Australian Government

National Land & Water Resources Audit

Estuarine, coastal and marine

Status of information for reporting against indicators under the National Natural Resource Management Monitoring and Evaluation Framework

www.nlwra.gov.au

About the National Land & Water Resources Audit

The National Land & Water Resources Audit ('the Audit') provides data, information and nationwide assessments of Australia's land, water and biological resources to support sustainable development. The Audit commenced in 1997 and published the first set of detailed assessment reports in 2002.

The Audit (2003–08) has six key areas of activity:

- developing a consistent national reporting mechanism for collating natural resource information collected under the National Natural Resource Management Monitoring and Evaluation Framework
- collating information to support the national State of the Environment (SoE) reports
- developing nationally consistent, but regionally relevant integrated resource condition reports
- facilitating reporting on the ongoing collection of natural resource information for key theme areas, including those related to the National Natural Resource Management Monitoring and Evaluation Framework
- reporting on national data and information management (in collaboration with ANZLIC — the Spatial Information Council)
- developing national assessments (as requested) and supporting program evaluations.

For further information see http://www.nlwra.gov.au

The Audit's mission

To provide data, information and nationwide assessments of Australia's land, water and biological resources to support sustainable development.

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Foreword

Effective management of natural resources requires good quality data and information at the right level of detail to be available for those who need it. Australia invests significant resources each year in the collection and maintenance of data to inform natural resource management decisions.

Since 1997, the National Land & Water Resources Audit has played a vital role in the national coordination, collation and reporting of this information. The Audit collaborates with a range of partners, including the Australian Government, state and territory governments, regional natural resource management bodies, industry, the private sector and community organisations.

This booklet is part of a series that describes the status of data and information relevant to national indicators agreed under the National Natural Resource Management Monitoring and Evaluation Framework. It specifically reports on the current status of information relating to indicators of the extent, distribution and condition of estuarine, coastal and marine (ECM) habitats. This is a vital step towards more strategic future investment.

Noteworthy advances in ECM information include:

- production of the National Intertidal/Subtidal Benthic Habitat Map Series and a National Shoreline Geomorphic and Stability Map
- public access to information about 12 000 beaches, held in the Australian Beach Safety and Management Program database
- continuing development of the OzCoasts website
- public access to processed high-spatial resolution and high-temporal resolution satellite imagery
- strong support for the emerging Environmental Condition Assessment Framework.

Geoff Gorrie
Chair, Audit Advisory Council

Acronyms and abbreviations

ARO	Australian Resources Online
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEWHA	Department of the Environment, Water, Heritage and the Arts
ECAF	Environmental Condition Assessment Framework
ECM	estuarine, coastal and marine
ICAG	Intergovernmental Coastal Advisory Group
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
MODIS	Moderate Resolution Imaging Spectroradiometer
National M&E Framework	National Natural Resource Management Monitoring and Evaluation Framework
NIMPIS	National Introduced Marine Pest Information System
NISB	national intertidal/subtidal benthic
NLWRA	National Land & Water Resources Audit ('the Audit')
NRM	natural resource management
SEAP	Streams and Estuaries Assessment Program

Contents

Executive summary

This booklet provides a summary of the current capacity to report on the estuarine, coastal and marine (ECM) matters for targets agreed under the National Natural Resource Management Monitoring and Evaluation Framework. The two ECM indicator headings are:

- ECM habitat extent and distribution
- ECM habitat condition.

Two recent major national initiatives — the National Intertidal/Subtidal Benthic Habitat Map Series and the National Shoreline Geomorphic and Stability Map — have significantly improved the capacity to report on the extent and distribution of key habitat types.

Many ECM areas are not mapped, and areas that are have usually been mapped only once. Therefore, a new indicator that assesses changes in extent, distribution and habitat condition through monitoring representative sites is proposed for development.

Nineteen nationally agreed indicators have been identified to support the assessment of the condition of ECM environments. These have been prioritised following state-based trials, and guidelines for measuring ten of those indicators have been developed. These guidelines were noted by the Audit Advisory Council in June 2008.

National standardisation of indicators and their collection and management methods should continue. Many are widely collected and it is important to capture and store data that can be used and reused for different purposes.

Recent reviews have shown that information about resource condition is severely limited; though, for some ECM assets, there are relatively rich sources of the basic data and information that could support other types of reports, such as vulnerability and risk assessments. However, for the vast majority of assets, even this information contains large gaps (eg bathymetry and dilution rates of estuarine water bodies).

The premise that there exists a core set of measures that can indicate ecological condition of ECM environments at the national scale is therefore inadequate. In response, the Environmental Condition Assessment Framework (ECAF) has been developed. The framework will enable vulnerability, pressure and risk assessments to be made in the absence of resource condition information, and in data-poor environments.

The proposed framework, which is receiving strong support from key ECM managers, is designed to enable more efficient national assessments by better aligning the natural resource information to managers' requirements. The ECAF will facilitate the growth of data and information needed to support management.

It is important to continue to strive to achieve 'national resource condition reporting'. A number of Australian Government, state and territory initiatives are increasing the capacity to report on ECM resources. These include:

- redevelopment of the national marine pests monitoring standards and database by the National Invasive Marine Pests Coordinating Group
- major collations of data and information about estuaries by state agencies, particularly in New South Wales, Queensland, Victoria and Western Australia
- expansion of mapping programs in deeper marine waters by the Australian Government, natural resource management (NRM) regions and state and territory agencies
- application of consistent monitoring methods for some seagrass, rocky substrates (reef) and coral reef habitats
- development of the OzCoasts website as a key piece of information infrastructure supporting the national ECM information base
- emergence and ongoing development of an integrated estuarine assessment framework based on the concept of stressors
- emergence of a proposal for a generic assessment framework (ie the ECAF) that will support efficient reporting and assessments at regional, state and territory and national levels.

Challenges still exist in a number of areas, including:

- national consistency in data collection and documentation
- long-term storage of, and access to, collected data
- collection of adequate contextual datasets
- almost entire lack of indicators of ecological processes
- lack of monitoring programs for intertidal (mangrove, saltmarsh, dune and beach) and soft sediment (sand and mud) habitats

- definition of marine NRM assets, and thus conceptual models and indicators
- lack of marine NRM region boundaries for New South Wales, Victoria, Western Australia and the Northern Territory
- need for a reporting unit smaller than the Integrated Marine and Coastal Regionalisation of Australia mesoscale bioregions, such as an 'ecosystem' or 'ecoregion', as suggested by Hilbert et al (2007).

The collection, collation and reporting of ECM habitats across multiple agencies and natural resource managers, all with different needs and perspectives, is an ongoing challenge. This booklet shows that the National Land & Water Resources Audit (the Audit) and its partners are making significant progress toward these goals.

Near-pristine Southport Lagoon, Tasmania (photo by Andy Short)

Nationally consistent estuarine, coastal and marine habitat information is critical for improved management of these natural resources.

Introduction

This booklet summarises the current capacity to report on habitat extent, distribution and condition for estuarine, coastal and marine (ECM) areas (see Box 1). These areas form part of the matters for target agreed under the National Natural Resource Management Monitoring and Evaluation Framework (National M&E Framework) (see Appendix 1).

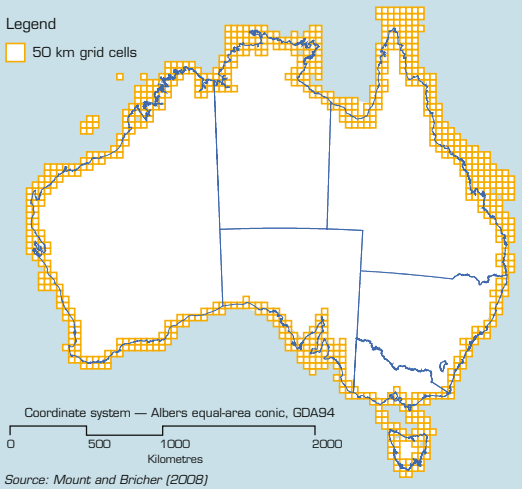
Nationally consistent ECM information is critical to:

- enable better management of Australia's natural resources
- achieve sustainable land management
- improve our capacity to manage biodiversity and other environmental values.

Box 1 Estuarine, coastal and marine area of interest

The grid cells shown on this map broadly represent the estuarine, coastal and marine (ECM) area of interest for natural resource management reporting and National Land & Water Resources Audit purposes (Mount and Bricher 2008). The map includes all of the state coastal waters (also commonly known as the three nautical mile marine boundary), the area of the land influenced by marine and coastal processes such as tides and salty winds, and the Great Barrier Reef.

The coastal zone is defined differently for different purposes; however, a broad definition is necessary when taking an overview of these environments.



Source: Mount and Bricher (2008)

(Note: some offshore islands are missing from this map)

An octopus in dense seagrass habitat in the near-pristine Southport Lagoon, Tasmania (photo by Cameron Veal)

The Natural Resource Policies and Programs Committee is responsible for all matters for target, except those related to the integrity of ECM areas, which are the responsibility of the Marine and Coastal Committee. In turn, the Marine and Coastal Committee has tasked the Intergovernmental Coastal Advisory Group (ICAG) to be the national coordinating committee for ECM information. ICAG consists of representatives from the Australian Government, each state government, the Northern Territory Government and the Australian Local Government Association (see Table 1). ICAG members meet several times a

year to work on the National Cooperative Approach to Integrated Coastal Zone Management Framework and Implementation Plan.

The Audit has been working with ICAG and the Department of the Environment, Water, Heritage and the Arts (DEWHA) on the ECM Work Plan 2006–2008 to further the capacity required to deliver national ECM assessments. The work plan is designed to develop the information base needed for reporting, including:

- addressing information needs (such as indicators)
- building data and information systems
- developing information products (eg report cards)
- scoping assessment methods.

Work has progressed on the national set of resource condition indicators, building on previous work by the Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management, and complemented with a series of trials and national consultations.

Table 1 Agencies represented on the Intergovernmental Coastal Advisory Group

Jurisdiction	Agency
NSW	Department of Environment and Climate Change
	Department of Planning
NT	Department of Natural Resources, Environment and the Arts
Qld	Environment of Protection Agency
SA	Department for Environment and Heritage
Tas	Department of Environment, Parks, Heritage and the Arts
Vic	Department of Sustainability and Environment
WA	Department for Planning and Infrastructure
Australian Government	Department of the Environment, Water, Heritage and the Arts Commonwealth Scientific and Industrial Research Organisation
Other	Australian Local Government Association

National indicators

Nineteen resource condition indicators for ECM habitats were identified and nationally agreed upon by ICAG (Table 2). The resource condition indicators have been prioritised in light of national trials and round-table consultations with key experts. Guidelines describing a standard approach to measuring 10 prioritised indicators are available on the Audit's website.[1]

Indicator guidelines allow nationally agreed standards to be set around the collection and management of ECM data and information. The guidelines specify the use of standards wherever possible, including standardised monitoring methods (data collection, analysis and interpretation) and data management. These guidelines are essential, as they enable data to be discovered, accessed and reused multiple times.

Flexibility is required when selecting indicators. New indicators are continuously being developed, and environmental assessment and reporting will vary with the circumstance and purpose of assessments. Therefore, in the future, indicator guidelines are likely to be updated and more indicators will be defined.

Drawing on learnings from state and territory trials and national consultations, indicator documentation has been modified from a 'protocol' format, which sought to define measurement standards and reporting (information) products, to one that presents 'guidelines' for collection and storage of monitoring data.

Indicator guidelines should be used as standards for collection, collation and storage of data, to help NRM service providers and community groups make observations that can be pooled and reused.

Further details of the indicators, including full guideline documentation, are progressively being made available on the Audit[2] and OzCoasts[3] websites.

1 http://www.nlwra.gov.au

2 http://www.nlwra.gov.au

3 http://www.ozcoasts.org.au

Table 2 Nationally agreed resource condition indicators (standard guidelines have been drafted for the 10 highlighted prioritised indicators)

National M&E Framework indicator heading	Indicator
ECM habitat extent and distribution	Extent and distribution of key habitat types
ECM habitat condition	
Biological condition	Algal blooms
	Animal or plant species abundance
	Chlorophyll a levels
	Coral bleaching
	Mass mortality events
	Pest species (number, density, distribution)
	Targeted pathogen counts
	Vertebrates impacted by human activities
Physical or chemical condition	Dissolved oxygen
	Nutrients
	pH
	Presence and amount of litter (marine debris)
	Salinity (EC)
	Sedimentation/erosion rates
	Shoreline position
	Temperature
	Toxicants (in water, sediments or biota)
	Water clarity (turbidity)

EC = electrical conductivity; ECM = estuarine, coastal and marine; National M&E Framework = National Natural Resource Management Monitoring and Evaluation Framework; pH = per hydrogen

Source: Souter and McKenzie (2006)

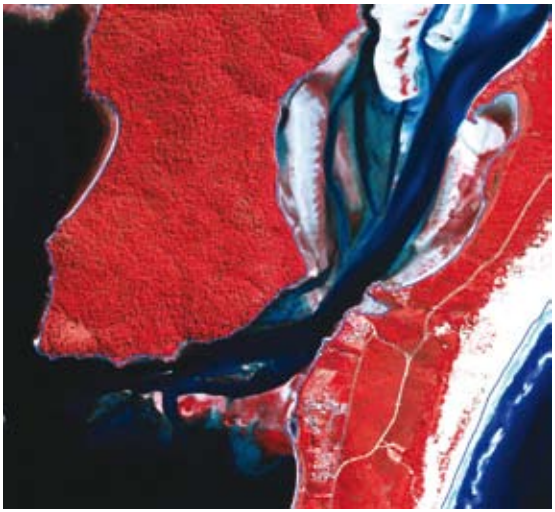
Indicator data needs

An initial assessment of the data required to report against the National M&E Framework indicators (Beaten Track Group 2004) was further refined after a series of state trials and national round-table consultations. The data requirements are classified as either protocol or contextual as follows:

- protocol data — specific data recorded to measure the indicator as defined in the protocol or guidelines
- contextual data — data required for interpretation and for understanding and communicating changes in trends; such data can be further categorised as 'critical' (ie essential to understanding the indicator) and 'useful' (ie adds value to the interpretation of the indicator).

Metadata are required for all datasets, and the Audit recommends the use of the Spatial Information Council's profile of the International Organisation for Standardization standard for spatial metadata.[4]

[4] http://www.anzlic.org.au/infrastructure_metadata.html



Infrared image of the estuarine entrance to Georges Bay, Tasmania, showing a complex system of habitats (including seagrass, dunes and dune vegetation) and unconsolidated substrates (image courtesy of SKM and Digital Globe, image processing by Richard Mount)

Tables 3–5 show the data needs for each of the indicators according to three categories:

- specific data for the indicator measurement as defined in the indicator guidelines
- critical contextual data needed to understand the indicator
- useful contextual data that helps to that helps to understand the indicator.

Table 3 Identified data needs for the extent and distribution indicators

Data need	Habitat indicator
Extent and distribution of NISB habitats	
Type of habitat according to the NISB Habitat Classification Scheme	***
Extent (ha) of each habitat type	***
Distribution (coverage and range) of each habitat type	***
Extent and distribution of estuaries and coastal wetlands	***
Extent and distribution of dunes and dune vegetation	***
Extent and distribution of shoreline habitats	***
Integrated Marine and Coastal Regionalisation of Australia (IMCRA)	***
NRM region boundaries, including marine segment	***
Bathymetry	**
Hydrodynamics and exposure (tidal, wave, current, entrance opening)	**
Catchment hydrology (estuaries)	**
Catchment (estuarine and fluvial) disturbance index (estuaries)	**
Nutrient and sediment loadings	**
Climate (rainfall, temperature)	**
Pest species (time series if possible)	*
Urbanisation pressures (time series if possible)	*
Land use (time series if possible)	*

ha = hectare; NISB = national intertidal/subtidal benthic; NRM = natural resource management

Key:

*** = specific data for the indicator measurement as defined in the guideline

** = critical contextual data needed to understand the indicator

* = useful contextual data that help to understand the indicator

Condition indicators

Condition indicators either cover naturally occurring components of the environment that can become damaging when out of the normal range (eg nutrients, suspended sediments), or may integrate the net result of ecosystem changes (eg as indicator species do).

Indicators, such as animal or plant species abundance and chlorophyll a, are mostly measures of the biotic response to the environmental conditions, and their interpretation generally requires a lot of contextual information. They are considered 'outcome' indicators; measured changes can be cautiously interpreted as integrating the effect of all conditions acting on the organisms.

Dissolved oxygen, nutrients and water clarity indicators can be supported by modelled estimates or direct measurements (including remote sensing methods).

The sedimentation/erosion rate indicator show the net results of the geomorphological processes acting on aquatic sediments in ECM environments. As for biotic indicators, contextual information is required to interpret the results.

Pest species, toxicants and litter are all indicators of the environment that are not naturally occurring. The data needs for assessing the extent, distribution and rate of pest species invasion include regular surveys of likely invasion sites.

As humans introduce a large number of toxicants into the environment, ambient monitoring of all toxicants is unfeasible. Data need to be obtained from observations of expected toxicants in likely locations such as the water column, sediments or embodied in biota. Correct interpretation of toxicant data relies on a thorough understanding of the ecosystem.

Pathways of litter into and through ECM environments are often complex. New conceptual models of these pathways allow monitoring to be targeted to critical litter types and locations. The 'standing crop' and 'accumulation rate' of litter are typically measured.

Marine biologists Cathy Sliwa and Brian Steves with the marine pest, the northern Pacific seastar (photo by Newspix)

Table 4 Condition indicators — biological

Data need	Animal or plant species abundance	Chlorophyll a levels	Pests
Animal or plant species abundance	***		
Chlorophyll a levels		***	
Extent, distribution and invasion rates of pest species			***
Extent and distribution of onshore weeds			***
Extent and distribution of onshore vertebrate pests			***
Integrated Marine and Coastal Regionalisation of Australia (IMCRA)	***	***	***
NRM region boundaries, including marine segment	***	***	***
Bathymetry	**	**	**
Hydrodynamics and exposure (tidal, wave, current, entrance opening)	**	**	**
Catchment hydrology (estuaries)	**	**	**
Stormwater discharge			
Catchment (estuarine and fluvial) disturbance index	**	**	**
Climate	**	**	**
Sediment characteristics	**	**	**
Land use and water use including aquaculture	**	**	**
Shipping activities			**
Urbanisation pressures	**	**	*

NRM = natural resource management
Key:
*** = specific data for the indicator measurement as defined in the guideline
** = critical contextual data needed to understand the indicator
* = useful contextual data that help to understand the indicator

Table 5 Condition indicators — physical and chemical

Data need	Toxicants	Litter	Water clarity	Dissolved oxygen	Nutrients	Sedimentation and erosion
Levels of toxicants in the water column, sediments or biota	***					
Standing crop of litter		***				
Rates of litter accumulation		***				
Nutrients (water column and sediments)					***	
Water clarity (turbidity)			***			
Dissolved oxygen				***		
Sedimentation/erosion rates						***
Integrated Marine and Coastal Regionalisation of Australia (IMCRA)	***	***	***	***	***	***
NRM region boundaries, including marine segment	***	***	***	***	***	***
Bathymetry	**	**	**	**	**	**
Hydrodynamics and exposure (tidal, wave, current, entrance opening)	**	**	**	**	**	**
Catchment hydrology (estuaries)	**		**	**	**	**
Stormwater discharge		**				
Catchment (estuarine and fluvial) disturbance index			**	**	**	**
Climate	**		**	**	**	**
Sediment characteristics	**	**	**	**	**	**
Land use and water use including aquaculture	**	**	**	**	**	**
Shipping activities		**				
Urbanisation pressures	*	*	**	**	**	**

NRM = natural resource management
Key:
*** = specific data for the indicator measurement as defined in the guideline
** = critical contextual data needed to understand the indicator
* = useful contextual data that help to understand the indicator

A further analysis of the specific data needed to report against the National M&E Framework resource condition indicators (Mount 2007) showed that reporting against the resource condition indicators is a high-level activity that requires substantial information on:

- human values
- management intentions
- environmental and ecological systems of interest
- the current situation.

The series of state-based indicator and report card trials have shown that although there are some excellent datasets being developed for resource condition reporting, the spatial coverage is patchy and the temporal resolution is coarse.

Awareness of these issues has driven the development of a more comprehensive framework that is not so dependent on resource condition, and enables the use of more readily available contextual and pressure data and information. The ECAF (Mount 2008) tackles these problems and provides a direction for the viable development of comprehensive ECM condition assessments.

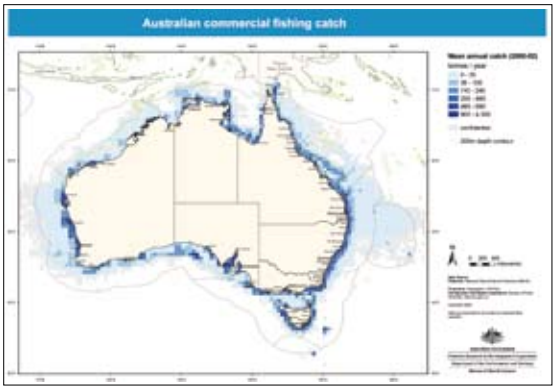
Data and information systems

National information systems

Some national databases of ECM information exist; however, many are small, contain old data or have limited value for NRM reporting needs. Currently, OzCoasts[5] is the best available national information system for collating, managing and disseminating ECM data and information related to NRM management at national, state and territory and regional levels.

Under the management of Geoscience Australia, OzCoasts is undergoing another round of development. This includes the production of an NRM reporting module, improved search facilities, and broadening of the information base into all estuarine, coastal and nearshore marine environments (including shorelines). A series of trials has proved the capacity of OzCoasts to receive and present environmental information using report cards. Development of remote sensing and shoreline vulnerability to climate change reporting modules is currently under development and will be available in the near future.

Other national web-based reporting systems that collate and report on indicator data include:



A map of Australian commercial fishing from the Marine Matters website

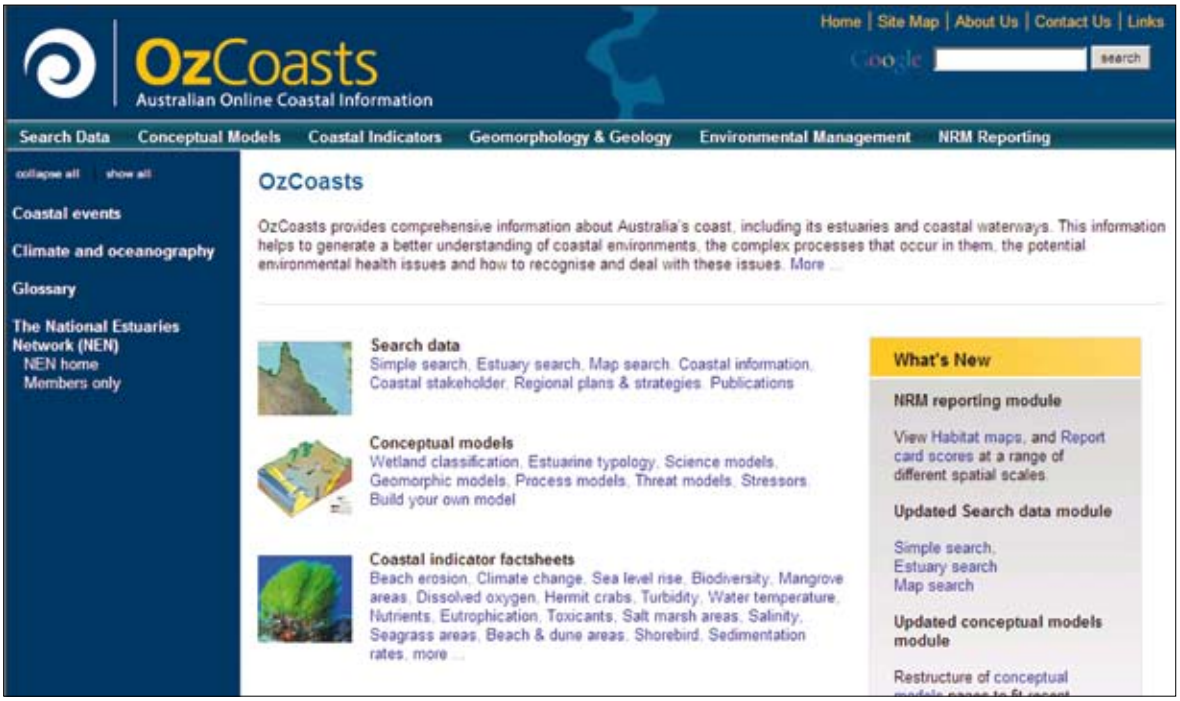
- Australian Resources Online (ARO) — the Audit is developing ARO as an NRM reporting module of the Australian Natural Resources Atlas[6] in collaboration with the Environmental Resources Information Network[7] within DEWHA. ARO is intended to be synchronised with the OzCoasts NRM reporting module.
- Marine Matters — the Department of Agriculture, Fisheries and Forestry hosts a website[8] that reports on Australian fisheries and fishing communities from 2000 to 2002.

5 http://www.ozcoasts.org.au

6 http://www.anra.gov.au

7 http://www.environment.gov.au/erin

8 http://www.daff.gov.au/brs/fisheries-marine/info/atlas-fishing



Screenshot of the OzCoasts website

The major information systems that provide access to other critical and contextual information are listed in Table 6.

A new national database of toxicant records is being developed by DEWHA. Currently, all toxicant information is sourced from state and territory agencies. The National Pollutant Inventory[9] presents the location of pollution sources and emissions, rather than environmental toxicant concentrations. No national litter database exists, though DEWHA is scoping the development of a database and monitoring protocols as plan.

9 http://www.npi.gov.au

Table 6 National information systems and datasets relevant to the ECM theme

Main system	Description	Website
ABS	Australian Bureau of Statistics population data	http://www.abs.gov.au
ACLUMP	Australian Land Use Mapping	http://www.brs.gov.au/landuse
AMSIS	Australian Marine Spatial Information System, includes jurisdictional marine boundaries	http://www.ga.gov.au/amsis
ANRDL	Australian Natural Resources Data Library	http://adl.brs.gov.au
ARO	Australian Resources Online	http://www.anra.gov.au
ASRIS	Australian Soils Resource Information System	http://www.asris.csiro.au
Bathymetry	Royal Australian Navy Hydrographer	http://www.hydro.gov.au
IMCRA	Integrated Marine and Coastal Regionalisation of Australia	http://www.environment.gov.au/coasts/mbp/imcra
MARS	Marine sediments database	http://www.ga.gov.au/oracle/mars
NIMPIS	National Introduced Marine Pests Information System	http://www.marine.csiro.au/crimp/nimpis
NRM region boundaries	Defines NRM marine boundaries	http://www.environment.gov.au/erin
NVIS	Native Vegetation Information System	http://www.environment.gov.au/erin/nvis
OzEstuaries	■ National estuaries database ■ ECM National Habitat Map Series — intertidal/subtidal benthic habitat mapping ■ National Shoreline Map — geomorphic and stability mapping ■ ABSAMP — Australian beaches database ■ Coastal remote sensing — repository of remote sensing images and map products for coastal shallow waters	http://www.ozcoasts.org.au
Seabed Mapping	Geoscience Australia's seabed mapping and characterisation program	http://www.ga.gov.au/oceans/mc_SMAC.jsp

ABSAMP = Australian Beach Safety & Management Program; ACLUMP = Australian Collaborative Land Use Mapping Programme; ECM = estuarine, coastal and marine; NRM = natural resource management

The OzCoasts website,[10] hosted at Geoscience Australia, is the main national information system holding estuarine data. Estuary datasets available through the OzCoasts search facility contain information gathered as part of the latest national estuaries assessment (NLWRA 2002). The data include:

- estuary location and geometry (length, width and perimeter)
- catchment and water areas
- geomorphic type
- estuary degree of modification (from near pristine to severely modified)
- geomorphic habitat (facies) areas.

The OzCoasts website provides tools for users to produce their own graphical conceptual models of estuarine functions, including hydrodynamics and nutrient cycling. Fact sheet summaries of current findings, drawn from scientific literature relevant to key environmental management issues, are also provided.

The National Introduced Marine Pest Information System (NIMPIS)[11] is a database that gives managers, researchers, students and the general public access to accurate, up-to-date information on the biology, ecology and distribution of introduced marine species. It also includes potential control options for those species designated as pests (both known and 'next' pests). Further development of the database and monitoring protocols is taking place under the auspices of the National Introduced Marine Pests Coordination Group.

Extent and distribution indicators

National Habitat Map Series

The ECM National Habitat Map Series (Mount and Bricher 2008) is a nationally consistent source of data of key habitats. States, territories and other key habitat-mapping agencies have contributed to these data (see Table 7). The main components of the map series are:

- National Intertidal/Subtidal Benthic (NISB) Classification Scheme (Mount et al 2007)
- NISB Habitat Map

[10] http://www.ozcoasts.org.au

[11] http://www.marine.csiro.au/crimp/nimpis

- NISB Habitat Distribution Map Series
- Estuaries, Dunes and Wetland Map Collections
- National Shoreline Map (Sharples and Mount, in press).

The NISB Habitat Classification Scheme (Figure 1) provides a nationally consistent scheme for habitats between the highest astronomical tide mark and the approximate outer limit of the photic benthic zone (approximately 50–70 m depth contour).

Table 7 State and territory information systems containing habitat mapping

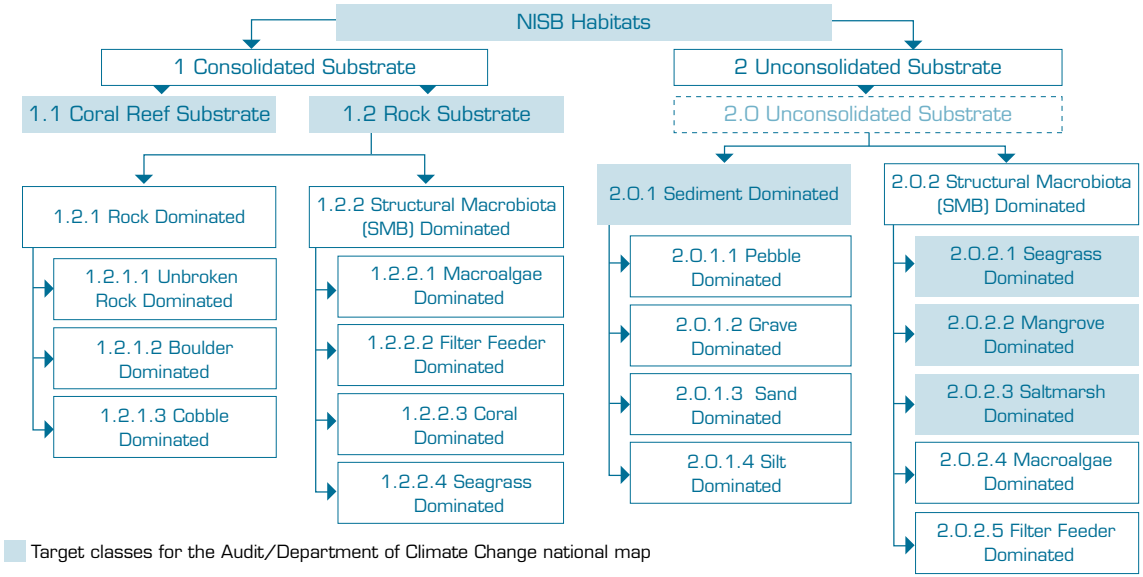
Jurisdiction	Main system	Website
NSW	■ Department of Environment and Climate Change ■ Department of Planning ■ Department of Natural Resources ■ Department of Primary Industries	http://www.environment.nsw.gov.au http://www.planning.nsw.gov.au http://www.dnr.nsw.gov.au http://www.dpi.nsw.gov.au
NT	■ Department of Natural Resources, Environment and the Arts	http://www.nt.gov.au
Qld	■ Department of Primary Industries and Fisheries ■ Environmental Protection Agency	http://www.dpi.qld.gov.au http://www.epa.qld.gov.au
SA	■ Department of Environment and Heritage ■ South Australian Research and Development Institute	http://www.saugov.sa.gov.au http://www.sardi.sa.gov.au
Tas	■ SEAMAP — Tasmanian Aquaculture and Fisheries Institute, University of Tasmania ■ Department of Primary Industries and Water	http://www.utas.edu.au/tafi/seamap http://www.dpiw.tas.gov.au
Vic	■ Parks Victoria ■ Department of Sustainability and Environment ■ Department of Primary Industries	http://www.parks.vic.gov.au http://www.dse.vic.gov.au http://www.dpi.vic.gov.au
WA	■ Department of Environment and Conservation ■ University of Western Australia	http://www.dec.wa.gov.au http://www.uwa.edu.au

The scheme was created to represent areas of marine and coastal habitats at the national level. As far as possible, it is compatible with mapping schemes used by the major producers of Australian habitat maps, such as state agencies and NRM regional bodies. The scheme's classes are typically used for habitat mapping and are conceptually similar to terrestrial land cover mapping.

The National Shoreline Geomorphic and Stability Map project (Sharples and Mount, in press) will deliver nationally consistent shoreline maps to Geoscience Australia and the Department of Climate Change. These maps are primarily collected for assessment of climate change impacts on the shoreline, but will also be useful to identify NRM regional environmental assets and provide a basis for reporting. The associated Australian Beach Safety & Management Program database contains environmental information about all 12 000 of Australia's sandy beaches. Access to both databases will be through the OzCoasts website.[12]

[12] http://www.ozcoasts.org.au

Figure 1 National Intertidal/Subtidal Benthic (NISB) Habitat Classification Scheme



Source: Mount et al (2007)

The Australian Shallow Waters Spectral Library

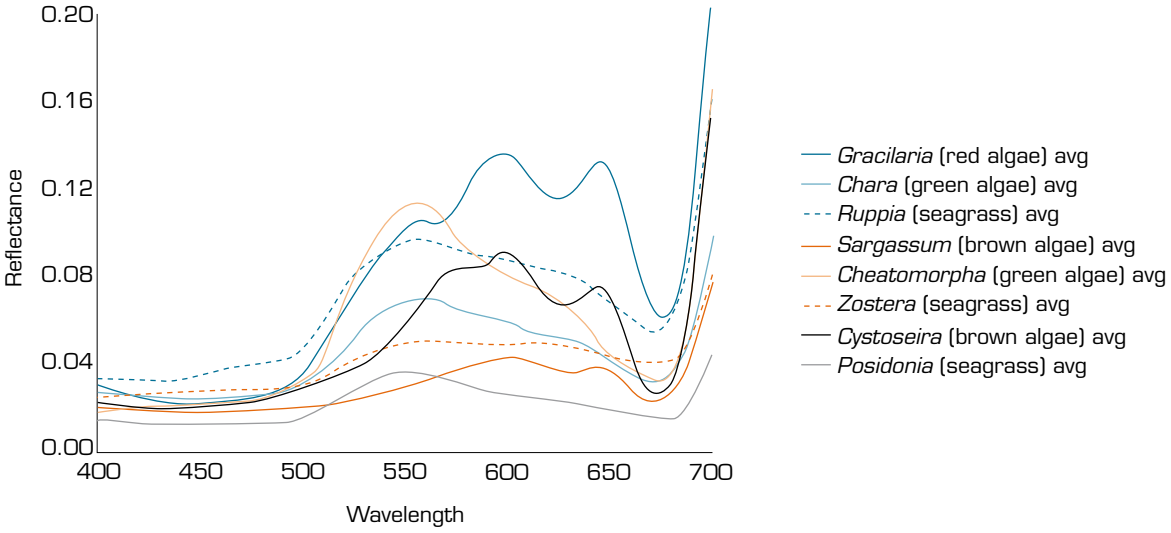
The Australian Shallow Waters Spectral Library has been developed through a collaboration of CSIRO, the Audit, Geosciences Australian, state and territory coastal management agencies and selected universities.

It is a comprehensive spectral library of optical spectral properties of water columns, substrates and habitats measured in Australia, and can be used for the interpretation of satellite imagery to assess subsurface habitat type, extent and (where possible) condition.

The library enables modellers to make a distinction between the reflectance properties of a water column and the reflectance properties of the substratum substrate and its many forms of vegetative or coralline cover. Modellers can use this to determine the habitat type of a region, and apply this information to produce habitat maps of that region (see Box 2).

The Australian Shallow Waters Spectral Library can be accessed via the OzCoasts website.[13]

[13] http://www.ozcoasts.org.au

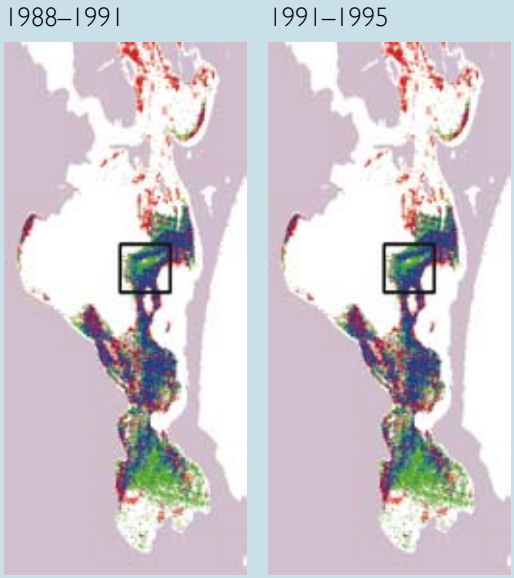


Seagrass and macroalgae spectra obtained from the substrate spectral library for Wallis Lake NSW. In order to accurately classify the substrate for this region, modellers compare these mixed spectral signatures to a set of pure reference spectra (also available from the spectral library), often referred to as 'end members', which are measured in the field or in the lab. Graph redrawn from Dekker et al (2005).

Box 2 Case study — habitat trend mapping

The spatial change in seagrass (*Zostera*) cover over a 14-year period was mapped retrospectively in Wallis Lake, New South Wales, Australia, using satellite Landsat imagery. Through change-detection analysis, the three main seagrass classes of interest could be assessed as 'declining', 'stable' or 'increasing'. To illustrate the variability of change over time, a change-detection map for *Zostera* was produced for the 1988–1991 and 1991–1995 images.

The 1988–1991 change-detection image clearly indicates *Zostera* loss from the central eastern basin. *Zostera* change is not uncommon and could be the result of seasonal or environmental conditions, although both images were acquired in approximately in the same season (February 1988 and March 1991). By 1995, *Zostera* had regrown, covering the scar feature identified in 1991.



Changes in *Zostera* cover in Wallis Lake, New South Wales

Red = loss; green = gain; blue = no change
The highlighted region shows a scar where the seagrass (*Zostera*) was lost in 1991, but had regrown by 1995.
Source: Dekker et al (2005)

Condition indicators

Each state and territory has information management systems that record many of the parameters of interest related to indicators. However, measurements are usually made for specific purposes, such as assessing sewage treatment plant performance or monitoring aquaculture, rather than for more general environmental conditions. Indicator efficacy trials have focused on collection and interpretation of indicators, rather than specifically creating a national data and information infrastructure.

Estuary in southern Tasmania (photo by Richard Mount)

Part of the proposed national framework's role is to harmonise Australia's various data management systems. The framework seeks to bring together assessments by the people who are in the best position to interpret the multiple sources of data and information available.

Some useful long-term habitat monitoring programs — particularly tropical and temperate reef monitoring and seagrass monitoring — are ongoing near Australia's urban areas (Hirst 2008). For example, easily accessible marine monitoring information about the Great Barrier Reef includes coral diseases[14] and bleaching,[15] and reef water quality.[16]

Each state has compiled datasets about estuaries that can be used to underpin their management and condition assessments (see Table 8).

[14] http://www3.aims.gov.au/pages/research/reef-monitoring/reef-monitoring-index.html

[13] http://www.gbrmpa.gov.au/corp_site/key_issues/climate_change/management_responses/current_condition_reports/conditions_report.html

[16] http://www.gbrmpa.gov.au/corp_site/key_issues/water_quality/marine_monitoring/marine_monitoring_report_2006

Table 8 State, territory and national estuarine information systems

State or territory	General description	Main system	Website
NSW	Comprehensive Coastal Assessment (CCA) and Monitoring Evaluation and Reporting (MER) contextual data	Department of Environment and Climate Change	http://www.environment.nsw.gov.au
		Department of Planning	http://www.planning.nsw.gov.au
NT	No specific database	Department of Natural Resources, Environment and the Arts	http://www.nt.gov.au/nreta
Qld	Wetlands Mapping, Streams and Estuaries Assessment Program and AquaBAMM	Environmental Protection Agency	http://www.epa.qld.gov.au
		Department of Primary Industries and Fisheries	http://www.dpi.qld.gov.au
SA	No specific database; Coorong project	Department for Environment and Heritage	http://www.environment.sa.gov.au
Tas	Estuaries Report (Edgar et al 1999) Conservation of Freshwater Ecosystem Values (CFEV)	Tasmanian Aquaculture and Fisheries Institute, University of Tasmania	http://www.utas.edu.au/tafi
		Department of Primary Industries and Water	http://www.dpiw.tas.gov.au
Vic	Linking catchments to the sea database and Gippsland Coastal Action Plan	Department of Sustainability and Environment and Deakin University	http://www.dse.vic.gov.au
		Gippsland Coastal Board	http://www.gcb.vic.gov.au
WA	Condition statements, eg south coast estuaries and Swan Canning; Swanland (Brearley 2005)	Department of Water	http://www.water.wa.gov.au

Marine

Marine jurisdictional boundaries

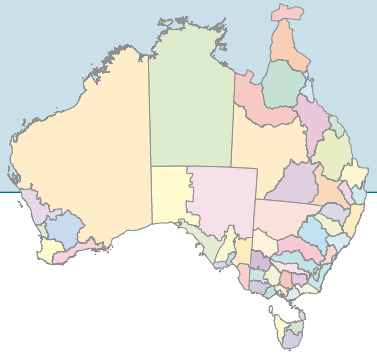
Geoscience Australia is the custodian of the Australian Marine Spatial Information System. In this system, more than 80 layers of Australian marine information (eg formal jurisdictional boundaries) can be viewed to create maps meeting specific requirements. The NRM regions (see Box 3) are the key mechanisms for delivery of NRM outcomes in Australia, and include marine segments where appropriate.

Broken starfish on sandy beach (photo Alana Innes)

Box 3 Natural resource management regions

The Australian Government, in association with state and territory governments, has identified 56 natural resource management (NRM) regions, covering all of Australia, to improve the sustainable management of natural resources on a regional scale. At least one regional body in each region manages and protects the region's natural resources. Where possible and appropriate, existing organisations are used.

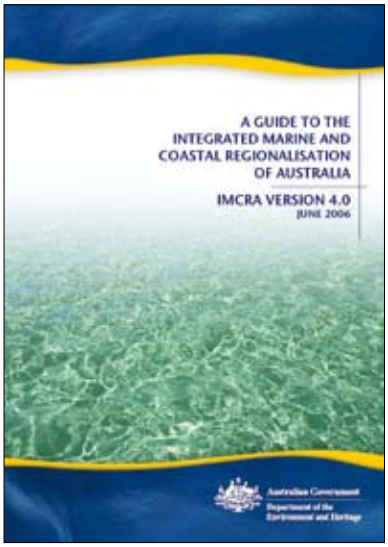
In order to ensure the best outcomes, investment in NRM plans by governments and other organisations is based on the establishment of clear targets and appropriate monitoring. A summary of each region, their NRM issues, and each region's NRM plan and contact information can be found at http://www.nrm.gov.au/nrm/region.html.

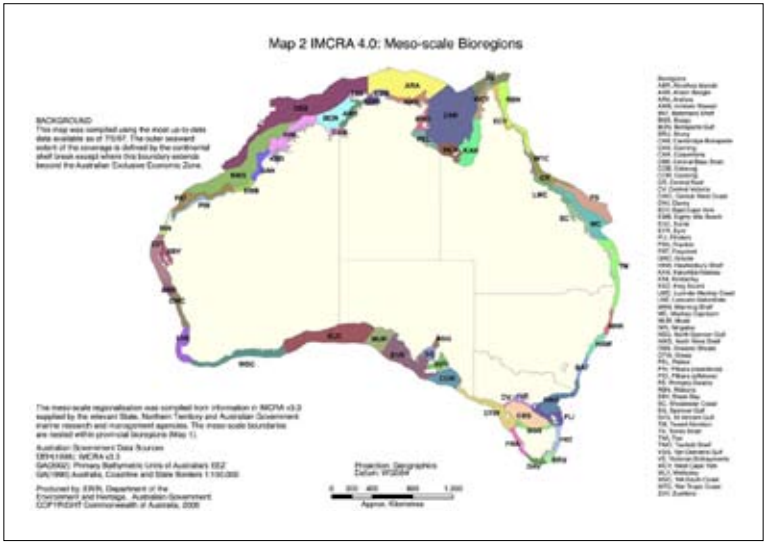


Integrated Marine and Coastal Regionalisation of Australia Version 4.0: combined inshore and off-shelf regionalisations

The Integrated Marine and Coastal Regionalisation of Australia Version 4.0 (IMCRA v4.0) (IMCRA 2006) provides an ecologically relevant spatial framework for assessing the condition of marine ecosystems around Australia. However, it has some limitations, and some areas need further development. For example, the regionalisation does not extend straightforwardly to estuaries, and other classifications are required. The marine environment also has an identified need (eg Hilbert et al 2007) to produce a subregionalisation of the IMCRA regions that is more consistent with management requirements.

IMCRA v4.0 combines the Interim Marine and Coastal Regionalisation of Australia (IMCRA v3.3), which provided a marine regionalisation of inshore waters, and the National Marine Bioregionalisation of off-shelf waters. Combining these two national-scale marine regionalisations in IMCRA v4.0 covers Australia's waters from the coast to the edge of the Exclusive Economic Zone (excluding Antarctica, Heard Island and Macdonald Island).





Integrated Marine and Coastal Regionalisation of Australia Version 4.0

Data availability and gaps

Almost no monitoring occurs of ecological assets such as biodiversity, or ecological functioning such as reproductive capacity, food webs or ecological resilience. Instead, most available data and information are about the biophysical aspects of the environment, such as habitat extent and water quality (eg Barton 2003). These data then act as surrogates and are used to infer estimates of 'ecological integrity'. However, there is considerable disagreement about many aspects of this process, and this is a major data gap for a national assessment of ecological condition.

Data availability and gaps are discussed in terms of:

- data needed for reporting on indicators
- understanding indicators in context including the need for contextual data
- measuring change and trends for all indicators.

Status of data and information for indicator reporting

Extent and distribution

The ECM National Habitat Map Series and the National Shoreline Geomorphic and Stability Mapping Project are nationally consistent sources of data. However, the habitat maps do not provide complete coverage, particularly in the open coast shallow waters and mapping has been conducted on different scales and at different times from 1984 to the present. Mapping activity is ongoing in most jurisdictions, so coverage will improve in the near-to-medium term.

Condition

Monitoring of the various resource condition indicators is patchy, with limited spatial and temporal coverage. This is because monitoring programs are typically conducted for a specific purpose or where there is a known problem, such as checking the performance of sewage treatment plants or the aquaculture industry. Few long-term environmental or ecological monitoring programs exist.

Data for reporting on the condition of key habitats are limited, although some useful seagrass and tropical and temperate reef monitoring is taking place. Monitoring of habitat condition is particularly limited in soft sediment environments (sand and muds) and in the intertidal zone (mangroves, saltmarsh and rocky shores) (Hirst 2008). Hirst states:

> ....despite their acknowledged importance there is no coordinated national strategy for monitoring the status and condition of these benthic habitats. Monitoring, where it is undertaken, is often fragmented and short

term in nature and typically there are few or no national standards for either the collection of monitoring data or the reporting of results. This situation currently severely impairs efforts to report on habitat condition and produce broad regional scale assessments about the status of a range of habitats across Australia.

The NIMPIS marine pest database provides an excellent platform for reporting on marine pests, but new data are limited. Monitoring protocols are under review and the database is still under development. The terrestrial weeds and vertebrate pests that occur in the coastal zone can be extracted from the national pest databases; however, some species are also pests in environments other than coasts, so definitions can cause challenges when producing reports.

Generally, no broadscale toxicant monitoring occurs, as it is regarded as too expensive. However, toxicant monitoring of the water column is emerging as an operational method under the Reef Plan (Hayes et al 2005). Toxicant data are mostly available following specific incidents or where there is reason to suspect contamination, for example, dioxins in Sydney Harbour or heavy metals in the Derwent River.

Litter and marine debris data is fragmented and provides patchy spatial and temporal coverage. Some marine debris data is held in specific databases (eg the Northern Territory's marine debris program[17]) or in reports of surveys at specific locations and times.

The last national estuaries assessment (NLWRA 2002) revealed only a handful of estuaries had detailed data; with some minor changes, that continues today. State and territory government departments hold datasets relating to their estuarine environments (see Table 8), but many states have identified a serious lack of fundamental data (eg Victoria — Barton 2003, Barton et al, in press). A collation of New South Wales data for monitoring and reporting purposes revealed that substantial effort was required to collate existing data. Some critical data, such as tidal limits, bathymetry and entrance opening patterns, were missing, and resource condition data was the least available type of data (DECC 2007). Table 9 lists the types of data that are needed for an assessment of the condition of an estuary.

Marine

Data in the marine environment are slowly being compiled by national agencies (including the National Oceans Office, Geoscience Australia, CSIRO and the Great Barrier Reef Marine Park Authority) and the key state and territory agencies (including those

[17] http://www.nt.gov.au/nreta/wildlife/marine

Table 9 Examples of data required for estuarine assessments[a]

Chlorophyll	Tidal prism	Sediment load	Air temperature change
Turbidity (NTU)	Tidal planes	Sewerage	Evaporation
Secchi disk	Tidal limits	Sewer discharges	Surface area
Macroalgae	Catchment area	Nutrient load	Bathymetry
Epiphytes	Salinity	Vegetation extent	Tidal prism
Seagrass	Estuary volume	Water extraction	Tidal planes
Mangrove	Catchment runoff	Stream macroinvertebrates	Tidal limits
Saltmarsh	Water load	Structures	Catchment area
Fish	Dilution	Aquaculture	Salinity
Coordinates	Residence time	Entrance works	Estuary volume
Geomorphology	Exchange efficiency	Entrance opening	Catchment runoff
Entrance condition	Tidal flushing	Harvesting	Water load
Rainfall	Total flushing	Invasive species	Dilution
Evaporation	Population	Carbon dioxide	Residence time
Surface area	Land use	Sea level rise	
Bathymetry	Runoff change	Rainfall change	

NTU = nephelometric turbidity units
a Data for estuarine assessments is not available for many estuaries.
Source: Adapted from DECC (2007)

with fisheries and marine conservation responsibilities). These include basic bathymetry, topography, sediment, habitat, oceanography and hydrodynamic data. The IMCRA provides a useful, ecologically relevant regionalisation (IMCRA 2006) and was recently updated, though there are calls to also develop IMCRA subregions or 'ecoregions' (eg Hilbert et al 2007). The national marine regional planning process is developing new methods for identifying 'key ecological features' (DEWR 2007) that could inform the identification of NRM marine assets. These methods depend on the production of ecological conceptual models, which, in turn, depend on contextual data for interpretation. Geoscience Australia's Seabed Mapping and Characterisation project is actively pursuing the development of 'seascapes' mapping to support the identification of marine biodiversity.

Pied oyster catcher (photo Claire Harris)

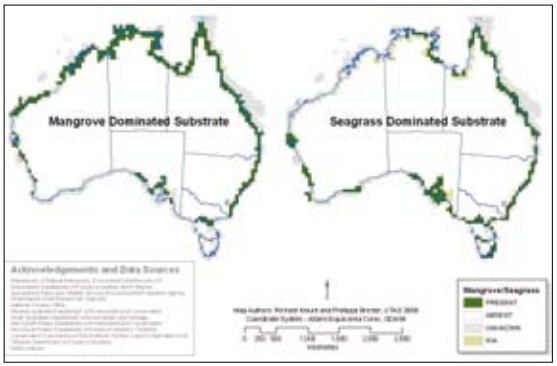
Data and information products

Key habitat extent and distribution

In collaboration with the Department of Climate Change, the Audit has built substantial capacity for long-term reporting on habitat extent and distribution at a variety of scales. For example, the NISB Habitat Classification Scheme (Mount et al 2007) identifies key coastal and marine habitat types (Figure 1):

- dunes and dune vegetation
- saltmarsh
- mangrove
- seagrass
- unconsolidated substrate (including sand and mud)
- rock substrate (cobbles to boulders and outcrops)
- coral reef.

Distribution maps for a single habitat across the whole of Australia are available as 50 km and 10 km grid cell maps of habitat distribution at the state, territory or regional level.



Source: Mount and Bricher (2008)

Samples of habitat distribution maps for mangrove and seagrass

Calculation of habitat extent (ie area) in hectares is dependent on the availability of suitable mapping databases that are thematically consistent. The depiction of the spatial distribution of habitat types is less map-dependent, as single site observations can be used and the edges of habitat ranges can be sampled to look for changes. Classifying some habitats (eg estuaries) into types will assist interpretation of indicator measurements. The extent of key habitats can be calculated using the high resolution polygons of habitat mapping and presented as tables (see Table 10 for an example).

Table 10 Example table of mapped extent in hectares by habitat type and reporting region

NRM region	Unonsoli-dated	Rock	Coral	Mangrove	Saltmarsh	Seagrass
Hunter-Central Rivers	32 751	3163	0	5302	3180	8610
Northern Rivers	49 373	11 535	0	3635	2239	1590
Northern Territory	988 742	0	356 840	0	575 309	30 963
Rangelands (WA)	1 292 471	775 952	85 389	8381	19 031	547 578
South East (Qld)	50 841	0	1177	14 996	2536	33 259
Southern Rivers	45 497	15 315	0	1 831	1410	4775
Sydney Metro	2342	1497	0	215	21	177

Data and information on ECM habitat extent and distribution for a range of boundaries of interest, including national, state and NRM regions, are available at Australia's Resources Online.[18]

Australia's Resources Online is a new application developed to report the latest information available against the National M&E Framework Indicators.

Screenshot of Australia's Resources Online website

Habitat mapping advances in remote sensing

Recently, significant advances have been made by CSIRO Land and Water, various universities, and state or territory agencies throughout Australia in

[18] http://www.anra.gov.au

the development of methods that support the consistent classification of ECM habitat condition and extent, based on remote sensing methods.

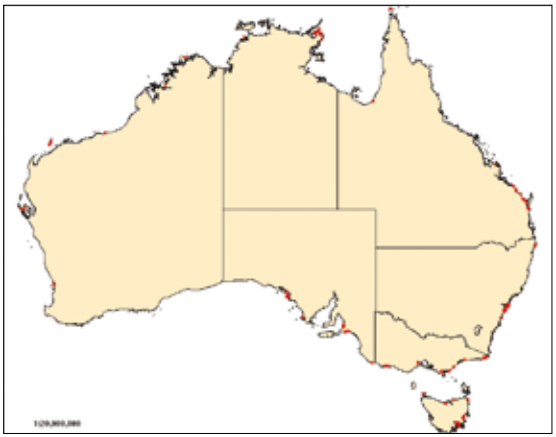
Access and management of multispectral imagery (ie high temporal resolution) of the entire continent taken twice daily, both at high-temporal resolution (ie frequently repeated) and high-spatial resolution satellite imagery, has allowed the processing and development of derived products for the Australian coastline. These derived products can provide a significant contribution towards increasing our understanding of terrestrial and marine interactions; for example, on the transport of terrestrial sediments, nutrients and toxicants via river plumes to the estuarine and marine environments.

Over 24 000 km^2 of high-spatial resolution QuickBird satellite data (QuickBird 2.5 metre pixels) has been acquired of priority locations around Australia (see Table 11 and Figure 2). A system for discovery, visualisation and access for this imagery will be made available via Geoscience Australia (subject to standard use and condition terms). The image on page 39 provides an example of a QuickBird image suitable of benthic habitat mapping.

Table 11 QuickBird scene selection by relevant state or territory agencies

	No. scenes	Area covered (km^2)
New South Wales	10	3 616.41
Northern Territory	10	3 347.60
Queensland	11	3 833.53
South Australia	10	3 453.12
Tasmania	10	3 283.54
Victoria	10	3 286.16
Western Australia	11	3 530.79
Total	72	24 351.13

Figure 2 Overview of the locations of the QuickBird scenes available



Note: The red dots indicate the locations prioritised by states and territories.

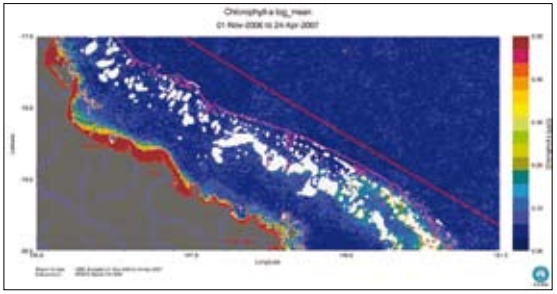
Example of a QuickBird scene that is suitable for benthic habitat mapping. This image, taken on 4 May 2002 over the Mornington Peninsula, demonstrates the level of pattern and texture that can be observed from this product (image courtesy of SKM and DigitalGlobe) (Dekker et al 2002)

Habitat condition

Resource condition monitoring via remote sensing techniques

Data information products using high-temporal Moderate Resolution Imaging Spectroradiometer (MODIS), which are low-spatial resolution data at 1-km pixels, are currently being produced and will be made available via the OzCoasts website.[19] Products include: information on total suspended solids, coloured dissolved organic matter, and vertical attenuation of light for selected NRM regions in the Great Barrier Reef (GBR) and for Tasmania; a 2002–07 MODIS-based assessment of chlorophyll off the Western Australian coast between Bunbury and Geraldton; and a similar assessment for total suspended solids in the Kimberley. An example of the wet-season chlorophyll a log mean average for the Burdekin NRM region is shown in the image below.

[19] http://www.ozcoasts.org.au



Water quality product of the Great Barrier Reef (from Tully in NW to Whitsundays SE) Lagoon: the log mean average chlorophyll a over a 6-month period over the 2006–07 wet season. The pink lines are the 20 m near coast and the 80 m outer reef bathymetry lines; the red straight line is the Great Barrier Reef World Heritage Area border; the white areas are the exposed coral reefs; and the grey is land (based on MODIS image data processed at CSIRO).

Report cards

Reporting ECM habitat condition indicators in the form of report cards has been trialled in New South Wales, Queensland, Victoria and Western Australia. The Queensland trial took place in the Burnett Mary NRM region. It was a partnership between that region and the Environmental Protection Agency, and used the agency's Streams and Estuaries Assessment Program (SEAP) approach.

SEAP is based on the concept of monitoring stressors — components of the environment that directly affect the region's ecology, including aquatic sediments and nutrients (Moss et al 2006). This approach allows the use of the most pertinent information sources, including indicators of any sort, as lines of evidence to support an assessment made for a particular purpose, such as a national assessment. The following screenshots of draft web pages show the same report cards, presented as a regional level report and as it would look incorporated into a national level NRM report (draft) in OzCoasts (Scheltinga and Tilden 2008).

An example of a regional-level report card — screenshot of a trial Burnett Mary natural resource management habitat condition report card

Example of a regional-level report integrated into a national-level report card — screenshot of a trial Burnett Mary natural resource management habitat condition report card

Discussion and way forward

The Audit and its partner organisations have developed methods and guidelines, undertaken trials, improved existing data and information, and refined data management and exchange infrastructures for reporting on ECM indicators.

A coordinated national assessment framework for reporting on the agreed indicators has been developed. This is a major advance, and further development and alignment of state and territory systems will be highly beneficial.

Ongoing coordination will require explicit assignment of responsibilities (and associated costs) for data collection and management at national, state and regional levels. The capacity of regional NRM bodies to undertake long-term monitoring is limited, in part by the duration of their funding arrangements and the nature of their reporting requirements. The partnerships developed through ICAG have greatly assisted in clarifying these responsibilities, and further advances will be effectively and efficiently achieved through this forum. Immense collaborative spirit and willingness exist to continue improving the understanding, capacity and outcomes in this arena.

Strategic, nationally coordinated investment in ECM data and information is essential to enable comprehensive, ongoing reporting on the agreed indicators, in keeping with the Audit's mission: to provide data, information and nationwide assessments of Australia's land, water and biological resources to support sustainable development.

Challenges and insights

The capacity to report on the ECM environments has improved since the first Australia-wide estuaries assessment (NLWRA 2002). However, the information base is still unlikely to produce comprehensive resource condition assessments or contribute significantly to performance assessments of investments in the near-to-medium term, because:

- few data are available for assessing resource condition
- few methods for assessing resource condition are available or suitable for national assessments, and few established reference conditions exist
- causative links between resource condition and pressures acting on the environment, which are needed to guide management actions, are not well established

- current resource condition indicators vary considerably across Australia, and have specific purposes such as assessing the performance of sewage treatment plants
- many NRM assets are yet to be identified, particularly in marine environments.

Given this situation, there is clearly a need to make use of available information to produce assessments that will assist with guiding management of these environments. The following sections discuss how this could be progressed.

A reporting framework has been developed as a way of moving beyond a focus on resource condition indicators towards more comprehensive, logical use of information. The ECAF is documented in the ECM National Assessment Scoping Report (Mount 2008) and Box 4 outlines the types of reports and outputs that could be generated.

The framework is based on the assumption that the information needed to assess the environmental condition of the asset and the information needed to manage those resources are the same. It seeks to efficiently match the available information to the information needed by management, and to identify when more information is required.

Even though the focus for the ECAF has expanded beyond merely reporting on resource condition indicators, there is a need to establish national standards for producing report cards and other assessments.

Way forward

To further the capacity to report on the integrity of ECM habitats and improve the ability to produce national level assessments into the future the following should be considered:

- Further mapping of habitats to cover open coasts, dunes and dune vegetation. Considering ECM habitat mapping as part of the national land cover program could be useful.
- Development of the subregional (ecoregion) level of the IMCRA. Some information sources are becoming available to support the process (eg habitat mapping and the seascapes program).
- Development of monitoring programs of habitat extent, distribution and condition, including
  - a new specific key habitat condition indicator
  - monitoring at representative locations
  - monitoring of shoreline habitats
  - expansion of temperate and tropical reef monitoring programs.

Box 4 Summary of reports and assessments from the Environmental Condition Assessment Framework

The Environmental Condition Assessment Framework (ECAF) reports are designed to support all phases of the management cycle. The first national estuarine assessment (NLWRA 2002) was essentially a 'first pass' assessment.

First pass assessment

Includes:

- inventories and gap analyses
- classifications
- conceptual models
- susceptibility assessments
- limited pressure assessments
- degree of modification assessments
- scientific research reports.

Second pass assessment

Includes all of the first pass items, plus:

- pressure assessments
- vulnerability assessments (as suggested in Allen Consulting 2005)
- risk assessments.

Third pass assessment

Includes all of the first and second pass items, plus:

- resource condition or status and trend indicator reports.

Overall Environmental Condition Assessment

An overall assessment is based on information drawn from all available passes (eg ECA report card).

- Continuous development of monitoring methods for animal and plant species and sedimentation/erosion indicator.
- Further development of national shallow water remote sensing information products (eg chlorophyll a levels, water clarity and temperature).
- Standards and guidelines for data storage and access (in addition to the established standards for data collection that already exist).

- National methods and standards are under development. However, standard methods and data management systems will need to be documented and rolled out to the states, the Northern Territory and regions.
- Further development of the data and information needed for producing conceptual models and report cards. This may need a one-off boost in the short term.
- Establish a consolidated list of national contextual data and information for all ECM environments. Information needs for estuaries are well defined in New South Wales, Victoria, Queensland and Western Australia; however, there is limited information for the coastal and marine environments.
- Long-term datasets are proving to be extremely valuable; ongoing monitoring of these environments is needed. Some excellent candidate methods exist that could be immediately expanded and implemented.

National assessments need a collaborative approach

Any national-level assessment[20] is clearly dependent on the states, territories and NRM regions as primary sources of data and information. In a national assessment, great benefits accrue with increasing collaboration between all stakeholders. Coordination to achieve this is one of the benefits of national leadership.

There are substantial benefits to gain via strong collaboration with relevant partners, to assist with:

- development of the information base through
  - a one-off boost to critical and contextual data
  - implementing long-term monitoring programs
  - implementing national databases including marine pests, toxicants and marine debris
  - continuing national shallow water remote sensing programs
- development and implementation of an assessment framework (eg the ECAF) to
  - make better use of the available natural resource information
  - guide the growth of the information base to directly support management needs
- further development and implementation of standards for
  - data collection, storage and access
  - reporting and assessments (including report cards)
- further development of an information infrastructure (ie OzCoasts).

[20] The word 'national' is defined here as a description of something that is produced or agreed by jurisdictions at all levels, including the Australian Government, state and territory governments, NRM regions and local governments.

Appendix 1 The National Monitoring and Evaluation Framework

The National Natural Resource Management Monitoring and Evaluation Framework (referred to in this series as 'the National M&E Framework') was endorsed by the Natural Resource Management Ministerial Council in 2002. It was developed to assess progress towards improved natural resource condition through the development of accurate, cost-effective and timely information on:

- the health of Australia's land, water, vegetation and biological resources
- the performance of programs, strategies and policies that provide national approaches to the conservation, sustainable use and management of these resources.

Assessment of information collated under the National M&E Framework will assist the Ministerial Council to 'identify areas of concern and to better target the use of resources'.

The framework identifies three key requirements for monitoring natural resource condition:

1. a set of natural resource condition indicators (including those for the 'matters for target' identified in the National Framework for Natural Resource Management Standards and Targets) to measure progress towards agreed national outcomes on a medium and long-term basis
2. a set of indicators for monitoring community and social processes relevant to or affected by NRM programs, as well as measures of the adoption of sustainable development and production techniques
3. contextual data pertinent to the indicator being considered.

The National Land & Water Resources Audit ('the Audit') is responsible for ongoing development of these indicators, as well as supporting the national collection and collation of data, and reporting against each indicator.

Such reporting will help to answer questions such as:

- What is the nature and extent of the issue?
- Is the existing or proposed intervention appropriate for the size of the issue?

- What types of intervention work best, are most cost effective, and have the best transferability across regions?
- What was the impact of the policy or program investment — in the intermediate and long term?

Monitoring and evaluation of core indicators supports evidence-based decision making at national, state and territory, and regional levels. However, each level may have a wide variety of data and information needs, in terms of content, context or scale. There is also complexity across the three levels of use associated with multiple needs, values, preferences and timeframes.

A complex coastal environment, Gold Coast, Queensland (photo by Newspix)

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About the 'Status of Natural Resource Information' series

This series of booklets outlines the status of data and information relating to indicators agreed under the National Natural Resource Management Monitoring and Evaluation Framework (2002). Each booklet describes the status of coordination, indicators, information management systems, and data and information products for a particular theme area.

- Estuarine, coastal and marine
- Inland aquatic (wetlands)
- Land salinity
- Land use
- Native vegetation
- Significant invasive species (vertebrate pests)
- Social and economic information
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