Australia
State of the Environment
2011

SOE 2011 National marine condition assessment – decision model and workshops

DECEMBER 2011

PRODUCED BY Trevor Ward
FOR the Department of Sustainability, Environment, Water, Population and Communities
ON BEHALF OF the State of the Environment 2011 Committee

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Cover image

Shark Bay, WA
Photo by Nick Rains

Preface

This report was developed for the Department of Sustainability, Environment, Water, Population and Communities to help inform the Australia State of the Environment (SoE) 2011 report.

The Minister for Environment is required, under the *Environment Protection and Biodiversity Conservation Act 1999*, to table a report in Parliament every five years on the State of the Environment.

The Australia State of the Environment (SoE) 2011 report is a substantive, hardcopy report compiled by an independent committee appointed by the Minister for Environment. The report is an assessment of the current condition of the Australian environment, the pressures on it and the drivers of those pressures. It details management initiatives in place to address environmental concerns and the effectiveness of those initiatives.

The main purpose of SoE 2011 is to provide relevant and useful information on environmental issues to the public and decision-makers, in order to raise awareness and support more informed environmental management decisions that lead to more sustainable use and effective conservation of environmental assets.

The 2011 SoE report, commissioned technical reports and other supplementary products are available online at www.environment.gov.au/soe.

SOE2011
National Marine Condition Assessment

Decision Model and Workshops

Background

The National State of the Environment Reporting system requires assessments of the condition of Australia's environment, including the marine ecosystems, as part of a systematic approach to national reporting. While there has been considerable development of information sources relating to regional and national scale drivers of the marine environment (such as aspects of climate change) and pressures (such as the distribution and activities of oil/gas exploration), there has been only limited advancement in data/knowledge about the condition of ecosystems (particularly the biodiversity aspects). Many indicators have been previously proposed as suitable for reporting on the condition of Australia's marine environments and ecosystems, but only few have been operationalised into the mainstream of data collection and synthesis at any of local, regional or national scales. As a result, State of the Environment Reports have previously been derived from limited and ad hoc assessments of the available data and examples.

In the absence of strong regional or national indicator datasets, and to limit the bias inherent in a narrow information base, the SOE2011 process has consulted experts to gauge expert opinion about the condition of Australia's marine ecosystems. There are datasets available from local areas, and there are many sub-regional scale studies and short term datasets about various aspects of marine ecosystems, but these are not part of a systematic collection of data and knowledge routinely synthesised for reporting purposes. This national expert consultation process reported here has drawn on the disparate datasets and the knowledge-base dispersed across a range of sources and institutions to capture a representative sample of existing expert knowledge about condition of the environment in a manner that can be used for SOE2011 reporting purposes.

The assessment outcomes from the National Marine Condition Assessment (NMCA) workshops are methodology-specific and must be interpreted with caution and no direct comparisons should be made with any other types of marine assessment studies. The NMCA assessment process has been designed to meet SOE reporting requirements, and different assessments, such as those constrained to a subset of the issues or the marine ecosystems, may not reach similar conclusions. The rapid assessment approach adopted in the NMCA represents a consensus view from the experts who participated in the workshop process and subsequent discussions, and the outcomes will not necessarily be in accord with the views held by all the experts. The outcomes from the NMCA process are independent of governments, and so also do not necessarily represent the views of the Australian Government or the Minister for Sustainability, Environment, Water, Population and Communities. The experts who participated in the NMCA process are listed at Appendix 1.

Objectives

The NMCA process is a form of expert elicitation. The intention of this expert elicitation was to engage with a broad range of marine experts who have a background and

experience in environmental issues and the conditions in Australia's marine ecosystems. The elicitation was conducted to seek:

1. agreement by the experts on an assessment structure that will provide an effective assessment of the state of the Australian marine environment (known here as the Decision Model). This includes the Parameters, their components, the assumptions and grading system to be used in reaching an assessment of the condition of the ecosystems/environment, for the purposes of (and consistent with) the overall framework of SOE2011;

2. assignment of scores to the components/parameters for the purpose of determining performance grades at the regional and national level; and

3. an indicative assessment of pressures based on known and impending threats to the components/parameters used here to determine condition.

Decision Model

Decision Parameters

The *Parameters* are aspects of the Decision Model that are fixed—the structural architecture of the decision—and are the constant factors with which the judgements about condition have been made by the experts. For this decision problem (State of the Environment Reporting 2011) the Parameters have been chosen to represent the intrinsic environmental attributes and values of the system under consideration, in this case the attributes of the ecosystem/environments of the reporting regions. The Great Barrier Reef Outlook Report provided initial guidance about the Parameters to use for assessment of a marine region, and these have been supplemented by additional aspects of each region in order to more fully represent the attributes and environmental values they contain. The Parameters have been established independent of the Inputs (these are judgements about the quality of the condition, see below); this is so that the perception of quality (such as a very poor or very good condition) does not impose a major bias in the choice of Parameters.

The components of the Parameters are the level at which scoring was conducted, and they represent the natural biophysical and taxonomic hierarchy of ecosystems and biodiversity of the region under consideration. SOE reporting is of necessity a broad overview process, and workshop participants were guided to develop/confirm components within each Parameter that are relevant to (or an important part of) the region as a whole. In short, decision components were established as important elements of the broad regional context, and fine-scale attributes were aggregated to a level that was susceptible to regional-scale assessment. In the workshops, participants were advised to use their fine-scale experience and fine-scale knowledge as surrogate knowledge to inform their judgement about a higher level component. Where this dominated grading decisions, it was documented through the assessment of information quality – described below.

Spatial Framework

The assessment process individually considered and assessed five large marine bioregions. These reporting regions (SOE Marine Bioregions —SOEMB) were established spatially by boundary extension of the Commonwealth's Marine Planning Regions (MPR) to bound marine waters from Mean High Water (MHW) at the continental and island coast to the outer extent of the EEZ and the Extended Continental Shelf (ECS). While the MPR
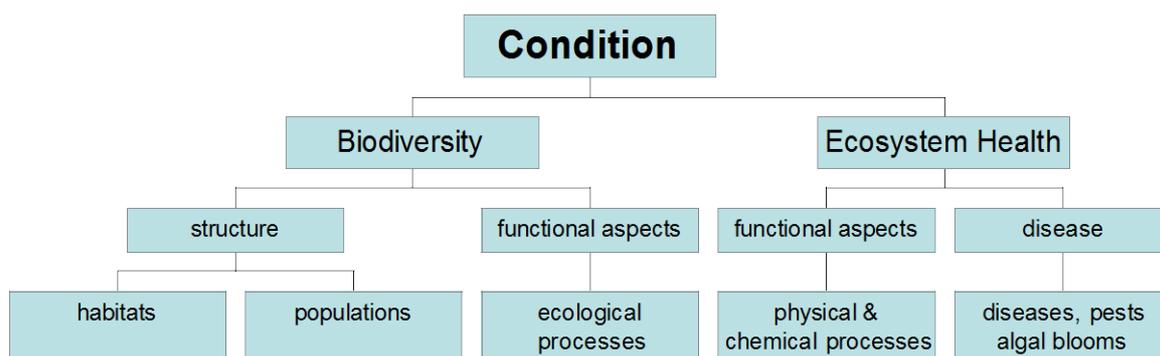
constituted the dominant geographic area of the SOEMB, the state-territory controlled waters were often found to have major sets of values and issues.

National Level Reporting by Aggregation

National-level condition assessments were derived by aggregating the regional assessments. The assessment ranks were aggregated linearly with equal weighting to reach a national-level assessment ranking for the regional Parameters and the overall condition and pressures. Weighting of components within Parameters is also equal.

Decision Inputs

The *Inputs* are aspects of the decision model that are specific to the condition of the matters (*components*) specified in the *Parameter*—the value judgement of the expert— and are the performance level about the condition expressed in terms specified by the grading system.

```
                            Condition
                 ┌──────────────┴──────────────┐
            Biodiversity                 Ecosystem Health
         ┌──────┴──────┐               ┌──────┴──────┐
     structure    functional aspects  functional aspects   disease
    ┌────┴────┐        │                    │               │
 habitats  populations  ecological    physical &      diseases, pests
                        processes   chemical processes   algal blooms
```

Grading System

Scores: initial scores were assigned (by the expert participants) to a component on a scale from 0 to 10, where 0 is consistent with the weakest level of performance or achievement of the grading criterion, and 10 is the strongest or highest level of achievement.
Grades: the levels of condition performance/achievement used for SOE2011 reporting purposes at the Parameter level are Very Poor, Poor, Good, Very Good.
Grading Statements: these were uniquely derived for each major aspect of the assessment to represent the four grades of performance/achievement, as outlined below, for each of the five condition assessment Parameters. Grading Statements provided guidance to inform the expert about the thresholds they should use in determining a score.
Benchmarks: in forming judgements about condition of the various ecological and environmental attributes and assets of the region, the benchmark (a point of reference for the condition) was set as the condition that would have existed prior to the commencement of the major changes in type and intensity of use and exploitation that have resulted in the current state of Australia's environments. This is taken to be the time of European settlement of the mainland, or a surrogate estimate for conditions at that time, even though it is recognised that humans had significant impacts on some ecosystems prior to that time and that those impacts rose slowly for some time afterwards (the use of the term

'benchmark' and its basis for application in the SOE2011 context is described more fully in the SOE2011 report). Readers should not confuse the use of a benchmark here with an objective for current management. Management objectives may be framed on the same attribute but set at levels more consistent with managed resource use, and involve shorter time scales and smaller space scales than are used here for environmental benchmarks.

Grading Terms

The grading statements are designed to capture spatial extent, temporal extent, and magnitude of decline in condition. The gradient from very good to very poor is constructed using the following standard terminology:

Major: large in area, important in structural or functional terms, affecting several attributes of the ecosystems that are considered important

Dependent Species: species that are ecologically linked to other species, habitats or ecosystem features through either trophic relationships (e.g. are major prey for higher order species) or through functional relationships (e.g. use of a habitat or ocean feature as structure for breeding aggregation, shelter or navigation cues).

Significant Changes (Decline): these are changes that are known, or are expected, to have measurable effects in ecosystems that are likely to be detrimental in the sense of creating a shift away from the natural state, including a shift in natural dynamics.

Substantial Changes: changes that are widespread or affect a number of important attributes of marine ecosystems, and are readily observable or measurable.

Grading Statements

The experts participating in the workshops were invited to contribute to scores, by SOEMB, for the parameters of condition and pressure, using these statements as guidance to the score they could assign.

Marine Biodiversity	
(this deals with the structural and functional aspects of biodiversity)	
Quality of Habitat for Species	*applies to habitat components and what is best understood about their status and trends expressed in terms of habitat quality for species*
Very Good (>7.5-10)	All major habitats are essentially structurally and functionally intact and able to support all dependent species
Good (>5-7.5)	There is some habitat loss, degradation or alteration in some small areas, leading to minimal degradation but no persistent substantial effects on populations of dependent species
Poor (>2.5-5)	Habitat loss, degradation or alteration has occurred in a number of areas, leading to persistent substantial effects on populations of some dependent species
Very Poor (0-2.5)	There is widespread habitat loss, degradation or alteration, leading to persistent substantial effects on many populations of dependent species
Populations of Species and Groups of Species	*applies to the major structural components and what is best understood about their status and trends expressed in terms of populations and*

		groups of species; this includes threatened species which may be assessed by species or as groups of species
Very Good (>7.5-10)	Only a few, if any, species populations have declined as a result of human activities or declining environmental conditions	
Good (>5-7.5)	Populations of a number of significant species but no species groups have declined significantly as a result of human activities or declining environmental conditions	
Poor (>2.5-5)	Populations of many species or some species groups have declined significantly as a result of human activities or declining environmental conditions	
Very Poor (0-2.5)	Populations of a large number of species or species groups have declined significantly as a result of human activities or declining environmental conditions	
Ecological Processes		*applies to what is best understood about the status and trends in the main ecological processes and effects of human activities*
Very Good (>7.5-10)	There are no significant changes in ecological processes as a result of human activities	
Good (>5-7.5)	There are some significant changes in ecological processes as a result of human activities in some areas, but these are not to the extent that they are significantly affecting ecosystem functions	
Poor (>2.5-5)	There are substantial changes in ecological processes as a result of human activities, and these are significantly affecting ecosystem functions in some areas	
Very Poor (0-2.5)	There are substantial changes in ecological processes across a wide area of the region as a result of human activities, and ecosystem function is seriously affected in much of the region	

Marine Ecosystem Health *(this deals with the processes affecting biodiversity)*		
Physical and Chemical Processes		*applies to what is best understood about the status and trends in the main physical and chemical processes as a result of human activities. The grading scale is based on a gradient in impacts of change.*
Little change/impact (>7.5-10)	There are no significant impacts of changes in physical or chemical processes as a result of human activities	
Some change/impact (>5-7.5)	There are some significant impacts of changes in physical or chemical processes as a result of human activities in some areas, but these are not to the extent that they are significantly affecting ecosystem functions	
Major change/impact (>2.5-5)	There are substantial impacts of changes in physical or chemical processes as a result of human activities, and these are significantly affecting ecosystem functions in some areas	

Extreme change/impact (0-2.5)	There are substantial impacts of changes in physical or chemical processes across a wide area of the region as a result of human activities, and ecosystem function is seriously affected in much of the region
Pests, Introduced Species, Diseases and Algal Blooms	*applies to what is best understood about the status and trends in the main outbreaks*
Very Good (>7.5-10)	The incidence and extent of diseases and algal blooms are at expected natural levels, and there are insignificant occurrences or outbreaks of pests, and the numbers and abundance of introduced species are minimal
Good (>5-7.5)	Diseases or algal blooms occur occasionally above expected occurrences or extent, and recovery is prompt with minimal affect on ecosystem functions; pests sometimes present and have been found at levels above natural occurrences but with limited ecosystem impacts; the occurrence, distribution and abundance of introduced species are limited and have minimal impact on ecosystem functions
Poor (>2.5-5)	Diseases or algal blooms occur regularly in some areas above natural levels of occurrence or extent; occurrences of pests require significant intervention or have significant effects on ecosystem function; occurrence, distribution and abundance of introduced species trigger management responses, or have resulted in significant impacts on ecosystem functions
Very Poor (0-2.5)	Disease or algal blooms occur regularly across the region at unnaturally high levels; occurrences of pests or introduced species are uncontrolled in some areas and are seriously affecting ecosystem functions

Pressures Affecting the Marine Environment *(this deals with high level factors that are, or may be, affecting the biodiversity and environmental values of the bioregion: the pressures)*	
Impacts on Environmental Values	*applies to what is best understood about the status and trends in the main factors affecting the environment*
Very Good (>7.5-10)	There are few or negligible impacts from this factor, and future impacts on the environmental values of the region are likely to be negligible.
Good (>5-7.5)	There are minor impacts in some areas, and future impacts from this factor on the environmental values of the region are likely to be minor and localised
Poor (>2.5-5)	The environmental impacts of this factor are significantly affecting the values of the region, and serious environment degradation is likely within 50 years.
Very Poor (0-2.5)	The current and predicted environmental impacts of this factor are widespread, irreversibly affecting the values of the region, and widespread and serious environment

	degradation is likely across the region within 10 years.

Parameters and Specific Components

The parameters to be assessed for the SOE2011 report were organised within the following headings, broadly following the structure of the assessment conducted for the Great Barrier Reef 2009 Outlook Report:
Marine Biodiversity
  Quality of Habitats for Species
  Populations of Species and Groups of Species
  Ecological Processes
Marine Ecosystem Health
  Physical and Chemical Processes
  Pests, Introduced Species, Diseases and Algal Blooms
  Pressures Affecting the Marine Environment

The Parameters (as above) were applied to each of the SOE2011 reporting regions (SOEMB). The Parameters were identical in all regions, but some components of various Parameters were considered to be unique to a region, and others were assessed in only some of the regions. The final set of components used in the assessment were established at the workshops, and finalised by consensus.

A proforma for the assessment, including Parameters and initial assessment components, was circulated prior to the workshop for each bioregion. Participants were invited to comment and input to the structure of the assessment. At the workshop, participants contributed to a group discussion and provided scores that best represented their judgement about the condition and trends of each component. Different views about scoring were resolved at the workshop, or by small group discussion during or after the workshops.

Procedures

The procedure used in this Condition Assessment was an iterated process of opinion updating known as the Closure Method, closely allied to the Delphi Method (Colyvan *et al.* 2009). The key aspect of this approach is that it provides for iterative updating of scores/gradings through a combination of individual and group work, supported by short explanatory statements and reasons. Given the diversity and expert standing of the participants in the assessment process, equal weighting procedures were applied to the scores/gradings.

The iterative process proceeded through the following steps:
Step1: prospective experts were identified with their field of specialty expertise by consultation with agencies and universities, by reference to earlier national workshop activities, and in consultation with the Marine Division of DSEWPAC. All identified individuals were invited to participate, and provided with a background document describing SOE2011, a one-page non-disclosure agreement, a brief description of the decision problem, a brief summary of the assessment approach, an outline of workshop logistics, an outline of anticipated products and timelines, an initial proposal for recognition of the expert's time/inputs, a summary of workshop potential timing and logistics.

Step2: upon acceptance and return of signed non-disclosure, each participant was provided with a detailed background paper on the assessment process (an early version of this paper), access to a set of supporting documents that contain various resources considered to contain the initial set of useful information, an initial proforma assessment form for the relevant bioregions to be assessed, a request to review and revise/confirm the components for condition and threats, and a description of the elicitation procedures, all for return to DSEWPAC. Where map expertise/experience gaps were not filled as a result of this process, selective invitations were issued for each specific gap that remained.

Step3: face-to-face workshops were conducted (see below for the locations, logistic details), and all participating experts were invited because of the history of knowledge and scientific experience in the regions and issues. Almost all experts attended in person, although some could only attend for specific days/times. Where the workshop was in agreement, the agenda was left flexible so that expertise of an individual expert could be used when it was available to the workshop. The workshops

(a) confirmed and agreed on the set of components for scoring,

(b) assigned a compromise consensus score/grade on each component,

(c) clarified factors/reasons for a spread of scores, where there was a significant spread of judgements,

(d) provided a relative estimate for uncertainty in the knowledge base for each component,

(e) provided a consensus judgement about the temporal change (increasing, decreasing, stable)

(f) agreed on a set of post-workshop process and timelines for finalisation of any outstanding materials, and

(g) provided feedback on any procedural or other issues, and suggestions for future improvements in the NMCA process.

At the workshop, the facilitator invited live consensus scoring directly into a proforma assessment form projected on-screen for each SOEMB. If there was any significant lack of consensus, small discussion groups were formed to clarify issues and where possible resolve scoring disagreements. If there remained any significant lack of consensus (which occurred very rarely) either a score was not assigned, the topic was sequestered for later further analysis, or the spread of scores was resolved with assignment of low information quality.

Step4: The completed workshop assessment form was then circulated back to all participants for confirmation by email.

Workshops

Workshops were held in Perth (1-3 March 2011, South-west and North-west SOEMB); Brisbane (22-24 March 2011, North and East SOEMB); and Hobart (12-14 April 2011, South-east SOEMB). Each workshop was assisted by a dedicated facilitator, and all scores and comments were entered to an on-screen spreadsheet so that all recorded information could be checked and verified by participants in real time. All participants were circulated the full raw data draft spreadsheet by email after the workshop, for subsequent checking and further verification, and where needed, the addition of further information, references etc.

Information Quality

For estimates of condition, trend, and importance of factors affecting the environment, the participants assigned estimates of the level of confidence in the information base they used

to make their judgements. Participants were advised that this uncertainty should cover all aspects of the information base, including such matters as technical quality/robustness, spatial and taxonomic coverage, process uncertainty, all forms of model uncertainty, and access to appropriate levels of detail. Participants were requested to directly assign the confidence surrounding their estimate as high, moderate or low.

The grading statements for the estimates of Confidence are:
High: Adequate high quality evidence and high consensus
Moderate: Limited or low quality evidence or limited consensus
Low: Evidence and consensus too low to make an assessment

The assessment process, including the workshops, was moderated by the SOE Committee and the SEWPAC SOE Team to ensure consistency of scoring approaches and findings across the workshops. In addition, several key experts attended all three workshops, and were able to ensure cross-workshop coherency of approaches and scoring assumptions.

Outputs

The outputs of the elicitation process focused on Condition and Pressures consist of the following products:
- A radar plot of workshop-derived scores for the assessment components for each of Most Places, Worst 10%, Best 10%;
- assignment of the median to a quartile (equivalent to one of the four reporting grades)
- text particularly capturing spatial and temporal aspects, and any major divergent views of participants.

The specific outputs of the elicitation process focused on Trend consist of the following products:
- assignment by the experts of a trend for the assessment components for each of Most Places, Worst 10%, Best 10%;
- text for the assignment of trend, particularly capturing spatial and temporal aspects, and any major divergent views of participants.

The specific outputs of the elicitation process focused on Confidence in Condition and Trend consisted of the following products:
- summary table of the H, M, L for each assessment component
- text for the assignments, including key strengths and weaknesses, and any major divergent views of participants.

Sources

This background paper has been prepared by Trevor Ward (SOE2011 Committee Member), with contributions from the SOE2011 Committee, the workshop participants and the SEWPAC SOE Team, and draws heavily on four primary sources:
1. Great Barrier Reef Outlook Report (2009) GBRMPA
2. Petra M. Kuhnert, Tara G. Martin and Shane P. Griffiths (2010) A guide to eliciting and using expert knowledge in Bayesian ecological models. Ecology Letters.
3. Mark Colyvan, Mark Burgman, Aidan Lyon, Helen Regan, Katie Steele (2009) Evaluation and Development of Formal Consensus Methods, ACERA Project 607 Final

Project Report.

Results

Biodiversity

The workshop assessments for quality of habitats, condition of species, and condition of ecological processes were combined to form a single assessment of biodiversity in each of the SOE regions.
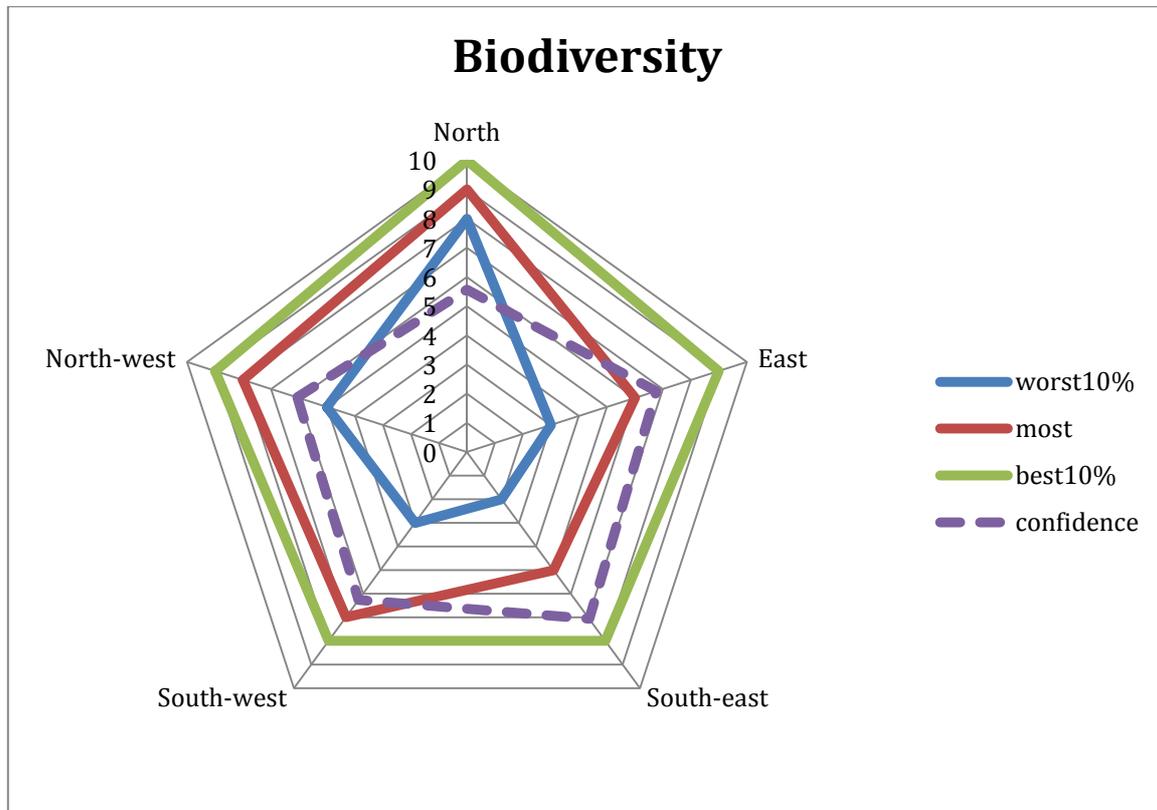

Figure S12. Condition of the biodiversity in each SOE region

Condition and confidence are both scaled from very poor or low (0) to very good or high (10).

1. Habitat Quality for Species

The overall national assessment of Habitat Quality for Species was determined by combining the scores for each of the components for each region. A description of the workshop process and the grading statements for each parameter used to compile these assessments is provided above.
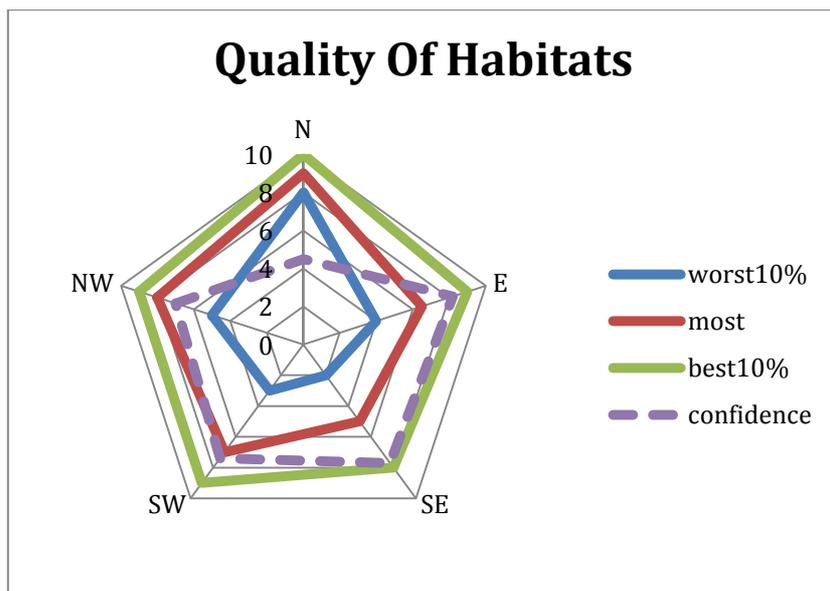
Quality Of Habitats

Figure S13 Quality of Habitats—overview of the regions

The condition of the habitats in each of Australia's five marine regions—'most' is the median condition of all the habitats in most places where they occur; 'worst 10%' is the median condition of the worst 10% of examples of each habitat; and 'best 10%' is the median condition of the best 10% of examples of each habitat. 'Confidence' represents the extent of confidence that has been placed on the assessment of these conditions by the experts at the assessment workshops.
Condition and confidence are both scaled from very poor or low (0) to very good or high (10).

The scores assigned by the participants to the components for each parameter are summarised in the scoring spreadsheet for each region (also available online as supplementary information).

2. Populations of Species and Groups of Species

The overall national assessment of the condition of Populations of Species and Groups of Species was determined by combining the scores for each of the components for each region. A description of the workshop process and the grading statements for each parameter used to compile these assessments is provided above.
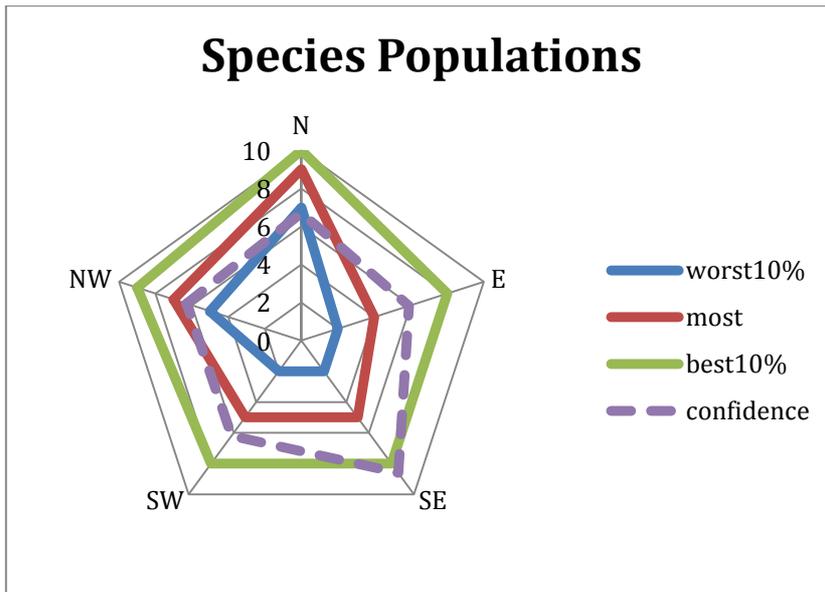
Figure S14 Condition of Species Populations—overview of the regions

The condition of populations of species and groups of species in each of Australia's five marine regions—'most' is the median condition of all the populations and species groups at most places where they occur; 'worst10%' is the median condition of the worst 10% of each population or species group where they occur; and 'best10%' is the median condition of the best 10% of each population or species group where they occur. 'Confidence' represents the extent of confidence that has been placed on the assessment of these conditions by the experts at the assessment workshops.
Condition and confidence are both scaled from very poor or low (0) to very good or high (10).

The scores assigned by the participants to the components for each parameter are summarised in the scoring spreadsheet for each region (also available online as supplementary information).
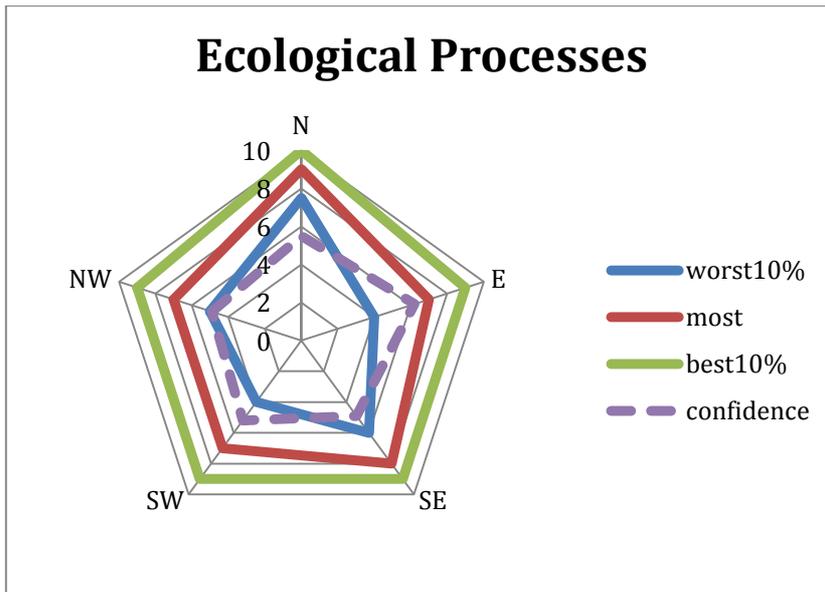
3. Ecological Processes

Figure S15 Condition of Ecological Processes—overview of the regions

The condition of ecological processes in each of Australia's five marine regions—'most' is the median condition of all the processes in most places where they occur; 'worst10%' is the median condition of the worst 10% of examples of each process; and 'best10%' is the median condition of the best 10% of examples of each process. 'Confidence' represents the extent of confidence that has been placed on the assessment of these conditions by the experts at the assessment workshops.
Condition and confidence are both scaled from very poor or low (0) to very good or high (10).

The scores assigned by the participants to the components for each parameter are summarised in the scoring spreadsheet for each region (also available online as supplementary information).

Ecosystem Health

The overall national assessment of the health of the marine ecosystems was determined by combining assessments of the of the major physical and chemical processes with the outbreaks of diseases, non-natural algal blooms and infestations by pests and introduced species in each of the SOE regions. A description of the workshop process and the grading statements for each parameter used to compile these assessments are provided above.
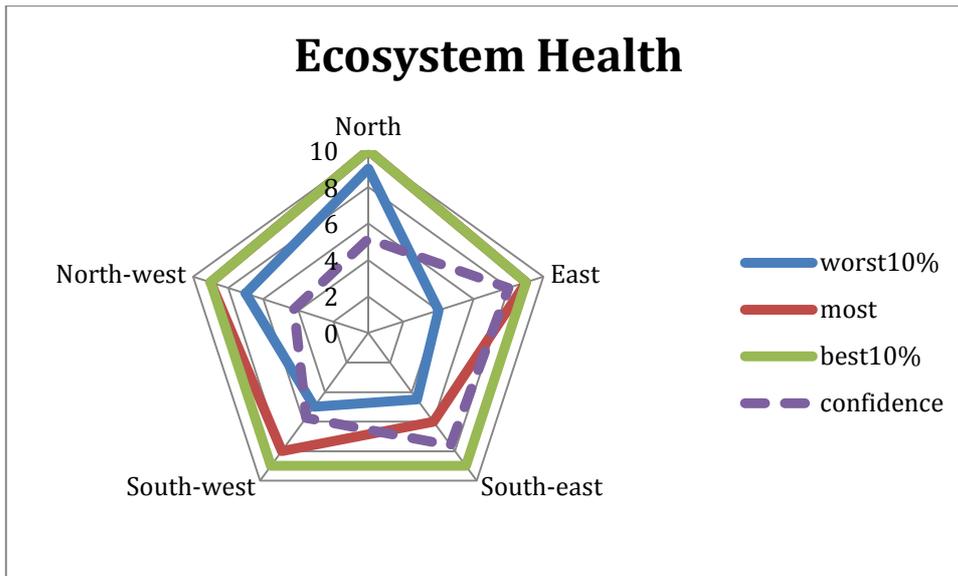
Figure S16 Condition of ecosystem health in each SOE region

Condition and confidence are both scaled from very poor or low (0) to very good or high (10).
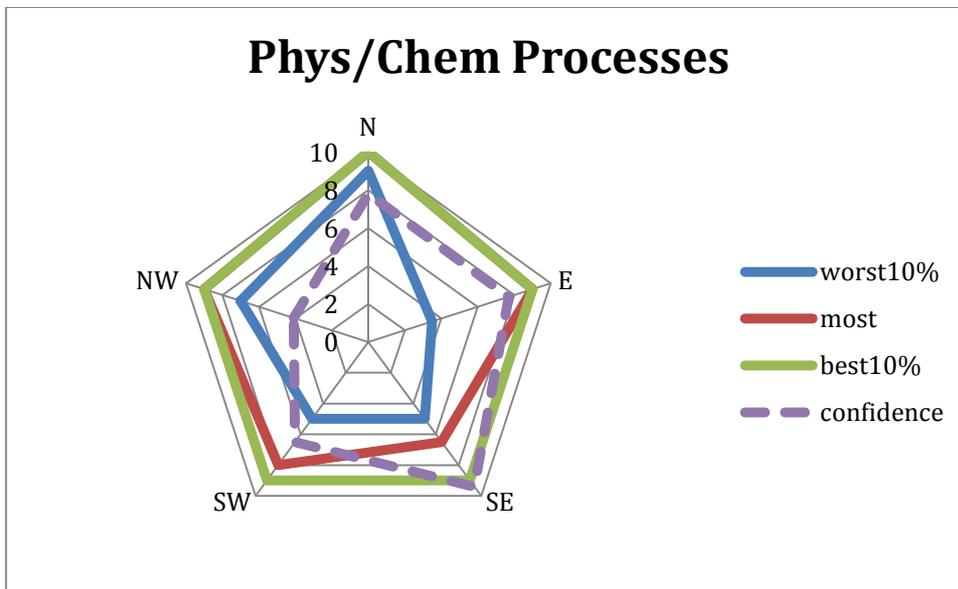
4. Physical and Chemical Processes

Figure S17 Condition of Physical and Chemical Processes—overview of the regions

The condition of physical and chemical processes in each of Australia's five marine regions—'most' is the median condition of all the processes in most places where they occur; 'worst10%' is the median condition of the worst 10% of examples of each process; and 'best10%' is the median condition of the best 10% of examples of each process. 'Confidence' represents the extent of confidence that has been placed on the assessment of these conditions by the experts at the assessment workshops.

Condition and confidence are both scaled from very poor or low (0) to very good or high (10).

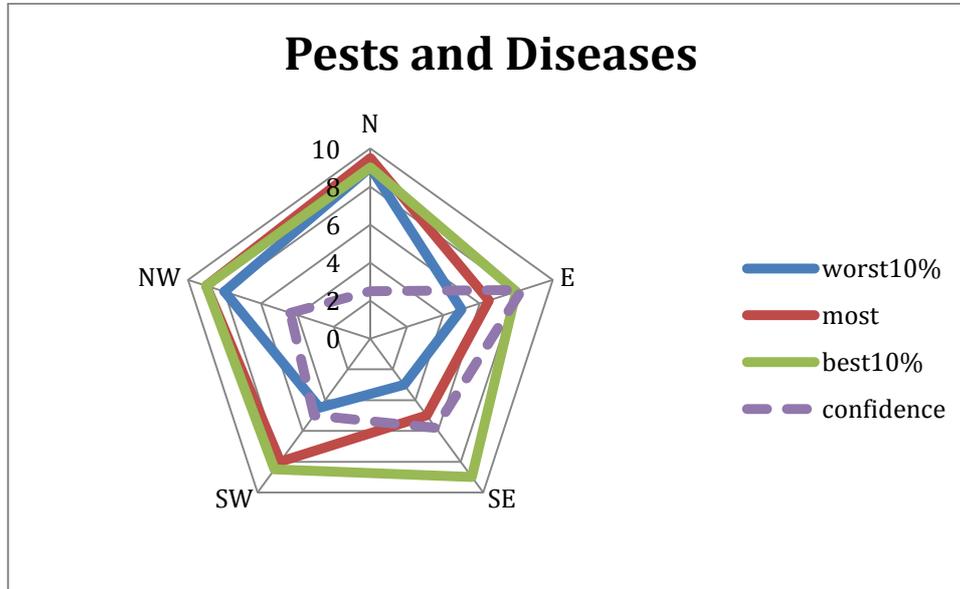**5. Pests, introduced species, diseases and algal blooms**

Figure S18 Pests and diseases—overview of the regions

The condition of pests, introduced species, diseases and algal blooms in each of Australia's five marine regions—'most' is the median condition in most places where they occur; 'worst10%' is the median condition of the worst 10% of examples; and 'best10%' is the median condition of the best 10% of examples. 'Confidence' represents the extent of confidence that has been placed on the assessment of these conditions by the experts at the assessment workshops.

Condition and confidence are both scaled from very poor or low (0) to very good or high (10).

Pressures

The overall national assessment of pressures on the marine ecosystems was determined in each SOE region at the National Marine Condition Assessment workshops. The pressures are reported here by region, and scored based on the severity of their impacts on the biodiversity and ecosystems. A description of the workshop process and the grading statements for each parameter used to compile these assessments are provided above.
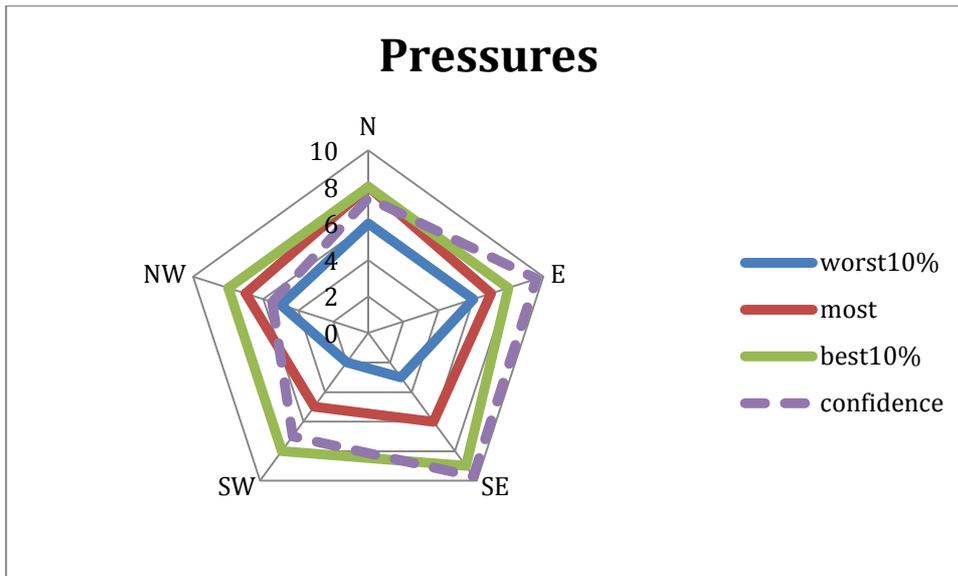
Figure S19 Pressures—overview of the regions

The impacts of the main pressures affecting the SOE marine regions—'most' is the median condition of the impact of the pressures where they occur in the region; 'worst10%' is the median condition of the worst 10% of pressures where they occur; and 'best10%' is the median condition of the best 10% of pressures where they occur. 'Confidence' represents the extent of confidence that has been placed on the assessment of these pressures by the experts at the assessment workshops.

Pressure and confidence are scaled from very poor (widespread and serious environment degradation across the region within 10 years) or low confidence (0) to very good (impacts on the environmental values of the region are likely to be negligible) or high confidence (10).

Appendix 1

2011 State of the Environment

National Marine Condition Assessment workshops

Workshop Participants

The following invited experts attended all or part of the NMCA workshops program. The SOE Committee and DSEWPAC gratefully acknowledge the input and advice provided by these experts in support of the NMCA process.

Name	Affiliation
Dr Russell Babcock	Commonwealth Scientific and Industrial Research Organisation
Dr Elaine Baker	University of Sydney
Prof Lynnath Beckley	Murdoch University
Mr Clay Bryce	Western Australian Museum
Mr Chris Burton	Western Whale Research Pty Ltd
Dr Bob Creese	New South Wales Department of Primary Industries
Dr Nancy Dahl-Tacconi	Department of Sustainability, Environment, Water, Populations and Communities
Dr Peter Davies	New South Wales Department of Environment, Climate Change and Water
Dr Arnold Dekker	Commonwealth Scientific and Industrial Research Organisation
Mr Geoff Dews	University Sunshine Coast
Dr Kirstin Dobbs	Great Barrier Reef Marine Park Authority
Dr Graham Edgar	University of Tasmania
Prof Karen Edyvane	Charles Darwin University
Dr Ian Eliot	Western Australia Department of Planning
Dr Kim Friedman	Western Australia Department of Environment and Conservation
Dr Jane Fromont	Western Australian Museum
Dr Dan Gaughan	Western Australia Department of Fisheries
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Dr Peter Harris	Geoscience Australia
Dr Alistair Hobday	Commonwealth Scientific and Industrial Research Organisation
Dr Pat Hutchings	Australian Museum
Mr Curt Jenner	Centre for Whale Research (Western Australia) Inc
Mr Boon Lim	Australian Government Department of Sustainability, Environment, Water, Populations and Communities
Mr Chris Marshall	Australian Government Department of Sustainability, Environment, Water, Populations and Communities
Mr Kevin McAlpine	Environmental Protection Authority Western Australia
Dr Mark Meekan	Australian Institute of Marine Science
Prof Jessica Meeuwig	University of Western Australia
Dr Stephen Newman	Western Australia Department of Fisheries
Dr Tim O'Hara	Museum Victoria
Prof John Pandolfi	University of Queensland
Dr Sue Pillans	Queensland Government Department of Employment, Economic Development and Innovation; University of Queensland
Dr Jeremy Prince	Biospherics Pty Ltd
Dr Lynda Radke	Geoscience Australia
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Associate Prof Greg Skilleter	University of Queensland
Mr Richard Stoklosa	E-Systems Pty Ltd
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Dr John Veron	Coral Reef Research
Prof Anya Waite	University of Western Australia
Prof Di Walker	University of Western Australia
Dr Trevor Ward	Greenward Consulting
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