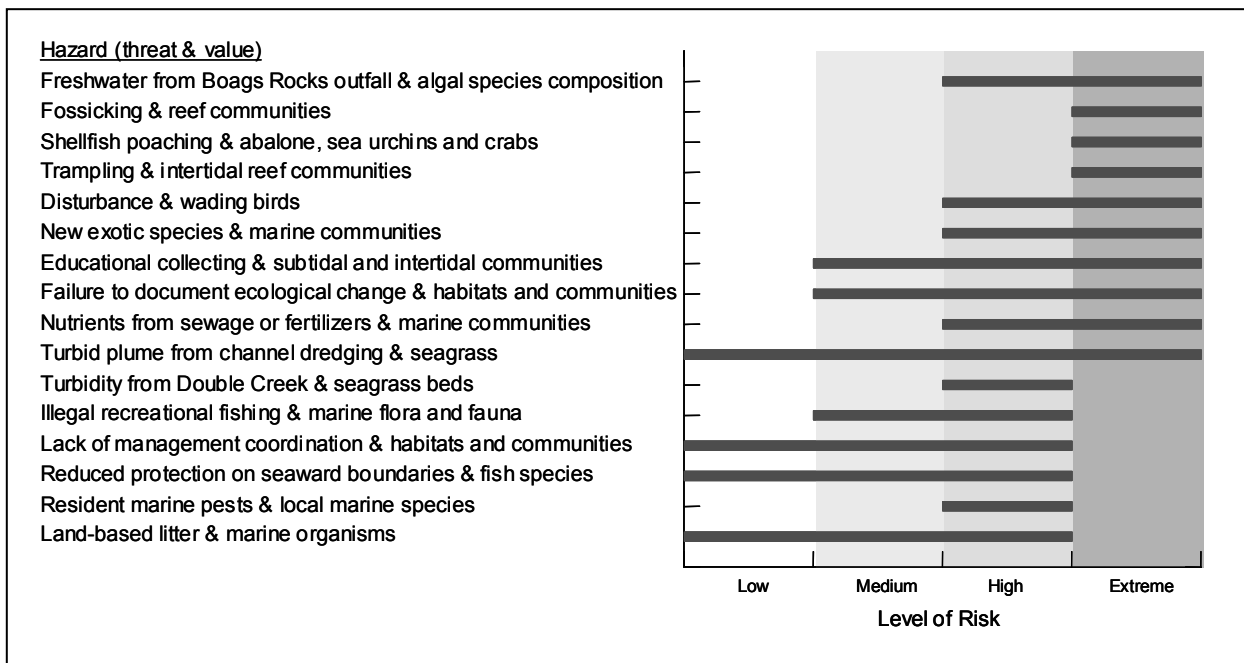


Figure 2.10.3 Hazards ordered as in Fig. 1, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

Table 2.10.3 Risk register for Mushroom Reef MS. Bounds represent the range of opinion among the four groups of participants. L = low risk, M = moderate risk, H = high risk, E = extreme risk.

Hazard	Likelihood	Consequence	Risk Score	Level of Risk
Failure to document ecological change affecting marine habitats and communities	2 - 4	3 - 4	6 - 16	M - E
Reduced protection on three seaward boundaries resulting in increased recreational fishing pressure on species within the sanctuary	1 - 5	1 - 2	1 - 10	L - H
Shellfish poaching (abalone, sea urchins and crabs) leading to decreased populations of those species	4 - 5	3 - 4	15 - 20	H - E
Increased populations of resident pest species (e.g. green shore crab) affecting local marine species	1 - 3	3 - 4	4 - 9	M - E
Turbid plume from channel dredging in Port Phillip Bay affecting seagrass (<i>Amphibolis</i>)	1 - 3	2 - 4	2 - 12	L - E
Increased turbidity from Double Creek affecting seagrass beds	3 - 5	1 - 3	5 - 10	L - E
Land-based litter resulting in entanglement in, smothering of, or ingestion by marine organisms	2 - 4	1 - 2	2 - 8	L - H
Lack of coordination of everyday activities among multiple management agencies affecting marine habitats and communities	2 - 5	2 - 3	4 - 10	L - E
Freshwater in plume from Boags Rocks affecting algal species composition	1 - 5	4 - 5	4 - 25	H - E
New releases or translocations of exotic marine species affecting marine communities	2 - 4	4 - 5	8 - 20	H - E
Impact of trampling on intertidal reef communities	5	3 - 4	15 - 20	E
Effects of illegal recreational fishing, including spearfishing, on marine flora and fauna	3 - 5	1 - 2	5 - 10	L - H
Individual/recreational fossicking effects on intertidal reef communities	5	3 - 4	15 - 20	E
Disturbance from fossicking, trampling and dogs affecting wading birds	4 - 5	2 - 4	8 - 20	H - E
Educational collecting affecting subtidal and intertidal communities	3 - 5	2 - 4	6 - 20	M - E
Nutrients from sewage or fertilizers (golf course, farming) affecting marine communities	3 - 5	2 - 4	8 - 15	M - E

Note: level of risk is based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

2.10.1 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2003) flagged 10 threats from a total of 22 considered, as posing high risks (Table 2.10.4). Most overlap to some extent with hazards identified in the workshop, the exception being damage to signs and markers. Abalone theft was the highest risk threat in the internal assessment, and is one component of the shellfish poaching hazard which ranked highly in the workshop risk register.

Table 2.10.4 Threats posing high risk to Mushroom Reef MS. Drawn from an internal Parks Victoria assessment (Parks Victoria 2003). High risk was defined as a risk score greater than 10.

Threat *	Risk Score
Abalone theft	25
Spear fishing	20
Recreational shellfish collection	20
Pollution – Marine Incidents (oil / chemical of effluent waste incidents)	15
Habitat damage – Intertidal or Subtidal – trampling & anchoring	16
Damage to signs and markers	12
Commercial fishing	12
Aquarium specimen collection	12
Bait collection – recreational	12
On shore litter	12

* the context of the internal assessment indicates that these threats are considered as occurring within the sanctuary.

The workshop produced several hazards with no comparable threat in the internal assessment:

- **Failure to document ecological change** affecting marine **habitats and communities**
- **Turbid plume from channel dredging** affecting **seagrass** (*Amphibolis*)
- Increased **turbidity from Double Creek** affecting **seagrass** beds
- **Lack of coordination** of everyday activities among multiple **management agencies** affecting **marine habitats and communities**
- **Freshwater** in plume from **Boags Rocks** affecting **algal species composition**
- **Nutrients from sewage or fertilizers** (golf course, farming) affecting **marine communities**

With the exception of “failure to document ...”, these hazards share a common characteristic in all originating with activities that occur outside the sanctuary.

2.11 Westernport 1: Churchill Island Marine National Park

An ecological risk assessment for the Yaringa, French Island and Churchill Island Marine National Parks was undertaken in a workshop setting at Hastings on 14th July 2004. The 12 workshop participants (Appendix 1) included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park.

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Participants were asked to identify threats of particular concern to them, and the natural attributes of the park they valued which were potentially affected by those threats. This strategy reflected a focus on single hazards, where a hazard was defined by both a threat and a value which could be affected by that threat. It resulted in an initial list of 30 hazards (Table 1).

To prompt a fuller consideration of hazards, and to identify values or threats that may have been overlooked, participants were provided with a list of 13 natural values specific to the Western Port parks, together with a generic list of potential threats to marine systems (Appendix 2). Participants were asked to consider the possible combinations of value and threat, then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 12 hazards being identified as of particular concern to at least one workshop participant (Table 2).

Table 2.11.1 Hazards of concern initially nominated by participants, Western Port workshop, July 2004.

Hazard
Hydrocarbon pollution from boats harming benthic and pelagic microbes.
Increased concentration of nitrogen and phosphorus from rivers and streams potentially causing algal blooms that kill fish.
Propellor scour from recreational boats removing seagrass.
Arrival of marine exotic species.
Invasion/introduction of (Northern Pacific) seastar affecting ecosystem processes.
Invasion/introduction of seaweed <i>Undaria</i> affecting ecosystem processes.
Fox predation of migratory seabirds resulting in non-viable populations.
Fox predation of resident seabirds resulting in non-viable populations.
Sediment load from rivers and streams.
Sediment load from bottom sediments redistributed as seagrass changes (assessment/measurement endpoint for sustainable ecosystem).
Increased stormwater leading to decreased saltmarsh habitat, decreased salinity, increased <i>Melaleuca</i> stands and decreased number of saltmarsh species.
Oil spill greater than 10 litres from tanker loading/unloading operations and potentially causing the death of any bird.
Illegal fishing leading to non-viable populations (of fish).
Illegal fishing leading to changed populations (of fish).
Attitudes to park values.
Wake from boats damaging shoreline leading to unacceptable erosion.
Microlights disturbing shorebirds affecting their survival.
Jet-skis disturbing shorebirds affecting their survival.
Dogs disturbing shorebirds affecting their survival.
Canoeists disturbing shorebirds affecting their survival.
Boat anchoring in parks damaging seagrass beds.
Onshore visitor activities affecting shorebirds.
Boat-based visitor activities affecting shorebirds.
Litter
Oceanography
Public attitude
Visitor access
Knowledge
Dredging
Re-zoning

Table 2.11.2 Additional threats nominated after considering pre-workshop lists of threats, Western Port workshop, July 2004.

Hazard
Wastewater discharge (contaminant load).
Aquaculture.
Groundwater.
Tributyltin.
Ballast water.
Powerlines causing bird deaths.
Development on north-west corner of French Is.
Bridge traffic disturbing birds at Churchill Is.
Feral animals.
Land pests (Spartina).
Dispersants used in oil spill cleanup.
Wind farms.

The following threats were briefly considered, but excluded from the present discussion as being beyond the control of Parks Victoria:

- global warming
- boats outside the parks
- lack of knowledge

(Note that in subsequent workshops, a decision was made to include consideration of threats of this nature. Although Parks Victoria has no control over such threats, it must nonetheless manage the marine habitats and communities under their influence.)

It was noted that the following activities are undertaken in or around Churchill Island MNP and may have ecological consequences for the park:

- illegal fishing
- collecting samples for research
- birdwatching
- boating
- canoeing
- foraging
- educational activities
- Snorkelling
- farming
- walking
- photography
- patrolling by park rangers
- jet-skiing etc.
- use of hovercraft
- construction/operation of public utilities
- pest control

- dogs
- riding of motorbikes

The next step in the assessment process was to select a subset of hazards deemed to be of most concern for the next stage of the risk assessment. Each participant voted for the two hazards that they believed were of greatest concern. Hazards scoring one or more votes were included in the risk register (Table 3).

This subset of hazards was then ranked as it applied to Churchill Island MNP, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into four groups of three people, each group being as mixed as possible in terms of the interests and experiences of its members. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from -0.58 to +0.48 with a median of -0.05 indicating little agreement among the groups. Individual hazards with high levels of disagreement were then discussed in detail, with a view to reducing differences of opinion arising from misunderstandings.

(i) **Increased** concentration of **nitrogen and phosphorus from rivers** and streams potentially causing algal blooms that kill fish

There was some concern with this hazard that the definition of the threat (i.e. increased nitrogen and phosphorus) was too broad for confident or consistent scoring. In addition, one group expanded their definition to include demonstrable effects on seagrass as well as algal blooms and fish kills.

(ii) **Increased stormwater** leading to decreased **saltmarsh habitat**, decreased salinity, increased *Melaleuca* stands and decreased number of saltmarsh species

Debate on the stormwater hazard centred on the volumes of stormwater being considered. One participant wished to score the likelihood of this hazard eventuating as zero on the basis of no substantial flow. A group scoring the hazard as moderately likely anticipated higher flows within the 10 year time frame as a result of increased development in the area surrounding the park. The source of the stormwater was also questioned, one group only considering that flowing from Phillip Island.

(iii) **Oil spill** greater than 10 litres from tanker loading/unloading operations and potentially **causing the death of any bird**

While oil spills were clearly a concern to all participants, it was suggested by one group that spills around the Hastings area would be unlikely to reach Churchill Island MNP on an incoming tide, and that French Island and Yaringa MNPs would be more at risk from this threat. There was also some debate over the volume of oil necessary to injure a bird.

The intention had been, after discussion of these hazards, to provide the groups with the opportunity to change likelihood and consequence scores if they wished, before

proceeding to consider the hazards in relation to the other two Western Port parks. However, discussion turned instead to consideration of the risk assessment process applied during the workshop (see Section 4). This discussion left insufficient time to undertake a formal assessment of the hazards for Yaringa and French Island MNPs during the workshop. However, a brief ranking exercise for French Island MNP was completed independently by two Parks Victoria staff, and is presented in Appendix 5.

The risk posed by each hazard at Churchill Island MNP was recorded in the risk register for that park (Table 3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 1 and 2. Risk scores for the oil spill / bird hazard ranged from the highest possible score of 25 to a very low score of 2, indicating a large difference of opinion among the groups. A further six hazards had upper bounds of 20 on their risk scores; these all had lower bounds between 1 and 5, again indicative of a broad range of opinion.

Table 2.11.3 Risk register, Churchill Island MNP, July 2004.

Hazard	Likelihood	Consequence	Risk Score	Level of Risk
Hydrocarbon pollution from boats harming benthic and pelagic microbes.	2 - 5	1 - 3	4 - 15	L - E
Increased concentration of nitrogen and phosphorus from rivers and streams potentially causing algal blooms that kill fish.	1 - 5	2 - 4	2 - 20	L - E
Arrival of marine exotic species.	2 - 5	2 - 4	4 - 20	L - E
Invasion/introduction of (Northern Pacific) seastar affecting ecosystem processes.	1 - 5	4 - 5	5 - 20	H - E
Fox predation on migratory seabirds resulting in non-viable populations.	2 - 5	2 - 3	6 - 15	M - E
Sediment load from rivers and streams.	1 - 5	1 - 4	2 - 20	L - E
Increased stormwater leading to decreased saltmarsh habitat , decreased salinity, increased <i>Melaleuca</i> stands and decreased number of saltmarsh species.	1 - 3	2 - 4	4 - 9	L - H
Oil spill greater than 10 litres from tanker loading/unloading operations and potentially causing the death of any bird .	1 - 5	2 - 5	2 - 25	L - E
Onshore visitor activities affecting shorebirds.	2 - 5	2 - 4	4 - 20	L - E
Boat-based visitor activities affecting seabirds.	1 - 5	1 - 4	1 - 20	L - E

Note: level of risk is based on likelihood and consequence in accordance with AS4360 Appendix E.

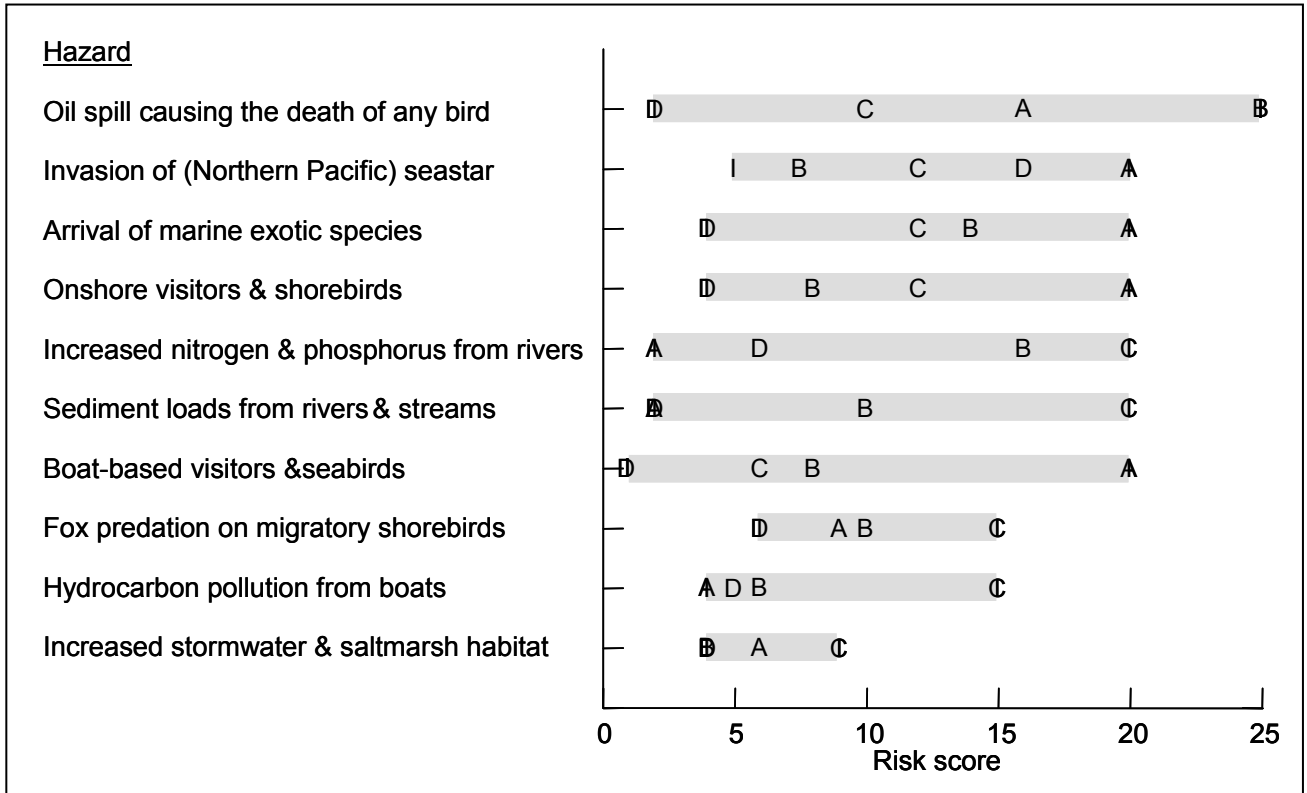


Figure 2.11.1 Summary of major risks to Churchill Island MNP, with hazards ordered firstly by maximum risk score, then by minimum risk score, and finally by the highest median score among the groups of participants.

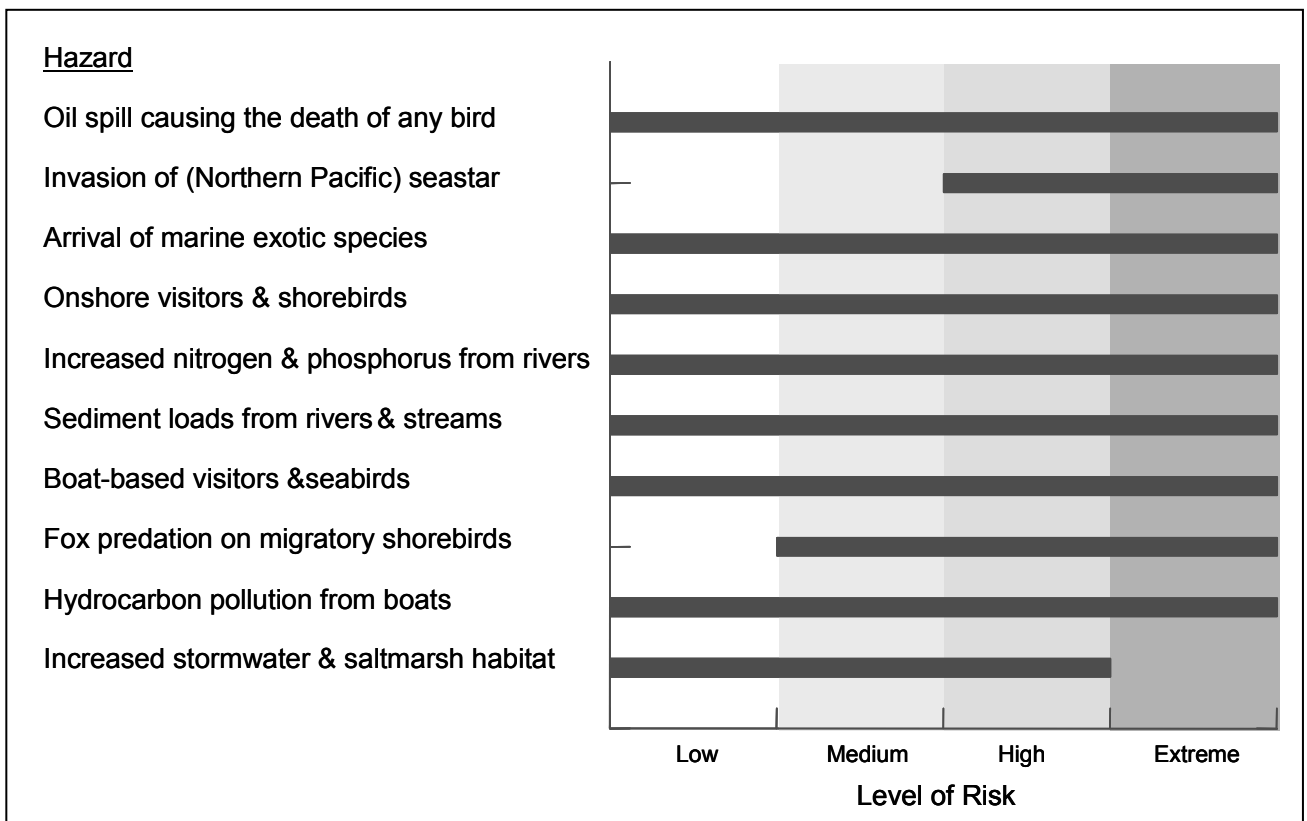


Figure 2.11.2 Hazards in Churchill Island MNP, showing level of risk based on likelihood and consequence in accordance with AS 4360 Appendix E.

In the absence of time to complete the assessment process for the remaining two parks, a conceptual model for non-marine influences on French Island MNP was quickly developed (Fig. 3), and the following additional threats relating specifically to Yaringa MNP were identified:

- dredging
- stormwater from Watsons Creek
- urban development, not subject to planning permits and bringing wildfire, access issues and trampling, marina development
- oceanographic issues - high water, boundary of seagrass beds and wetlands

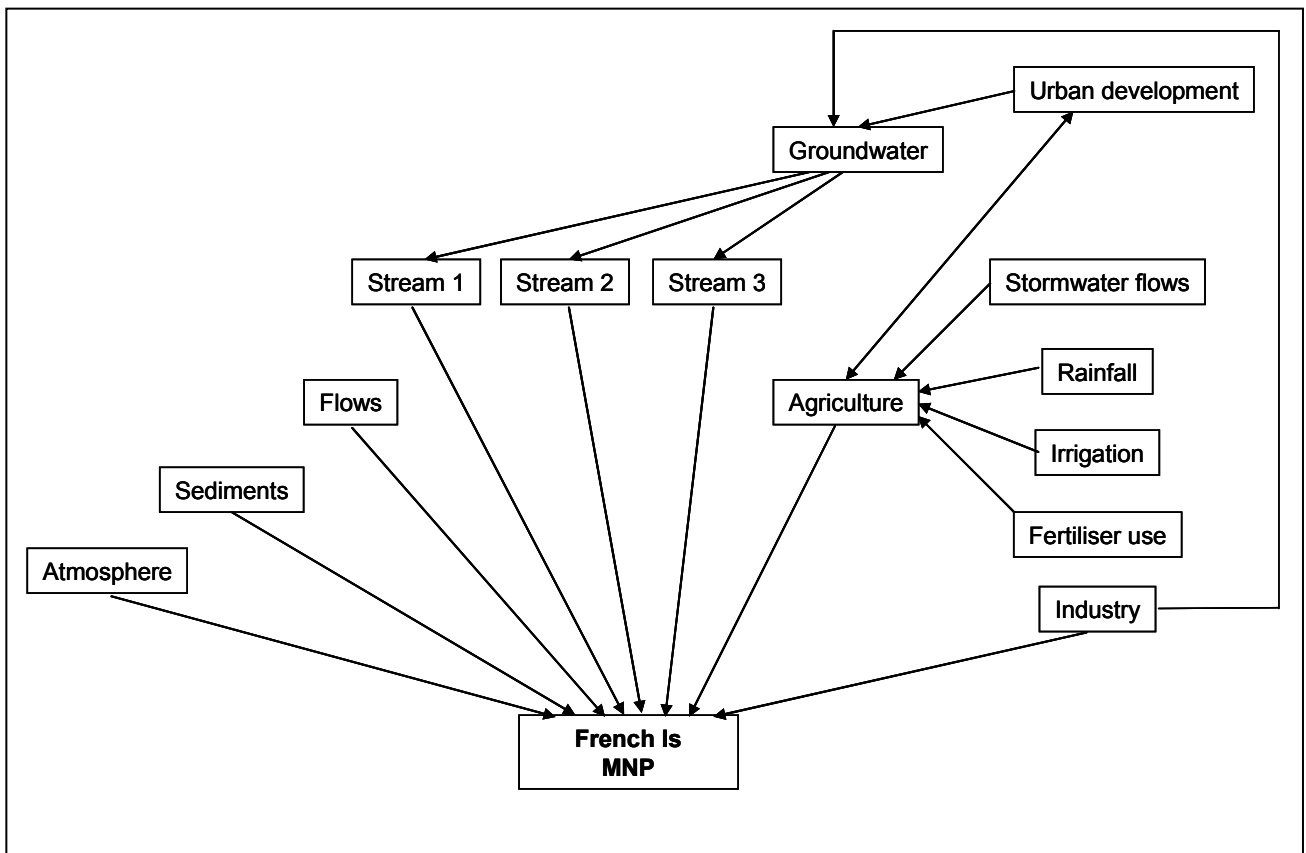


Figure 2.11.3 Conceptual model of non-marine influences on French Is Marine National Park

2.11.1 Comparison with a previous Parks Victoria assessment

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2003) flagged 9 of 20 identified threats to Churchill Island MNP as posing high risk (Table 4). Two of these threats, marine exotics and pollution via marine incidents, were also seen in the workshop risk register. In addition, the onshore driving of vehicles (Table 4) could be one of the unspecified visitor activities identified in the workshop as disturbing shorebirds (Table 3).

Table 2.11.4 Threats posing high risk to Churchill Island MNP.

Drawn from an internal Parks Victoria assessment (Parks Victoria 2003).

Threat *	Risk Score
Onshore fires	25
Onshore litter	25
Onshore driving vehicles	20
Marine exotics	20
Pollution - marine incidents (oil / chemical of effluent waste incidents) / recreation / commercial	20
Onshore dogs	15
Recreational fishing - day, night, shore, boat	12
Commercial fishing (illegal fishing within MPAs by licensed fishers) inside boundaries at night	12
Recreational shellfish collection	12

* the context of the internal assessment indicates that these threats are considered as occurring within the sanctuary.

Five hazards on the workshop risk register for Churchill Island MNP had no comparable threat in the internal assessment. These were:

- **Increased** concentration of **nitrogen and phosphorus from rivers** and streams potentially causing algal blooms that kill fish
- **Fox predation on migratory seabirds** resulting in non-viable populations
- **Sediment load from rivers** and streams
- **Increased stormwater** leading to decreased **saltmarsh habitat**, decreased salinity, increased *Melaleuca* stands and decreased number of saltmarsh species
- **Boat-based visitor** activities affecting **seabirds**

With the exception of “boat-based visitor activities ...”, these hazards relate to land management practices in the area surrounding the marine national park.

2.11.2 Discussion of the Workshop Process

During the course of the workshop, there was extensive discussion of the risk assessment process applied. The following issues were raised:

- the relative merits of small groups or a single large group for the risk ranking exercise
- the difficulty of considering hazards in the absence of factual information
- the relative merits of a forced consensus approach and one that incorporates differences of opinion
- the ability of one or a few people to adequately represent those of the wider stakeholder community
- the relevance to this process of hazards that are not "internal", i.e. those that originate beyond the parks and/or affect the wider marine environment

2.12 Westernport 2: Yaringa and French Island Marine National Parks

An ecological risk assessment for the Yaringa and French Island Marine National Parks was undertaken in a workshop setting at Warneet on 2nd February 2006. The 24 workshop participants (Appendix 1) included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park.

The first step in the workshop process was to conduct an unstructured brainstorming session to elicit concerns from participants. A brief overview of the more significant natural attributes of the park was provided. This process resulted in an initial list of 35 hazards (Table 2.12.1). Participants were then presented with a matrix of six types of marine natural values that the national parks are important for protecting, together with a generic list of 115 potential threats to the marine ecosystems in the park, generating a possible 690 value/threat combinations. Participants were then asked to consider these potential hazards and add any of concern to the previous list. This structured process resulted in an additional 5 hazards being identified as being of particular concern to at least one workshop participant (Table 2.12.2).

Table 2.12.1: Initial list of hazards from unstructured brainstorming session, Yaringa and French Island MNPs.

Initial Definition	Subsequent definition if refined
Sedimentation from development corridor causing loss of seagrass	
Increasing pressure from urban development impacting on Marine NPs	Increasing pressure from urban activities impacting on Marine NPs
Lack of knowledge about the way changes in hydrology (including the rate of siltation) impact on flora and fauna in the Marine NPs	
Major oil spills from Port of Hastings distributed on tides causing impacts to the marine ecosystem	
Impacts of farm effluents and contaminants on marine flora and fauna	
Accidental or deliberate removal of mangroves causing erosion and loss of biodiversity	
Lack of knowledge of marine ecosystems leading to poor management decisions and loss of biodiversity	
Exotic marine species from commercial shipping/ recreational boating/ aquaculture causing change in species composition in Marine NPs	
Lack of recognition of boundaries by public. Not managing the park within the context of the marine system and inputs	

Lack of knowledge of values at all social and political levels, leading to lack of coordinated and effective management, reducing conservation of natural values	Lack of perception of importance of values at all social and political levels, leading to lack of coordinated and effective management, reducing conservation of natural values
Lack of integrated arrangements/management leading to negative impacts on Marine NPs	
Lack of information/education within catchment on impacts of poor land management and tools/strategies that could improve land management and affect inputs to Marine NPs	Poor uptake of information/education within catchment on impacts of poor land management and tools/strategies that could improve land management and affect inputs to Marine NPs
Increased recreational usage causing increased negative impacts eg litter and contaminants	Increased recreational usage in & around Marine NPs causing increased negative impacts eg litter and contaminants
Noisy and fast moving vessels disturbing birds, leading to reduced shore-bird abundance	
Lack of resources for compliance and enforcement leading to broader impacts	
Erosion of Lang Lang cliffs causing smothering slime over seagrass, resulting in seagrass dieback	Coastal erosion causing smothering slime over seagrass, resulting in seagrass dieback
Increasing use of port/harbour facilities increasing risk of oil spill or ballast water contaminants impacting on flora and fauna.	
Inappropriate recreational fishing causing depletion of fish stocks.	
Management action directed towards wrong causal factors relating to seagrass decline	
Noise and toxicants from increasing harbour usage impacting on marine flora and fauna.	
Impacts of hydrocarbons and heavy metals on marine flora and fauna.	
Pathogens from migratory species being introduced into the parks causing decline of species.	
Impacts of dredging from the expansion of Port of Hastings causing sedimentation smothering marine communities.	
Mechanical destruction of sea grass beds from boat propellers/hulls/anchors.	
Lack of knowledge about of all risks leading to poor management of Marine NPs.	

Increasing recreational use causing increasing litter impacting on park values.	
Run-off and effluent from unsewered development.	
Trampling saltmarsh by cattle helps maintain shorebird roosts, loss of trampling will reduce roost quality.	
Use of roadside herbicides causing unknown impacts to marine ecosystems.	
Lack of detection/monitoring of invasive species (eg Spartina) leading to displacement of native biota.	
Disturbance to roosting and feeding birds by people leading to a reduction in abundance of migratory birds in Marine NPs.	
Nutrients/toxicants leaking from old landfill/quarries to the bay, impacting on flora and fauna of the parks.	
Sediment and runoff from unsealed roads impacting on flora and fauna of Marine NPs.	
Changes in velocity of hydrological flows increasing erosion and sediment inputs into parks.	
Sunburn and resultant death of seagrass from hot weather.	

Table 2.12.2: Additional hazards from structured brainstorming session

Initial Definition	Subsequent definition if refined
Commercial netting impacting on seagrass and seagrass communities.	
Changes in profile of bay changing water temperature, impacting on flora and fauna in Marine NPs	
Lack of management of community expectations leading to a loss of community support.	
Pathogens from aquaculture translocating into environment and impacting negatively on species within the park.	
Lack of participation of stakeholders in planning process leading to a lack of compliance.	

The next step in the process was to select subset of hazards considered to be of highest concern to the largest number of participants, for a more detailed assessment of risk. Participants were allotted four votes each, and asked to allocate those votes across the hazards of most concern to them. Hazards that scored 3 votes or more were included in the next stage of the risk assessment, and included on the Risk Register (Table 2.12.3).

Participants were then assembled into 5 groups of 3 or 4 people to assess the level of risk associated with each hazard, with each group containing as diverse as possible a mix of backgrounds and experience. Groups were asked to subjectively assign a level of likelihood for each hazard occurring, and a degree of the severity of the consequences for the values impacted should it occur, according to a pre-defined 5-point scale for both likelihood and consequence (Appendix 3). These scales of likelihood and consequence, and the process for ranking and ascribing a level of risk to each hazard are broadly based on the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999).

Table 2.12.3: Risk Register, Yaringa and French Island MNPs.

Hazards to Biodiversity at Yaringa & French Island MNPs	Range of Likelihood scores between Groups	Range of Consequence scores between Groups	Range of Risk scores between Groups	Level of Risk
Coastal erosion causing smothering slime over seagrass, resulting in seagrass dieback	3 - 5	4 - 5	12 - 25	E – E
Lack of resources for compliance and enforcement leading to broader ecological impacts	5 - 5	3 - 4	15 - 20	E – E
Sedimentation from development corridor causing loss of seagrass	4 - 5	3 - 5	12 - 20	H – E
Lack of integrated arrangements/ management leading to negative impacts on Marine NPs	3 - 5	3 - 4	12 - 20	H – E
Increasing pressure from urban activities impacting on Marine NPs	4 - 5	3 - 4	12 - 20	H – E
Lack of knowledge of marine ecosystems leading to poor management decisions and loss of biodiversity	3 - 5	3 - 5	9 - 20	H – E
Impacts of farm effluents and contaminants on marine flora and fauna	4 - 5	2 - 4	8 - 20	H – E
Lack of perception of importance of values at all social and political levels, leading to lack of coordinated and effective management, reducing conservation of natural values	2 - 5	3 - 4	8 - 20	H – E
Poor uptake of information/education within catchment on impacts of poor land management and tools/strategies that could improve land management and affect inputs to Marine NPs	2 - 5	2 - 5	6 - 20	M – E
Noisy and fast moving vessels disturbing birds, leading to reduced shore-bird abundance	2 - 5	3 - 4	6 - 20	M – E
Increased recreational usage (in & around Marine NPs) causing increased negative impacts eg litter and contaminants	4 - 5	1 - 4	5 - 20	H – E
Exotic marine species from commercial shipping/ recreational boating/ aquaculture causing change in species composition in Marine NPs	2 - 5	1 - 5	4 - 20	M – E
Lack of knowledge about the way changes in hydrology (including the rate of siltation) impact on flora and fauna in the Marine NPs.	3 - 4	2 - 4	6 - 16	M – E

Lack of recognition of boundaries by public. Not managing the park within the context of the marine system and inputs.	2 - 4	2 - 4	4 - 16	L - E
Accidental or deliberate removal of mangroves causing erosion and loss of biodiversity.	1 - 3	2 - 4	2 - 9	L - H
Major oil spills from Port of Hastings distributed on tides causing impacts to the marine ecosystem.	1 - 1	4 - 5	4 - 5	H - H

Note: Risk Rating is based on likelihood and consequence in accordance with AS4360:1999.

The results of the group assessments were then entered on software designed to record, score and rank hazards. The software allows easy recognition of the degree of agreement between groups, using Spearman's rank correlation coefficient. Coefficient values ranged between +0.13 and +0.76, with a median value of +0.49, indicating a moderate level of disagreement between the groups. Differences between groups in the assessment of individual hazards were then discussed in more detail to ascertain whether the differences were due to differences in interpretation of the hazard description, or the scale definitions of likelihood and consequence.

i) Noisy and fast moving vessels disturbing birds, leading to reduced shore-bird abundance.

Two groups felt that likelihood was higher because of the perception of an abundance of power water craft (PWC), and the potential for more hovercraft due to the location of nearby builders. Another group felt that shallow water would restrict the ability of PWC to get close enough to shorebirds to disturb them, whilst another group reported observations of no real disturbance from passing boats.

ii) Poor uptake of information/education within catchment on impacts of poor land management and tools/strategies that could improve land management and affect inputs to Marine NPs

One group felt strongly that the community uptake of information that would improve land management practices was at a good level due to peer pressure, whilst another group felt that uptake was poorer in the catchment that they were familiar with. One conclusion may be that the level of uptake may differ between catchments.

iii) Exotic marine species from commercial shipping/ recreational boating/ aquaculture causing change in species composition in Marine NPs

Two groups assigned a large range in consequence based on the range of impacts different exotic species may have. One of these groups felt that an "invasive" subset of exotic species could be assigned a more specific, and relatively high, level of consequence.

iv) Lack of recognition of boundaries by public. Not managing the park within the context of the marine system and inputs.

This hazard received a wide range of scores due to it being perceived as being two separate issues. This hazard was originally discussed as being an issue of the parks

having artificial boundaries with many inputs from outside those boundaries impacting on the parks and therefore requiring to be managed. The first part of this hazard implied a compliance issue and some groups identified a range of scores based on this ambiguity.

v) Accidental or deliberate removal of mangroves causing erosion and loss of biodiversity.

One group judged likelihood to be low for this hazard assuming that while there had been a history of illegal clearing and loss, that little further loss was likely. Others felt that there was strong potential for further illegal clearing at Yaringa.

vi) Lack of perception of importance of values at all social and political levels, leading to lack of coordinated and effective management, reducing conservation of natural values.

Several groups judged the likelihood of this hazard to be quite high, with one group expressing cynicism that things would improve, whereas another group was more optimistic of progress in terms of effective and coordinated management.

vii) Sedimentation from development corridor causing loss of seagrass.

One group judged this to be of lower likelihood and consequence than other groups, feeling that there were now regulatory controls in place that should decrease impacts. Other groups felt that such controls were not sufficient and that the problem still exists.

viii) Coastal erosion causing smothering slime over seagrass, resulting in seagrass dieback.

One group felt that the intact stands of mangroves within both parks offered some protection from erosion, and that the erosion that was occurring was sufficiently distant to not affect the parks. Other groups judged the likelihood and consequence of sediments smothering seagrass in the parks to be relatively high.

ix) Lack of resources for compliance and enforcement leading to broader ecological impacts.

Most groups except one, felt that while lack of compliance was highly likely, that the consequences were not extreme.

x) Lack of knowledge about the way changes in hydrology (including the rate of siltation) impact on flora and fauna in the Marine NPs.

One group interpreted this hazard to be about catchment hydrology rather than the hydrological processes within the bay itself, which reduced their assessment of the potential consequences. Others correctly interpreted this hazard to be about the way in which processes may change rates of siltation and topography.

xi) Lack of integrated arrangements/ management leading to negative impacts on Marine NPs.

While there was overall consistency between groups in the assessed consequence of this hazard, the likelihood assigned by one group was relatively low, mainly due to lack of certainty.

Following the discussion on each of the selected hazards, groups were given the opportunity to change likelihood and consequence scores if they felt that the rationale of groups assigning different scores had merit. Changes to the scores were entered in the software and risks and rankings were recalculated. The median correlation increased only from 0.49 to 0.52 indicating only a minor increase in agreement among groups on the ranking of the hazards.

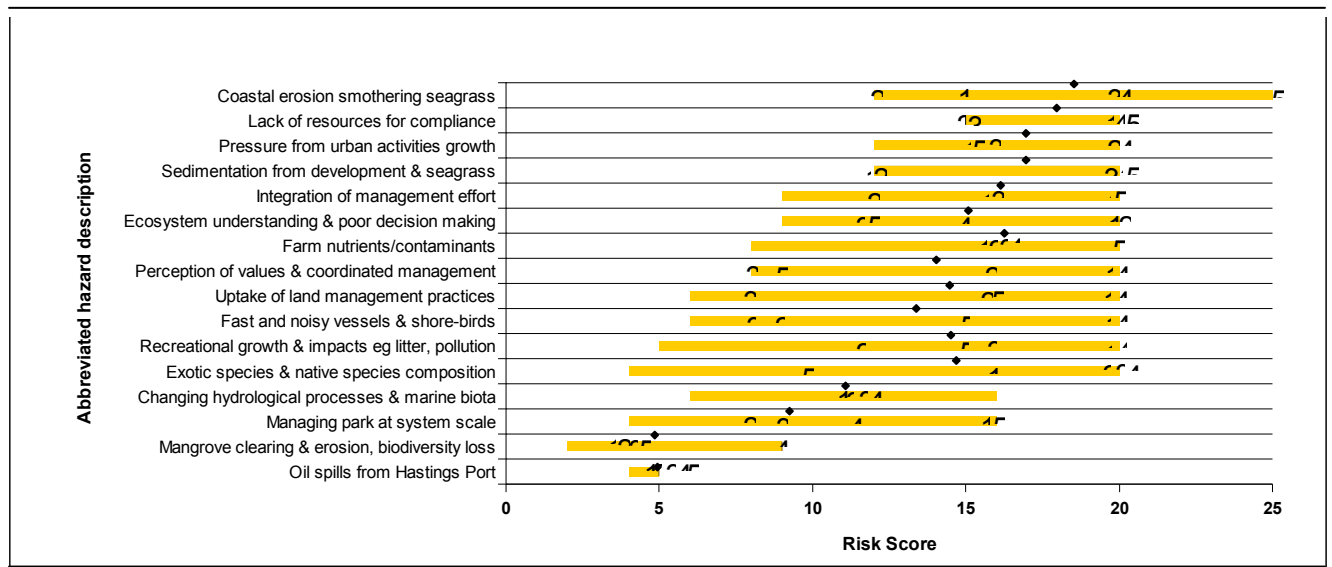


Figure 2.12.1:Range of risk scores for each hazard as calculated from the likelihood and consequence. Scores allocated by each of five groups. Numbers indicate the mid-point risk score for each group, and black dots indicate the mean of group mid-scores.

The range of scores expressed by the groups for likelihood, consequence and risk for each hazard were recorded in the risk register. The range in the Level of Risk as determined from the lowest and highest likelihood and consequence scores for each hazard, is also recorded in the register. The priority order of hazards, ranked in descending order by maximum of assessors’ maximum risk score, then by maximum of minima and finally by the average of the mid-point risk scores among the five groups of participants is presented in Figure 2.12.1. In this figure, the numbers on the bars indicates the mid-point score for that group number, and the small diamond indicates the mean risk score for that hazard.

Figure 2.12.2 shows the hazards in the same rank order as Figure 2.12.1, and indicates the level of risk based on likelihood and consequence in accordance with AS4360:1999.

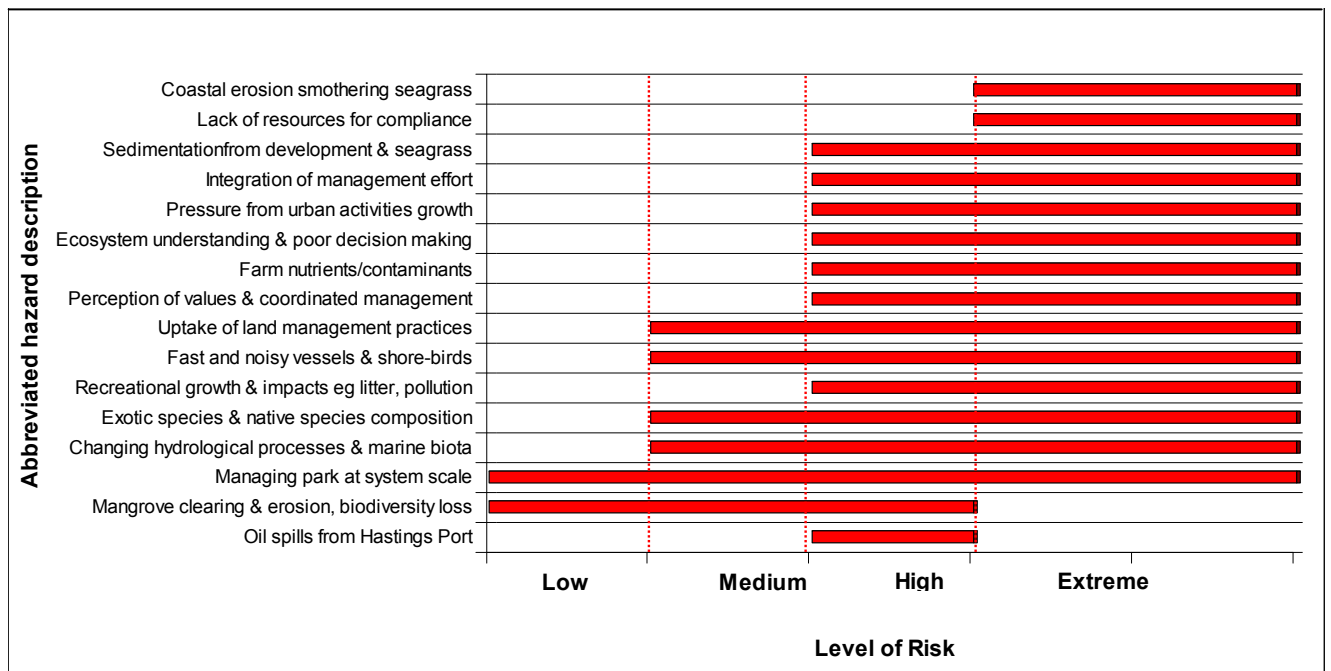


Figure 2.12.2: Level of risk associated with the top sixteen hazards/values of concern based on likelihood and consequence.

Two hazards had levels of risk that were assessed to be extreme. These risks were:

- **Coastal erosion** causing smothering slime over seagrass, resulting in **seagrass dieback**;
- **Lack of resources** for compliance and enforcement leading to broader ecological impacts.
- A further seven hazards had levels of risk that ranged between High and Extreme. These risks were:
- **Sedimentation** from development corridor causing **loss of seagrass**;
- Lack of **integrated arrangements/ management** leading to negative impacts on Marine NPs;
- Increasing pressure from **urban activities** impacting on Marine NPs;
- **Lack of knowledge** of marine ecosystems leading to poor management decisions and **loss of biodiversity**;
- Impacts of **farm effluents and contaminants** on **marine flora and fauna**
- **Lack of perception of importance of values** at all social and political levels, leading to lack of coordinated and effective management, reducing **conservation of natural values**
- **Increased recreational usage** (in & around Marine NPs) causing increased negative impacts eg **litter and contaminants**

2.12.1 Previous Risk Assessments for Yaringa and French Island Marine National Parks

An internal Parks Victoria risk assessment undertaken as part of the compliance planning process (Parks Victoria 2003) flagged as high risk, 2 of 12 identified threats to Yaringa MNP, and 5 of 12 identified threats to French Island MNP (Table 2.12.4). Exotic marine species and pollution from maritime sources were the major concerns for both parks in the internal assessment, and also figured in the workshop risk register.

Table 2.12.4. Threats posing high risk to Yaringa and French Island MNPs. Drawn from an internal Parks Victoria assessment (Parks Victoria 2003).

Park	Threat *	Risk Score
Yaringa MNP	Marine exotics	20
	Pollution - marine incidents (oil / chemical or effluent waste incidents)	20
French Island MNP	Marine exotics	20
	Pollution - marine incidents (oil / chemical of effluent waste incidents) / recreation / commercial	20
	Commercial Fishing (illegal fishing within MPA by licensed fishers)	16
	Recreational fishing - day, night, shore, boat.	15
	Commercial operations in MPA - breach of permit, no permit (no permit e.g. charter dive/fish)	10

* the context of the internal assessment indicates that these threats are considered as occurring within the sanctuary.

The majority of risk register hazards for both Yaringa MNP and French Island MNP had no comparable threat in the internal assessment:

- **Coastal erosion** causing smothering slime over seagrass, resulting in **seagrass dieback**
- **Lack of resources** for compliance and enforcement leading to broader ecological impacts
- **Sedimentation** from development corridor causing **loss of seagrass**
- **Lack of integrated arrangements/ management** leading to negative impacts on Marine NPs
- Increasing pressure from **urban activities** impacting on Marine NPs
- **Lack of knowledge** of marine ecosystems leading to poor management decisions and **loss of biodiversity**
- Impacts of **farm effluents and contaminants** on **marine flora and fauna**
- **Lack of perception of importance of values** at all social and political levels, leading to lack of coordinated and effective management, reducing **conservation of natural values**

- Poor **uptake of information/education** within catchment on impacts of poor land management and tools/strategies that could improve land management and **affect inputs** to Marine NPs
- **Noisy and fast moving vessels** disturbing birds, leading to reduced **shore-bird abundance**
- Lack of knowledge about the way **changes in hydrology** (including the rate of siltation) impact on **flora and fauna** in the Marine NPs.
- Lack of recognition of boundaries by public. Not managing the park within the context of the marine system and inputs.

With the exception of “noisy and fast moving vessels ...”, the threats contained in the above hazards refer to events and activities that occur outside the parks.

2.13 Bunurong Marine National Park

An ecological risk assessment for the Bunurong Marine National Park and the Bunurong Marine and Coastal Park was undertaken in a workshop setting at Cape Paterson on 17th November 2004. The 16 workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the parks (Appendix 1).

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify threats of particular concern to themselves, and the natural attributes of the parks they valued which were potentially affected by those threats and resulted in an initial list of 14 hazards (Table 2.13.1).

Participants were then provided with a list of 5 natural values specific to the park, together with a generic list of 127 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 635 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 13 hazards being identified as of particular concern to at least one workshop participant (Table 2.13.2).

Table 2.13.1 Initial list of hazards from unstructured brainstorming session.

Initial definition	Subsequent definition if refined
Increased residential development leading to increased urban stormwater <i>runoff</i> , and thus reduced water quality, and increased trampling of intertidal biota causing disruption to the food chain.	Split into two hazards: Increased residential development in the broader catchment, leading to increased urban stormwater <i>runoff</i> , and thus reduced water quality relative to background. Increased residential development in the broader catchment, leading to increased trampling of intertidal biota, causing disruption to the food chain.
Leaching of pollutants (heavy metals and chemicals) from tip into groundwater and thus into Screw Creek, the Tarwin River and Andersons Inlet, leading to bioaccumulation <i>in park biota</i> .	
Lack of political commitment resulting in insufficient resources (money & staff) for Parks Victoria to effectively manage the park (i.e. to monitor, manage and implement actions).	
Lack of effective (i.e. well-resourced) and broadly-based education (i.e. ecosystem- <i>focussed</i>) of park and agency staff, the general community and park visitors, affecting...	
Increased nutrients from agricultural runoff in the Bunurong coastal plains catchment, resulting in altered ecosystem function in subtidal reef communities.	
Failure of larval supply from outside the park, leading to <i>recruitment</i> failure within the park.	

Lack of ecological baseline data leading to uninformed management decisions, resulting in changes beyond natural variation in biodiversity and species richness within the park.	
Lack of information on drain locations leading to lack of effective controls on discharges into the park, resulting in reduced water quality and altered flow quantity.	
Land and sea-sourced litter (e.g. plastics, fish hooks, cigarette butts) affecting birds and fish (e.g. ingestion, entanglement).	
Introduction and establishment of new <i>or</i> existing exotic species, leading to competition with or predation <i>on</i> native species.	
Changes in coastal systems (e.g. dune stabilisation with marran grass) leading to impacts on shorebirds, waders and intertidal organisms.	
Oil spill from tanker (sufficient to invoke and AMSA response) affecting intertidal and shallow subtidal organisms.	
Increased boating activity leading to increased anchoring, causing <i>increased</i> damage to seagrass beds and reef biota.	
Dogs off-lead disturbing hooded plovers, resulting in decreased <i>plover</i> populations.	

Table 2.13.2 Additional hazards from structured brainstorming session.

Initial definition	Subsequent definition if refined
Noise from personal water craft or other recreational boats <i>disturbing</i> shorebirds and marine mammals.	
Acts of environmental vandalism (e.g. deliberate spread of introduced species <i>or pollutants</i>) leading to decreased water quality.	
Poaching of abalone, rock lobster or aquarium species resulting in decreased populations of the <i>target</i> species.	
Sea level rise due to global warming leading to changes to marine habitats.	
Failure of Parks Victoria to meet community expectations leading to a lack of community support <i>for the park</i> with subsequent detrimental effects on the park.	

Inappropriate coastal development (strip development on existing farm land) adjacent to the park leading to increased trampling in intertidal areas and reduced water quality.	Later split into two hazards: Inappropriate coastal development (strip development on existing farm land) adjacent to the park leading to increased trampling in intertidal areas. Inappropriate coastal development (strip development on existing farm land) adjacent to the park leading to reduced water quality.
Discharge of garbage from commercial shipping leading to ingestion or entanglement impacts on birds or fish.	
Increased sediment load (above natural levels) from stormwater and catchment sources, leading to smothering of benthic organisms, and reduced light penetration and thus reduced plant growth.	
Lack of coordination among multiple management agencies in relation to pollution issues, leading to reduced water quality.	
Insufficient resourcing of <i>relevant agencies</i> for enforcement (e.g. no-take zones, bag limits) leading to altered ecosystem functioning (<i>via changes to community structure etc</i>)	
Horses in the intertidal disturbing shorebirds, trampling chicks or trampling intertidal benthos.	
Concentration of fishing effort on edge of MNP leading to reduced populations of target species <i>inside the park</i> .	
Licensed discharge of industrial wastewaters near the park leading to reduced water quality <i>within the park</i> .	

As individual hazards were nominated, some were discussed in detail to enhance participants' understanding and to minimize differences in interpretation.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern for the next stage of the risk assessment. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored three or more votes were included in the risk register (Table 2.13.3).

Table 2.13.3 Risk register

Hazard	Likelihood	Consequence	Risk score	Level of Risk
Increased residential development in the broader catchment, leading to increased urban stormwater <i>runoff</i> , and thus reduced water quality relative to background.	3 - 5	1 - 4	3 - 20	L - E
Increased residential development in the broader catchment, leading to increased trampling of intertidal biota, causing disruption to the food chain .	4 - 5	2 - 4	8 - 20	H - E
Lack of political commitment resulting in insufficient resources (money & staff) for Parks Victoria to effectively manage the park (i.e. to monitor, manage and implement actions).	4 - 5	2 - 4	10 - 20	H - E
Lack of effective (i.e. well-resourced) and broadly-based education (i.e. ecosystem- <i>focussed</i>) of park and agency staff, the general community and park visitors, affecting . . .	2 - 5	2 - 4	6 - 20	M - E
Increased nutrients from agricultural runoff in the Bunurong coastal plains catchment, resulting in altered ecosystem function in subtidal reef communities .	2 - 5	3 - 4	6 - 20	M - E
Introduction and establishment of new <i>or</i> existing exotic species , leading to competition with or predation <i>on</i> native species .	3 - 5	3 - 5	9 - 25	H - E
Dogs off-lead disturbing hooded plovers , resulting in decreased <i>plover</i> populations.	4 - 5	3 - 5	12 - 20	H - E
Poaching of abalone, rock lobster or aquarium species resulting in decreased populations of the <i>target</i> species.	2 - 4	3 - 4	6 - 16	M - E
Inappropriate coastal development (strip development on existing farm land) adjacent to the park leading to increased trampling in intertidal areas.	4 - 5	2 - 4	8 - 20	H - E
Inappropriate coastal development (strip development on existing farm land) adjacent to the park leading to reduced water quality .	3 - 5	2 - 4	6 - 20	M - E
Insufficient resourcing of relevant agencies for enforcement (e.g. no-take zones, bag limits) leading to altered ecosystem functioning (<i>via changes to community structure etc</i>)	2 - 4	3 - 4	8 - 16	H - E

Note: Level of Risk is based on Likelihood and Consequence in accordance with AS4360 Appendix E.

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into four groups of four. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants

were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from -0.10 to +0.59, with a median of +0.25, indicating some disagreement overall among the groups. Individual hazards with high levels of disagreement were then discussed in detail (see below).

(i) **Poaching of abalone, rock lobster or aquarium species** resulting in decreased populations of the *target* species.

It was suggested that the level of poaching in the Bunurong area is low because of effective enforcement by Fisheries Victoria. However, this view was not universally accepted within the workshop. While it was accepted that enforcement was an important issue, there was a concern that poaching will only increase with time. It was then suggested that the area is not a popular one with poachers simply because population levels of abalone and rock lobster are naturally low.

If enforcement effort in the general area is currently sufficient to maintain population numbers of target species, is it possible that greater effort may be needed in the park itself in the future?

Ecological questions raised in the discussion concerned the level of poaching needed to actually affect population numbers, and what secondary impacts on other species might be expected as a result of reduced populations of target species.

(ii) **Lack of effective** (i.e. well-resourced) and **broadly-based education** (i.e. ecosystem-*focussed*) of park and agency staff, the general community and park visitors, affecting . . .

Discussion of this hazard raised the question of how important education is to the immediate well-being of the park.

One group believed that current standards of education are acceptable, while another observed that existing programs are probably in need of improvement.

It was noted that education is a subject dear to the hearts of Advisory Group members. It was also noted that this (the series of workshops, or all park-related assessments?) may be the first time that ecological risk assessment has been undertaken in a systematic fashion along the Victorian coast.

(iii) Introduction and establishment of new *or* existing **exotic species**, leading to competition with or predation *on* **native species**.

This hazard was given the maximum possible scores for both likelihood and consequence by one group, while the remaining groups rated it on a par with other hazards of concern.

(iv) Inappropriate coastal **development** (**strip** development on existing farm land) adjacent to the park leading to reduced **water quality**.

It was stated that the dilution factor associated with inputs from development would be large. In combination with mixing and water movement along the coastline, it would be sufficient to ensure that effects on water quality in the park would be insignificant. The point was also made that poor quality septic systems used in the past would not be acceptable under current (building?) standards.

Discussion of water quality issues also identified some confusion about whether this hazard (and presumably also the residential development / water quality hazard) should

be considering water quality itself as a value or impacts on other ecological values arising from poor water quality. (Note that water quality has the potential to be either threat or value in an ecological risk assessment. In this workshop, the final wording of the hazards was such that water quality appears to be the specified value of concern, not merely an intermediate step to impacts on some other ecological value.)

Following the discussion of selected hazards, groups were given the opportunity to change likelihood and consequence scores if they wished. Changes were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in a substantial increase in agreement for one pair of groups, but little or no change among other pairs. While the minimum and median correlations were changed only marginally, the maximum correlation coefficient rose from +0.59 to +0.78.

Providing an opportunity to revise likelihood and consequence scores was itself the subject of some discussion at the workshop, one participant holding the view that all original disagreement should be retained. It was also suggested that tighter defining of hazards at the outset might have reduced disagreement among groups.

The risk posed by each hazard was recorded in the risk register (Table 3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 1 and 2. The hazard of greatest concern identified with this ordering was:

- Introduction and establishment of new *or* existing **exotic species**, leading to competition with or predation *on* **native species**.

A further eight of the ten remaining hazards had an upper risk score bound of 20 (Figure 2.13.1).

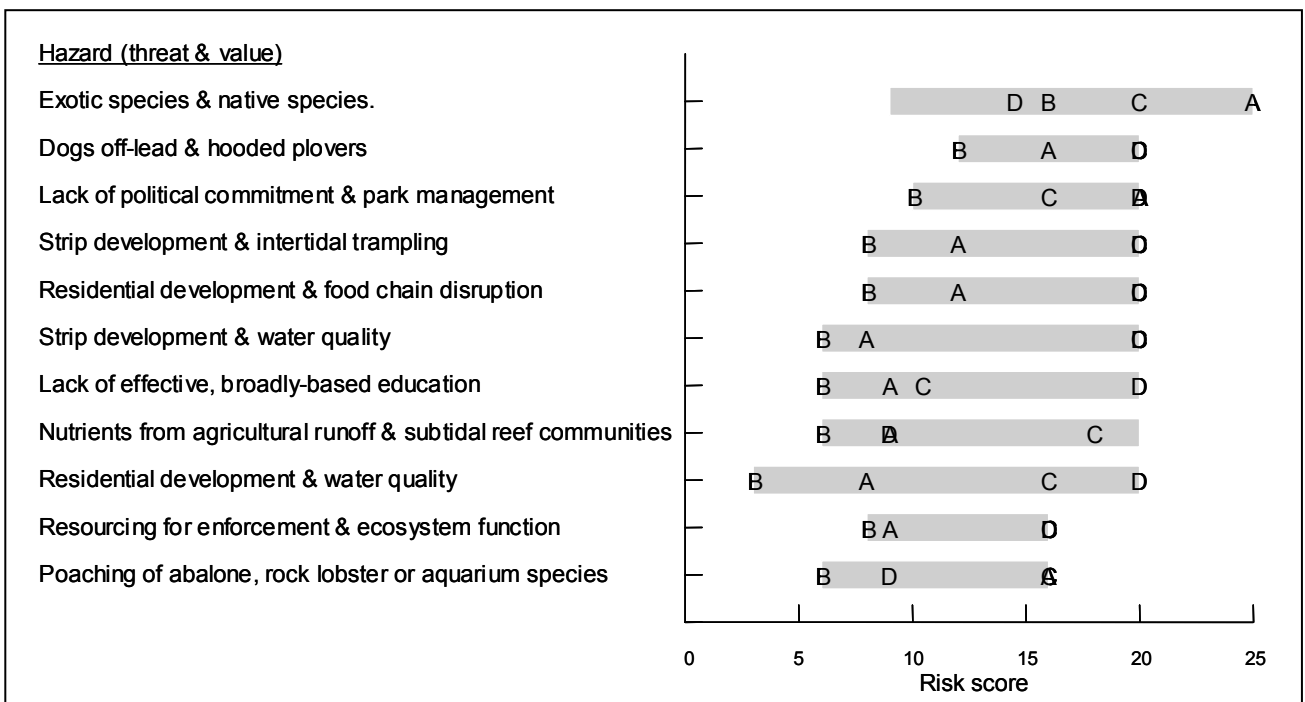


Figure 2.13.1 Summary of major risks to Bunurong MNP and MCP, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the four groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the four groups.

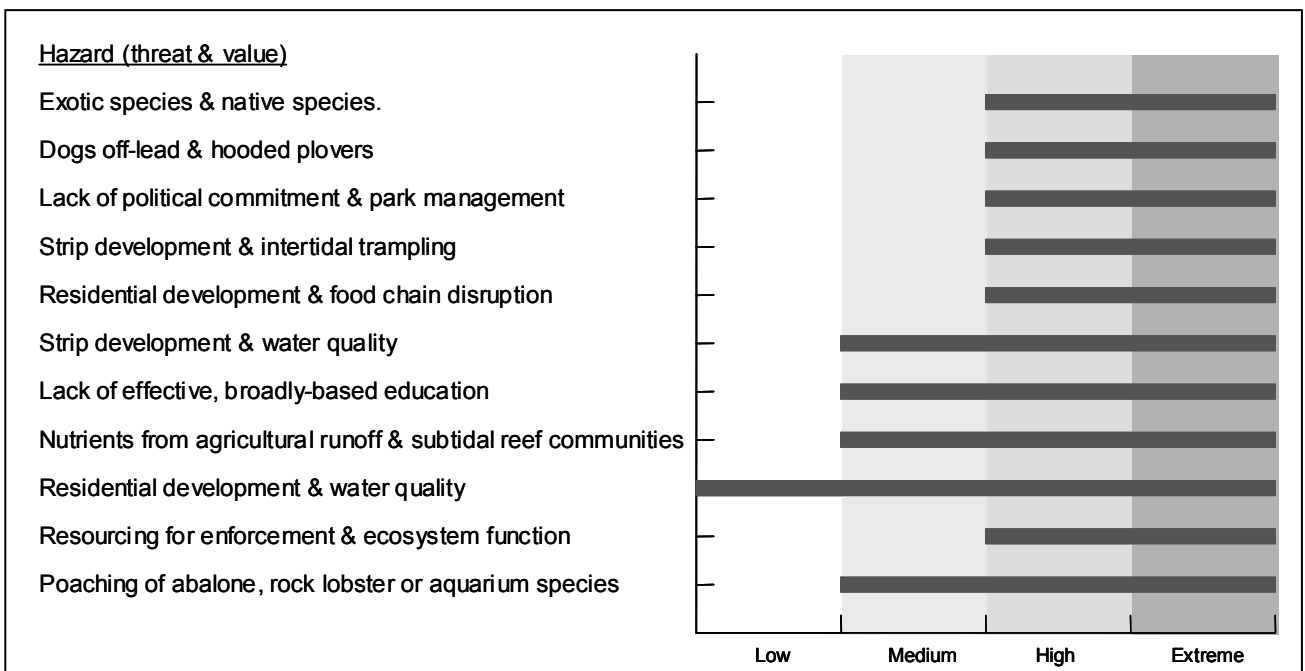


Figure 2.13.2 Hazards ordered as in Fig. 2.13.1, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E.

2.13.1 Comparison with a previous Parks Victoria assessment

Parks Victoria undertook an internal assessment for the Bunurong MNP as part of its compliance planning process (Parks Victoria 2003). That assessment considered 49 threats, of which 27 were rated as either extreme or high risks (Table 4). Fishing and pollution figured prominently in the internal assessment, with different fishing methods and potential sources of pollution listed individually.

Table 2.13.4 Summary of threats to Bunurong MNP (after Parks Victoria 2003)

Type of threat	No. of threats				Total no. of threats
	extreme risk	high risk	moderate risk	low risk	
Licensed commercial fishing	0	4	3	10	17
Poaching (unlicensed commercial fishing)	1	1	0	0	2
Recreational fishing	2	3	0	3	8
Pollution	3	7	1	1	12
Exotic incursions	1	1	0	0	2
Other (including culturally-based threats)	1	3	1	3	8
All types of threat	8	18	5	17	49

Among the extreme or high risk threats related to fishing in the internal assessment, only poaching of abalone and rock lobster was also ranked among the risk register hazards at the workshop. Exotic species were also considered to be an important threat in both assessments. Of particular note is the overlap with pollution related threats in the two assessments, both highlighting catchment-based water quality issues of stormwater runoff and nutrients.

The following six hazards from the workshop risk register (Table 2.13.3) had no comparable threat in the internal assessment:

- Increased **residential development** in the broader catchment, leading to increased trampling of intertidal biota, causing **disruption to the food chain**.
- **Lack of political commitment** resulting in insufficient resources (money & staff) for Parks Victoria to effectively **manage the park** (i.e. to monitor, manage and implement actions).
- **Lack of effective** (i.e. well-resourced) and **broadly-based education** (i.e. ecosystem-*focussed*) of park and agency staff, the general community and park visitors, affecting . . .
- **Dogs off-lead** disturbing **hooded plovers**, resulting in decreased *plover* populations.
- Inappropriate coastal **development (strip** development on existing farm land) adjacent to the park leading to increased **trampling in intertidal** areas.
- Insufficient **resourcing of relevant agencies for enforcement** (e.g. no-take zones, bag limits) leading to altered **ecosystem functioning** (*via changes to community structure etc*)

2.14 Wilsons Promontory and Corner Inlet Marine National Parks

An ecological risk assessment for the Wilsons Promontory and Corner Inlet Marine National Parks was undertaken in a workshop setting at Tidal River on 15 September 2004. The 21 workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park (Appendix 1).

The risk assessment was designed to consider the parks collectively, but with scope to restrict individual hazards to specific protected areas.

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify a threat of concern and the natural attribute they valued that could be affected by that threat and resulted in an initial list of 24 hazards (Table 2.14.1), eight of which were specific to Corner Inlet MNP, and one specific to Wilsons Promontory MNP.

Participants were then provided with a list of 19 natural values specific to the parks, together with a generic list of 108 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate over 2000 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process produced an additional 8 hazards (Table 2.14.2), one of which was park specific.

To minimize differences in interpretation among the participants, some hazards were more tightly defined at this stage (Tables 2.14.1 & 2.14.2). Two particular questions arose at this stage of the process:

- The potential for the high profile of the parks resulting in the wider marine ecosystem receiving reduced management attention was discussed. This may eventually affect the parks themselves because, in an ecological sense, the parks are not separate from that wider region. Should the management of this risk to the parks really be the province of external agencies (e.g. CMA) given that the actions of concern take place beyond the parks? This problem may be related to the general lack of ecological knowledge of the marine ecosystem, given that organisations tend to be reluctant to act in the absence of data.
- Is there a mis-match between community expectations of what the parks will “deliver” and the eventual outcomes generated by the presence of the parks?

Table 2.14.1 Initial list of hazards from unstructured brainstorming session, Wilsons Promontory and Corner Inlet MNPs.

Initial definition	Subsequent definition if refined
Levels of turbidity and phosphorus from rivers, exceeding SEPP requirements, affecting seagrass in Corner Inlet MNP. Sediments and nutrients in catchment runoff affecting water quality and seagrass in Corner Inlet MNP.	First hazard subsumed in less specific second hazard: Sediments and nutrients in catchment runoff affecting water quality and seagrass in Corner Inlet MNP.
Visual impact of people (<i>i.e. disturbance</i>) on intertidal shorebirds and seabirds in Corner Inlet MNP	

Noise from boats, hovercraft and personal water craft disturbing intertidal shorebirds and seabirds in Corner Inlet MNP	
Dredging operations in Corner Inlet affecting water quality and seagrass beds and disturbing shorebirds and seabirds in MNP	
Exotic species and pathogens introduced via ballast water or recreational boating, affecting biodiversity by competing with local species	Split into two separate hazards: Exotic species and pathogens introduced via ballast water or recreational boating, affecting biodiversity by competing with local species in Wilsons Promontory MNP. Exotic species and pathogens introduced via ballast water or recreational boating affecting, biodiversity by competing with local species in Corner Inlet MNP.
Presence of boats affecting breeding colonies of seals on Kanowna Is by increasing pup mortality (pups crushed/drowned when colony disturbed) and disruption to the social order (bulls losing territory on beach when colony disturbed)	
Increasing human population leading to increasing inappropriate behaviour by individuals, development and land use surrounding the MNPs, and increasing management complexity	
Lack of fencing or poorly maintained fencing adjoining Corner Inlet Marine & Coastal Park, allowing intrusion of hard-hoofed animals to the water's edge, resulting in destruction of saltmarsh and mangrove areas with flow-on effects to water quality and seagrass	
Illegal harvesting of abalone and rock lobster (WP MNP) and finfish (WP & CI MNPs) leading to declining populations of those species	
Major oil or chemical spill damaging seagrass and bare mudflat habitats in Corner Inlet MNP or penguins, seals and rocky intertidal habitat in Wilsons Promontory MNP	Split into two separate hazards: Major oil or chemical spill from vessel damaging seagrass and bare mudflat habitats in Corner Inlet MNP Major oil or chemical spill from vessel damaging penguins, seals and rocky intertidal habitat in Wilsons Promontory MNP
Anchoring of recreational boats affecting subtidal reefs (WP MNP) or seagrass beds (WP & CI MNPs)	
Altered timing and flow of freshwater into Corner Inlet affecting ecological processes <i>in Corner Inlet MNP</i> including fish breeding and occurrence of micro and macro algal blooms	
High profile of MNPs leading to reduced management and/or environmental focus on surrounding marine areas, to the subsequent detriment of the MNPs	

Logging of plantations across the upper catchment of Corner Inlet, leading to sedimentation effects on seagrass, sand slugs from in-stream habitat releasing nutrients to <i>MNP</i> , and nutrients stored in the sediments of <i>MNP</i> affecting algal communities and seagrass.	
Lack of ecological baseline data affecting <i>the management of</i> marine habitats and communities (WP & CI MNPs)	
Jurisdictional boundary complexity, "island-based" management focus, and <i>the complexity of</i> inter-agency relationships affecting marine habitats and communities in both MNPs.	
Inertia in decision-making affecting marine habitats and communities in both MNPs	
Failure of MNPs to meet <i>community expectations (regardless of whether or not those expectations are justified)</i> , leading to reduced community support and thus affecting the future of the parks	
Lack of government recognition of individual preferences leading to effects on marine communities and habitats	
Lack of widespread community awareness (among both locals and visitors, in both urban and rural communities) of the interconnectedness of ecosystem components (e.g. land to sea)	
Global warming leading to <i>changes in</i> sea level and sea temperature, and thus affecting marine habitats	
Construction of seawalls affecting breeding of fish such as shark and flounder	Presence of seawalls affecting breeding of fish such as shark and flounder
Pathogens and exotic species introduced via aquaculture competing with local marine species	

Note: The safety of visitors to the Wilsons Promontory MNP who are at risk of falling from cliffs or rock platforms into the sea, was also raised as a concern, but was regarded as a human health risk.

Table 2.14.2 Additional hazards from structured brainstorming session, Wilsons

Promontory and Corner Inlet MNPs.

Initial definition	Subsequent definition if refined
Nutrients from septic tanks and secondary sewage treatment plants affecting seagrass in Corner Inlet MNP, subtidal rocky reef in Wilsons Promontory MNP	Split into two separate hazards: Nutrients from septic tanks and secondary sewage treatment plants affecting seagrass in Corner Inlet MNP. Nutrients from untreated sewage affecting subtidal rocky reef <i>near South East Point lightstation</i> or from seepage from settling ponds at Tidal River <i>affecting marine habitats and communities of Norman Bay</i> , in Wilsons Promontory MNP
Heavy metals from tin mines via Bennison Creek after heavy rain, affecting biota in Corner Inlet MNP	
Litter from all sources leading to strangling, entanglement or ingestion by birds in Corner Inlet MNP, or by marine mammals, penguins and <i>other</i> birds in Wilsons Promontory MNP	
Propeller scour affecting seagrass beds and <i>bare</i> mudflats	
Dumping of munitions or chemicals affecting marine habitats and communities	
Exploration for oil, gas or minerals affecting marine habitats and communities	
Increased shipping leading to <i>increased occurrence</i> of shipwreck or grounding, causing physical damage to habitats	
Whale watching <i>activities</i> causing disturbance to whales	

The next step in the assessment process was to select a subset of hazards deemed to be of most concern, for the next stage of the risk assessment. Each participant was allotted four votes to be distributed over the full list of hazards in a way that best reflected their concerns. Hazards that scored two or more votes were promoted to the risk register (Table 2.14.3).

Table 2.14.3 Risk register, Wilsons Promontory and Corner Inlet MNPs.

Hazard	Likelihood	Consequence	Risk score	Level of Risk
Nutrients from septic tanks and secondary sewage treatment plants affecting seagrass in Corner Inlet MNP	3 - 5	2 - 4	6 - 20	M - E
Nutrients from untreated sewage affecting subtidal rocky reef near <i>South East Point lightstation</i> or from seepage from settling ponds at Tidal River affecting <i>marine habitats and communities of Norman Bay</i> , in Wilsons Promontory MNP	3 - 5	1 - 4	5 - 20	M - E
Propeller scour affecting seagrass beds and <i>bare</i> mudflats	2 - 5	2 - 4	4 - 20	L - E
Presence of seawalls affecting breeding of fish such as shark and flounder	2 - 5	1 - 5	5 - 25	H - E
Altered timing and flow of freshwater into Corner Inlet affecting ecological processes in Corner Inlet MNP including fish breeding and occurrence of micro and macro algal blooms	3 - 5	3 - 4	9 - 20	H - E
High profile of MNPs leading to reduced management and/or environmental focus on surrounding marine areas , to the subsequent detriment of the MNPs	1 - 5	1 - 4	2 - 16	L - E
Logging of plantations across the upper catchment of Corner Inlet , leading to sedimentation effects on seagrass , sand slugs from in-stream habitat releasing nutrients <i>to MNP</i> , and nutrients stored in the sediments <i>of MNP</i> affecting algal communities and seagrass	1 - 5	3 - 5	3 - 25	M - E
Sediments and nutrients in catchment runoff affecting water quality and seagrass in Corner Inlet MNP	4 - 5	3 - 5	12 - 25	H - E
Dredging operations in Corner Inlet affecting water quality and seagrass beds and disturbing shorebirds and seabirds in MNP	4 - 5	2 - 4	8 - 20	H - E
Exotic species and pathogens introduced via ballast water or recreational boating, affecting biodiversity by competing with local species in Corner Inlet MNP .	1 - 5	4 - 5	5 - 25	H - E
Exotic species and pathogens introduced via ballast water or recreational boating, affecting biodiversity by competing with local species in Wilsons Promontory MNP .	1 - 5	4 - 5	5 - 25	H - E

Presence of boats affecting breeding colonies of seals on Kanowna Is by increasing pup mortality (pups crushed/drowned when colony disturbed) and disruption to the social order (bulls losing territory on beach when colony disturbed)	3 - 4	1 - 4	4 - 16	M - E
Major oil or chemical spill from vessel damaging seagrass and mudflat habitats in Corner Inlet MNP	2 - 3	4 - 5	8 - 15	H - E
Major oil or chemical spill from vessel damaging penguins, seals and rocky intertidal habitat in Wilsons Promontory MNP	1 - 4	3 - 5	5 - 16	H - E

Note: Level of Risk based on Likelihood and Consequence in accordance with AS4360 App. E (SA/SNZ 1999)

This subset of 14 hazards listed in the risk register was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into five groups of three or four people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood. Hazards with high levels of disagreement were then discussed in detail (see below).

(i) ***Exotic species and pathogens introduced via ballast water or recreational boating, affecting biodiversity by competing with local species***

The two exotic species hazards (one for each park) received the full range of scores for likelihood. In general, the likelihood of these hazards eventuating was rated as moderately likely or higher, but one group felt there was insufficient information to justify any particular score and thus gave bounds of 1 to 5. A second group believed exotic species were unlikely to affect biodiversity in the Wilsons Promontory MNP. Their position was based on the regular passage of shipping in the past (Note: a designated Inshore Traffic Zone for shipping lies less than 2 km south of the Promontory), and the assumption any exotic species likely to arrive would already have done so. In contrast, the same group saw the Corner Inlet MNP as more vulnerable to this hazard because they expected shipping traffic inside the Inlet to increase over the next ten years. A third group nominated the Northern Pacific seastar *Asterias amurensis* as the key species of concern.

There was little disagreement among the groups over the severity of the consequences of this hazard, all scoring either major or catastrophic.

(ii) ***Major oil or chemical spill from vessel***

This hazard was also listed for the two parks, with the value being seagrass and mudflats for Corner Inlet MNP, and penguins, seals and rocky intertidal habitat for Wilsons Promontory MNP.

Two participants advised that oil spills occur outside the parks at a rate of about one per year, seven having occurred in the last six years. The group scoring likelihood the highest (i.e. 3 - 4) was prompted by the most recent of these spills, while another group was not influenced by that particular spill and considered the chance of a spill affecting penguins, seals and rocky intertidal habitat as very unlikely in the next ten years. (Note: Three oil spills considered to be "significant" by AMSA occurred in or near Victorian waters between 1988 and 2003. Quantities of oil spilled were 184 tonnes, 345 tonnes and an unknown amount. (AMSA 2003))

(iii) ***Presence of seawalls affecting breeding of fish such as shark and flounder***

Seawalls were considered an issue in the light of the effects of global warming and a possible rise in sea level. An initial difficulty with this hazard revolved around whether the threat referred to existing or future seawalls. It was suggested that tighter coastal planning controls would be unlikely to allow the construction of new seawalls, and the presence of existing seawalls was accepted as the threat. There is also the possibility that some existing seawalls may be removed; about one year ago, one such action was proposed.

There was an assumption that the construction of seawalls in the past would have had an impact on the surrounding environment, but that impact would have stabilised over time, and would no longer be readily apparent.

(iv) ***Dredging operations in Corner Inlet affecting water quality and seagrass beds and disturbing shorebirds and seabirds in MNP***

While there was little disagreement on this particular hazard (likelihood 4 - 5, consequence 2 - 4), it did prompt considerable discussion.

Dredging was expected to occur in the inlet, but in the absence of information on spoil disposal, participants were generally unsure of potential effects. If disposal was on-shore but spoil was later washed back into the inlet (*perhaps during a storm?*), it was believed that the impact could be considerable.

(v) ***Propeller scour affecting seagrass beds and bare mudflats***

Likelihood for this hazard varied from highly likely to unlikely. The former rating was assigned with an expectation that seagrass beds suffering extensive physical damage would take a considerable time to recover. The latter was based on the observation that vessel movements to date do not appear to have produced such effects in the parks.

(vi) ***Presence of boats affecting breeding colonies of seals on Kanowna Is by increasing pup mortality (pups crushed/drowned when colony disturbed) and disruption to the social order (bulls losing territory on beach when colony disturbed)***

The difference of opinion over this hazard was largely related to the severity of the consequences. Some participants saw this hazard as an animal welfare issue, and pointed out that protection of flora and fauna is a basic function of the marine national parks. Another believed that seals were in sufficient abundance that the loss of some individuals would have no long-term ecological impact, and further, that seals are over-protected.

This hazard highlighted the potential for a conflict of interests surrounding protected areas. In this case, the issue was conservation within a protected area versus legal harvesting of a natural resource just beyond that area. Seals are seen by some as competing with commercial fishing interests, while fishers are often automatically blamed for seal deaths, irrespective of their true involvement.

(Note: Kanowna Island is one of the four major breeding colonies of the Australian fur seal in Victoria (ECC 2000, PIRC 2005), and is thus considered an important conservation area. A census in summer 2002/2003 recorded just over 2300 live pups in the colony, suggesting the total population was about 9000 (PIRC 2005).)

Previous experience at the marine park workshops and in other risk assessments (Burgman 2001) suggests that some groups might have wished to make some changes to their scores at this point. However, a shortage of time did not allow the groups to reconvene to consider possible changes.

The risk posed by each hazard was recorded in the risk register (Table 2.14.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards is presented in Figures 2.14.1 and 2.14.2. Five hazards were given a maximum risk score by at least one group:

- Sediments and nutrients in **catchment runoff** affecting **water quality and seagrass in Corner Inlet MNP**.
- Presence of **seawalls** affecting **breeding of fish** such as shark and flounder.
- **Exotic species and pathogens** introduced via ballast water or recreational boating affecting **biodiversity** by competing with local species in **Corner Inlet MNP**.
- **Exotic species and pathogens** introduced via ballast water or recreational boating affecting **biodiversity** by competing with local species in **Wilson's Promontory MNP**.
- **Logging** of plantations across the **upper catchment of Corner Inlet**, leading to sedimentation effects on **seagrass**, sand slugs from in-stream habitat releasing nutrients *to MNP*, and nutrients stored in the sediments *of MNP* affecting and **algal** communities and seagrass.

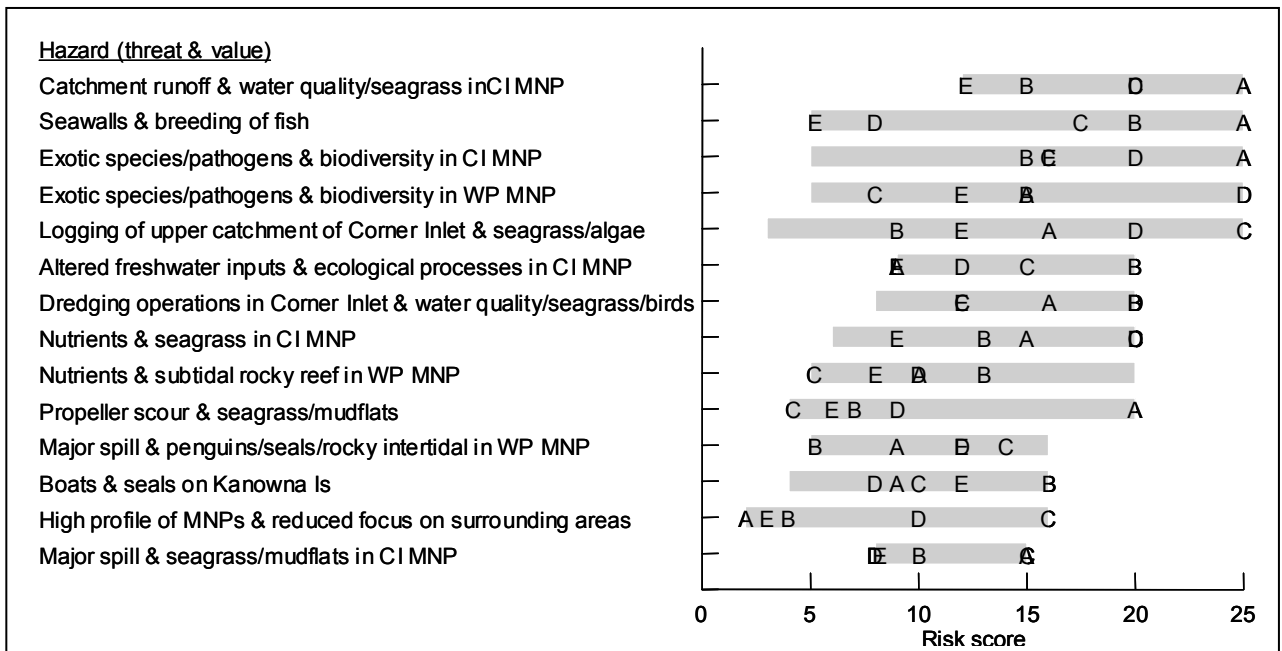


Figure 2.14.1 Summary of major risks to Wilsons Promontory and Corner Inlet MNPs, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the five groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the five groups.

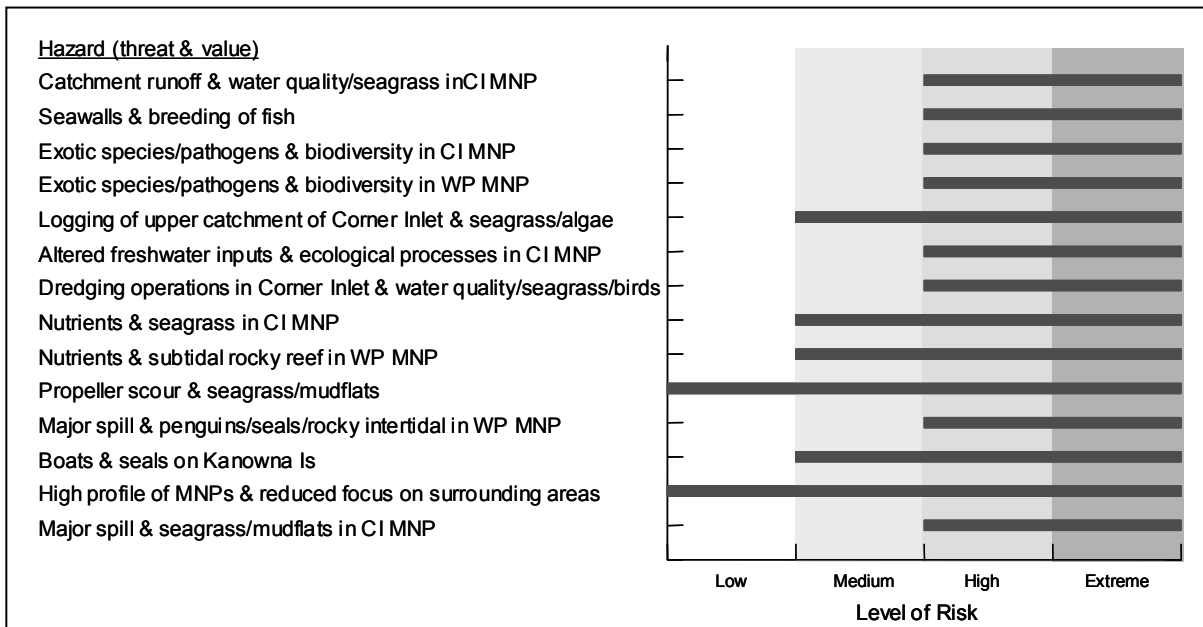


Figure 2.14.2 Hazards ordered as in Fig. 1, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E (SA/SNZ 1999).

2.14.1 Comparison with a previous Parks Victoria assessment

Parks Victoria undertook an internal assessment as part of its compliance planning process (Parks Victoria, unpublished). For Wilsons Promontory MNP the assessment considered 47 threats, of which 33 were rated as either extreme or high risks (Table 4). For Corner Inlet MNP, 35 threats were assessed, 18 achieving scores indicating extreme or high risks.

Table 2.14.4 Summary of threats to Wilsons Promontory and Corner Inlet MNPs rated as extreme or high risks. (after Parks Victoria unpublished)

Type of threat	No. of threats to Wilsons Promontory MNP				No. of threats to Corner Inlet MNP				Total no. of threats
	extreme risk	high risk	mod. risk	low risk	extreme risk	high risk	mod. risk	low risk	
Licensed commercial fishing	6	6	1	5	0	3	1	4	26
Poaching (unlicensed commercial fishing)	1	0	0	0	0	0	1	0	2
Recreational fishing	5	0	1	2	0	2	1	2	13
Pollution	2	7	0	1	3	6	1	2	22
Exotic incursions	2	0	0	0	1	0	0	0	3
Other (including culturally-based threats)	2	2	3	1	1	2	4	1	16
All types of threat	18	15	5	9	5	13	8	9	82

Fishing related threats figured prominently in the internal assessment, with individual fishing methods and target species listed individually. Fishing was far less prominent in the workshop hazard lists, with only one hazard focussed on fishing (the illegal harvesting of rock lobster and abalone; Table 1), while another directly addressed a threat to fish stocks from seawalls (Tables 2 & 3).

The balance of threats between the two marine national parks in the workshop was also different to that of the internal assessment. In the workshop, there were nine threats specific to Corner Inlet MNP, but only two specific to Wilsons Promontory MNP, reversing the emphasis evident in the internal assessment (35 and 47 respectively).

The following hazards from the workshop risk register (Table 3) had no comparable threat in the internal assessment:

- Presence of **seawalls** affecting **breeding of fish** such as shark and flounder
- **High profile of MNPs** leading to **reduced** management and/or environmental **focus** on **surrounding marine areas**, to the subsequent detriment of the MNPs
- **Dredging operations in Corner Inlet** affecting **water quality** and **seagrass** beds and disturbing **shorebirds** and **seabirds** in MNP

2.14.2 Concerns with the risk assessment process

Two issues with the risk assessment process arose during the course of the workshop:

- The interpretation of likelihood caused difficulty for some participants. In internal risk assessments, Parks Victoria has used descriptions of the various levels of likelihood that relate to the frequency with which events occur, for example, highly likely meaning approximately once per week. The definitions used in this workshop (Appendix 3) were deliberately broader, not being exclusively and explicitly linked with frequency, and not being tied to any particular time frame. This was aimed at allowing greater flexibility with infrequent but regular events, and permitting participants to assign scores based on their degree of belief in the occurrence of an event if they so wished.
- The risk assessment process used in this workshop dealt with individual hazards and did not specifically address cumulative effects. For example, dredging would presumably occur in response to a demand from, or a desire to encourage increased shipping activity in the inlet. Thus, as well as the possible effects of sedimentation and release of contaminants, it could also plausibly lead to an increased chance of invasion by exotic marine species. Participants were of course, free to take into account the presence or absence of one hazard when assigning scores to another. The logic behind such decisions would not be apparent in the scores themselves, but it was the role of the post-ranking discussion to reveal these details.

2.15 Ninety Mile Beach Marine National Park

An ecological risk assessment for the Ninety Mile Beach Marine National Park was undertaken in a workshop setting at Sale on 16th March 2005. The seven workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park (Appendix 1).

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. Each participant was asked to identify threats of particular concern to them, and the natural attributes of the park that they valued and were potentially affected by those threats. This resulted in an initial list of 19 hazards (Table 2.15.1).

Participants were then provided with a list of 8 natural values specific to the park, together with a generic list of 143 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 1144 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 19 hazards being identified as of particular concern to at least one workshop participant (Table 2.15.2).

Table 2.15.1 Initial list of hazards from unstructured brainstorming session, Ninety Mile Beach MNP.

Initial definition	Subsequent definition if refined
<p>Incident with large commercial shipping leading to release of less than 10 tonnes of contaminants (oil or fuel) affecting subtidal invertebrates.</p> <p>Incident with large commercial shipping leading to release of less than 10 tonnes of contaminants (oil or fuel) affecting intertidal invertebrates.</p> <p>Incident with large commercial shipping leading to release of 10 - 1000 tonnes of contaminants (oil or fuel) affecting subtidal invertebrates.</p> <p>Incident with large commercial shipping leading to release of 10- 1000 tonnes of contaminants (oil or fuel) affecting intertidal invertebrates.</p> <p>Incident with large commercial shipping leading to release of more than 1000 tonnes of contaminants (oil or fuel) affecting subtidal invertebrates.</p> <p>Incident with large commercial shipping leading to release of more than 1000 tonnes of contaminants (oil or fuel) affecting intertidal invertebrates.</p>	<p>Combined into single hazard:</p> <p>Incident with large commercial shipping leading to release of contaminants (oil or fuel) affecting subtidal or intertidal invertebrates.</p>
<p>Incident with small commercial or recreational vessels leading to release of less than 10 tonnes of contaminants (oil or fuel) affecting subtidal or intertidal invertebrates.</p>	
<p>Incident with oil platform leading to release of contaminants (oil or fuel) affecting subtidal or intertidal invertebrates.</p>	

Illegal harvesting of finfish by licenced commercial fisher, on commercial scale by unlicenced fisher, or by recreational fisher affecting pelagic or park communities or ecosystem.	
Illegal harvesting of finfish on commercial scale by unlicenced fisher affecting pelagic or park communities or ecosystem.	
Illegal harvesting of finfish by recreational fisher affecting pelagic or park communities or ecosystem.	
Trawling or scallop dredging affecting subtidal soft sediment and reef (<i>i.e. benthic</i>) habitats	
Contaminants (e.g. selenium) discharged from Saline Wastewater Outfall Pipeline resulting in bioaccumulation or changes to life cycles of local species.	
Increased turbidity from terrestrial runoff resulting in changes in primary production beyond the bounds of natural variation.	
Nutrients, pesticides, herbicides and sediments discharged from Merriman Creek resulting in changes in primary production beyond the bounds of natural variation and changes to the life cycles of local species.	
Increased turbidity due to <i>dredging</i> at Lakes Entrance resulting in changes in primary production beyond the bounds of natural variation.	
Nutrients, originating in Seaspray (from septic tanks etc) in groundwater causing changes in primary production beyond the bounds of natural variation.	
Visitor activities on shore (e.g. dune buggies, dogs off-lead) affecting the feeding and roosting of shorebirds	Visitor activities on shore within the park (e.g. dune buggies, dogs off-lead) affecting the feeding and roosting of shorebirds
Non-complementary regulations in adjacent reserves affecting birds that use the park (e.g. Hooded Plover)	

Table 2.15.2 Additional hazards from structured brainstorming session, Ninety Mile Beach MNP.

Initial definition	Subsequent definition if refined
Introduction of pathogens via fish bait or berley for either commercial or recreational fishing, affecting local species	Introduction of pathogens via fish bait or berley for either commercial or recreational fishing (but probably largely recreational) affecting local species
Introduction of exotic marine species via ballast water or hull fouling, resulting in displacement of native species. Introduction of exotic marine species via recreational boating, resulting in displacement of native species. Introduction of exotic marine species via natural dispersal from adjacent waters, resulting in displacement of native species.	Combined into a single hazard: Introduction of exotic marine species via ballast water or hull fouling, recreational boating, or natural dispersal from adjacent waters, and resulting in displacement of native species.
Coastal processes (natural or accelerated) including subsidence altering hydrodynamic processes and affecting intertidal habitats and communities	
Lack of ecological knowledge leading to inappropriate management and consequently resulting in changes to habitats and communities beyond the bounds of natural variation	
Gross litter from townships affecting benthic communities. Gross litter from townships affecting pelagic communities. Gross litter from townships affecting intertidal organisms <i>and</i> seabirds.	Combined into a single hazard Gross litter from on-shore sources affecting benthic communities, pelagic communities, and intertidal organisms <i>and</i> seabirds.
Litter from sea-based sources (e.g. garbage from passing shipping, foam & plastic from fishing boats) affecting benthic communities. Litter from sea-based sources (e.g. garbage from passing shipping, foam & plastic from fishing boats) affecting pelagic communities. Litter from sea-based sources (e.g. garbage from passing shipping, foam & plastic from fishing boats) affecting intertidal organisms <i>and</i> seabirds.	
Lost fishing gear affecting benthic communities. Lost fishing gear affecting pelagic communities. Lost fishing gear affecting intertidal organisms <i>and</i> seabirds.	
Disturbance of shorebirds by horses	
Predation by introduced terrestrial predators (e.g. cats, foxes) affecting shorebirds	
Illegal opening of the mouth of Merriman Creek after an extended dry period causing a release of concentrated contaminants affecting park communities	

Inappropriate development (e.g. housing or rezoning) or use (e.g. resource theft or cetacean stranding) of adjacent land affecting park habitats and communities	
Seismic testing on boundary of park affecting pelagic communities and transient marine mammals	

As individual hazards were nominated, some were discussed in detail to enhance participants' understanding and to minimize differences in interpretation. Points made concerning particular threats or values are presented below:

- The risk posed by illegal fishing will vary with the type of fishing gear used, for example, net, line or trawl. The scale of illegal activities was also estimated (Figure 2.15.1), with unlicensed commercial-scale harvesting believed to be responsible for a large catch.
- It was reported that the number of hooded plovers detected each year is very variable.
- Regarding the coastal process hazard, it was reported that a seven year study of subsidence has been carried out by CSIRO and DPI.
- The environment of the park was believed to be in good condition, but a lack of ecological knowledge meant that management actions had no sound ecological basis.

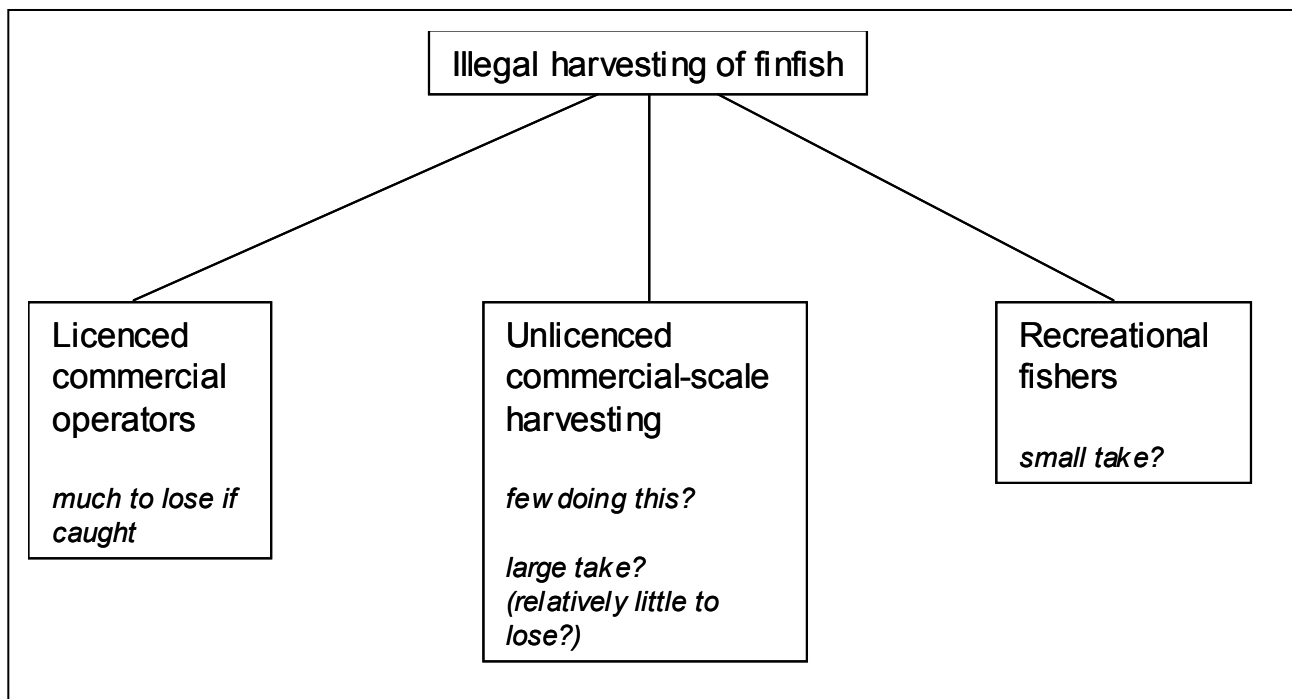


Figure 2.15.1 Scale of illegal harvesting of finfish in the Ninety Mile Beach MNP.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored at least one vote were included in the risk register (Table 2.15.3).

Table 2.15.3 Risk register, Ninety Mile Beach MNP

Hazard	Likelihood	Consequence	Risk score	Level of Risk
Incident with large commercial shipping leading to release of contaminants (oil or fuel) affecting subtidal or intertidal invertebrates .	1	2 - 4	2 - 4	L - H
Illegal harvesting of finfish by licenced commercial fisher affecting pelagic or park communities or ecosystem.	2 - 4	3	6 - 12	M - H
Trawling or scallop dredging affecting subtidal soft sediment and reef (<i>i.e. benthic</i>) habitats	3	3 - 4	9 - 12	H - E
Nutrients, pesticides, herbicides and sediments discharged from Merriman Creek resulting in changes in primary production beyond the bounds of natural variation and changes to the life cycles of local species.	1 - 3	2 - 4	2 - 8	L - H
Visitor activities on shore within the park (e.g. dune buggies, dogs off-lead) affecting the feeding and roosting of shorebirds	4 - 5	2 - 4	8 - 20	H - E
Introduction of pathogens via fish bait or berley for either commercial or recreational fishing (but probably largely recreational) affecting local species	1 - 3	2 - 4	4 - 12	M - E
Introduction of exotic marine species via ballast water or hull fouling, recreational boating, or natural dispersal from adjacent waters, and resulting in displacement of native species .	1 - 3	4 - 5	4 - 15	H - E
Lack of ecological knowledge leading to inappropriate management and consequently resulting in changes to habitats and communities beyond the bounds of natural variation	1 - 2	1 - 3	1 - 6	L - M
Gross litter from on-shore sources affecting benthic communities, pelagic communities, and intertidal organisms <i>and</i> seabirds.	4 - 5	2 - 3	8 - 12	H
Illegal harvesting of finfish on commercial scale by unlicenced fisher affecting pelagic or park communities or ecosystem.	1 - 2	2 - 3	2 - 4	L - M
Illegal harvesting of finfish by recreational fisher affecting pelagic or park communities or ecosystem.	1 - 4	2	2 - 8	L - H

Note: Level of Risk is based on Likelihood and Consequence in accordance with AS4360 Appendix E

This subset of hazards was then ranked, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999). Participants were divided into three groups of two or three people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so.

Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessments differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient, values ranged from +0.22 to +0.69, with a median of +0.40, indicating a moderate level of disagreement overall among the groups. Individual hazards with high levels of disagreement were then discussed in detail (see below).

(i) **Gross litter from on-shore sources affecting benthic communities, pelagic communities, and intertidal organisms and seabirds.**

One group believed there is a large amount of litter in the park that is not visible to observers. There was also some disagreement over whether or not litter in the park came mainly from Seaspray.

(ii) **Visitor activities on shore** within the park (e.g. dune buggies, dogs off-lead) affecting the feeding and roosting of **shorebirds**

A group scoring this hazard highest was concerned that the effects of harassment on nesting behaviour are cumulative and that individuals of threatened species may eventually cease to use the park even for feeding and roosting. Another group believed that while events such as disturbance by dogs are regular occurrences, they do not pose a great problem for the shorebirds.

(iii) Introduction of **pathogens via fish bait or berley** for either commercial or recreational fishing (but probably largely recreational) affecting **local species**

One group admitted to assigning a mid-range score to both likelihood and consequence because of a lack of knowledge on which to base any other choice. Groups who scored consequence more highly did so because of a perceived potential for an introduced pathogen to have very serious effects. One of these groups further qualified their decision as being specific to the Ninety Mile Beach environment.

Following the discussion of selected hazards, groups were given the opportunity to change likelihood and consequence scores if they wished. Any changes were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in a large increase in agreement for one pair of groups (A & C), but slight reductions in the level of agreement for the other two pairs. The minimum correlation coefficient rose from +0.22 to +0.32, the median from +0.40 to +0.57, and the maximum rose from +0.69 to +0.76.

The risk posed by each hazard was recorded in the risk register (Table 2.15.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores is presented in Figures 2.15.2 and 2.15.3. The hazards of greatest concern identified in the Ninety Mile Beach workshop also had the greatest uncertainty associated with them. Those hazards were

- **Visitor activities on shore** within the park (e.g. dune buggies, dogs off-lead) affecting the feeding and roosting of **shorebirds**
- Introduction of **exotic marine species** via ballast water or hull fouling, recreational boating, or natural dispersal from adjacent waters, and resulting in **displacement of native species**.

Workshop participants suggested that future monitoring or research effort should be directed at the following topics:

- exotic species
- harvesting by licensed fishermen
- water quality

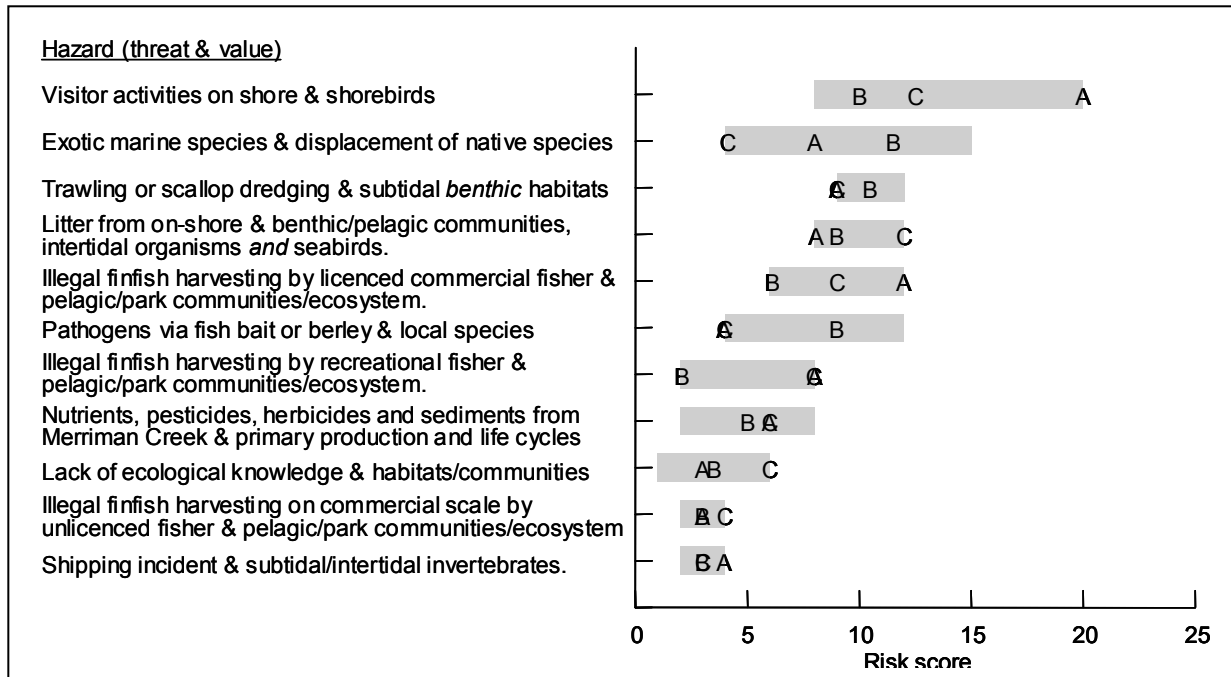


Figure 2.15.2 Summary of major risks to Ninety Mile Beach MNP, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the three groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Letters represent the median scores of the three groups.

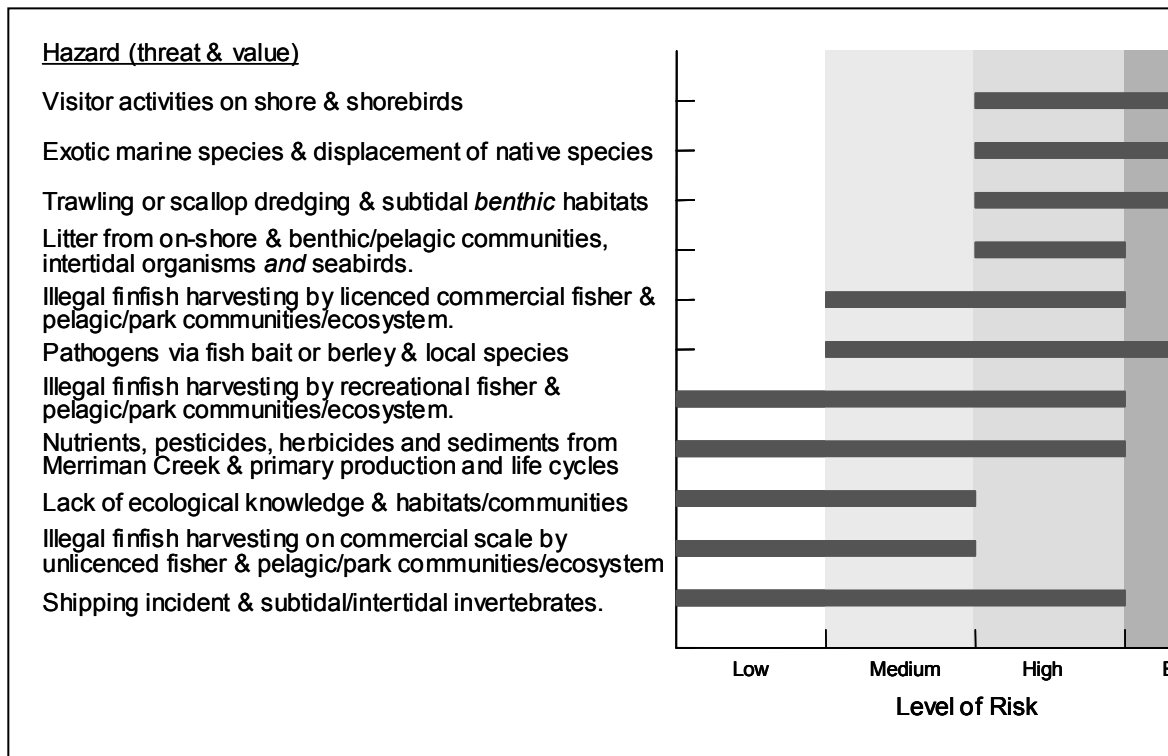


Figure 2.15.3 Hazards ordered as in Figure 2.15.2, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E.

2.15.1 Comparison with a previous Parks Victoria assessment

Parks Victoria undertook an internal assessment for the Ninety Mile Beach MNP as part of its compliance planning process (Parks Victoria 2003). That assessment considered 37 threats, of which 25 were rated as either extreme or high risks (Table 2.15.4). Fishing and pollution figured prominently in the internal assessment, with different fishing methods and potential sources of pollution listed individually. These two types of threat were also prominent in the risk register from the workshop (Table 2.15.3), with 7 of the 11 hazards involving either fishing or pollution, and 6 of those 7 with risk levels up to high or extreme.

Table 2.15.4 Summary of threats to Ninety Mile Beach MNP (after Parks Victoria 2003c)

Type of threat	No. of threats				Total no. of threats
	extreme risk	high risk	moderate risk	low risk	
Licensed commercial fishing	7	4	2	0	13
Poaching (unlicensed commercial fishing)	1	0	0	0	1
Recreational fishing	0	1	0	2	3
Pollution	1	7	2	1	11
Exotic incursions	0	2	0	0	2
Other (including culturally-based threats)	0	2	4	1	7
All types of threat	9	16	8	4	37

Only two hazards from the workshop risk register (Table 2.15.3) had no comparable threat in the internal assessment:

- Introduction of **pathogens via fish bait or berley** for either commercial or recreational fishing (but probably largely recreational) affecting **local species**
- **Lack of ecological knowledge** leading to inappropriate management and consequently resulting in changes to **habitats and communities** beyond the bounds of natural variation

2.16 East Gippsland Marine National Parks and Sanctuary

An ecological risk assessment for Point Hicks Marine National Park, Cape Howe Marine National Park and Beware Reef Marine Sanctuary was undertaken in a workshop setting at Cann River on 2nd December 2004. The 13 workshop participants included Parks Victoria staff and members of the Parks Victoria Advisory Group for the park (Appendix 1).

The first step of the elicitation process on the day was to conduct an unstructured brainstorming session to elicit concerns from participants. The term "parks" will henceforth be used as a collective term for all three marine protected areas. Each participant was asked to identify threats of particular concern to them, together with the natural attributes of the parks that they valued and which were potentially affected by those threats. This resulted in an initial list of 20 hazards (Table 2.16.1).

To prompt a fuller consideration of hazards, and to identify values or threats that may have been overlooked, participants were then provided with a list of 15 natural values specific to the East Gippsland parks, together with a generic list of 130 potential threats to marine systems (Appendix 2). Combined in a hazard matrix, these two lists generate 1950 possible hazards for consideration. Participants were asked to consider the possible combinations of value and threat, and then add to the previous list of hazards if they wished. This structured brainstorming process resulted in an additional 12 hazards being identified as of particular concern to at least one workshop participant (Table 2.16.2).

Table 2.16.1 Initial list of hazards from unstructured brainstorming session, East Gippsland workshop.

Initial definition	Subsequent definition if refined
Poaching of abalone in commercial quantities leading to decreased abalone populations and consequent impacts on subtidal reef communities.	
Poaching of rock lobster in commercial quantities leading to decreased rock lobster populations and consequent impacts on subtidal reef communities.	Poaching of rock lobster (any quantity) quantities leading to decreased rock lobster populations and consequent impacts on subtidal reef communities.
Introduced marine pests from recreational boats leading to impacts on relevant ecological communities.	
Introduced species from commercial vessels leading to changes in community structure.	Introduced species from commercial vessels (including secondary introductions) leading to changes in community structure.
Tier 3 oil spill (>100,000 litres) impacting on ecosystem processes.	Tier 3 oil spill (>100,000 litres) from <i>commercial</i> shipping impacting on ecosystem processes.
Tier 2 oil spill (1,000 - 100,000 litres) impacting on ecosystem processes.	Tier 2 oil spill (1,000 - 100,000 litres) from <i>commercial</i> shipping impacting on ecosystem processes.
Tier 1 oil spill (<1,000 litres) impacting on ecosystem processes.	Tier 1 oil spill (<1,000 litres) from <i>commercial</i> shipping impacting on ecosystem processes.
Sewage from commercial shipping leading to impacts on pelagic fish.	
Sewage from recreational vessels leading to impacts on habitats and communities.	

Litter from commercial vessels leading to impacts on pelagic fish.	Litter, including lost fishing gear, from commercial vessels leading to impacts on pelagic fish.
Litter from recreational vessels leading to impacts on habitats and communities.	
Human trampling leading to impacts on subtidal (<i>intertidal?</i>) reef communities.	
Anchoring of recreational boats causing physical damage to subtidal reef habitats and communities.	
Divers causing physical damage to subtidal habitats and communities.	
Increased access to parks from construction of open access boat ramp, leading to increased illegal activities and thus decreased populations of target species (i.e. those for human consumption).	
Litter from campsites (<i>in adjacent terrestrial national parks</i>) leading to impacts on habitats and communities.	
Lack of ecological knowledge leading to inappropriate management and thus impacts on habitats and communities.	
Increased sediment loads from catchment runoff associated with fire operations (e.g. prescribed burning, road construction) leading to decreased water quality.	
Increased sediment loads from catchment runoff from park/forest roads leading to decreased water quality.	
Increased sediment loads from catchment runoff associated with timber harvesting leading to decreased water quality.	

Table 2.16.2 Additional hazards from structured brainstorming session, East Gippsland workshop.

Initial definition	Subsequent definition if refined
Artificial opening of river mouths leading to changes to water quality, hydrodynamic processes and subtidal reef communities.	
Predation by feral terrestrial species (cats, dogs, foxes, pigs) leading to decreased populations of threatened shorebirds.	
Introduced pathogens in fish bait leading to impacts on pelagic fish stocks.	
Efficacy of boundary signage leading to reduced populations of fin fish or abalone.	
Illegal trawling leading to damage to soft sediment substrate.	
Edge effects (i.e. fishing immediately outside park boundaries) leading to decreased populations of fin fish, abalone and southern rock lobster.	
Lack of monitoring, exacerbated by remoteness, leading to impacts on habitats and communities.	
Spill from rupture of oil pipeline from offshore platform leading to impacts on park biota.	
Inappropriate urban development of coastal land leading to increased nutrients and toxicants and thus decreased water quality in the park.	
Lack of community support (for the park) leading to impacts on intertidal communities.	
Harassment of seals leading to reduced seal population.	
Seismic testing leading to impacts on marine mammals.	

As individual hazards were nominated, some were discussed in detail to enhance participants' understanding and to minimize differences in interpretation. One question raised (but not answered during the workshop) was how damage to subtidal habitats by divers (Table 2.16.1) might be quantified.

The next step in the assessment process was to select a subset of hazards deemed to be of most concern. Each participant was allotted four votes, to be distributed over the full list hazards in a manner that best reflected their concerns. Hazards that scored three or more votes were included in the risk register (Table 2.16.3).

Table 2.16.3 Risk register, East Gippsland workshop. Key to parks: PH = Point Hicks MNP, CH = Cape Howe MNP, BR = Beware Reef MS.

Hazard	Par k	Likelihood	Consequen ce	Risk score	Level of Risk
Increased sediment loads from catchment runoff associated with timber harvesting leading to decreased water quality .	PH	2 - 4	1 - 3	2 - 12	L - H
	CH	1 - 4	1 - 3	1 - 12	L - H
	BR	2 - 5	2 - 3	4 - 15	L - E
Lack of ecological knowledge leading to inappropriate management and thus impacts on habitats and communities .	PH	2 - 5	2 - 4	6 - 20	M - E
	CH	2 - 5	2 - 4	6 - 20	M - E
	BR	2 - 5	3 - 4	6 - 20	M - E
Increased sediment loads from catchment runoff from park/forest roads leading to decreased water quality .	PH	2 - 4	1 - 3	2 - 12	L - H
	CH	1 - 4	1 - 3	1 - 12	L - H
	BR	2 - 4	1 - 4	2 - 16	L - E
Anchoring of recreational boats causing physical damage to subtidal reef habitats and communities.	PH	2 - 5	1 - 3	2 - 10	L - H
	CH	2 - 5	1 - 3	2 - 15	L - E
	BR	4 - 5	2 - 4	8 - 20	H - E
Litter , including lost fishing gear, from commercial vessels leading to impacts on pelagic fish .	PH	3 - 4	2 - 3	8 - 12	H
	CH	3 - 4	2 - 3	6 - 12	M - H
	BR	2 - 4	2 - 3	4 - 12	L - H
Introduced species from commercial vessels (including secondary introductions) leading to changes in community structure.	PH	2 - 5	2 - 5	4 - 25	L - E
	CH	2 - 5	2 - 5	4 - 20	L - E
	BR	2 - 5	2 - 5	4 - 25	L - E
Poaching of abalone in commercial quantities leading to decreased abalone populations and consequent impacts on subtidal reef communities .	PH	3 - 5	2 - 4	8 - 20	H - E
	CH	3 - 5	2 - 4	8 - 20	H - E
	BR	3 - 5	2 - 4	6 - 20	M - E
Introduced marine pests from recreational boats leading to impacts on relevant ecological communities.	PH	1 - 4	3 - 5	4 - 20	M - E
	CH	1 - 4	3 - 5	4 - 20	M - E
	BR	2 - 5	3 - 5	8 - 25	H - E

Note: Level of Risk is based on Likelihood and Consequence in accordance with AS4360 Appendix E

Because all three parks were likely to be subject to all eight hazards, but possibly to different degrees, it was decided to score the full set of hazards for each park individually. The subset of hazards was ranked for each park, broadly following the process outlined in the Australian Standard for Risk Management, AS4360 (SA/SNZ 1999).

Participants were divided into four groups of two or three people. Each group subjectively assigned values to the likelihood of the hazard eventuating and the severity of the consequences should it do so, for each park individually. Both likelihood and consequence were scored on a scale of 1 to 5, where a higher value indicated a greater likelihood or a more severe consequence (Appendix 3). Participants were asked to record any instances in which their assessment differed from that of another group by more than 2 points on the 5 point scales, for either consequence or likelihood.

The extent of agreement between groups was indicated by Spearman's rank correlation coefficient. Across the three parks, correlations varied widely. The minimum value of -0.03 indicated no real pattern between Groups C and D in relation to Point Hicks MNP. The maximum of +0.82 indicated strong agreement between Groups A and C over Cape Howe MNP. Individual hazards with the highest levels of disagreement were then discussed in detail (see below). Disagreements were generally greater for likelihood scores than those for consequence.

(i) **Lack of ecological knowledge** leading to inappropriate management and thus impacts on **habitats and communities**.

The group scoring this hazard lowest for likelihood believed that management interventions will focus on preventing impacts from threatening processes, and that detailed understanding of ecological processes is not necessary for such interventions. This group acknowledged that an understanding of the existing flora and fauna was important, for example, to recognise the establishment of a new pest species in a park.

The example of sea urchin barrens was raised to emphasize the importance of addressing the causes of ecological impacts, for which ecological knowledge is required, rather than dealing only with the end results. However, it was observed that dealing with one potential problem in a localised area may create problems in other areas. For example, the management of introduced species in ballast water tends to focus on established ports, rather than other areas of the coastline which may include features such as marine protected areas.

It was notable that people within one group who agreed on the scoring for this hazard, did so for quite different reasons.

(ii) **Anchoring of recreational boats** causing physical damage to **subtidal reef** habitats and communities.

Differences for this hazard were restricted to Point Hicks and Cape Howe MNPs. Uncertainty over the frequency of boat anchoring in these parks, and how the frequency of anchoring could be related to the workshop definitions of levels of likelihood caused some difficulty with scoring for this hazard.

(iii) **Introduced marine pests from recreational boats** leading to impacts on relevant **ecological communities**.

Differences of opinion over this hazard centred on different estimates of the number of recreational boats visiting the parks. The greater the number of boats, the higher the likelihood of an introduction occurring via this pathway, and the higher the likelihood of resultant effects on the ecological communities of the parks. The group scoring likelihood lowest for this hazard referred to the lack of boat ramps at Point Hicks and Cape Howe, and to rarely sighting recreational boats at those parks. However, the situation may be somewhat different at Beware Reef MS, which was noted as being more popular with visitors from Melbourne. (There is also a boat ramp nearby at Cape Conran.)

(iv) **Introduced species from commercial vessels** (including secondary introductions) leading to changes in **community structure**.

It was recognised that the impact of an introduced species would depend greatly on the species concerned. There was also concern with exactly what "changes in community structure" might entail.

(v) Increased **sediment loads** from catchment runoff from **park/forest roads** leading to decreased **water quality**.

A collective lack of knowledge of the effect of roads in the surrounding area on sediment loads in catchment runoff hampered discussion of this hazard. However, there was concern about sediment plumes reaching Beware Reef MS.

Following the discussion of selected hazards, groups were given the opportunity to change likelihood and consequence scores if they wished. Any changes were entered in the ranking software and the risks (Appendix 4) and ranks recalculated. The changes resulted in considerable widening of the range of correlation scores. While agreement between Groups A and C over Cape Howe MNP increased to an extremely high level (+0.92), agreement between Groups A and D in relation to Beware Reef MS decreased substantially, from +0.45 in Round 1 to -0.27 in Round 2.

The risk posed by each hazard was recorded in the risk register (Table 2.16.3), where the range of values for likelihood, consequence and risk for each hazard reflects the final range of opinion among the groups of participants. A priority order of the hazards based on a three-tiered ordering of risk scores for the three parks together is presented in Figures 2.16.1 and 2.16.2. The hazards of greatest concern identified in the East Gippsland workshop were also those with the greatest uncertainty about the final scores. All three related to introduced species, but varied in the source of the introduction and the park concerned:

- **Introduced marine pests from recreational boats** leading to impacts on relevant **ecological communities** - Beware Reef MS.
- **Introduced species from commercial vessels** (including secondary introductions) leading to changes in **community structure**. - Beware Reef MS.
- **Introduced species from commercial vessels** (including secondary introductions) leading to changes in **community structure**. - Point Hicks MNP.

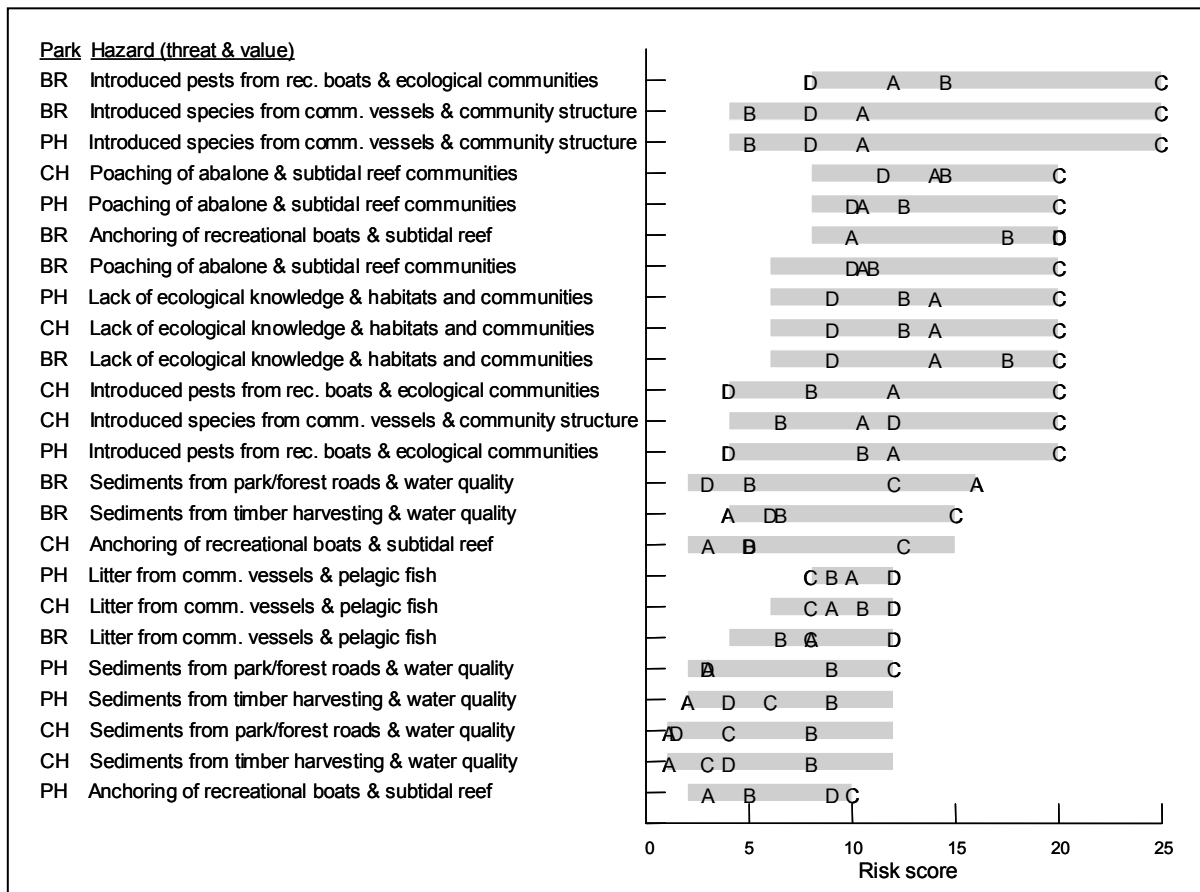


Figure 2.16.1 Summary of major risks to Point Hicks MNP, Cape Howe MNP and Beware Reef MS, with hazards ordered firstly by maximum risk score, then by minimum score and finally by the highest median score among the four groups of participants. Description of the hazards should be read in conjunction with full definitions given in the risk register above. Key to parks: PH = Point Hicks MNP, CH = Cape Howe MNP, BR = Beware Reef MS. Letters on score intervals represent the median scores of the four groups.

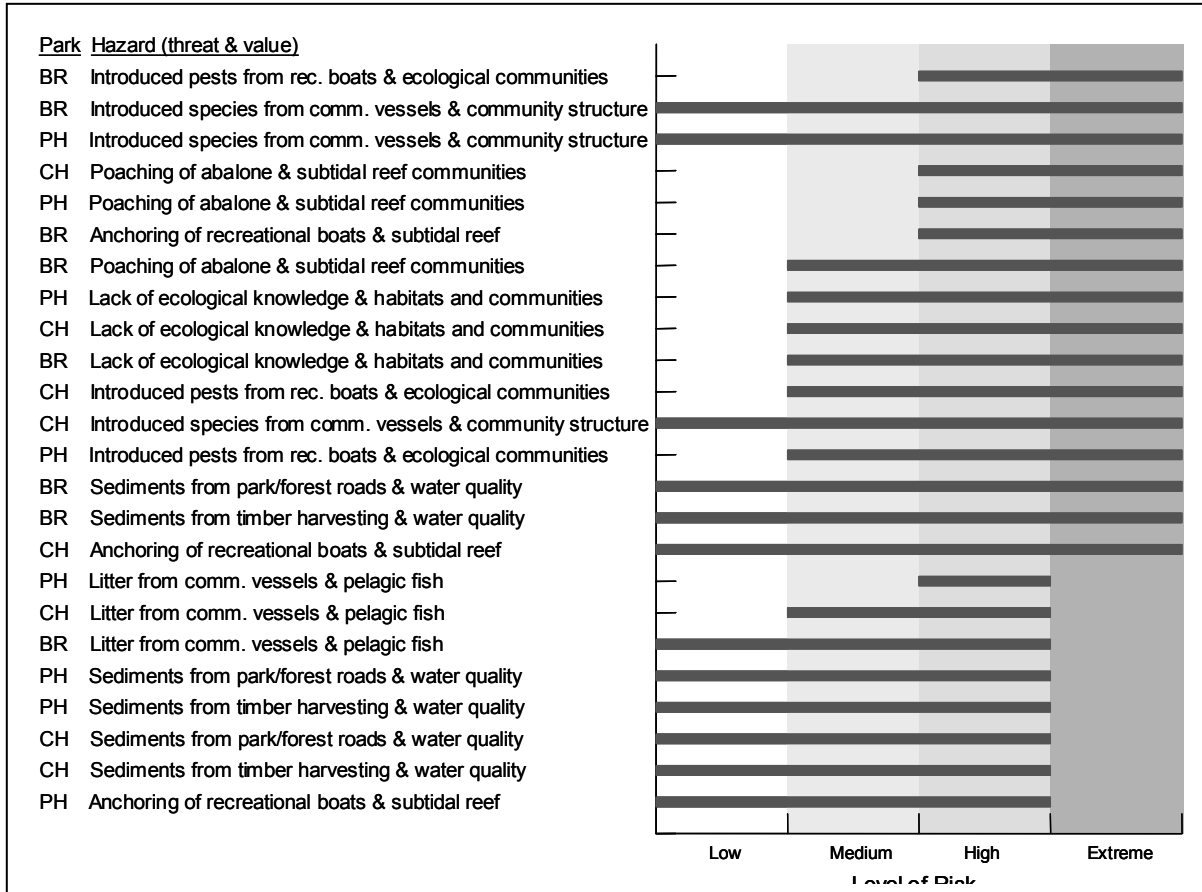


Figure 2.16.2 Hazards ordered as in Fig. 1, showing level of risk based on likelihood and consequence in accordance with AS4360 Appendix E.

2.16.1 Comparison with a previous Parks Victoria assessment

Risk assessments for the East Gippsland parks have been undertaken internally by Parks Victoria on at least two occasions; for the East Region Compliance Plan of 2003, and more recently at a workshop for Parks Victoria staff held in May 2004. In the latter assessment, threats with a score of 10 or higher were rated as "intolerable" (Table 2.16.4). Introduced species, poaching (non-licensed organised harvesting) and illegal commercial harvesting were the threats of most concern in the 2004 assessment. The present assessment was consistent with that of the staff workshop, with six of the top seven hazards listed in the risk register addressing the same threats (Table 2.16.3).

Table 2.16.4 High risk threats from the internal workshop for East Gippsland parks held by Parks Victoria in May 2004.

Threat	Habitat	Park or Sanctuary	Level of Risk (1 - 25)
Poaching * (key species: abalone)	subtidal reef	Point Hicks MNP	16
Poaching * (key species: abalone)	subtidal reef	Beware Reef MS	16
Illegal harvesting - commercial (main target species: abalone)	subtidal reef	Cape Howe MNP	15
Poaching * (key species: abalone)	subtidal reef	Cape Howe MNP	12
Marine pest introduction from adjacent / commercial activities	subtidal reef	Cape Howe MNP	10
Marine pest introduction from adjacent / commercial activities	intertidal reef	Cape Howe MNP	10
Marine pest introduction from adjacent / commercial activities	sandy beaches	Cape Howe MNP	10

* poaching in this context was defined as non-licensed organised harvesting

There was one risk register hazard with no equivalent threat in the staff workshop assessment:

- **Lack of ecological knowledge** leading to inappropriate management and thus impacts on **habitats and communities**.

References

- Anon. (2003) Flexing our mussels to keep out exotic pests. *Natural Heritage*. 14: 27.
- AMSA. (2003) *Major oil spills in Australia*. Australian Maritime Safety Authority. <http://www.amsa.gov.au/Marine_Environment_Protection/Educational_resources_and_information/Major_Oil_Spills_in_Australia/index.asp> (accessed 10/1/2005)
- Burgman, M.A. (2001) Flaws in subjective assessments of ecological risks and means for correcting them. *Australian Journal of Environmental Management*. 8: 219-226.
- Campbell, S.J. & Burrige, T.R. (1998) Occurrence of *Undaria pinnatifida* (Phaeophyta: Laminariales) in Port Phillip Bay, Victoria, Australia. *Marine and Freshwater Research*. 49: 379-381.
- Cohen, B.F., Currie, D.R. & McArthur, M.A. (2000) Epibenthic community structure in Port Phillip Bay, Victoria, Australia. *Marine and Freshwater Research*. 51: 689-702
- DSE. (2004) *Great Ocean Road Region: Towards a Vision for the Future*. Department of Sustainability and Environment, Melbourne.
- DSE. (2004) *Northern Pacific Seastar in Port Phillip Bay*. Dept of Sustainability and Environment (Vic). <<http://www.dse.vic.gov.au/DSE/nrenrcm.nsf/LinkView/8146C236CC417D764A256A10007F062D92CD71AF8C1AF2E74A2567CA00817767>> (Accessed 17/1/2005)
- ECC. (2000) *Marine Coastal & Estuarine Investigation. Final Report*. Environment Conservation Council, East Melbourne.
- EPA. (1996) *Ballast water, hull fouling and exotic marine organism introductions via ships - a Victorian study*. EPA Publication 494. Environment Protection Authority, Melbourne, Vic.
- Parks Victoria. (2003a) Regional Compliance Plan - Marine National Parks and Sanctuaries: City and Bays Region. Unpublished.
- Parks Victoria. (2003b) Marine National Parks and Marine Sanctuaries, City and Bays Region - Regional Compliance Plan. Parks Victoria, Melbourne.
- Parks Victoria.(2003c) (unpublished) East Region Marine Compliance Plan - Draft, April 2003.
- Parks Victoria. (2004) *Regional Compliance Plan - West Region*. Unpublished.
- PIRC. (2005) *Seal research: seal numbers*. Phillip Island Research Centre, Phillip Island Nature Park.<<http://www.penguins.org.au/04/roger/content.asp?page=4>> (accessed 25/1/2005).
- Plummer, A, Morris, L, Blake, S & Ball, D (2003). *Marine Natural Values Study, Victorian Marine National Parks and Sanctuaries*. Parks Victoria Technical Series No. 1, Parks Victoria, Melbourne.
- SA/SNZ. (1999) *Risk Management*. (AS/NZS 4360:1999) Standards Australia, Sydney, and Standards New Zealand, Wellington.
- SA/SNZ (2004) Risk Management (AS/NZS 4360:2004) Standards Australia International Ltd, Sydney and Standards New Zealand, Wellington
- SA/SNZ (2004) Risk Management Guidelines (HB 436:2004) Standards Australia International Ltd, Sydney and Standards New Zealand, Wellington

Smyth & Bahrtd. (2004) *Kooyang Sea Country Plan*. Report prepared by Smyth and Bahrtd Consultants on behalf of the Framlingham Aboriginal Trust and Winda Mara Aboriginal Corporation. Framlingham Aboriginal Trust, Purnim, Vic. and Winda Mara Aboriginal Corporation, Heywood, Vic.

Viridans. (2005) *Rare animals in Victoria: rare animals that may be invaders*. <<http://www.viridans.com.au/RAREAN/Varare14.htm>> (Accessed 18/1/2005)

APPENDICES

For access to these Appendices please refer to the Parks Victoria Website:

<http://www.parkweb.vic.gov.au>

and follow the link to our publication database and the link to the Technical Series.

Appendix I Workshop Participants

Appendix II Values and Threats

Appendix III Definitions of Likelihood and Consequence (after SA/SNZ 1999 and ICE/FIA 1998)

Appendix IV Raw results of ranking exercise - Round 2

Parks Victoria is responsible for managing the Victorian protected area network, which ranges from wilderness areas to metropolitan parks and includes both marine and terrestrial components.

Our role is to protect the natural and cultural values of the parks and other assets we manage, while providing a great range of outdoor opportunities for all Victorians and visitors.

A broad range of environmental research and monitoring activities supported by Parks Victoria provides information to enhance park management decisions. This Technical Series highlights some of the environmental research and monitoring activities done within Victoria's protected area network.

Healthy Parks Healthy People

For more information contact the **Parks Victoria Information Centre** on **13 1963**, or visit www.parkweb.vic.gov.au

Appendix I Workshop Participants

Discovery Bay MNP

Name	Position/Expertise	Organization
Anthony Boxshall	Manager, Marine National Parks Research	Parks Victoria
Graeme Grant	abalone diver	
Barry Hayden	Marine Planner	Parks Victoria
Peter Hill	Ranger, Portland	Parks Victoria
Denise Lovett	Cultural Officer	Winda-Mara Aboriginal Corporation
Cameron McCallum	Fisheries Officer, Portland	Fisheries Victoria
Ted Miessner	sailing / member, Portland Field Naturalists' Club	

Twelve Apostles MNP, the Arches MS and Merri MS

Name	Position/Expertise	Organization
Linda Avery	marine scientist	Infaua Data
Mick Foley	Ranger	Parks Victoria
Linda Grant	catchment management	Glenelg Hopkins Catchment Management Authority
Barry Hayden	Marine Planner	Parks Victoria
Natasha Johnson	Ranger, Port Campbell	Parks Victoria
Laurie Laurenson	fisheries biology	School of Ecology & Environment, Deakin University
Sonia Lloyd	Planner	Parks Victoria
Neil Martin	Traditional / cultural	Framlingham Aboriginal Trust
Paul Millar	fisheries management	Dept. of Primary Industries - Fisheries Victoria
Nisha Powell	Environment Program Manager (acting) Warrnambool	Parks Victoria
Mandy Watson	cetaceans, wildlife	Dept. of Sustainability & Environment
Ian Westhorpe	fisheries management / boating	Dept. of Primary Industries - Fisheries Victoria

Unable to attend workshop, but attended dinner the previous evening:

Lionel Harradine Cultural Officer & Elder Framlingham Aboriginal Trust

Unable to attend workshop, but emailed concerns to Parks Victoria:

John Amor coastal management Coast Action/Coastcare

Marengo Reefs MS

Name	Position/Expertise	Organization
Ruth Beilin	social scientist	University of Melbourne
Carlie Bronk	Ranger	Parks Victoria
Will Cox	Ranger In Charge, Otways	Parks Victoria
Judy Forrester	Otway Herbs; member of Friends of Otway National Park	
Tim Godfrey	diver, marine enthusiast and author	
Linda Greenwood	Team Leader, National Parks Planning	Parks Victoria
Barry Hayden	Marine Planner	Parks Victoria
Tony James		Marengo Holiday Park
Steve McDougal	25 years experience in area	Dept of Sustainability and Environment
Gary McPike	General Manager	Apollo Bay - Kennett River Public Reserves Committee of Management
Dora Novak	Environment Officer	Colac Otway Shire Council
Andrew Orchard	local amateur fisherman / local police officer	
Gary Summers	Ranger; 25 years experience on coast	Parks Victoria

Participated in site visit but unable to attend workshop:

Lisa Deppeler Landcare officer / Apollo Bay Sailing Club

Visited workshop briefly:
Wendy Skene

Fisheries Officer, Apollo Bay

Fisheries Victoria

Point Addis MNP, Eagle Rock MS and Point Danger MS

Name	Position/Expertise	Organization
Reg Abraham	Cultural Officer	Wathaurong Aboriginal Corporation
Dale Antonysen	local Ranger in Charge	Parks Victoria
Dale Appleton	local Ranger specialising in marine national parks	Parks Victoria
Anthony Boxshall	Manager, Marine National Parks Research Programs	Parks Victoria
David Burgess	fisheries management, specialising in compliance	Dept. of Primary Industries - Fisheries Victoria
Steve Cameron	local issues and land management	Surf Coast Shire
Andrew Gilroy	environmental education, local diver.	Eco-Logic Environment & Education Services
Linda Greenwood	Team Leader, National Parks Planning	Parks Victoria
Barry Hayden	local Marine Planner	Parks Victoria
Travis Lee	local Ranger with interest in marine education	Parks Victoria
Nicole Maher	local marine ecologist and educator	
Nisha Powell	Marine Ranger, Warrnambool	Parks Victoria
Kate Stapleton		Parks Victoria
Neville Wright	fisheries management, specialising in recreation & strategy	Dept. of Primary Industries - Fisheries Victoria

Last minute withdrawal from workshop, but attended pre-workshop dinner:

Rowan MacKenzie Environmental Officer Barwon Water

Barwon Bluff MS

Name	Position/Expertise	Organization
Duscha Bradley		PIRVic, Queenscliff; Friends of the Bluff MS
Anthony Boxshall	Manager, Marine National Parks Research Programs	Parks Victoria
Warren Chapman	Reserves Manager	Barwon Coast
Paul Clissold	Producer of "Living on the Edge" CD	
Brooke Connor	Ranger, Queenscliff	Parks Victoria
Andrea Dennett		Friends of the Bluff MS
Jon Duthie		Friends of the Bluff MS; Barwon Heads Foreshore Committee
Alex Giannuzzi	Manager	Marine Discovery Centre, Queenscliff
Lachie Jackson	Ranger, Queenscliff	Parks Victoria
Bob Macafee	President	Barwon Heads Association
Kate McMahon	Marine Planner, City & Bays	Parks Victoria
Steve McPhee	Ranger in Charge, Bellarine	Parks Victoria
Dianne Moore		Coast Action/Coastcare
Mark Rodrigue	Education Officer	Marine Discovery Centre, Queenscliff
Graeme Tribe		Geelong Field Naturalists
Steve Tuohy	Ranger, Queenscliff	Parks Victoria

Port Phillip Heads MNP

Name	Position/Expertise	Title/Group
Reg Abrahams	Cultural Officer	Wathaurong Aboriginal Cooperative
Dale Appleton		Western Coastal Board (on secondment from Parks Victoria)
Bill Cull	commercial fishing	
Louisa Flander	epidemiology	University of Melbourne
Dave Giblet	Ranger	Parks Victoria
Madeline Glynn	Coastal Planner	Coast Action/Coastcare
Linda Greenwood	Team leader, Parks Planning	Parks Victoria
Sonia Lloyd	Marine Planner	Parks Victoria
Sue Longmore	Facilitator	Swan Bay Integrated Catchment Management Project
Judy Muir	tour operator	Polperro Dolphin Swims
Andrew Murray	dive operator	Dive Victoria Pty Ltd
Greg Parry	marine ecology	Marine & Freshwater Resources Institute
Julie Richmond	Project Officer, State of the Parks	Parks Victoria
Mark Rodrigue	Education Officer	Marine Discovery Centre
Ralph Roob	marine and environmental remote sensing	University of Melbourne
Len Salter	dive operator	Queenscliff Dive Centre
Amy Simpson	Fisheries Officer	Dept. of Primary Industries - Fisheries Victoria
Geoff Sparkes	dive operator	Interdive
Angeline Tew	Marine Planner	Parks Victoria
Steve Tuohy	Ranger	Parks Victoria
Kevin York	Planner	Parks Victoria

Point Cooke Marine Sanctuary

Name	Position/Expertise	Organization
Russell Brookes	Ranger, Point Cooke	Parks Victoria
Ewan Cowie		Friends of Skeleton Creek
Mark Cullen	Acting Ranger-in-Charge, Point Cooke	Parks Victoria
Joe Gatt	President	Altona Boating & Angling Club
Linda Greenwood	Team Leader, Parks Planning	Parks Victoria
Moira Lavery	Strategic Planner	Wyndham City Council
Belinda Lyons	Coastal Planner, Port Phillip District	Parks Victoria
Bernie McCarrick	Ranger, Pt Cooke Coastal Park	Parks Victoria
Kate McMahon	Marine Program Planner, City & Bays	Parks Victoria
Cameron Miller	Monitoring Scientist	Parks Victoria
Joe Mumford	Team Leader, Marine Parks & Coastal Program	Parks Victoria
Phil Pegler	Team Leader, Environment Programs	Parks Victoria
John Ross	Secretary	Altona Boating & Angling Club
Eric Savage	Ranger, Pt Cooke Coastal Park	Parks Victoria
William Steele		Melbourne Water

Unable to attend workshop, but attended pre-workshop dinner:

Denise Perryman

Friends of Skeleton Creek

Anne Wilshire

Friends of Skeleton Creek

Jawbone MS

Name	Position/Expertise	Organization
Leon Atkinson	Indigenous Team Leader, City & Bays Region	Parks Victoria
Anthony Boxshall	Manager, Marine National Parks Research	Parks Victoria
Mark Burgman	ecological risk assessment	University of Melbourne
Kath Campbell	Marine, Coastal and Catchment Officer	Parks Victoria
Martin de los Rios	postgraduate student	University of Melbourne
Peter Johnstone	Ranger, Williamstown	Parks Victoria
Clare Johnston	Parks Planning Officer	Hobsons Bay City Council
Richard Leppitt	terrestrial vegetation	Friends of Williamstown Wetland
Sonia Lloyd	Management Planning Officer - Marine	Parks Victoria
John McIlvaney	local resident; fishing, snorkelling	
Mark Morrissy	Acting Ranger-in-Charge, Williamstown	Parks Victoria
Steve Riley	underwater photographer; Reef Watch Victoria volunteer	
Rosemary Robins	social aspects of risk assessment	University of Melbourne
Angeline Tew	Marine Planner, City & Bays Region	Parks Victoria
Garrett Drago	teacher; marine education	Williamstown High School

Ricketts Point MS

Name	Position/Expertise	Organization
Belinda Ainley	Foreshore Co-Ordinator	Kingston City Council
Anthony Boxshall	Manager, Marine National Parks Research Program	Parks Victoria
Anne Casey	Planner	Parks Victoria
Michael Coleman	Environment Officer	Bayside City Council
Edena Critch	Ranger in Charge	Parks Victoria
Alex Edwards		Coast action/Coastcare
Paul Hardie		Beaumaris Yacht Club
Gabrielle Humphris	long-term familiarity with area	
Ian Jones	recreational fishing community	
Sonia Lloyd	Marine Planner	Parks Victoria
Moira Longden		Friends of Watkins Bay
Cameron Miller	Monitoring Scientist	Parks Victoria
Ted Pearce		
Phil Pegler	Team Leader, Environment Programs	Parks Victoria
Jody Plecas		Gould League / EPA
Elisa Raulings		Monash University
Alan Robertson	long-term familiarity with area	
Kris Rowe	Environment Team Leader	Parks Victoria
Rob Saunders	Maritime Manager, City & Bays	Parks Victoria
Angeline Tew	Marine Planner	Parks Victoria
Terry Walshe	ecological risk assessment	University of Western Australia
Amy Weir	Environment Research Officer	Bayside City Council
Bob Whiteway	Convener	Marine Care Ricketts Point

Mushroom Reefs MS

Name	Position/Expertise	Organization
Ian Brett	surfer	
David Bryant	underwater photographer	
Glenys Greenwood	diver	
Neil Hallam	marine biologist	
Mike Harris	aquaculture	
Geoff Hodges	Planner	Parks Victoria
Penelope Johns	waderbird interests	
Ken Lacey		Flinders Yacht Club
Kris Rowe	Environment Team Leader, Rosebud	Parks Victoria
Wolfgang Sasse	chemist/interest in marine ecology	
Adam Shortis	naval activities	West Head Gunnery HMAS Cerberus
Victor Teoh	Ranger in Charge, Rosebud	Parks Victoria
Angeline Tew	Marine Planner, City and Bays Region	Parks Victoria
John Turnball	Harbour Master	Toll Westernport
Linda Greenwood	Team Leader, National Parks Planning	Parks Victoria
Andrew Musgrove	Ranger, Rosebud	Parks Victoria
Anne Van De Meene	Planner	Parks Victoria

Unable to attend workshop, but offered comments prior to dinner the previous evening:

Henry Kursch commercial fishing

Western Port workshop (1)

Name	Position/Expertise	Organization
Ty Caling	Regional Program Planner - Marine	Parks Victoria, Bairnsdale
Denis Cox		Coast Action/Coastcare
Jill Fitzroy-Kelly	birds	Friends of Churchill Island
Kate Glennie		Parks Victoria
Linda Greenwood	Team Leader, Parks Planning	Parks Victoria, Melbourne
Chris Harty		Chris Harty Planning and Environmental Management
Geoff Hodges	Planner	Parks Victoria
Rosalind Jessop		Phillip Island Penguin Parade
Sonia Lloyd		Parks Victoria, Melbourne
Thierry Rolland		Parks Victoria, San Remo
Angeline Tew	Marine Planner	Parks Victoria, Melbourne
Jeff Weir		Dolphin Research Institute

Western Port workshop (2): Yaringa and French Island MNPs

Name	Organization
Richard Appleman	Western Port Fishcare
Ruth Beilin	University of Melbourne
Frank Gray	Yaringa Marina
Jan Carey	University of Melbourne
Neville Clarke	Victorian Recreational Fishing Association
Denis Cox	Coast Action/Coastcare
Dick Cox	Toll Group Westernport

Jill Fitzroy-Kelly		Friends of Churchill Island
Anna Galloway		Esso
Tim Healy		Western Port Seagrass Partnership
Michael Jansen		City of Casey
Rosalind Jessop		Phillip Island Nature Park
Ralph Kenyon		Port of Hastings
Anwyn Martin		
Robert Molloy		Western Port Research Coordination Project (CSIRO)
Raphael Treffny		University of Melbourne
Phil Pegler	Team Leader, Environment Programs	Parks Victoria
Mark Rodrigue	Integrated Coastal Zone Mgt Officer	Parks Victoria
Thierry Rolland	Marine Park Ranger	Parks Victoria
Angeline Tew	Marine Park Planner	Parks Victoria
Sam Hand		Mornington Peninsula Shire
Ian Stevenson		Cardinia Shire
Shane Vedamuttu		Toll Group Westernport
Jeff Weir		Dolphin Research Institute
Gerard Cook		Friends of French Island

Bunurong MNP

Name	Position/Expertise	Organization
Terri Allen	plants; long-term resident	Advisory Group Member
Sandy Brown	Ranger in Charge, Bass Coast	Parks Victoria
Ty Caling	District Planner	Parks Victoria
Linda Greenwood	Team Leader, National Parks & Conservation Policy	Parks Victoria
Gordon Groth	Environment Manager	South Gippsland Water
Sue Hadden	Senior Flora & Fauna Officer	Dept of Sustainability and Environment
Don Hough	Manager, Marine Biodiversity Unit	Dept of Sustainability and Environment
June Laycock	diving, fishing	Advisory Group Member
Barry Lewis	Engineer	Southern Rural Water
Brian Martin	Ranger	Parks Victoria
Gary Martyn	oceanography, local residents & ratepayers association	Advisory Group Member
Greg Mattingley	Marine Planner	Parks Victoria
David Sutton	vegetation; local ratepayers association	Advisory Group Member
Lex Thorbecke	dive business operator	Advisory Group Member
Evelyn Timmers	diving	SEAL Diving Services. Latrobe Valley Scuba Club.
Jim Whitelaw	birds	Advisory Group Member

Unable to attend workshop, but provided his major concern by email:

Stephen Swearer	marine ecology, life history of fish	University of Melbourne. Advisory Group Member
-----------------	--------------------------------------	---

Wilsons Promontory and Corner Inlet MNPs

Name	Position/Expertise	Title/Group
Dick Brumley	Fisheries Manager Officer	Dept. of Primary Industries - Fisheries Victoria
Ty Caling	Marine Planner	Parks Victoria
Tanya Cowell	Regional Coordinator, South Gippsland	Waterwatch
John Davies		Wilsons Promontory Advisory Group
Kylie Debono	Project Officer, River Health	West Gippsland Catchment Management Authority
Mary Ellis		South Gippsland Conservation Society, Foster Branch
Mal Gibson	Operations Manager	West Gippsland Catchment Management Authority
Linda Greenwood	Team Leader - Planning	Parks Victoria
Matt Hoskins	Ranger, Tidal River	Parks Victoria
Stuart Judd	Team Leader - Tidal River	Parks Victoria
Craig Mackenzie	Team Leader - Tidal River	Parks Victoria
Greg Mattingley	District Planner	Parks Victoria
Ross McGowan	Executive Director	Seafood Industry Victoria
Pauline Mullet	Spokesperson	Yeerung Kurnai
Joe Pinzone	President	Corner Inlet Fisheries and Habitat Association Inc.
Bree Roffey	Environmental Officer	South Gippsland Water
Jonathon Stevenson	Ranger, Foster	Parks Victoria
Maria	volunteer	Parks Victoria
Susan Taylor	Flora and Fauna Officer	Dept. of Sustainability & Environment
Anne Van De Meene	Management Planning Officer	Parks Victoria
Ian Wills	Chairperson	Prom Country Regional Tourism Inc.

Ninety Mile Beach MNP

Name	Position/Expertise	Organization
Ty Caling	Marine Planner	Parks Victoria
Angie Gutowski	Coastal Planner	Dept of Sustainability and Environment
Craig Jennion		Parks Victoria
Sarah Shiels	Environmental Advisor	Esso Australia Pty Ltd
Steve Shinnars	Environmental Water Quality Governance Manager	Gippsland Water
Andy Stevens	Marine Projects Officer	Environment Protection Authority
Jonathon Stevenson	Ranger, Foster	Parks Victoria

East Gippsland MNPs and Sanctuary

Name	Position/Expertise	Organization
John Ariens	underwater photography	EG Advisory Group Member
Susan Bartlett	Ranger, Cape Howe & Point Hicks	Parks Victoria
Anthony Boxshall	Manager, Research & Monitoring	Parks Victoria
Ty Caling	Marine Planner	Parks Victoria
Mark Duthie		Esso Australia Pty Ltd
Mike Irvine	Ranger, Beware Reef MS	Parks Victoria
Marcela Lopez	student volunteer	Parks Victoria
Allison Marion	Planner, East Gippsland	Parks Victoria
Brett Millington	Executive Officer	Gippsland Coastal Board
Peter Sands		EG Advisory Group Member
Sarah Shields		Esso Australia Pty Ltd
Andy Stevens	water quality	Environment Protection Authority (Vic), Centre for Environmental Sciences
Erin Webb		Fisheries Victoria

Unable to attend workshop, but provided written comments:

Edward Pinceratto

BHP Billiton Petroleum Pty Ltd

Alan Taylor

Eastern Zone Abalone Industry Association

Appendix II Values and Threats

Discovery Bay Marine National Park

1. Ecological values specific to Discovery Bay MNP

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000) and the Marine Natural Values Study (Plummer et al. 2003).

Value
A Part of largest coastal basalt formation in western Victoria, and among highest wave energy environments in State.
B Rocky habitats of complex forms, including low profile calcarenite-capped basalt platforms, isolated low calcarenite reefs, and heavy sloping basalt walls.
C Calcarenite reefs with thick growths of sessile invertebrates (33 - 55 m).
D Basaltic reefs covered by kelps, including <i>Ecklonia radiata</i> (18 m)
E Subtidal soft sediments of mainly fine sand, with carbonate content about 80%.
F High diversity of intertidal and shallow subtidal invertebrates, including rock lobster and abalone.
G Blue whales and great white sharks are regular visitors to area.

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Bait collection	Biological interaction
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Disturbance and damage by horses	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals as a result of inadequate fencing	Biological interaction
Legal fishing or other collection of organisms in areas surrounding reserve	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft/poaching)	Biological interaction
Acid rain from nearby industries	Contaminants / pollutants
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (i.e. nutrients) via drains and runoff	Contaminants / pollutants
Air-borne pollution from aircraft operation	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants

Contaminants from antifouling (recreational)	Contaminants / pollutants
Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants
Cooling water discharge from shipping	Contaminants / pollutants
Elevated levels of lead etc from accumulated ammunition in sediments	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants
Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants
Grey water discharges from shipping	Contaminants / pollutants
Heavy metals and chemicals from industrial or waste disposal sites leaching into groundwater	Contaminants / pollutants
Industrial discharge (e.g. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers or other deck cargo from shipping	Contaminants / pollutants
Major rain event after extended dry period causing water body with concentrated contaminants to overflow in park	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pesticides and herbicides in runoff from land	Contaminants / pollutants
Pesticides and herbicides in groundwater from nearby market gardens	Contaminants / pollutants
Pollution from inboard or outboard motor operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Rupturing of gas pipelines	Contaminants / pollutants
Sewage discharges resulting from failure of treatment plant	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Re-introduction of species mistakenly believed to be local	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Misc
Change in indigenous practices	Misc
Coastal management practices in areas adjacent to parks	Misc
Delayed access/lack of equipment for emergencies in remote parks	Misc
Edge effects (concentration of usage around park borders)	Misc
Failure of parks to meet community expectations, leading to lack of community support	Misc
Failure to document ecological change	Misc
Fragmentation of ecological processes (e.g. larval supply)	Misc
Fragmentation of habitats	Misc
High profile of protected areas, resulting in reduced management focus on surrounding areas	Misc

Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc
Inertia in decision-making	Misc
Information sufficient to stimulate vandalism but insufficient to deter it	Misc
Infrastructure vandalism	Misc
Insufficient resourcing for enforcement of no-take zones, bag limits etc.	Misc
Lack of co-ordination among multiple management agencies	Misc
Lack of ecological knowledge	Misc
Lack of efficacy of signage	Misc
Lack of environmental etiquette on the part of park visitors	Misc
Lack of flexibility in management to respond to new hazards	Misc
Lack of government recognition of individual preferences	Misc
Lack of political commitment to effectively resource parks	Misc
Misguided action to deal with introduced pests	Misc
Native title claims	Misc
Reduced protection of MNPS or MSs on seaward boundaries	Misc
Single-focus management agencies	Misc
Technology creep (new extraction/exploration methods)	Misc
Noise from aircraft (repeated operation for training/testing)	Noise
Noise from fishing boats	Noise
Noise from recreational vessels, including PWCs	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in coastal systems (e.g. dune stabilisation)	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by aircraft crash	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Increased frequency of extreme storm events (due to global warming?)	Physical change
Injury/death of organisms from active fishing gear legally operated outside reserve	Physical change
Injury/death of organisms from litter (e.g. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light

Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Localised change in turbidity/light from propeller operation	Turbidity / light
Urban discharge (e.g. stormwater)	Turbidity / light

Twelve Apostles MNP, the Arches MS or Merri MS

1. Ecological values specific to the Twelve Apostles MNP, the Arches MS or Merri MS

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the marine notes available on the Parks Victoria web site, and the Marine Natural Values Study (Plummer et al. 2003).

Value	Park/Sanct.
Dramatic underwater arches and canyons with marine life striking in colour and shape	Twelve Apostles
Imposing deep (16 – 55 m) sloping reefs offshore from Moonlight Head *	Twelve Apostles
Substrate complexity, including various geological rock types (limestone, calcarenite, mudstone, sandstone)	Twelve Apostles
Rocky habitats complex in form	Twelve Apostles
Subtidal soft sediments	Twelve Apostles
Highest diversity of intertidal and shallow subtidal invertebrates on limestone in Victoria	Twelve Apostles
Sandstone intertidal rocky platforms around Moonlight Head, characterized by rich intertidal and shallow subtidal invertebrate communities	Twelve Apostles
Shoreline, rockstacks and islands providing breeding colonies for seabirds	Twelve Apostles
Four species of threatened shorebirds and seabirds (Blue Petrel, Hood Plover, Little Egret, Wand Albatross) *	Twelve Apostles
Spectacular limestone arches and canyons in 19 - 25 m of water	Arches
Invertebrates characteristic of deeper Bass Strait waters in 19 - 25 m of water	Arches
Giant kelp forests providing important habitat for suite of marine animals	Arches
Seabed at river mouth providing range of habitats and diverse marine life	Merri
Rocky overhangs and canyons supporting variety of fish	Merri
Penguin colonies (Merri & Middle Is)	Merri
Frequent visitation by dolphin marine mammals *	Merri
Flora and fauna traditionally accessed by local Aboriginal groups	Merri
Nine species of threatened shorebirds *	Merri

* definition edited during workshop

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified at previous Parks Victoria workshops.

Activity	Disturbance category
Collecting of specimens by divers	Biological interaction
Collection of specimens	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (eg. rockpool ramble)	Biological interaction
Introduction of fish bait	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft)	Biological interaction
Acts of terrorism	Contaminants
Agricultural discharge (eg. drains)	Contaminants

Chemical spills from recreational activities	Contaminants
Chemical spills from shipping	Contaminants
Contaminants from antifouling (recreational)	Contaminants
Contaminants from antifouling (shipping)	Contaminants
Contaminants from ballast water discharge	Contaminants
Contaminants from vessel maintenance	Contaminants
Cooling water discharge from shipping	Contaminants
Garbage discharges from recreational vessels	Contaminants
Garbage discharges from shipping	Contaminants
Grey water discharges from recreational vessels	Contaminants
Grey water discharges from shipping	Contaminants
Industrial discharge (eg. dairy)	Contaminants
Loss of containers	Contaminants
Oil spill from shipping	Contaminants
Oily waste from shipping	Contaminants
Pollution from outboard operation	Contaminants
Release of contaminants by dredging/disposal	Contaminants
Release of contaminants from recreational groundings/sinkings	Contaminants
Release of contaminants from ship groundings/sinkings	Contaminants
Rupturing of gas pipelines	Contaminants
Sewage discharges (recreational)	Contaminants
Sewage discharges (shipping)	Contaminants
Shore-based litter	Contaminants
Treated wastewater (sewage)	Contaminants
Urban discharge (eg. stormwater)	Contaminants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Pathogens via shipping ballast water discharge	Introduced pathogens
Inappropriate off-site development (eg. wind farms)	Misc
Inappropriate on-site development (eg. moorings, markers, signage)	Misc
Infrastructure vandalism	Misc
Noise from fishing boats	Noise
Noise from recreational boating	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (eg. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change

Excavation for development	Physical change
Injury/death of organisms from litter (eg. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Change in turbidity from agricultural discharge (eg. drains)	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (eg. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (eg. stormwater)	Turbidity / light
Failure to document ecological change	x
Lack of co-ordination among multiple management agencies	x
Lack of flexibility in management to respond to new hazards	x
Single-focus management agencies	x

Marengo Reefs Marine Sanctuary

1. Ecological values specific to Marengo Reefs MS

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000) and the Marine Natural Values Study (Plummer et al. 2003)

Value
A Intertidal and subtidal rocky reefs with many microhabitats (Little Henty Reef)
B Bull kelps, many other seaweeds, and rich community of invertebrates including sea urchins, soft corals
C Small area of subtidal soft sediment communities

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Bait collection	Biological interaction
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Disturbance and damage by horses	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals as a result of inadequate fencing	Biological interaction
Predation by introduced species (e.g. fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft/poaching)	Biological interaction
Acid rain from nearby industries	Contaminants / pollutants
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (i.e. nutrients) via drains and runoff	Contaminants / pollutants
Air-borne pollution from aircraft operation	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants
Contaminants from antifouling (recreational)	Contaminants / pollutants
Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants
Cooling water discharge from shipping	Contaminants / pollutants
Elevated levels of lead etc from accumulated ammunition in sediments	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants
Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants
Grey water discharges from shipping	Contaminants / pollutants

Heavy metals and chemicals from industrial or waste disposal sites leaching into groundwater	Contaminants / pollutants
Industrial discharge (e.g. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers or other deck cargo from shipping	Contaminants / pollutants
Major rain event after extended dry period causing waterbody with concentrated contaminants to overflow in park	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pesticides and herbicides in groundwater from nearby market gardens	Contaminants / pollutants
Pollution from inboard or outboard motor operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Rupturing of gas pipelines	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Re-introduction of species mistakenly believed to be local	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Misc
Change in indigenous practices	Misc
Coastal management practices in areas adjacent to parks	Misc
Delayed access/lack of equipment for emergencies in remote parks	Misc
Edge effects (concentration of usage around park borders)	Misc
Failure of parks to meet community expectations, leading to lack of community support	Misc
Failure to document ecological change	Misc
Fragmentation of ecological processes (e.g. larval supply)	Misc
Fragmentation of habitats	Misc
High profile of protected areas, resulting in reduced management focus on surrounding areas	Misc
Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc
Inertia in decision-making	Misc
Information sufficient to stimulate vandalism but insufficient to deter it	Misc
Infrastructure vandalism	Misc
Insufficient resourcing for enforcement of no-take zones, bag limits etc.	Misc
Lack of co-ordination among multiple management agencies	Misc
Lack of ecological knowledge	Misc
Lack of efficacy of signage	Misc
Lack of environmental etiquette on the part of park visitors	Misc
Lack of flexibility in management to respond to new hazards	Misc
Lack of government recognition of individual preferences	Misc

Lack of political commitment to effectively resource parks	Misc
Misguided action to deal with introduced pests	Misc
Native title claims	Misc
Reduced protection of MNPS or MSs on seaward boundaries	Misc
Single-focus management agencies	Misc
Technology creep (new extraction/exploration methods)	Misc
Noise from aircraft (repeated operation for training/testing)	Noise
Noise from fishing boats	Noise
Noise from recreational vessels, including PWCs	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in coastal systems (e.g. dune stabilisation)	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Increased frequency of extreme storm events (due to global warming?)	Physical change
Injury/death of organisms from litter (e.g. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (e.g. stormwater)	Turbidity / light

Point Addis MNP, Eagle Rock MS or Point Danger MS

1. Ecological values specific to Point Addis MNP, Eagle Rock MS or Point Danger MS

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the marine notes available on the Parks Victoria web site, and the Marine Natural Values Study (Plummer et al. 2003).

Value	Park or Sanctuary
Sandy beach	Pt Addis
Intertidal rocky reef with rockpools	Pt Addis
Deeper water reef with abundant fish life	Pt Addis
Biota of Ingoldsby Reef, including leafy sea-dragon	Pt Addis
Seagrass beds - Amphibolis	Pt Addis
Subtidal soft sediments, with abundant epibenthos providing shelter for fish	Pt Addis
Pt Addis limestone - State geological significance	Pt Addis
Availability of biota for fishing and food collection by local Aboriginal people	Pt Addis
Presence of Australian Fur Seals and dolphins	Pt Addis
High wave-energy shoreline (suitable for surfing - Bells Beach)	Pt Addis
Varied geology (sandstone & basalt) with platforms, pools, fissures & boulder fields	Eagle Rock
Diversity of invertebrates on rock platforms (intertidal and subtidal)	Eagle Rock
Subtidal kelp forests	Eagle Rock
Opisthobranch fauna - 96 species, 20% of which are undescribed	Pt Danger
High invertebrate diversity on limestone substrate	Pt Danger

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002)

Activity	Disturbance category
Collecting of specimens by divers	Biological interaction
Collection of specimens	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (eg. rockpool ramble)	Biological interaction
Introduction of fish bait	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft)	Biological interaction
Acts of terrorism	Contaminants
Agricultural discharge (eg. drains)	Contaminants
Chemical spills from recreational activities	Contaminants
Chemical spills from shipping	Contaminants
Contaminants from antifouling (recreational)	Contaminants
Contaminants from antifouling (shipping)	Contaminants

Contaminants from ballast water discharge	Contaminants
Contaminants from vessel maintenance	Contaminants
Cooling water discharge from shipping	Contaminants
Garbage discharges from recreational vessels	Contaminants
Garbage discharges from shipping	Contaminants
Grey water discharges from recreational vessels	Contaminants
Grey water discharges from shipping	Contaminants
Industrial discharge (eg. dairy)	Contaminants
Loss of containers	Contaminants
Oil spill from shipping	Contaminants
Oily waste from shipping	Contaminants
Pollution from outboard operation	Contaminants
Release of contaminants by dredging/disposal	Contaminants
Release of contaminants from recreational groundings/sinkings	Contaminants
Release of contaminants from ship groundings/sinkings	Contaminants
Rupturing of gas pipelines	Contaminants
Sewage discharges (recreational)	Contaminants
Sewage discharges (shipping)	Contaminants
Shore-based litter	Contaminants
Treated wastewater (sewage)	Contaminants
Urban discharge (eg. stormwater)	Contaminants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Pathogens via shipping ballast water discharge	Introduced pathogens
Acts of terrorism	Mechanical change
Change to habitat by wrecked shipping	Mechanical change
Damage to habitat by wrecked recreational vessels	Mechanical change
Damage to habitat from anchoring of recreational vessels	Mechanical change
Damage to habitat from anchoring of shipping	Mechanical change
Damage to habitat from anchoring of tourism vessels	Mechanical change
Damage to habitat from European artefact collection (eg. from shipwrecks)	Mechanical change
Damage to habitat from terrestrial vehicles	Mechanical change
Damage/change to habitat from disposal of dredged material	Mechanical change
Damage/change to habitat from dredging	Mechanical change
Excavation for development	Mechanical change
Injury/death of organisms from litter (eg. fishing gear)	Mechanical change
Obliteration of habitat from coastal construction	Mechanical change
Propeller scour/damage from recreational vessels	Mechanical change
Propeller scour/damage from shipping	Mechanical change
Reclamation for development	Mechanical change
Inappropriate off-site development (eg. wind farms)	Misc

Inappropriate on-site development (eg. moorings, markers, signage)	Misc
Infrastructure vandalism	Misc
Noise from fishing boats	Noise
Noise from recreational boating	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Change in turbidity from agricultural discharge (eg. drains)	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (eg. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (eg. stormwater)	Turbidity / light
Failure to document ecological change	x

Barwon Bluff MS

1. Ecological values specific to Barwon Bluff MS

This list was compiled from Marine Coastal & Estuarine Investigation (ECC 2000), PV Marine Notes, and Marine Natural Values Study (Plummer et al. 2003)

Value	
A	Sandstone and basalt reefs with thick patches of giant and bull kelp
B	Shore platforms with diversity of marine life (used extensively for marine education)
C	Spectacular subtidal sandstone arches and gutters
D	Complex geology - basalt from lava flow from Mt Duneed & old sandstone formed under ancient seas
E	Probable foraging area for nearby Hooded Plovers (endangered sp; FFG listed)

2. Generic list of potential threats identified prior to the workshop

This list is modified from one provided by Ty Caling (PV Bairnsdale) which was based on SERMP report "Impacts - identifying disturbances". It includes threats identified at previous workshops in this series.

Activity	Disturbance category
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals via inadequate fencing	Biological interaction
Predation by introduced species (e.g. fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft)	Biological interaction
Acid rain from nearby industries	Contaminants / pollutants
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (e.g. drains)	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants

Contaminants from antifouling (recreational)	Contaminants / pollutants
Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants
Cooling water discharge from shipping	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants
Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants
Grey water discharges from shipping	Contaminants / pollutants
Industrial discharge (e.g.. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pollution from outboard operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g.. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Miscellaneous
Change in indigenous practices	Miscellaneous
Coastal management practices in areas adjacent to parks	Miscellaneous
Delayed access/lack of equipment for emergencies in remote parks	Miscellaneous

Edge effects (concentration of usage around park borders)	Miscellaneous
Failure of parks to meet community expectations, leading to lack of community support	Miscellaneous
Failure to document ecological change	Miscellaneous
Fragmentation of ecological processes (e.g. larval supply)	Miscellaneous
High profile of protected areas, resulting in reduced management focus on surrounding areas	Miscellaneous
Inappropriate off-site development (e.g. wind farms)	Miscellaneous
Inappropriate on-site development (e.g. moorings, markers, signage)	Miscellaneous
Inertia in decision-making	Miscellaneous
Infrastructure vandalism	Miscellaneous
Lack of co-ordination among multiple management agencies	Miscellaneous
Lack of ecological knowledge	Miscellaneous
Lack of efficacy of signage	Miscellaneous
Lack of environmental etiquette on the part of park visitors	Miscellaneous
Lack of flexibility in management to respond to new hazards	Miscellaneous
Lack of government recognition of individual preferences	Miscellaneous
Misguided action to deal with introduced pests	Miscellaneous
Native title claims	Miscellaneous
Reduced protection of MNPS or MSs on seaward boundaries	Miscellaneous
Single-focus management agencies	Miscellaneous
Technology creep (new extraction/exploration methods)	Miscellaneous
Noise from fishing boats	Noise
Noise from recreational boating	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change

Increased frequency of extreme storm events (due to global warming?)	Physical change
Injury/death of organisms from litter (e.g. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (e.g. stormwater)	Turbidity / light

Port Phillip MNP

1. Park specific ecological values

These values were identified prior to the workshop from the draft management plan for the Port Phillip Heads Marine National Park.

Value	Section of park
High invertebrate diversity on intertidal calcarenite reef	Pt Lonsdale
Algal diversity and abundance on Lighthouse Reef	Pt Lonsdale
Undercut structure of Lonsdale Reef (feature seldom found on Vic open coast)	Pt Lonsdale
Diverse fish and invertebrate communities on Lonsdale Wall	Pt Lonsdale
Shorebird feeding habitat of State significance - calcarenite shore and reef platforms	Pt Lonsdale
Presence of threatened marine mammals	Pt Lonsdale
Islets and shoals of Mud Islands - highly unusual feature and of State significance	Mud Islands
Dense seagrass beds supporting invertebrates and juvenile fish	Mud Islands
Shorebird habitat of international significance (RAMSAR & Register of National Estate)	Mud Islands
Salt marsh communities largely protected from human disturbance	Mud Islands
Shorebird habitat of international significance (RAMSAR & Register of National Estate)	Swan Bay
Orange-bellied parrot - key wintering site	Swan Bay
Extensive seagrass beds with diverse community and providing important fish habitat and nursery areas	Swan Bay
Intertidal mudflats and extensive saltmarsh of regional significance and supporting rich fauna	Swan Bay
Distributary delta of regional significance (Yarram Creek)	Swan Bay
Unusual natural shoal formation topped with man-made rock structure and supporting rich benthos	Popes Eye
Artificial structure where Australasian Gannets nest and roost - State significance	Popes Eye
Diverse and abundant fish assemblages (fishing prohibited since mid/late 1970s)	Popes Eye
Unusual geomorphological feature (steep remnant section of Yarra River) with associated fauna	Portsea Hole
Dynamic sedimentation regime with sustained sandy accretion at Observatory Point	Pt Nepean
Unusual shore platform, developed in contrasting wave environments	Pt Nepean
Extensive calcarenite reefs with diverse flora and fauna and long history of protection from boat landings	Pt Nepean
Presence of pods of dolphins along bayside coast	Pt Nepean
Shorebird habitat - reef and sandy beach	Pt Nepean

2. Additional non-ecological values identified after considering pre-workshop list in Parks Victoria draft management plan.

Cultural values – aboriginal values

- reef, intertidal and coastal food resources
- cultural sites – historic and archaeological
- long-term history e.g. ancient course of Yarra River at Portsea Hole

3. Generic list of potential threats identified prior to workshop:

The majority of these threats were identified prior to the workshop. Those that arose during the workshop are denoted by an asterisk.

Activity	Disturbance source	Disturbance category
2-stroke outboard operation	Recreational activities	Contaminants
Agricultural discharge (e.g. drains)	Land based	Contaminants
Agricultural discharge (e.g. drains)	Land based	Turbidity / light
Alter tidal flow	Human changes coastal zone	Turbidity / light
Anchoring	Recreational activities	Mechanical change
Anchoring	Shipping	Mechanical change
Anchoring	Tourism	Mechanical change
Ballast water discharge	Recreational activities	Introduced marine species
Ballast water discharge	Shipping	Contaminants
Ballast water discharge	Shipping	Introduced marine species
Ballast water discharge	Shipping	Introduced pathogens
Boating	Recreational activities	Biological interaction
Boating	Recreational activities	Noise
Boating	Tourism	Noise
Chemical spills	Recreational activities	Contaminants
Chemical spills	Shipping	Contaminants
Coastal construction	Human changes coastal zone	Turbidity / light
Collection of species	Recreational activities	Biological interaction
Cooling water	Shipping	Contaminants
Damage to indigenous cultural artefact, object and/or relic	Harvesting	Mechanical change
Damage to indigenous cultural artefact, object and/or relic	Human changes coastal zone	Mechanical change
Damage to indigenous cultural artefact, object and/or relic	Recreational activities	Mechanical change
Death (e.g. drowning)	x	x
Deliberate harassment of wildlife	Recreational activities	Biological interaction
Discarding of fish	Harvesting	Biological interaction
Disposal of waste	Aquaculture	Introduced marine species
Diving	Harvesting	Biological interaction
Diving	Recreational activities	Biological interaction
Dogs	Recreational activities	Biological interaction
Domestic waste disposal	Land based	Turbidity / light
Dredging	Human changes coastal zone	Chemical change
Dredging	Human changes coastal zone	Turbidity / light
Dredging channels	Shipping	Contaminants
Erosion	Human changes coastal zone	Turbidity / light
European artefact collection (e.g. from shipwrecks)	Harvesting	Mechanical change
European artefact collection (e.g. from shipwrecks)	Human changes coastal zone	Mechanical change
European artefact collection (e.g. from shipwrecks)	Recreational activities	Mechanical change
Exclusion of specific recreational activities	Recreational activities	x
Exclusion of specific recreational activities	Tourism	x
Exclusion of specific recreational activities	x	x
Feeding	Aquaculture	Introduced marine species
Garbage discharges	Recreational activities	Contaminants
Garbage discharges	Shipping	Contaminants
Grey water discharges	Recreational activities	Contaminants

Grey water discharges	Shipping	Contaminants
Groundings / sinking	Recreational activities	Contaminants
Groundings / sinking	Shipping	Contaminants
Harvesting	Harvesting	Noise
Hull fouling (incl. prevention)	Recreational activities	Contaminants
Hull fouling (incl. prevention)	Shipping	Contaminants
Inappropriate off-site development (e.g. wind farms)	Human changes coastal zone	x
Inappropriate on-site development (e.g. moorings, markers, signage)	Human changes coastal zone	x
Industrial discharge (e.g. dairy)	Land based	Contaminants
Industrial discharge (e.g. dairy)	Land based	Turbidity / light
Infrastructure vandalism	Recreational activities	x
Infrastructure vandalism	Tourism	x
Interactions with wildlife (e.g. rockpool ramble)	Tourism	Biological interaction
Introduction of fish bait	Harvesting	Biological interaction
Introduction of fish bait	Harvesting	Introduced marine species
Licensed commercial: Dredging (scallop fishery)	Harvesting	Biological interaction
Licensed commercial: Hand harvest (abalone)	Harvesting	Biological interaction
Licensed commercial: Hand harvest (sea urchin)	Harvesting	Biological interaction
Licensed commercial: Line fishing (pelagic long lines)	Harvesting	Biological interaction
Licensed commercial: Line fishing (small scale)	Harvesting	Biological interaction
Licensed commercial: Line fishing (squid jigging)	Harvesting	Biological interaction
Licensed commercial: Line fishing (trot lines)	Harvesting	Biological interaction
Licensed commercial: Line fishing large scale (demersal drop lines)	Harvesting	Biological interaction
Licensed commercial: Line fishing large scale (demersal long lines)	Harvesting	Biological interaction
Licensed commercial: Mesh netting (large)	Harvesting	Biological interaction
Licensed commercial: Mesh netting (small)	Harvesting	Biological interaction
Licensed commercial: Purse seine	Harvesting	Biological interaction
Licensed commercial: Trapping (Crabs)	Harvesting	Biological interaction
Licensed commercial: Trapping (Fish)	Harvesting	Biological interaction
Licensed commercial: Trapping (Octopus)	Harvesting	Biological interaction
Licensed commercial: Trapping (Rock Lobster)	Harvesting	Biological interaction
Licensed commercial: Trawling (Danish Seine)	Harvesting	Biological interaction
Licensed commercial: Trawling (Otter Board)	Harvesting	Biological interaction
Licensed recreational: Bait collection (incl. shellfish)	Harvesting	Biological interaction
Licensed recreational: Hand harvest (abalone)	Harvesting	Biological interaction
Licensed recreational: Hand harvest (rock lobster)	Harvesting	Biological interaction
Licensed recreational: Line fishing	Harvesting	Biological interaction
Licensed recreational: Net (Dip)	Harvesting	Biological interaction
Licensed recreational: Net (Hauling)	Harvesting	Biological interaction
Licensed recreational: Net (Hoop)	Harvesting	Biological interaction
Licensed recreational: Spearing	Harvesting	Biological interaction
Loss of containers	Shipping	Contaminants
Loss of education opportunities (e.g. pollution, other users)	x	x
Loss of scientific opportunities (e.g. pollution, other users)	x	x
Maintenance	Aquaculture	Introduced marine species
Noise	Recreational activities	Contaminants
Noise	Shipping	Contaminants

Oil spill	Shipping	Contaminants
Oily waste	Shipping	Contaminants
Physical location	Aquaculture	Introduced marine species
Potential shipwrecks	Recreational activities	Mechanical change
Potential shipwrecks	Shipping	Mechanical change
Potential shipwrecks	Tourism	Mechanical change
Propeller action	Recreational activities	Contaminants
Propeller action	Recreational activities	Mechanical change
Propeller action	Shipping	Contaminants
Propeller action	Shipping	Mechanical change
Propeller action	Tourism	Mechanical change
Public injury (e.g. boating accident)	x	x
Removal of Indigenous cultural artefact, object and/or relic	Harvesting	Mechanical change
Removal of Indigenous cultural artefact, object and/or relic	Human changes coastal zone	Mechanical change
Removal of Indigenous cultural artefact, object and/or relic	Recreational activities	Mechanical change
Sewage discharges	Land based	Turbidity / light
Sewage discharges	Recreational activities	Contaminants
Sewage discharges	Shipping	Contaminants
Shipping	Shipping	Noise
Shipping maintenance	Shipping	Contaminants
Shooting	Recreational activities	Biological interaction
Shore-based litter	Land based	Contaminants
Sourcing feed	Aquaculture	Introduced marine species
Sourcing stock	Aquaculture	Introduced marine species
Stock escape	Aquaculture	Introduced marine species
Translocation of pens	Aquaculture	Introduced marine species
Treated wastewater (sewage)	Land based	Contaminants
Unlicensed commercial fishing (theft)	Harvesting	Biological interaction
Urban discharge (e.g. stormwater)	Land based	Contaminants
Urban discharge (e.g. stormwater)	Land based	Turbidity / light
Vehicle usage (e.g. hovercraft, beach buggy, motorbike)	Recreational activities	Biological interaction
Vehicle usage (e.g. hovercraft, beach buggy, motorbike)	Recreational activities	Mechanical change
Vehicle usage (e.g. hovercraft, beach buggy, motorbike)	Tourism	Mechanical change
Vessel and gear fouling	Harvesting	Introduced marine species
Vessel and gear fouling	Recreational activities	Introduced marine species
Vessel and gear fouling	Shipping	Introduced marine species
x	Defence	x
x	Emerging	x
x	Indigenous customary use	x
x	Ocean dumping	x
x	Petroleum	x
x	Submarine cables	x
x	x	Artificial light
x	x	Electromagnetic radiation
x	x	Nuclear radiation
x	x	Temperature change
* Rupturing of gas pipelines	x	Contaminants
* Acts of terrorism	x	Contaminants
* Acts of terrorism	x	Mechanical change

* Failure to document ecological change	x	x
* Excavation for development	x	Mechanical change
* Reclamation for development	x	Mechanical change

Point Cooke MS

1. Ecological values specific to Point Cooke MS

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the marine notes available on the Parks Victoria web site, and the Marine Natural Values Study (Plummer et al. 2003).

	Value
A	Very shallow shore of Port Phillip Bay with narrow beaches of mud and sand
B	Low basalt reef with algae and associated epibenthic fauna
C	Probable contribution to feeding grounds for migratory birds from nearby Ramsar site

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Disturbance and damage by horses	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals as a result of inadequate fencing	Biological interaction
Predation by introduced species (e.g. fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft)	Biological interaction
Acid rain from nearby industries	Contaminants / pollutants
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (e.g. drains)	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants
Contaminants from antifouling (recreational)	Contaminants / pollutants
Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants
Cooling water discharge from shipping	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants
Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants

Grey water discharges from shipping	Contaminants / pollutants
Industrial discharge (e.g.. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers or other deck cargo from shipping	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pollution from inboard or outboard motor operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Rupturing of gas pipelines	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Re-introduction of species mistakenly believed to be local	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Misc
Change in indigenous practices	Misc
Coastal management practices in areas adjacent to parks	Misc
Delayed access/lack of equipment for emergencies in remote parks	Misc
Edge effects (concentration of usage around park borders)	Misc
Failure of parks to meet community expectations, leading to lack of community support	Misc
Failure to document ecological change	Misc
Fragmentation of ecological processes (e.g. larval supply)	Misc
High profile of protected areas, resulting in reduced management focus on surrounding areas	Misc
Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc
Inertia in decision-making	Misc
Information sufficient to stimulate vandalism but insufficient to deter it	Misc
Infrastructure vandalism	Misc
Lack of co-ordination among multiple management agencies	Misc
Lack of ecological knowledge	Misc
Lack of efficacy of signage	Misc
Lack of environmental etiquette on the part of park visitors	Misc
Lack of flexibility in management to respond to new hazards	Misc
Lack of government recognition of individual preferences	Misc

Misguided action to deal with introduced pests	Misc
Native title claims	Misc
Reduced protection of MNPS or MSs on seaward boundaries	Misc
Single-focus management agencies	Misc
Technology creep (new extraction/exploration methods)	Misc
Noise from fishing boats	Noise
Noise from recreational boating	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g.. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Increased frequency of extreme storm events (due to global warming?)	Physical change
Injury/death of organisms from litter (e.g.. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g.. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (e.g. stormwater)	Turbidity / light

Jawbone MS

1. Ecological values specific to the Jawbone MS

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the marine notes available on the Parks Victoria web site, and the Marine Natural Values Study (Plummer et al. 2003).

Value
A Largest occurrence of mangroves in Port Phillip Bay (among massive basalt boulders)
B Diverse algal community and associated fauna - unusually unmodified for Port Phillip Bay
C Subtidal sediments of fine clayey sands which support high species richness
D Basalt platform that serves as a roosting site for migratory waders
E Shorebird feeding area of national significance

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Disturbance and damage by horses	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals as a result of inadequate fencing	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft/poaching)	Biological interaction
Acid rain from nearby industries	Contaminants / pollutants
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (i.e. nutrients) via drains and runoff	Contaminants / pollutants
Air-borne pollution from aircraft operation	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants
Contaminants from antifouling (recreational)	Contaminants / pollutants
Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants

Cooling water discharge from shipping	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants
Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants
Grey water discharges from shipping	Contaminants / pollutants
Heavy metals and chemicals from tip leaching into groundwater	Contaminants / pollutants
Industrial discharge (e.g. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers or other deck cargo from shipping	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pesticides and herbicides in groundwater from nearby market gardens	Contaminants / pollutants
Pollution from inboard or outboard motor operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Rupturing of gas pipelines	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballastwater discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Re-introduction of species mistakenly believed to be local	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Misc
Change in indigenous practices	Misc
Coastal management practices in areas adjacent to parks	Misc
Delayed access/lack of equipment for emergencies in remote parks	Misc
Edge effects (concentration of usage around park borders)	Misc
Failure of parks to meet community expectations, leading to lack of community support	Misc
Failure to document ecological change	Misc
Fragmentation of ecological processes (e.g. larval supply)	Misc
Fragmentation of habitats	Misc
High profile of protected areas, resulting in reduced management focus on surrounding areas	Misc
Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc

Inertia in decision-making	Misc
Information sufficient to stimulate vandalism but insufficient to deter it	Misc
Infrastructure vandalism	Misc
Insufficient resourcing for enforcement of no-take zones, bag limits etc.	Misc
Lack of co-ordination among multiple management agencies	Misc
Lack of ecological knowledge	Misc
Lack of efficacy of signage	Misc
Lack of environmental etiquette on the part of park visitors	Misc
Lack of flexibility in management to respond to new hazards	Misc
Lack of government recognition of individual preferences	Misc
Lack of political commitment to effectively resource parks	Misc
Misguided action to deal with introduced pests	Misc
Native title claims	Misc
Reduced protection of MNPS or MSs on seaward boundaries	Misc
Single-focus management agencies	Misc
Technology creep (new extraction/exploration methods)	Misc
Noise from fishing boats	Noise
Noise from recreational vessels, including PWCs	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in coastal systems (e.g. dune stabilisation)	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Increased frequency of extreme storm events (due to global warming?)	Physical change
Injury/death of organisms from litter (e.g. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light

Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (e.g. stormwater)	Turbidity / light

Ricketts Point MS

1. Ecological values specific to Ricketts Point MS

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the marine notes available on the Parks Victoria web site, and the Marine Natural Values Study (Plummer et al. 2003).

	Value
A	Rocky (sandstone) intertidal and subtidal habitats
B	Sandy beaches
C	Subtidal soft sediments
D	Seagrass meadows
E	Small area of regional significance for roosting and feeding shorebirds
F	Widest shore platform in area. Tertiary Black Rock sandstone (regional/local structural, palaeontological and geomorphological significance)

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals via inadequate fencing	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft)	Biological interaction
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (e.g. drains)	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants
Contaminants from antifouling (recreational)	Contaminants / pollutants
Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants
Cooling water discharge from shipping	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants

Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants
Grey water discharges from shipping	Contaminants / pollutants
Industrial discharge (e.g.. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pollution from outboard operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Rupturing of gas pipelines	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g.. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Misc
Change in indigenous practices	Misc
Delayed access/lack of equipment for emergencies in remote parks	Misc
Edge effects (concentration of usage around park borders)	Misc
Failure of parks to meet community expectations, leading to lack of community support	Misc
Failure to document ecological change	Misc
High profile of protected areas, resulting in reduced management focus on surrounding areas	Misc
Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc
Inertia in decision-making	Misc
Infrastructure vandalism	Misc
Lack of co-ordination among multiple management agencies	Misc
Lack of ecological knowledge	Misc
Lack of flexibility in management to respond to new hazards	Misc
Lack of government recognition of individual preferences	Misc
Native title claims	Misc
Reduced protection of MNPS or MSs on seaward boundaries	Misc
Single-focus management agencies	Misc
Technology creep (new extraction/exploration methods)	Misc

Noise from fishing boats	Noise
Noise from recreational boating	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g.. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Injury/death of organisms from litter (e.g.. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g.. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g.. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (e.g.. stormwater)	Turbidity / light

Mushroom Reefs MS

1. Ecological values specific to Mushroom Reef MS

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the marine notes available on the Parks Victoria web site, and the Marine Natural Values Study (Plummer et al. 2003).

Value
One of most diverse intertidal rocky reef communities in Victoria
Highly complex intertidal basalt substrate providing rich variety of microhabitats
Abalone population
Gastric-brooding seastar (<i>Smilasterias multipara</i>)
Seagrass beds (<i>Amphibolis antarctica</i>)

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002)

Activity	Disturbance category
Collecting of subtidal specimens by divers	Biological interaction
Collection of intertidal specimens	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (eg. rockpool ramble)	Biological interaction
Introduction of fish bait	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft)	Biological interaction
Acts of terrorism resulting in spills from shipping	Contaminants/Pollutants
Agricultural discharge (eg. drains)	Contaminants/Pollutants
Chemical spills from recreational activities	Contaminants/Pollutants
Chemical spills from shipping	Contaminants/Pollutants
Contaminants from antifouling (recreational)	Contaminants/Pollutants
Contaminants from antifouling (shipping)	Contaminants/Pollutants
Contaminants from ballast water discharge	Contaminants/Pollutants
Contaminants from vessel maintenance	Contaminants/Pollutants
Cooling water discharge from shipping	Contaminants/Pollutants
Garbage discharges from recreational vessels	Contaminants/Pollutants
Garbage discharges from shipping	Contaminants/Pollutants
Grey water discharges from recreational vessels	Contaminants/Pollutants
Grey water discharges from shipping	Contaminants/Pollutants
Industrial discharge (eg. dairy)	Contaminants/Pollutants
Loss of containers	Contaminants/Pollutants
Oil spill from shipping	Contaminants/Pollutants
Oily waste from shipping	Contaminants/Pollutants
Pollution from outboard operation	Contaminants/Pollutants
Release of contaminants by dredging/disposal	Contaminants/Pollutants

Release of contaminants from recreational groundings/sinkings	Contaminants/Pollutants
Release of contaminants from ship groundings/sinkings	Contaminants/Pollutants
Rupturing of gas pipelines	Contaminants/Pollutants
Sewage discharges (recreational)	Contaminants/Pollutants
Sewage discharges (shipping)	Contaminants/Pollutants
Shore-based litter	Contaminants/Pollutants
Treated wastewater (sewage)	Contaminants/Pollutants
Urban discharge (eg. stormwater)	Contaminants/Pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Pathogens via shipping ballast water discharge	Introduced pathogens
Inappropriate off-site development (eg. wind farms)	Misc
Inappropriate on-site development (eg. moorings, markers, signage)	Misc
Infrastructure vandalism	Misc
Noise from fishing boats	Noise
Noise from recreational boating	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism resulting in damage to habitat	Physical change
Artificial opening of river mouths	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (eg. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Excavation for development	Physical change
Injury/death of organisms from litter (eg. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Change in turbidity from agricultural discharge (eg. drains)	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (eg. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (eg. stormwater)	Turbidity / light

Alienation of indigenous culture of ecosystem management	x
Edge effects along protection/no protection boundaries	x
Failure to document ecological change	x
Lack of co-ordination among multiple management agencies	x
Lack of flexibility in management to respond to new hazards	x
Single-focus management agencies	x

Yaringa and French Island MNPs: Values and generic threat listing

POTENTIAL THREATS Modified from list provided by Ty Caling (PV Bairnsdale) which was based on SERMP report "Impacts - identifying disturbances". Includes threats identified at previous PV workshops.	VALUES at French Island and Yaringa Marine National Parks					
	Seagrass communities/habitat	Mangrove and saltmarsh communities/habitat	Mudflat habitat	Migratory wader and shorebirds	Deep tidal channels and habitat	Sand spits & ridges of geomorph. sig.
Activity						
Casual fossicking by divers in subtidal						
Casual fossicking in intertidal						
Damage to habitats/organisms by divers						
Deliberate harassment of wildlife						
Discarding of fish						
Disturbance by dogs						
Disturbance to fauna by recreational boating						
Disturbance to fauna by terrestrial vehicles						
Educational/research collection of specimens						
Illegal recreational fishing (theft)						
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)						
Introduction of fish bait						
Intrusion of hard-hoofed animals via inadequate fencing						
Predation by introduced species (e.g fox, cat)						
Presence of farm carcasses						
Shooting						
Unlicensed commercial fishing (theft)						
Acts of terrorism						
Agricultural discharge (e.g. drains)						
Artificial opening of river mouths						
Bacterial contamination from dog excrement						
Chemical spills from recreational activities						
Chemical spills from shipping						
Contaminants from antifouling (recreational)						
Contaminants from antifouling (shipping)						
Contaminants from ballast water discharge						
Contaminants from vessel maintenance						
Cooling water discharge from shipping						
Garbage discharges from recreational vessels						
Garbage discharges from shipping						
Grey water discharges from recreational vessels						
Grey water discharges from shipping						
Industrial discharge (e.g. dairy)						
Legal dumping of munitions or chemicals in marine areas						
Loss of containers						
Natural petroleum seepage from offshore						
Oil spill from shipping						
Oily waste from shipping						
Pollution from outboard operation						

POTENTIAL THREATS	VALUES					
	at French Island and Yaringa Marine National Parks					
Modified from threat list provided by Ty Caling (PV Bairnsdale) which was based on SERMP report "Impacts - identifying disturbances". Includes threats identified at previous PV workshops.	Seagrass communities/habitat	Mangrove and saltmarsh communities/habitat	Mudflat habitat	Migratory wader and shorebirds	Deep tidal channels and habitat	Sand spits & ridges of geomorph. sig.
Activity						
Release of contaminants by dredging/disposal						
Release of contaminants from recreational groundings/sinkings						
Release of contaminants from ship groundings/sinkings						
Rupturing of gas pipelines						
Sewage discharges (recreational)						
Sewage discharges (shipping)						
Shore-based litter						
Treated wastewater (sewage)						
Urban discharge (e.g. stormwater)						
Exotic species via aquaculture stock						
Exotic species via ballast water discharge						
Exotic species via commercial fishing vessels						
Exotic species via feeding in aquaculture operations						
Exotic species via fish bait						
Exotic species via hull fouling of commercial shipping						
Exotic species via recreational vessels						
Exotic species via translocation of aquaculture pens						
Pathogens via aquaculture operations						
Pathogens via discarded fish bait						
Pathogens via shipping ballast water discharge						
Alienation of indigenous cultural values/perspectives in management						
Change in indigenous practices						
Delayed access/lack of equipment for emergencies in remote parks						
Edge effects (concentration of usage around park borders)						
Failure of parks to meet community expectations, leading to lack of community support						
Failure to document ecological change						
High profile of protected areas, resulting in reduced management focus on surrounding areas						
Inappropriate off-site development (e.g. wind farms)						
Inappropriate on-site development (e.g. moorings, markers, signage)						
Inertia in decision-making						
Infrastructure vandalism						
Lack of co-ordination among multiple management agencies						
Lack of ecological knowledge						

POTENTIAL THREATS	VALUES					
	at French Island and Yaringa Marine National Parks					
Modified from list provided by Ty Caling (PV Bairnsdale) which was based on SERMP report "Impacts - identifying disturbances". Includes threats identified at previous PV workshops.	Seagrass communities/habitat	Mangrove and saltmarsh communities/habitat	Mudflat habitat	Migratory wader and shorebirds	Deep tidal channels and habitat	Sand spits & ridges of geomorph. sig.
Activity						
Lack of flexibility in management to respond to new hazards						
Lack of government recognition of individual preferences						
Native title claims						
Reduced protection of MNPS or MSs on seaward boundaries						
Single-focus management agencies						
Technology creep (new extraction/exploration methods)						
Noise from fishing boats						
Noise from recreational boating						
Noise from shipping						
Noise from tour boats						
Acts of terrorism						
Artificial opening of river mouths						
Change in sea level due to global warming						
Change in sea temperature due to global warming						
Change to habitat by wrecked shipping						
Damage to habitat by wrecked recreational vessels						
Damage to habitat from anchoring of recreational vessels						
Damage to habitat from anchoring of shipping						
Damage to habitat from anchoring of tourism vessels						
Damage to habitat from European artefact collection (e.g.. from shipwrecks)						
Damage to habitat from terrestrial vehicles						
Damage/change to habitat from disposal of dredged material						
Damage/change to habitat from dredging						
Damage/change to habitat from major geological events (e.g. earthquakes)						
Excavation for development						
Injury/death of organisms from litter (e.g.. fishing gear)						
Obliteration of habitat from coastal construction						
Propeller scour/damage from recreational vessels						
Propeller scour/damage from shipping						
Reclamation for development						
Stray military/naval projectiles						
Change in turbidity from agricultural discharge (e.g.. drains)						
Change in turbidity from artificial opening of river mouths						
Change in turbidity/light from altered tidal flow						
Change in turbidity/light from coastal construction						

POTENTIAL THREATS	VALUES at French Island and Yaringa Marine National Parks					
Modified from list provided by Ty Caling (PV Bairnsdale) which was based on SERMP report "Impacts - identifying disturbances". Includes threats identified at previous PV workshops.	Seagrass communities/habitat	Mangrove and saltmarsh communities/habitat	Mudflat habitat	Migratory wader and shorebirds	Deep tidal channels and habitat	Sand spits & ridges of geomorph. sig.
Activity						
Change in turbidity/light from disposal of dredged material						
Change in turbidity/light from domestic waste disposal						
Change in turbidity/light from dredging						
Change in turbidity/light from erosion						
Change in turbidity/light from industrial discharge (e.g.. dairy)						
Change in turbidity/light from sewage discharges						
Urban discharge (e.g.. stormwater)						

Note: Values list compiled from Marine Coastal & Estuarine Investigation (ECC 2000) and Marine Natural Values Study (Plummer et al. 2003)

Bunurong MNP

1. Ecological values specific to Bunurong MNP

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the marine notes available on the Parks Victoria web site, and the Marine Natural Values Study (Plummer et al. 2003).

Value	
A	Extensive intertidal rock platforms, and subtidal rocky reefs which extend several kilometres from shore but which are in relatively shallow water.
B	Mixed brown algal marine ecological community (<i>Cystophora/Sargassum</i> dominated), rich in red and brown species
C	Highest diversity of intertidal and shallow subtidal invertebrate fauna recorded in Victoria on sandstone.
D	Beds of seagrass <i>Amphibolis antarctica</i>
E	Threatened marine mammals (seals & whales) - reported sightings.

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Disturbance and damage by horses	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals as a result of inadequate fencing	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft)	Biological interaction
Acid rain from nearby industries	Contaminants / pollutants
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (e.g. drains)	Contaminants / pollutants
Air-borne pollution from aircraft operation	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants
Contaminants from antifouling (recreational)	Contaminants / pollutants
Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants

Cooling water discharge from shipping	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants
Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants
Grey water discharges from shipping	Contaminants / pollutants
Industrial discharge (e.g.. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers or other deck cargo from shipping	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pesticides and herbicides in groundwater from nearby market gardens	Contaminants / pollutants
Pollution from inboard or outboard motor operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Rupturing of gas pipelines	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Re-introduction of species mistakenly believed to be local	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Misc
Change in indigenous practices	Misc
Coastal management practices in areas adjacent to parks	Misc
Delayed access/lack of equipment for emergencies in remote parks	Misc
Edge effects (concentration of usage around park borders)	Misc
Failure of parks to meet community expectations, leading to lack of community support	Misc
Failure to document ecological change	Misc
Fragmentation of ecological processes (e.g. larval supply)	Misc
Fragmentation of habitats	Misc
High profile of protected areas, resulting in reduced management focus on surrounding areas	Misc
Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc
Inertia in decision-making	Misc
Information sufficient to stimulate vandalism but insufficient to deter it	Misc
Infrastructure vandalism	Misc

Lack of co-ordination among multiple management agencies	Misc
Lack of ecological knowledge	Misc
Lack of efficacy of signage	Misc
Lack of environmental etiquette on the part of park visitors	Misc
Lack of flexibility in management to respond to new hazards	Misc
Lack of government recognition of individual preferences	Misc
Misguided action to deal with introduced pests	Misc
Native title claims	Misc
Reduced protection of MNPS or MSs on seaward boundaries	Misc
Single-focus management agencies	Misc
Technology creep (new extraction/exploration methods)	Misc
Noise from fishing boats	Noise
Noise from recreational boating	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Increased frequency of extreme storm events (due to global warming?)	Physical change
Injury/death of organisms from litter (e.g. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (e.g. stormwater)	Turbidity / light

Wilsons Promontory and Corner Inlet MNPs

1. Ecological values specific to Wilsons Promontory and Corner Inlet MNPs.

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the marine notes available on the Parks Victoria web site, and the Marine Natural Values Study (Plummer et al. 2003).

Value	Park
A Unusual granite habitats, including extensive heavy reefs with smooth surfaces, boulders and rubble and low profile reefs	Wilsons Prom
B Smooth-walled granite cliffs plunging abruptly to the sea-floor	Wilsons Prom
C Sandy beaches sloping gradually to depths of 30 to 50 m within 3 km offshore	Wilsons Prom
D Significant seagrass beds in some sheltered bays (e.g. Amphibolis & Halophila in Waterloo Bay, Heterozostera in Oberon Bay)	Wilsons Prom
E Deep heavy reefs with dense cover of epifauna, especially sponges, stalked ascidians and sea whips, and abundant fish life	Wilsons Prom
F Soft sediment areas with diverse biotic assemblages	Wilsons Prom
G Phyllospora-Ecklonia dominated macroalgal community, with fleshy red algae and some other brown species abundant (MEC M6)	Wilsons Prom
H Phyllospora dominated macroalgal community, with Ecklonia & encrusting corallines abundant (MEC M7)	Wilsons Prom
I South to east invertebrate community: very abundant Heliocidaris erythrogramma (urchin), Haliotis rubra (blacklip abalone) & Cenolia trichoptera (feather star) and typically Nectria macrobranchia (seastar) (MEC IN1)	Wilsons Prom
J North west invertebrate community: very abundant Heliocidaris erythrogramma (urchin), Haliotis rubra (black-lip abalone) & Cenolia trichoptera (feather star) and typically Patiriella brevispina and P. vernicina (seastars) (MEC IN1)	Wilsons Prom
K Western fish community with dominant species Casioperca rasor (barber perch), Notolabrus tetricus (blue-throated wrasse), N. fucicola (purple wrasse), Dinolestes lewini (long-finned pike) and Odax cyanomelax (herring cale) (MEC F3)	Wilsons Prom
L Eastern fish community with dominant species Casioperca rasor (barber perch), Notolabrus tetricus (blue-throated wrasse), N. fucicola (purple wrasse) and Dinolestes lewini (long-finned pike) (MEC F4)	Wilsons Prom
M Nationally significant area for recovery of Great White shark populations	Wilsons Prom
N Representative areas of extensive beds of seagrass Posidonia australis	Corner Inlet
O High invertebrate diversity in soft sediments	Corner Inlet
P Intertidal flats that form part of internationally significant feeding areas for migratory waders	Corner Inlet
Q Breeding colonies of Little Penguins	Wilsons Prom
R Breeding colonies of Australian Fur Seals	Wilsons Prom
S Shorebird habitat of State significance on islands within MNP	Wilsons Prom

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction

Disturbance to fauna by terrestrial vehicles	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g.. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft)	Biological interaction
Acts of terrorism	Contaminants
Agricultural discharge (e.g.. drains)	Contaminants
Artificial opening of river mouths	Contaminants
Bacterial contamination from dog excrement	Contaminants
Chemical spills from recreational activities	Contaminants
Chemical spills from shipping	Contaminants
Contaminants from antifouling (recreational)	Contaminants
Contaminants from antifouling (shipping)	Contaminants
Contaminants from ballast water discharge	Contaminants
Contaminants from vessel maintenance	Contaminants
Cooling water discharge from shipping	Contaminants
Garbage discharges from recreational vessels	Contaminants
Garbage discharges from shipping	Contaminants
Grey water discharges from recreational vessels	Contaminants
Grey water discharges from shipping	Contaminants
Industrial discharge (e.g.. dairy)	Contaminants
Loss of containers	Contaminants
Natural petroleum seepage from offshore	Contaminants
Oil spill from shipping	Contaminants
Oily waste from shipping	Contaminants
Pollution from outboard operation	Contaminants
Release of contaminants by dredging/disposal	Contaminants
Release of contaminants from recreational groundings/sinkings	Contaminants
Release of contaminants from ship groundings/sinkings	Contaminants
Rupturing of gas pipelines	Contaminants
Sewage discharges (recreational)	Contaminants
Sewage discharges (shipping)	Contaminants
Shore-based litter	Contaminants
Treated wastewater (sewage)	Contaminants
Urban discharge (e.g.. stormwater)	Contaminants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens

Pathogens via shipping ballast water discharge	Introduced pathogens
Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc
Infrastructure vandalism	Misc
Noise from fishing boats	Noise
Noise from recreational boating	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g.. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Injury/death of organisms from litter (e.g.. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change
Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity from agricultural discharge (e.g.. drains)	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g.. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (e.g.. stormwater)	Turbidity / light
Alienation of indigenous cultural values/perspectives in management	x
Change in indigenous practices	x
Delayed access/lack of equipment for emergencies in remote parks	x
Edge effects (concentration of usage around park borders)	x
Failure to document ecological change	x
Lack of co-ordination among multiple management agencies	x
Lack of flexibility in management to respond to new hazards	x
Lack of ecological knowledge	x
Native title claims	x

Reduced protection of MNPS or MSs on seaward boundaries	x
Single-focus management agencies	x
Technology creep (new extraction/exploration methods)	x

Ninety Mile Beach MNP

1. Ecological values specific to Ninety Mile Beach MNP

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000) and the Marine Natural Values Study (Plummer et al. 2003).

Value	
A	Subtidal soft sediments, consisting of fine to medium sands with some silt, gravelly sand and shell material
B	Patchy, low profile calcarenite reefs dominated by invertebrates
C	Large, endemic southern Australian seastar <i>Coscinasterias muricata</i>
D	Unusual soft coral <i>Pseudogorgia godeffroyi</i> , only found in Victoria between McGaurans and Delray beaches
E	Low relief reefs that may be remnants of dune systems formed when sea levels were lower
F	Fossils in mud between some reefs
G	Likely feeding area for aggregations of young white sharks
H	Known feeding area of snapper

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Bait collection	Biological interaction
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Disturbance and damage by horses	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals as a result of inadequate fencing	Biological interaction
Legal fishing or other collection of organisms in areas surrounding reserve	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction
Unlicensed commercial fishing (theft/poaching)	Biological interaction
Acid rain from nearby industries	Contaminants / pollutants
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (i.e. nutrients) via drains and runoff	Contaminants / pollutants
Air-borne pollution from aircraft operation	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants
Contaminants from antifouling (recreational)	Contaminants / pollutants

Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants
Cooling water discharge from shipping	Contaminants / pollutants
Elevated levels of lead etc from accumulated ammunition in sediments	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants
Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants
Grey water discharges from shipping	Contaminants / pollutants
Heavy metals and chemicals from industrial or waste disposal sites leaching into groundwater	Contaminants / pollutants
Industrial discharge (e.g. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers or other deck cargo from shipping	Contaminants / pollutants
Major rain event after extended dry period causing waterbody with concentrated contaminants to overflow in park	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Nutrients in groundwater from nearby farms	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pesticides and herbicides in runoff from land	Contaminants / pollutants
Pesticides and herbicides in groundwater from nearby market gardens	Contaminants / pollutants
Pollution from inboard or outboard motor operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Rupturing of gas pipelines	Contaminants / pollutants
Sewage discharges resulting from failure of treatment plant	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Re-introduction of species mistakenly believed to be local	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Misc
Change in indigenous practices	Misc
Coastal management practices in areas adjacent to parks	Misc
Delayed access/lack of equipment for emergencies in remote parks	Misc
Edge effects (concentration of usage around park borders)	Misc
Failure of parks to meet community expectations, leading to lack of community support	Misc

Failure to document ecological change	Misc
Fragmentation of ecological processes (e.g. larval supply)	Misc
Fragmentation of habitats	Misc
High profile of protected areas, resulting in reduced management focus on surrounding areas	Misc
Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc
Inertia in decision-making	Misc
Information sufficient to stimulate vandalism but insufficient to deter it	Misc
Infrastructure vandalism	Misc
Insufficient resourcing for enforcement of no-take zones, bag limits etc.	Misc
Lack of co-ordination among multiple management agencies	Misc
Lack of ecological knowledge	Misc
Lack of efficacy of signage	Misc
Lack of environmental etiquette on the part of park visitors	Misc
Lack of flexibility in management to respond to new hazards	Misc
Lack of government recognition of individual preferences	Misc
Lack of political commitment to effectively resource parks	Misc
Misguided action to deal with introduced pests	Misc
Native title claims	Misc
Reduced protection of MNPS or MSs on seaward boundaries	Misc
Single-focus management agencies	Misc
Technology creep (new extraction/exploration methods)	Misc
Noise from aircraft (repeated operation for training/testing)	Noise
Noise from fishing boats	Noise
Noise from recreational vessels, including PWCs	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in coastal systems (e.g. dune stabilisation)	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by aircraft crash	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from erosion of nearby cliff tops	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Increased frequency of extreme storm events (due to global warming?)	Physical change
Injury/death of organisms from active fishing gear legally operated outside reserve	Physical change
Injury/death of organisms from litter (e.g. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change

Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Localised change in turbidity/light from propeller operation	Turbidity / light
Urban discharge (e.g. stormwater)	Turbidity / light

Point Hicks MNP, Cape Howe MNP & Beware Reef MS

1. Ecological values specific to Point Hicks MNP, Cape Howe MNP & Beware Reef MS.

This list was compiled from the Marine Coastal & Estuarine Investigation (ECC 2000), the Marine Natural Values Study (Plummer et al. 2003) and draft Environmental Conservation Objectives (Parks Victoria 2004a, b & c).

	Value	Park/sanctuary
A	Rocky habitats with varied forms, from large boulders rising to six metres, to clusters of smaller rocks and stones	Point Hicks
B	Subtidal soft sediments of variable grainsize, with a low carbonate content	Point Hicks
C	Very high faunal species richness, including intertidal and shallow subtidal invertebrates	Point Hicks
D	Plentiful and beautiful marine flora and fauna, including spectacular subtidal reefs with colourful and diverse sessile invertebrates	Point Hicks
E	Kelps including Ecklonia and Phyllospora, and small algae	Point Hicks
F	Significant pelagic species - which?	Point Hicks
G	Rocky habitats with complex structure, including eroded low -profile sandstone reef and high-profile granite reef	Cape Howe
H	Sandstone reefs to 50 m depth heavily covered with diverse array of sponges, hydroids, ascidians and gorgonians	Cape Howe
I	Subtidal soft sediments of mainly fine and medium grainsize, with a low carbonate content	Cape Howe
J	High diversity of intertidal and shallow subtidal invertebrates	Cape Howe
K	Presence of many warmer-water species at the southern limits of their range	Cape Howe
L	Probable foraging area for threatened sea/shorebirds	Cape Howe
M	Isolated granite reef, arising from sandy substrate and having forests of bull kelp	Beware Reef
N	Diversity of invertebrates, algae and fish	Beware Reef
O	Haul-out area for Australian fur seals	Beware Reef

2. Generic list of potential threats identified prior to the workshop

The list is modified from one provided by T. Caling (Parks Victoria, Bairnsdale) which was based on South-East Regional Marine Plan assessment report "Impacts - identifying disturbances" (NOO 2002). It includes threats identified in previous workshops in this series.

Activity	Disturbance category
Casual fossicking by divers in subtidal	Biological interaction
Casual fossicking in intertidal	Biological interaction
Damage to habitats/organisms by divers	Biological interaction
Deliberate harassment of wildlife	Biological interaction
Discarding of fish	Biological interaction
Disturbance by dogs	Biological interaction
Disturbance to fauna by recreational boating	Biological interaction
Disturbance to fauna by terrestrial vehicles	Biological interaction
Disturbance and damage by horses	Biological interaction
Educational/research collection of specimens	Biological interaction
Illegal recreational fishing (theft)	Biological interaction
Interactions with wildlife (e.g. rockpool ramble, dolphin swims)	Biological interaction
Introduction of fish bait	Biological interaction
Intrusion of hard-hoofed animals as a result of inadequate fencing	Biological interaction
Predation by introduced species (e.g fox, cat)	Biological interaction
Presence of farm carcasses	Biological interaction
Shooting	Biological interaction

Unlicensed commercial fishing (theft)	Biological interaction
Acid rain from nearby industries	Contaminants / pollutants
Acts of terrorism	Contaminants / pollutants
Agricultural discharge (i.e. nutrients) via drains and runoff	Contaminants / pollutants
Air-borne pollution from aircraft operation	Contaminants / pollutants
Artificial opening of river mouths	Contaminants / pollutants
Bacterial contamination from dog excrement	Contaminants / pollutants
Chemical spills from recreational activities	Contaminants / pollutants
Chemical spills from shipping	Contaminants / pollutants
Contaminants from antifouling (recreational)	Contaminants / pollutants
Contaminants from antifouling (shipping)	Contaminants / pollutants
Contaminants from ballast water discharge	Contaminants / pollutants
Contaminants from vessel maintenance	Contaminants / pollutants
Cooling water discharge from shipping	Contaminants / pollutants
Garbage discharges from recreational vessels	Contaminants / pollutants
Garbage discharges from shipping	Contaminants / pollutants
Grey water discharges from recreational vessels	Contaminants / pollutants
Grey water discharges from shipping	Contaminants / pollutants
Heavy metals and chemicals from tip leaching into groundwater	Contaminants / pollutants
Industrial discharge (e.g. dairy)	Contaminants / pollutants
Legal dumping of munitions or chemicals in marine areas	Contaminants / pollutants
Loss of containers or other deck cargo from shipping	Contaminants / pollutants
Natural petroleum seepage from offshore	Contaminants / pollutants
Oil spill from shipping	Contaminants / pollutants
Oily waste from shipping	Contaminants / pollutants
Pesticides and herbicides in groundwater from nearby market gardens	Contaminants / pollutants
Pollution from inboard or outboard motor operation	Contaminants / pollutants
Release of contaminants by dredging/disposal	Contaminants / pollutants
Release of contaminants from recreational groundings/sinkings	Contaminants / pollutants
Release of contaminants from ship groundings/sinkings	Contaminants / pollutants
Rupturing of gas pipelines	Contaminants / pollutants
Sewage discharges (recreational)	Contaminants / pollutants
Sewage discharges (shipping)	Contaminants / pollutants
Shore-based litter	Contaminants / pollutants
Treated wastewater (sewage)	Contaminants / pollutants
Urban discharge (e.g. stormwater)	Contaminants / pollutants
Exotic species via aquaculture stock	Introduced marine species
Exotic species via ballast water discharge	Introduced marine species
Exotic species via commercial fishing vessels	Introduced marine species
Exotic species via feeding in aquaculture operations	Introduced marine species
Exotic species via fish bait	Introduced marine species
Exotic species via hull fouling of commercial shipping	Introduced marine species
Exotic species via recreational vessels	Introduced marine species
Exotic species via translocation of aquaculture pens	Introduced marine species
Re-introduction of species mistakenly believed to be local	Introduced marine species
Pathogens via aquaculture operations	Introduced pathogens
Pathogens via discarded fish bait	Introduced pathogens
Pathogens via shipping ballast water discharge	Introduced pathogens
Alienation of indigenous cultural values/perspectives in management	Misc

Change in indigenous practices	Misc
Coastal management practices in areas adjacent to parks	Misc
Delayed access/lack of equipment for emergencies in remote parks	Misc
Edge effects (concentration of usage around park borders)	Misc
Failure of parks to meet community expectations, leading to lack of community support	Misc
Failure to document ecological change	Misc
Fragmentation of ecological processes (e.g. larval supply)	Misc
Fragmentation of habitats	Misc
High profile of protected areas, resulting in reduced management focus on surrounding areas	Misc
Inappropriate off-site development (e.g. wind farms)	Misc
Inappropriate on-site development (e.g. moorings, markers, signage)	Misc
Inertia in decision-making	Misc
Information sufficient to stimulate vandalism but insufficient to deter it	Misc
Infrastructure vandalism	Misc
Insufficient resourcing for enforcement of no-take zones, bag limits etc.	Misc
Lack of co-ordination among multiple management agencies	Misc
Lack of ecological knowledge	Misc
Lack of efficacy of signage	Misc
Lack of environmental etiquette on the part of park visitors	Misc
Lack of flexibility in management to respond to new hazards	Misc
Lack of government recognition of individual preferences	Misc
Lack of political commitment to effectively resource parks	Misc
Misguided action to deal with introduced pests	Misc
Native title claims	Misc
Reduced protection of MNPS or MSs on seaward boundaries	Misc
Single-focus management agencies	Misc
Technology creep (new extraction/exploration methods)	Misc
Noise from fishing boats	Noise
Noise from recreational vessels, including PWCs	Noise
Noise from shipping	Noise
Noise from tour boats	Noise
Acts of terrorism	Physical change
Artificial opening of river mouths	Physical change
Change in sea level due to global warming	Physical change
Change in sea temperature due to global warming	Physical change
Change to habitat by wrecked shipping	Physical change
Damage to habitat by wrecked recreational vessels	Physical change
Damage to habitat from anchoring of recreational vessels	Physical change
Damage to habitat from anchoring of shipping	Physical change
Damage to habitat from anchoring of tourism vessels	Physical change
Damage to habitat from European artefact collection (e.g. from shipwrecks)	Physical change
Damage to habitat from terrestrial vehicles	Physical change
Damage/change to habitat from disposal of dredged material	Physical change
Damage/change to habitat from dredging	Physical change
Damage/change to habitat from major geological events (e.g. earthquakes)	Physical change
Excavation for development	Physical change
Increased frequency of extreme storm events (due to global warming?)	Physical change
Injury/death of organisms from litter (e.g. fishing gear)	Physical change
Obliteration of habitat from coastal construction	Physical change

Propeller scour/damage from recreational vessels	Physical change
Propeller scour/damage from shipping	Physical change
Reclamation for development	Physical change
Stray military/naval projectiles	Physical change
Change in turbidity from agricultural discharge (e.g. drains)	Turbidity / light
Change in turbidity from artificial opening of river mouths	Turbidity / light
Change in turbidity/light from altered tidal flow	Turbidity / light
Change in turbidity/light from coastal construction	Turbidity / light
Change in turbidity/light from disposal of dredged material	Turbidity / light
Change in turbidity/light from domestic waste disposal	Turbidity / light
Change in turbidity/light from dredging	Turbidity / light
Change in turbidity/light from erosion	Turbidity / light
Change in turbidity/light from industrial discharge (e.g. dairy)	Turbidity / light
Change in turbidity/light from sewage discharges	Turbidity / light
Urban discharge (e.g. stormwater)	Turbidity / light

References:

- ECC. (2000) *Marine Coastal & Estuarine Investigation. Final Report*. Environment Conservation Council, East Melbourne.
- NOO. (2002) *Impacts - identifying disturbances*. The South-east Regional Marine Plan Assessment Reports. National Oceans Office, Hobart.
- Parks Victoria (2004a) *Point Hicks MNP Environmental Conservation Objectives*. Final Draft, 25 June 2004. Parks Victoria, unpublished.
- Parks Victoria (2004b) *Cape Howe MNP Environmental Conservation Objectives*. Final Draft, 25 June 2004. Parks Victoria, unpublished.
- Parks Victoria (2004c) *Beware Reef MS Environmental Conservation Objectives*. Final Draft, 25 June 2004. Parks Victoria, unpublished.
- Plummer, A, Morris, L, Blake, S & Ball, D (2003). *Marine Natural Values Study, Victorian Marine National Parks and Sanctuaries*. Parks Victoria Technical Series No. 1, Parks Victoria, Melbourne.

Appendix III

Definitions of Likelihood and Consequence (after SA/SNZ 1999 and ICE/FIA 1998)

Likelihood

- Highly likely (5): Expected to occur in most circumstances
(For “everyday” events, approx. once per week.
More than 85% chance of occurring within specified time
frame)
- Likely (4): Will probably occur in most circumstances
(For “everyday” events, approx. once per month.
50-85% chance of occurring within specified time frame)
- Moderately likely (3): Might occur at some time
(For “everyday” events, approx. once every 3 to 6 months.
21-49% chance of occurring within specified time frame)
- Unlikely (2): Could occur at some time
(For “everyday” events, approx. once per year.
1-20% chance of occurring within specified time frame)
- Very unlikely (1): Not expected to happen
(For “everyday” events, approx. once every 2 to 5 years.
Less than 1% chance of occurring within specified time frame)

Ecological Consequences

- Catastrophic (5): Major ecological kill, long-term or permanent disruption of
ecological processes, substantial ecological change.
- Major (4): Likelihood of long-term or permanent, major ecological
impact.
- Moderate (3): Temporary ecological impact extending beyond originating
disturbance, some local or short-term ecologically important
consequences.
- Minor (2): Temporary and non serious ecological impact.
- Insignificant (1): No serious ecological impact.

ICE/FIA. (1998) *RAMP: Risk analysis and management for projects*. Institution of
Civil Engineers and the Faculty and Institute of Actuaries. Thomas Telford, London.

SA/SNZ. (1999) *Risk Management*. (AS/NZS 4360:1999) Standards Australia,
Sydney, and Standards New Zealand, Wellington.

Qualitative Risk Analysis Matrix – Level of Risk
(after SA/SNZ 1999 and ICE/FIA 1998)

LIKELIHOOD		CONSEQUENCES				
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Highly likely	(5)	S	S	H	H	H
Likely	(4)	M	S	S	H	H
Moderately likely	(3)	L	M	S	H	H
Unlikely	(2)	L	L	M	S	H
Very unlikely	(1)	L	L	M	S	S

Risk rating

H = high risk; procedures to be established immediately to reduce risk.

M = moderate risk; procedures to be established within a reasonable time frame.

L = low risk; procedures to be established when resources are available.

Appendix IV Raw results of ranking exercise - Round 2

Discovery Bay MNP

Hazard	<u>Group A</u>			<u>Group B</u>		
	Like	Cons	Risk	Like	Cons	Risk
Poaching near Blacks Beach & abalone populations	3 - 4	3 - 4	9 - 16	3	3	9
Lack of clear communication of park purpose & park habitats and communities	2 - 3	1 - 2	2 - 6	3	2	6
Illegal edge fishing & rock lobster populations	3	2	6	4	3	12
Lack of ecological knowledge & habitats, communities and processes	3 - 4	2 - 4	6 - 16	2	3 - 4	6 - 8
Lack of impact monitoring and research & habitats, communities and processes	3 - 4	3	9 - 12	2	3 - 4	6 - 8
Oil spill & intertidal, subtidal, fish, mammals and birds	1	3 - 4	3 - 4	1	4	4
Increased sea temperature & intertidal <i>and subtidal</i> reef communities	1	3 - 4	3 - 4	2	4	8
Sea-sourced litter & fish, birds or seals	3 - 4	1 - 3	3 - 12	3	2	6
Seismic testing & pelagic species, food chains and <i>demersal</i> fish	1 - 3	2 - 3	2 - 9	2	2	4
Exotic species via aquaculture & ecological integrity	1	4	4	1	4	4

Description of the hazards should be read in conjunction with full definitions given in the risk register.

Twelve Apostles MNP, the Arches MS and Merri MS

Hazard	<u>Group A</u>			<u>Group B</u>		
	Like	Cons	Risk	Like	Cons	Risk
Lack of knowledge	4	3	12	5	4	20
"Island-based" management	5	3	15	5	4	20
External management complexity	2	2	4	3	3	9
Seismic testing & larger marine vertebrates	4	4	16	4	3	12
Oil spills & seabirds and intertidal habitats/communities	5	5	25	5	4	20
Marine debris & marine organism	3	3	9	5	2	10
Developments around Merri MS	4	3	12	4	4	16
Edge effects & Merri and the Arches MSs	4	2	8	5	4	20
Runoff & general ecology of Merri MS	5	3 - 4	15 - 20	4	4	16
Pest plants and animals & displacement of local species	3	4	12	4	5	20
Alienation of indigenous values & marine biodiversity	4	2	8	5	2	10
Artificial openings of river mouths	3	2	6	5	3	15
Government influence	5	3	15	5	3	15
Technology creep	4	3	12	4	4	16
Terrestrial events and water quality	4	4	16	5	4	20
Land-based litter & marine environment	3	2	6	5	2	10
Funding for management	4	3	12	5	4	20

Hazard	<u>Group C</u>			<u>Group D</u>		
	Like	Cons	Risk	Like	Cons	Risk
Lack of knowledge	5	4	20	5	4	20
"Island-based" management	4	3 - 4	12 - 16	5	4	20
External management complexity	3	3	9	5	3	15
Seismic testing & larger marine vertebrates	4 - 5	2 - 4	8 - 20	3	3	9
Oil spills & seabirds and intertidal habitats/communities	4	3 - 5	12 - 20	5	5	25
Marine debris & marine organism	4	1 - 3	4 - 12	5	3 - 4	15 - 20
Developments around Merri MS	5	3	15	5	3	15
Edge effects & Merri and the Arches MSs	5	3 - 4	15 - 20	5	4	20
Runoff & general ecology of Merri MS	5	3	15	5	3	15
Pest plants and animals & displacement of local species	5	1 - 5	5 - 25	3	5	15
Alienation of indigenous values & marine biodiversity	4	1 - 3	4 - 13	5	1	5
Artificial openings of river mouths	5	3	15	4	3	12
Government influence	5	1 - 3	5 - 15	5	2 - 3	10 - 15
Technology creep	5	1 - 3	5 - 15	5	3	15
Terrestrial events and water quality	5	1 - 5	5 - 25	5	3	15
Land-based litter & marine environment	5	1 - 3	5 - 15	5	3 - 4	15 - 20
Funding for management	4	3	12	5	4	20

Marengo Reefs MS

Hazard (threat & value)	<u>Group A</u>			<u>Group B</u>		
	Like	Cons	Risk	Like	Cons	Risk
Divers or snorkellers & edible species	4	4	16	4 - 5	4	16 - 20
Failure of sewage treatment plant & algal communities	2	4	8	1	3 - 4	3 - 4
Groups of human visitors on the reef & seals	4	3	12	5	4	20
Recreational divers & flora and fauna	4	2	8	4	2	8
Small size of the sanctuary & habitats and communities	4	3 - 4	12 - 16	3	2	6
Marine pests & ecological processes	3 - 4	4	12 - 16	3	3 - 4	9 - 12
Nutrient increase & community composition	5	4 - 5	20 - 25	3	3	9
Fishing in areas surrounding the sanctuary & fin fish	5	4	20	4	3	12
Aggregated land-based litter & marine mammals, birds and fish	5	3	15	3 - 4	2	6 - 8
Small boats or PWCs & birds, seals, fish, algae and invertebrates	4	2	8	5	3	15
Lack of public awareness & flora and fauna	4	2	8	3 - 4	3	9 - 12
Lack of clear boundary marks & flora and fauna	5	3	15	3	3	9
Increased sediment & algae and filter feeders	5	3 - 4	15 - 20	3	3	9
Sea-based litter & marine mammals, birds or fish	4	3	12	3	2	6
Coastal infrastructure & benthos, filter feeders or algae	5	4 - 5	20 - 25	3	3	9
Lack of ecological knowledge & species and communities	4	4	16	2	2	4

Hazard (threat & value)	<u>Group C</u>			<u>Group D</u>		
	Like	Cons	Risk	Like	Cons	Risk
Divers or snorkellers & edible species	5	5	25	4	3	12
Failure of sewage treatment plant & algal communities	2	4	8	1	1	1
Groups of human visitors on the reef & seals	5	3 - 5	15 - 25	5	2	10
Recreational divers & flora and fauna	3	2	6	3	2	6
Small size of the sanctuary & habitats and communities	4	4	16	5	4	20
Marine pests & ecological processes	3	4 - 5	12 - 15	2	5	10
Nutrient increase & community composition	4	4	16	3	4	12
Fishing in areas surrounding the sanctuary & fin fish	5	4	20	5	3	15
Aggregated land-based litter & marine mammals, birds and fish	5	2 - 3	10 - 15	3	2	6
Small boats or PWCs & birds, seals, fish, algae and invertebrates	5	3	15	5	2	10
Lack of public awareness & flora and fauna	4	4	16	4	2	8
Lack of clear boundary marks & flora and fauna	4	4	16	5	4	20
Increased sediment & algae and filter feeders	4	4	16	3	3	9
Sea-based litter & marine mammals, birds or fish	2	2	4	4	3	12
Coastal infrastructure & benthos, filter feeders or algae	4	4	16	3	4	12
Lack of ecological knowledge & species and communities	3	4	12	5	4	20

Description of the hazards should be read in conjunction with full definitions given in the risk register.

Point Addis MNP, Eagle Rock MS and Point Danger MS

Hazard	Group A			Group B		
	Like	Cons	Risk	Like	Cons	Risk
New and emerging marine pests	4 - 5	1 - 5	4 - 25	3	1 - 4	3 - 12
Moderate oil pollution from maritime source	4 - 5	3	12 - 15	5	3	15
Trampling and disturbance to intertidal platforms	5	2 - 4	10 - 20	5	3	15
Nutrients and heavy metals from sewage	4	3 - 4	12 - 16	4	4	16
Lack of ecological knowledge	4	3 - 5	12 - 20	5	1 - 5	5 - 25
Shipwreck (large enough for AMSA response)	2 - 3	5	10 - 15	2	4	8
Increased cost of management	4	3 - 4	12 - 16	3	1 - 3	3 - 9
Increased small boating activity	5	2	10	5	2 - 3	10 - 15
Man-made discharges of freshwater	4	1 - 4	4 - 16	3 - 4	3	9 - 12
Dogs, horses and vehicles	3	2	6	4	2	8
Plastic and other litter from sea or land	5	3	15	5	3	15
Organised poaching of abalone	4 - 5	3	12 - 15	5	3 - 4	15 - 20

Hazard	Group C			Group D		
	Like	Cons	Risk	Like	Cons	Risk
New and emerging marine pests	4	4 - 5	16 - 20	4	4	16
Moderate oil pollution from maritime source	5	3	15	3 - 4	2 - 3	6 - 12
Trampling and disturbance to intertidal platforms	5	4	20	4	2 - 3	8 - 12
Nutrients and heavy metals from sewage	5	4	20	3	3	9
Lack of ecological knowledge	5	2 - 4	10 - 20	5	4	20
Shipwreck (large enough for AMSA response)	1	4	4	2	3 - 5	6 - 10
Increased cost of management	4 - 5	2	8 - 10	2 - 3	2 - 3	4 - 9
Increased small boating activity	4 - 5	4	16 - 20	2	1 - 2	2 - 4
Man-made discharges of freshwater	4	4	16	3	2 - 3	6 - 9
Dogs, horses and vehicles	5	3	15	2	4	8
Plastic and other litter from sea or land	5	3	15	2	3 - 4	6 - 8
Organised poaching of abalone	5	4	20	3	4	12

Barwon Bluff MS

Hazard	Group A			Group B		
	Like	Cons	Risk	Like	Cons	Risk
Trampling & abundance and diversity of organisms	5	3	15	4	3	12
Nutrients from the Barwon River & ecological processes	3	4	12	3	3	9
Increasing human population & <i>ecological</i> condition	5	3	15	3	3	9
Organised education groups & decreased biodiversity	3 - 4	4	12 - 16	3	3	9
Lack of accurate baseline data & threat to biodiversity	3 - 4	3 - 4	9 - 16	3	3	9
Pollution from commercial shipping & plant and animal communities	2	3	6	2 - 3	3	6 - 9
Introduced species	2	5	10	2	4	8
Insufficient information stimulating vandalism	2	2	4	4	2	8
Lack of resourcing & changes in species composition	4	4	16	4	3	12
Lack of environmental etiquette & intertidal damage	3	3	9	4	2	8
Poaching/vandalism & reduced abundances	5	3	15	4	3	12
Lack of appreciation of natural values	5	3	15	4	2	8
Litter, oils etc from stormwater	3	3	9	4	2	8
Coastal infrastructure & sand movement	2	4	8	1	2	2
Failure to document ecological change	3 - 4	2 - 4	6 - 16	3	2	6
Water-based recreational activities & disturbance to wildlife	5	2 - 4	10 - 20	4	2	8
Catchment infrastructure & sand movement	2	3	6	2	2	4
Freshwater from stormwater	1	2	2	2	2	4

Hazard	Group C			Group D		
	Like	Cons	Risk	Like	Cons	Risk
Trampling & abundance and diversity of organisms	5	3 - 4	15 - 20	5	3	15
Nutrients from the Barwon River & ecological processes	3 - 4	3 - 4	9 - 16	2	3	6
Increasing human population & <i>ecological</i> condition	4	4	16	5	4	20
Organised education groups & decreased biodiversity	4	3	12	4	3	12
Lack of accurate baseline data & threat to biodiversity	3 - 4	4	12 - 16	4	4	16
Pollution from commercial shipping & plant and animal communities	3	3 - 5	9 - 15	2	2	4
Introduced species	4	3 - 4	12 - 16	3	5	15
Insufficient information stimulating vandalism	3	3	9	3	2	6
Lack of resourcing & changes in species composition	4	4 - 5	16 - 20	5	4	20
Lack of environmental etiquette & intertidal damage	3	3	9	4	3	12
Poaching/vandalism & reduced abundances	5	3 - 5	15 - 25	3	3	9
Lack of appreciation of natural values	3	3	9	3	2	6
Litter, oils etc from stormwater	3	3	9	2	3	6
Coastal infrastructure & sand movement.	2	3	6	1	2 - 3	2 - 3
Failure to document ecological change	3	4	12	4	4	16
Water-based recreational activities & disturbance to wildlife	5	3	15	5	2	10
Catchment infrastructure & sand movement.	3	3	9	1	3 - 4	3 - 4
Freshwater from stormwater	1	2	2	2	3	6

Port Phillip Heads MNP

Hazard	Group A			Group B			Group C		
	Like	Cons	Risk	Like	Cons	Risk	Like	Cons	Risk
Sand movement & benthic biota	5	2 - 3	10 - 15	4	4	16	-	-	18
Nutrient loads & algal blooms	2	4	8	2	4	8	-	-	12
Failure to document ecological change	4	3	12	2	3	6	-	-	19
Oil spill from ship grounding	2	3 - 5	6 - 10	1	5	5	-	-	8
Sediments & park visitation	5	2	10	4	4	16	-	-	19
Lack of community awareness	2	4	8	3	3	9	-	-	13
Exotic species & ecological change	4	4	16	5	5	25	-	-	18
Sediments & seagrass/fauna	5	2 - 3	10 - 15	4	4	16	-	-	13
Development & loss of wetlands	4	3	12	3	3	9	-	-	12
Spoil dumping & wetland birds	3	3	9	5	2 - 3	10 - 15	-	-	19
Loss of fish resources & illegal fishing	2	1	2	2	4	8	-	-	10
Planning decisions & ecological values	3	4	12	4	4	16	-	-	17

Hazard	Group D			Group E			Group F		
	Like	Cons	Risk	Like	Cons	Risk	Like	Cons	Risk
Sand movement & benthic biota	4	3	12	4	2	8	4	3	12
Nutrient loads & algal blooms	4	3	12	2	3	6	1	4	4
Failure to document ecological change	2	5	10	3	4	12	3	3	9
Oil spill from ship grounding	3	4	12	1 - 2	4	4 - 8	1	5	5
Sediments & park visitation	4	3	12	5	4	20	4	5	20
Lack of community awareness	4	3	12	3	2 - 3	6 - 9	2	4	8
Exotic species & ecological change	5	4	20	2 - 3	4	8 - 12	3	4	12
Sediments & seagrass/fauna	4	3	12	4	3 - 4	12 - 16	2	2	4
Development & loss of wetlands	2	3	6	2	4	8	4	3	12
Spoil dumping & wetland birds	3	2	6	3	3 - 4	9 - 12	2	2	4
Loss of fish resources & illegal fishing	2	1	2	2	2	4	3	2	6
Planning decisions & ecological values	2	2	4	3	3	9	3	4	12

Point Cooke MS

Hazard	Group <u>A</u>			Group <u>B</u>		
	Like	Cons	Risk	Like	Cons	Risk
Walkers disturbing birds	5	2	10	5	4	20
Dogs & declining bird populations	3	3	9	4	4	16
Feral carnivores & declining bird populations	4	2	8	5	3	15
Nutrient loads & macroalgal species composition.	3	3	9	5	4	20
Poaching of abalone	5	4	20	5	4	20
General collecting & reduced populations of target species.	3	2	6	5	1	5
Invasive species competing with <i>local</i> biota.	5	3 - 4	15 - 20	5	5	25
Trampling & damage to intertidal shellfish and seagrass	5	3	15	4	2	8
Rising sea level & shorebird habitat and rocky reef	1	4	4	5	1 - 4	5 - 20
Seaward signs and boundary markers & illegal fishing	5	3 - 4	15 - 20	3	3	9
Failure to document ecological change	3	4	12	3	4	12
Spill from commercial shipping	1	5	5	3	3	9
Channel deepening & plants, fish and filter feeding organisms.	4	3	12	4	2 - 3	8 - 12
Industrial spills or seepage into Skeleton Creek	3	2	6	5	3	15
Pesticides and herbicides & algae and invertebrates	2	3	6	2	4	8

Hazard	Group <u>C</u>			Group <u>D</u>		
	Like	Cons	Risk	Like	Cons	Risk
Walkers disturbing birds	5	3	15	5	4	20
Dogs & declining bird populations	4	2	8	2	2	4
Feral carnivores & declining bird populations	4	2	8	4	3	12
Nutrient loads & macroalgal species composition.	3	3	9	4	3	12
Poaching of abalone	5	3	15	5	3	15
General collecting & reduced populations of target species.	3	2	6	5	3	15
Invasive species competing with <i>local</i> biota.	5	4	20	5	4	20
Trampling & damage to intertidal shellfish and seagrass	5	2	10	3	2	6
Rising sea level & shorebird habitat and rocky reef	2	4	8	5	4	20
Seaward signs and boundary markers & illegal fishing	2	1 - 2	2 - 4	3	3	9
Failure to document ecological change	4	1 - 5	4 - 20	3	4	12
Spill from commercial shipping	2	4	8	2	4	8
Channel deepening & plants, fish and filter feeding organisms.	3 - 4	3 - 4	9 - 16	2	3	6
Industrial spills or seepage into Skeleton Creek	2	3	6	3	4	12
Pesticides and herbicides & algae and invertebrates	3	4	12	2	3	6

Jawbone MS

Hazard (threat & value) *	<u>Group A</u>			<u>Group B</u>			<u>Group C</u>		
	Like	Cons	Risk	Like	Cons	Risk	Like	Cons	Risk
Trampling & mangroves	3	3	9	4	3	12	4	3	12
Continuous pollution from Kororoit Creek & biodiversity	5	1 - 3	5 - 15	4	2	8	5	2	10
Dogs off-lead & migratory wading birds	5	3	15	5	3	15	5	3	15
Stormwater from drain near school & biodiversity	5	3	15	3	3	9	4	3	12
Commercial-scale poaching & abalone & mussels	5	4	20	2	5	10	4	3 - 4	12 - 16
Domestic cats & shorebird populations	4	3	12	3	3	9	4	3	12
Marine pests new to MS & ecological processes.	2	4	8	3	5	15	3	3	9
Contaminants in lake overflow & biodiversity	1	3	3	1	2	2	3	2 - 3	6 - 9
Channel Deepening project & algae and seagrass	3 - 4	3 - 4	9 - 16	2	4	8	4	3	12
Public access via informal tracks & intertidal zone	5	4	20	5	3	15	4	3	12
Lack of knowledge & biodiversity	5	1 - 4	5 - 20	3	3	9	5	1 - 4	5 - 20
Small size of sanctuary & populations within MS	4	4	16	4	4	16	3	2 - 3	6 - 9
Spills from Kororoit Creek & biodiversity	1	3 - 5	3 - 5	1	4	4	2 - 3	4 - 5	8 - 15

* Description of the hazards should be read in conjunction with full definitions given in the risk register.

Ricketts Point MS

Hazard	Group A			Group B			Group C		
	Like	Cons	Risk	Like	Cons	Risk	Like	Cons	Risk
<u>Trampling & intertidal organisms</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>5</u>	<u>4</u>	<u>20</u>
<u>Visitor groups & intertidal assemblages</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>4</u>	<u>4</u>	<u>16</u>
<u>Marine pests</u>	<u>5</u>	<u>3 - 5</u>	<u>15 - 25</u>	<u>3</u>	<u>5</u>	<u>15</u>	<u>5</u>	<u>5</u>	<u>25</u>
<u>Dogs & shorebirds and seabirds</u>	<u>3</u>	<u>2 - 3</u>	<u>6 - 9</u>	<u>3</u>	<u>2 - 3</u>	<u>6 - 9</u>	<u>3</u>	<u>3</u>	<u>9</u>
<u>Nutrients from stormwater & intertidal algae</u>	<u>3</u>	<u>4</u>	<u>12</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>3</u>	<u>3</u>	<u>9</u>
<u>Turbidity and toxicants from Channel Deepening</u>	<u>3</u>	<u>4</u>	<u>12</u>	<u>2</u>	<u>2 - 4</u>	<u>4 - 12</u>	<u>2 - 3</u>	<u>4</u>	<u>8 - 12</u>
<u>Bureaucratic inertia and lack of co-ordination</u>	<u>4</u>	<u>2 - 4</u>	<u>8 - 16</u>	<u>4</u>	<u>4</u>	<u>16</u>	<u>2</u>	<u>2</u>	<u>4</u>
<u>Failure to document ecological change</u>	<u>2</u>	<u>3</u>	<u>6</u>	<u>4</u>	<u>4</u>	<u>16</u>	<u>2</u>	<u>4</u>	<u>8</u>
<u>Lack of environmental etiquette & intertidal</u>	<u>4</u>	<u>3</u>	<u>12</u>	<u>4</u>	<u>4</u>	<u>16</u>	<u>5</u>	<u>4</u>	<u>20</u>
<u>Lack of accessible ecological knowledge</u>	<u>3</u>	<u>2 - 4</u>	<u>6 - 12</u>	<u>4 - 5</u>	<u>3 - 4</u>	<u>12 - 20</u>	<u>5</u>	<u>3 - 4</u>	<u>15 - 20</u>
<u>Water-based recreational activities & habitats</u>	<u>3</u>	<u>2 - 3</u>	<u>6 - 9</u>	<u>3</u>	<u>1</u>	<u>3</u>	<u>4</u>	<u>3</u>	<u>12</u>
<u>Adjacent coastal management practices</u>	<u>4</u>	<u>3 - 4</u>	<u>12 - 16</u>	<u>5</u>	<u>3</u>	<u>15</u>	<u>2</u>	<u>4</u>	<u>8</u>
<u>Lack of consistent resourcing for management</u>	<u>3</u>	<u>3 - 4</u>	<u>9 - 12</u>	<u>4</u>	<u>4</u>	<u>16</u>	<u>1</u>	<u>3</u>	<u>3</u>
<u>Loss of local community support</u>	<u>3</u>	<u>3</u>	<u>9</u>	<u>2</u>	<u>2 - 3</u>	<u>4 - 6</u>	<u>3</u>	<u>3</u>	<u>9</u>

Hazard	Group D			Group E		
	Like	Cons	Risk	Like	Cons	Risk
Trampling & intertidal organisms	5	3 - 4	15 - 20	5	3 - 4	15 - 20
Visitor groups & intertidal assemblages	5	3 - 4	15 - 20	5	3 - 4	15 - 20
Marine pests	3 - 4	4	12 - 16	5	4	20
Dogs & shorebirds and seabirds	5	3 - 4	15 - 20	5	2 - 3	10 - 15
Nutrients from stormwater & intertidal algae	3	3	9	3	2	6
Turbidity and toxicants from Channel Deepening	2 - 3	3 - 4	6 - 12	3 - 4	4 - 5	12 - 20
Bureaucratic inertia and lack of co-ordination	4	2	8	2	2	4
Failure to document ecological change	2 - 3	2 - 4	4 - 12	3	3	9
Lack of environmental etiquette & intertidal	4	3	12	4	2	8
Lack of accessible ecological knowledge	2 - 3	2 - 4	4 - 12	5	3	15
Water-based recreational activities & habitats	3	2	6	4	2	8
Adjacent coastal management practices	3	3	9	3	3	9
Lack of consistent resourcing for management	3 - 4	3	9 - 12	3	3	9
Loss of local community support	2 - 3	2 - 3	4 - 9	2	2	4

Mushroom Reefs MS

Hazard	Group A			Group B		
	Like	Cons	Risk	Like	Cons	Risk
Failure to document ecological change & habitats and communities	4	4	16	3	3	9
Reduced protection on three boundaries & fish species	5	2	10	1	1	1
Shellfish poaching & abalone, sea urchins and crabs	5	4	20	5	3	15
Resident pest species & local <i>marine</i> species	2	4	8	1	4	4
Turbid plume from dredging & seagrass	1	2 - 3	2 - 3	1	3	3
Turbidity from Double Creek & seagrass	5	1	5	5	2	10
Land-based litter & marine organisms	2	1	2	3	2	6
Lack of management coordination & marine habitats and communities	5	2	10	2	2	4
Freshwater from Boags Rocks & algal species composition	1	4	4	4	5	20
New exotic <i>marine</i> species & marine communities	2	4	8	3	5	15
Trampling & intertidal reef communities	5	4	20	5	4	20
Illegal recreational fishing & marine flora and fauna	5	2	10	5	1	5
Fossicking & intertidal reef communities	5	3	15	5	4	20
Disturbance & wading birds	5	3	15	5	2	10
Educational collecting & subtidal and intertidal communities	5	3	15	5	4	20
Nutrients from sewage or fertilizers & marine communities	5	2	10	5	3	15

Hazard	Group C			Group D		
	Like	Cons	Risk	Like	Cons	Risk
Failure to document ecological change & habitats and communities	2	3	6	4	4	16
Reduced protection on three boundaries & fish species	4	2	8	2	2	4
Shellfish poaching & abalone, sea urchins and crabs	4	4	16	5	4	20
Resident pest species & local <i>marine</i> species	3	3	9	3	3	9
Turbid plume from dredging & seagrass	3	3 - 4	9 - 12	2	3	6
Turbidity from Double Creek & seagrass	3	3	9	4	2	8
Land-based litter & marine organisms	3	2	6	4	2	8
Lack of management coordination & marine habitats and communities	4	2	8	3	3	9
Freshwater from Boags Rocks & algal species composition	4	4	16	5	5	25
New exotic <i>marine</i> species & marine communities	4	4	16	4	4 - 5	16 - 20
Trampling & intertidal reef communities	5	4	20	5	3	15
Illegal recreational fishing & marine flora and fauna	3	2	6	4	2	8
Fossicking & intertidal reef communities	5	4	20	5	3	15
Disturbance & wading birds	5	4	20	4	2	8
Educational collecting & subtidal and intertidal communities	4	3	12	3	2	6
Nutrients from sewage or fertilizers & marine communities	3	4	12	4	2 - 3	8 - 12

Yaringa and French Island MNPs

Abbreviated Hazard description	Group 1 Likelihood		Group 1 Consequence		Group 1 Risk Score		Group 2 Likelihood		Group 2 Consequence		Group 2 Risk Score		Group 3 Likelihood		Group 3 Consequence		Group 3 Risk Score	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Coastal erosion smothering seagrass	4	4	4	4	16	16	3	3	4	4	12	12	4	4	5	5	20	20
Lack of resources for compliance	5	5	4	4	20	20	5	5	3	3	15	15	5	5	3	3	15	15
Sedimentation from development & seagrass	4	4	3	3	12	12	4	4	3	3	12	12	4	4	5	5	20	20
Integration of management effort	4	4	3	4	12	16	3	4	3	3	12	12	4	4	4	4	16	16
Pressure from urban activities growth	5	5	3	3	15	15	5	5	4	4	20	20	4	4	3	4	12	16
Ecosystem understanding & poor decision making	5	5	4	4	20	20	5	5	4	4	20	20	3	4	3	3	9	12
Farm nutrients/contaminants	5	5	3	4	15	20	4	4	4	4	16	16	4	4	2	4	8	16
Perception of values & coordinated management	5	5	3	4	15	20	4	4	4	4	16	16	2	2	4	4	8	8
Uptake of land management practices	3	4	2	5	6	20	4	4	4	4	16	16	2	2	4	4	8	8
Fast and noisy vessels & shore-birds	4	5	3	4	12	20	3	3	3	3	9	9	2	2	3	4	6	8
Recreational growth & impacts eg litter, pollution	5	5	1	4	5	20	4	4	3	3	12	12	4	4	2	4	8	16
Exotic species & native species composition	3	4	2	4	6	16	5	5	4	4	20	20	4	4	1	5	4	20
Changing hydrological processes & marine biota	3	3	3	4	9	12	4	4	3	3	12	12	3	3	2	4	6	12
Managing park at system scale	2	4	2	4	4	16	4	4	2	2	8	8	2	3	3	3	6	9
Mangrove clearing & erosion, biodiversity loss	1	1	2	4	2	4	2	2	2	2	4	4	1	1	3	4	3	4
Oil spills from Hastings Port	1	1	4	5	4	5	1	1	5	5	5	5	1	1	5	5	5	5

Abbreviated Hazard description	Group 4 Likelihood		Group 4 Consequence		Group 4 Risk Score		Group 5 Likelihood		Group 5 Consequence		Group 5 Risk Score	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
Coastal erosion smothering seagrass	5	5	4	4	20	20	5	5	5	5	25	25
Lack of resources for compliance	5	5	4	4	20	20	5	5	4	4	20	20
Sedimentation from development & seagrass	5	5	4	4	20	20	5	5	4	4	20	20
Integration of management effort	5	5	4	4	20	20	5	5	4	4	20	20
Pressure from urban activities growth	5	5	4	4	20	20	5	5	3	3	15	15
Ecosystem understanding & poor decision making	3	3	5	5	15	15	3	3	3	4	9	12
Farm nutrients/contaminants	4	4	4	4	16	16	5	5	4	4	20	20
Perception of values & coordinated management	5	5	4	4	20	20	3	3	3	3	9	9
Uptake of land management practices	5	5	4	4	20	20	4	4	4	4	16	16
Fast and noisy vessels & shore-birds	5	5	4	4	20	20	5	5	3	3	15	15
Recreational growth & impacts eg litter, pollution	5	5	4	4	20	20	5	5	3	3	15	15
Exotic species & native species composition	5	5	4	4	20	20	2	2	5	5	10	10
Changing hydrological processes & marine biota	4	4	3	3	12	12	4	4	3	4	12	16
Managing park at system scale	4	4	3	3	12	12	3	4	2	4	6	16
Mangrove clearing & erosion, biodiversity loss	3	3	3	3	9	9	2	2	2	2	4	4
Oil spills from Hastings Port	1	1	5	5	5	5	1	1	5	5	5	5

Bunurong MNP

Hazard	Group A			Group B		
	Like	Cons	Risk	Like	Cons	Risk
Residential development & water quality	4	2	8	3	1	3
Residential development & food chain disruption	4	3	12	4	2	8
Lack of political commitment & park management	5	4	20	5	2	10
Lack of effective, broadly-based education	2 - 4	3	6 - 12	3	2	6
Nutrients from agricultural runoff & subtidal reef communities.	3	3	9	2	3	6
Exotic species & native species.	5	5	25	4	4	16
Dogs off-lead & hooded plovers	4	4	16	4	3	12
Poaching of abalone, rock lobster or aquarium species	4	4	16	2	3	6
Strip development & intertidal trampling	4	3	12	4	2	8
Strip development & water quality	4	2	8	3	2	6
Resourcing for enforcement & ecosystem function	3	3	9	2	4	8

Hazard	Group C			Group D		
	Like	Cons	Risk	Like	Cons	Risk
Residential development & water quality	4 - 5	3 - 4	12 - 20	5	4	20
Residential development & food chain disruption	5	4	20	5	4	20
Lack of political commitment & park management	4	4	16	5	4	20
Lack of effective, broadly-based education	3	3 - 4	9 - 12	5	4	20
Nutrients from agricultural runoff & subtidal reef communities.	4 - 5	4	16 - 20	3	3	9
Exotic species & native species.	4	5	20	3 - 4	3 - 5	9 - 20
Dogs off-lead & hooded plovers	4	5	20	5	4	20
Poaching of abalone, rock lobster or aquarium species	4	4	16	3	3	9
Strip development & intertidal trampling	5	4	20	5	4	20
Strip development & water quality	5	4	20	5	4	20
Resourcing for enforcement & ecosystem function	4	4	16	4	4	16

Wilsons Promontory and Corner Inlet MNPs

Hazard	Group A			Group B			Group C		
	Like	Cons	Risk	Like	Cons	Risk	Like	Cons	Risk
<u>Nutrients & seagrass in CI MNP</u>	<u>5</u>	<u>3</u>	<u>15</u>	<u>3 - 5</u>	<u>2 - 4</u>	<u>6 - 20</u>	<u>5</u>	<u>4</u>	<u>20</u>
<u>Nutrients & subtidal rocky reef in WP MNP</u>	<u>5</u>	<u>2</u>	<u>10</u>	<u>3 - 5</u>	<u>2 - 4</u>	<u>6 - 20</u>	<u>5</u>	<u>1</u>	<u>5</u>
<u>Propeller scour & seagrass beds and bare mudflats</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>2</u>	<u>3 - 4</u>	<u>6 - 8</u>	<u>2</u>	<u>2</u>	<u>4</u>
<u>Seawalls & breeding of fish</u>	<u>5</u>	<u>5</u>	<u>25</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>5</u>	<u>3 - 4</u>	<u>15 - 20</u>
<u>Altered freshwater inputs & ecological processes in CI MNP</u>	<u>3</u>	<u>3</u>	<u>9</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>5</u>	<u>3</u>	<u>15</u>
<u>High profile of MNPs & reduced focus on surrounding areas</u>	<u>2</u>	<u>1</u>	<u>2</u>	<u>4</u>	<u>1</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>16</u>
<u>Logging upper catchment of Corner Inlet & algae and seagrass</u>	<u>4</u>	<u>4</u>	<u>16</u>	<u>1 - 5</u>	<u>3</u>	<u>3 - 15</u>	<u>5</u>	<u>5</u>	<u>25</u>
<u>Catchment runoff & water quality and seagrass in CI MNP</u>	<u>5</u>	<u>5</u>	<u>25</u>	<u>5</u>	<u>3</u>	<u>15</u>	<u>5</u>	<u>4</u>	<u>20</u>
<u>Dredging operations in Corner Inlet & water quality, seagrass beds, birds</u>	<u>4</u>	<u>4</u>	<u>16</u>	<u>5</u>	<u>4</u>	<u>20</u>	<u>4</u>	<u>2 - 4</u>	<u>8 - 16</u>
<u>Exotic species/pathogens & biodiversity in CI MNP.</u>	<u>5</u>	<u>5</u>	<u>25</u>	<u>1 - 5</u>	<u>5</u>	<u>5 - 25</u>	<u>4</u>	<u>4</u>	<u>16</u>
<u>Exotic species/pathogens & biodiversity in WP MNP.</u>	<u>3</u>	<u>5</u>	<u>15</u>	<u>1 - 5</u>	<u>5</u>	<u>5 - 25</u>	<u>2</u>	<u>4</u>	<u>8</u>
<u>Boats & breeding colonies of seals on Kanownas</u>	<u>3</u>	<u>3</u>	<u>9</u>	<u>4</u>	<u>4</u>	<u>16</u>	<u>4</u>	<u>1 - 4</u>	<u>4 - 16</u>
<u>Major oil/chemical spill & seagrass and mudflat habitats in CI MNP</u>	<u>3</u>	<u>5</u>	<u>15</u>	<u>2</u>	<u>5</u>	<u>10</u>	<u>3</u>	<u>5</u>	<u>15</u>
<u>Major oil/chemical spill & penguins, seals and rocky intertidal in WP MNP</u>	<u>3</u>	<u>3</u>	<u>9</u>	<u>1</u>	<u>5</u>	<u>5</u>	<u>3 - 4</u>	<u>4</u>	<u>12 - 16</u>

Hazard	Group D			Group E		
	Like	Cons	Risk	Like	Cons	Risk
Nutrients & seagrass in CI MNP	5	4	20	3	3	9
Nutrients & subtidal rocky reef in WP MNP	5	2	10	4	2	8
Propeller scour & seagrass beds and bare mudflats	3	3	9	3	2	6
Seawalls & breeding of fish	2	4	8	5	1	5
Altered freshwater inputs & ecological processes in CI MNP	4	3	12	3	3	9
High profile of MNPs & reduced focus on surrounding areas	5	2	10	1	3	3
Logging upper catchment of Corner Inlet & algae and seagrass	5	4	20	4	3	12
Catchment runoff & water quality and seagrass in CI MNP	5	4	20	4	3	12
Dredging operations in Corner Inlet & water quality, seagrass beds, birds	5	4	20	4	3	12
Exotic species/pathogens & biodiversity in CI MNP.	4	5	20	4	4	16
Exotic species/pathogens & biodiversity in WP MNP.	5	5	25	3	4	12
Boats & breeding colonies of seals on Kanownas	4	2	8	4	3	12
Major oil/chemical spill & seagrass and mudflat habitats in CI MNP	2	4	8	2	4	8
Major oil/chemical spill & penguins, seals and rocky intertidal in WP MNP	3	4	12	3	4	12

Ninety Mile Beach MNP

Hazard	<u>Group A</u>			<u>Group B</u>			<u>Group C</u>		
	Like	Cons	Risk	Like	Cons	Risk	Like	Cons	Risk
Shipping incident & subtidal/intertidal invertebrates.	1	4	4	1	2 - 4	2 - 4	1	3	3
Illegal finfish harvesting by licenced commercial fisher & pelagic/park communities/ecosystem.	4	3	12	2	3	6	3	3	9
Trawling or scallop dredging & subtidal <i>benthic</i> habitats	3	3	9	3	3 - 4	9 - 12	3	3	
Nutrients, pesticides, herbicides and sediment from Merriman Creek & primary production and life cycles	2	3	6	1 - 2	2 - 4	2 - 8	3	2	6
Visitor activities on shore & shorebirds	5	4	20	4	2 - 3	8 - 12	5	2 - 3	10 - 15
Pathogens via fish bait or berley & local species	1	4	4	3	2 - 4	6 - 12	1	4	4
Exotic marine species & displacement of native species.	2	4	8	2 - 3	4 - 5	8 - 15	1	4	4
Lack of ecological knowledge & habitats/communities	1	3	3	1 - 2	1 - 3	1 - 6	2	3	6
Litter from on-shore & benthic/pelagic communities, intertidal organisms and seabirds	4	2	8	4 - 5	2	8 - 10	4	3	12
Illegal finfish harvesting on commercial scale by unlicenced fisher & pelagic/park communities/ecosystem.	1	3	3	1 - 2	2	2 - 4	2	2	4
Illegal finfish harvesting by recreational fisher & pelagic/park communities/ecosystem.	4	2	8	1	2	2	4	2	8

Description of the hazards should be read in conjunction with full definitions given in the risk register.

Point Hicks MNP, Cape Howe MNP & Beware Reef MS

Key to parks: PH = Point Hicks MNP, CH = Cape Howe MNP, BR = Beware Reef MS.

Hazard	Park	Group A			Group B		
		Like	Cons	Risk	Like	Cons	Risk
Sediment loads from timber harvesting & water quality	PH	2	1	2	3 - 4	2 - 3	6 - 12
	CH	1	1	1	2 - 4	2 - 3	4 - 12
	BR	2	2	4	2 - 3	2 - 3	4 - 9
Lack of ecological knowledge & habitats and communities	PH	4	3 - 4	12 - 16	5	2 - 3	10 - 15
	CH	4	3 - 4	12 - 16	5	2 - 3	10 - 15
	BR	4	3 - 4	12 - 16	5	3 - 4	15 - 20
Sediment loads from park/forest roads & water quality	PH	3	1	3	3 - 4	2 - 3	6 - 12
	CH	1	1	1	2 - 4	2 - 3	4 - 12
	BR	4	4	16	2	2 - 3	4 - 6
Anchoring of recreational boats & subtidal reef	PH	2	1 - 2	2 - 4	2 - 3	2	4 - 6
	CH	2	1 - 2	2 - 4	2 - 3	2	4 - 6
	BR	4	2 - 3	8 - 12	5	3 - 4	15 - 20
Litter from commercial vessels & pelagic fish	PH	4	2 - 3	8 - 12	3	3	9
	CH	3 - 4	2 - 3	6 - 12	3 - 4	3	9 - 12
	BR	2 - 4	2 - 3	4 - 12	2 - 3	2 - 3	4 - 9
Introduced species from commercial vessels & community structure	PH	2 - 3	3 - 5	6 - 15	2	2 - 3	4 - 6
	CH	2 - 3	3 - 5	6 - 15	2 - 3	2 - 3	4 - 9
	BR	2 - 3	3 - 5	6 - 15	2	2 - 3	4 - 6
Poaching of abalone & subtidal reef communities	PH	3	3 - 4	9 - 12	3 - 4	3 - 4	9 - 16
	CH	4	3 - 4	12 - 16	3 - 5	3 - 4	9 - 20
	BR	3	3 - 4	9 - 12	3 - 4	2 - 4	6 - 16
Introduced marine pests from recreational boats & ecological communities	PH	3	3 - 5	9 - 15	2 - 3	3 - 5	6 - 15
	CH	3	3 - 5	9 - 15	2	3 - 5	6 - 10
	BR	3	3 - 5	9 - 15	3 - 4	3 - 5	9 - 20

Hazard	Park	Group C			Group D		
		Like	Cons	Risk	Like	Cons	Risk
Sediment loads from timber harvesting & water quality	PH	2	3	6	2	2	4
	CH	1	3	3	2	2	4
	BR	5	3	15	3	2	6
Lack of ecological knowledge & habitats and communities	PH	5	4	20	2 - 3	3 - 4	6 - 12
	CH	5	4	20	2 - 3	3 - 4	6 - 12
	BR	5	4	20	2 - 3	3 - 4	6 - 12
Sediment loads from park/forest roads & water quality	PH	4	3	12	2	1 - 2	2 - 4
	CH	2	2	4	1	1 - 2	1 - 2
	BR	4	3	12	2	1 - 2	2 - 4
Anchoring of recreational boats & subtidal reef	PH	5	2	10	3	3	9
	CH	5	2 - 3	10 - 15	2	2 - 3	4 - 6
	BR	5	4	20	5	4	20
Litter from commercial vessels & pelagic fish	PH	4	2	8	4	3	12
	CH	4	2	8	4	3	12
	BR	4	2	8	4	3	12
Introduced species from commercial vessels & community structure	PH	5	5	25	2	4	8
	CH	5	4	20	3	4	12
	BR	5	5	25	2	4	8
Poaching of abalone & subtidal reef communities	PH	5	4	20	4	2 - 3	8 - 12
	CH	5	4	20	4 - 5	2 - 3	8 - 15
	BR	5	4	20	4	2 - 3	8 - 12
Introduced marine pests from recreational boats & ecological communities	PH	4	5	20	1	4	4
	CH	4	5	20	1	4	4
	BR	5	5	25	2	4	8