

INTRODUCING OZCOASTS

**Integrated web access to key Estuarine, Coastal
and Marine Indicator information and data for
Natural Resource Management – Final Report**

AGS9

OzCoasts Web Team & Richard Mount



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Executive Summary

The OzCoasts website (formerly called OzEstuaries) was released as part of a collaborative project with the National Land and Water Resources Audit (NLWRA). The title of the project was: *Integrated web access to key Estuarine, Coastal and Marine Indicator Information and data for Natural Resource Management*. The major new addition to the website was a module dedicated to NRM Reporting.

The major components of the NRM Reporting module are Habitat Extent, Distribution and Monitoring and Report Card Reporting. The *Report Card* tool allows users to view overall report scores and trends (if available) at a range of different scales including national, states, regional (CMA's, NRM zones and LGA's) and bioregional (IMCRA and Marine Planning regions), and to get a statistical breakdown of the scores for the area selected. The tool also accommodates the more individualistic approaches of the States or regional groups (Burnett-Mary (Qld)) to report carding and monitoring. The Habitat Extent, Distribution and Monitoring tool comprises high spatial resolution polygons as mapped by the state agencies and thematically attributed with the recently agreed National Intertidal/Subtidal Benthic (NISB) Habitat Classifications. There are national, state and regional summaries comprising vector polygon layers of 10 or 50 km grid cells with colour coding to indicate whether a habitat is present, absent or unknown within a grid cell. The module will also host the national Estuarine, Coastal and Marine Indicator protocols when these are made available.

Some potential future enhancements to the module are described and include new functions which would enable users to: (i) interrogate sections of pie-charts to learn more about a condition class of estuaries in a region of interest (Report Card Tool); and (ii) view changes in habitat areas over time. In addition, a new Linear Features Reporting tool has been scoped and will likely comprise three nationally-consistent GIS line maps (“Smartline”): (i) Smartline geomorphology (simple); (ii) Smartline Geomorphology (advanced); and (iii) Smartline Sensitivity. The smartline maps will comprise the initial content of a new module dedicated to Coastal Sensitivity (expected to be released in Dec 08), and will form the foundation for the first pass national coastal vulnerability to climate change assessment (Sponsored by the Department of Climate Change). Some potential new remote sensing tools and applications are also briefly described.

Acknowledgments

The habitat mapping component of the NRM module was developed as part of a collaborative project between the Department of Climate Change (DCC) and the National Land and Water Resourced Audit to support:

- (i) A first pass vulnerability assessment of the whole Australian coastline
- (ii) Reporting on the extent and distribution of key ECM habitats for NRM purposes.
- (iii) The development of marine ‘ecoregions’ or bioregional subregions.

The project was led by Richard Mount (UTAS) and project outputs are published under the following titles:

Mount, R.E. and P.J. Bricher, 2008a. *Estuarine, Coastal and Marine (ECM) National Habitat Mapping Project, Project Report*, Version 1 February 2008. Spatial Science Group, School of Geography and Environmental Studies, University of Tasmania. Report to the Department of Climate Change and the National Land and Water Resources Audit, Canberra, ACT

Mount, R.E. and P.J. Bricher, 2008b. *Estuarine, Coastal and Marine (ECM) National Habitat Map Series User Guide Version 1* February 2008. Spatial Science Group, School of Geography and Environmental Studies, University of Tasmania. Report to the Department of Climate Change and the National Land and Water Resources Audit, Canberra, ACT.

A very large number of agencies at the national and state level participated in this national project. The project was dependent on the goodwill and cooperation of these partners and contributors. The project documentation includes acknowledgements of the individuals and agencies who were involved:

The report card section has benefited from helpful discussions with Rob Thorman (NLWRA), Jan Tilden and David Scheltinga (QLD EPA) and Tony Roper (NSW Department of the Environment and Climate Change).

Darren Skene (GA) and Chris Sharples (UTAS) generously provided some content (New Linear Features Tool) for the Recommendation for the Future section of this report, and their input and ideas are helping to guide the conceptualisation of the tool. Ideas expressed by attendees at a joint workshop for of the NLWRA sponsored *Remote Sensing for Coastal Habitat Extent, Condition and Trend Assessment* projects (Dec 12/2007) form the basis of the Remote Sensing Products sub-section (Arnold Dekker, Viv Bordas, Peter Davies (NSW DECC), Peter Fearns, Lesley Clementson, Elizabeth Botha, Stuart Phinn, Rob Thorman, Richard Mount, Lynda Radke, Christopher Auricht, Magnus Wettle and Brendan Brooke).

1. Introduction

1.1 THE NATIONAL MONITORING AND EVALUATION FRAMEWORK

Australian state, territory and local governments are investing considerable effort and funds into natural resource management (NRM), through programs such as the National Action Plan for Salinity and Water Quality (NAP) and the Natural Heritage Trust (NHT). The National Monitoring and Evaluation Framework (NM&EF) was established in 2002 to assess the condition of Australia's land, water and biological resources, and the performance of NHT/NAP (and other) government programs. The framework includes a series of broad themes or Matters for Target, against which reports are made using a range of indicators and report cards. Estuarine, coastal and marine habitat integrity (ECM) is one of ten matters for target of biophysical relevance. The NM&EF supports the development of indicator protocols intended to promote consistency in monitoring and reporting against targets on a national scale.

The NM&EF also supports the timely dissemination of complete and accurate information on resource condition. Regular publishing for communication to stakeholders is vital to NRM, to ensure that investments are directed to the areas of highest priority and to assess the effectiveness of the national policies, strategies and programs. The adequacy of decision making and planning processes are linked to the quality and completeness of relevant information, and the mechanisms through which the information is made available. Information on resource condition informs policy at national and state levels, and underpins management at regional and local scales.

The role of the National Land and Water Resources Audit (Audit or NLWRA) in the NM&EF has been to co-ordinate the collation of data and information on resource condition, and to develop a network of systems to make the data and information accessible. The main NRM online reporting mechanism will be Australia's Resources Online (ARO), forming part of the Natural Resources Atlas. However, as Geoscience Australia (GA) already hosted a comprehensive national website with significant coastal content, the Intergovernmental Coastal Advisory Group (ICAG) agreed that information pertaining to the ECM matter for target should reside there. The website was initially called OzEstuaries, is now called OzCoast and OzEstuaries, and will soon be re-released under the name OzCoasts. The URL for the website is www.ozcoasts.org.au.

1.2 HISTORY OF OZCOASTS

The *OzEstuaries* website was conceived during the first NLWRA to incorporate estuarine datasets compiled at that time (NLWRA 2002). *OzEstuaries* subsequently expanded into a knowledge and information system under the banner of the Coastal CRC. It was at this stage that information relevant to the broader coastline also began to be incorporated in the website. That information included modules dedicated to coastal indicators, conceptual models of coastal waterway function and the content in the current Geology & Geomorphology module.

The OzCoast module of the Coastal CRC website was launched in May 2006. The site was developed to make coastal data and information (including regional NRM plans), decision support tools, process facilitation, conceptual models and local knowledge and values more accessible to coastal NRM decision-makers (Rosenthal and Barchiesi, 2007). Stakeholder engagement in research and education was a key strength of the Coastal CRC and OzCoast was

a case in point because there was extensive stakeholder consultation throughout the planning and development of the site. The content of OzCoast was shaped by: (i) a “buddy group” of interested end-users; (ii) bi-annual meetings with the National Estuaries Network (NEN); (iii) the results of a literature review of the constraints and behaviours of decision makers; and (iv) a more focussed survey on the knowledge-seeking behaviour of decision makers from state and local governments and regional NRM bodies (Tilden *et al.*, 2005).

Geoscience Australia recognised that OzCoast content would compliment OzEstuaries, and assumed custodianship of the module in July 2006 with the intention of integrating the web material and further developing the broader coastal data and information system. All major external OzCoast stakeholders (Qld EPA, Qld NRMW, DEH, DAFF and NLWRA) supported this decision. Indeed, merging OzCoast and OzEstuaries into a single entity under the “OzCoast” banner was always the long-term vision of the Coastal CRC.

It was decided that the transition of OzEstuaries to OzCoasts should occur in two steps so as not to confuse the users. In the first step, staff from the Marine and Coastal Environment and Innovation and Specialist Services groups at GA integrated the content of OzCoast into an Environmental Management module, and the re-released the website under the name OzCoast and OzEstuaries (August 2007). For the second step, GA entered into a collaborative project with the NLWRA (Oct 2006: Integrated web access to key Estuarine, Coastal and Marine Indicator Information and data for Natural Resource Management) and it was agreed that key deliverables would be released in the same website but under a new name - OzCoasts. Those key deliverables (Milestones 4/4 and 5/2) include web-display of indicator protocols and a preliminary indicator/report card exploration tool. Indeed, a module dedicated to NRM Reporting has been the major new addition to the site. The NRM Reporting module and other new features to the site are described in the following session.

2. New Features in OzCoasts

2.1 NEW NRM REPORTING MODULE

The new NRM Reporting module will provide online access to key information and data that supports NRM Reporting (Figure 1). The module accommodates the national NRM ECM indicator protocols, and has data exploration tools for viewing information that relates to Habitat Extent, Distribution and Monitoring and Report Card reporting as described below.

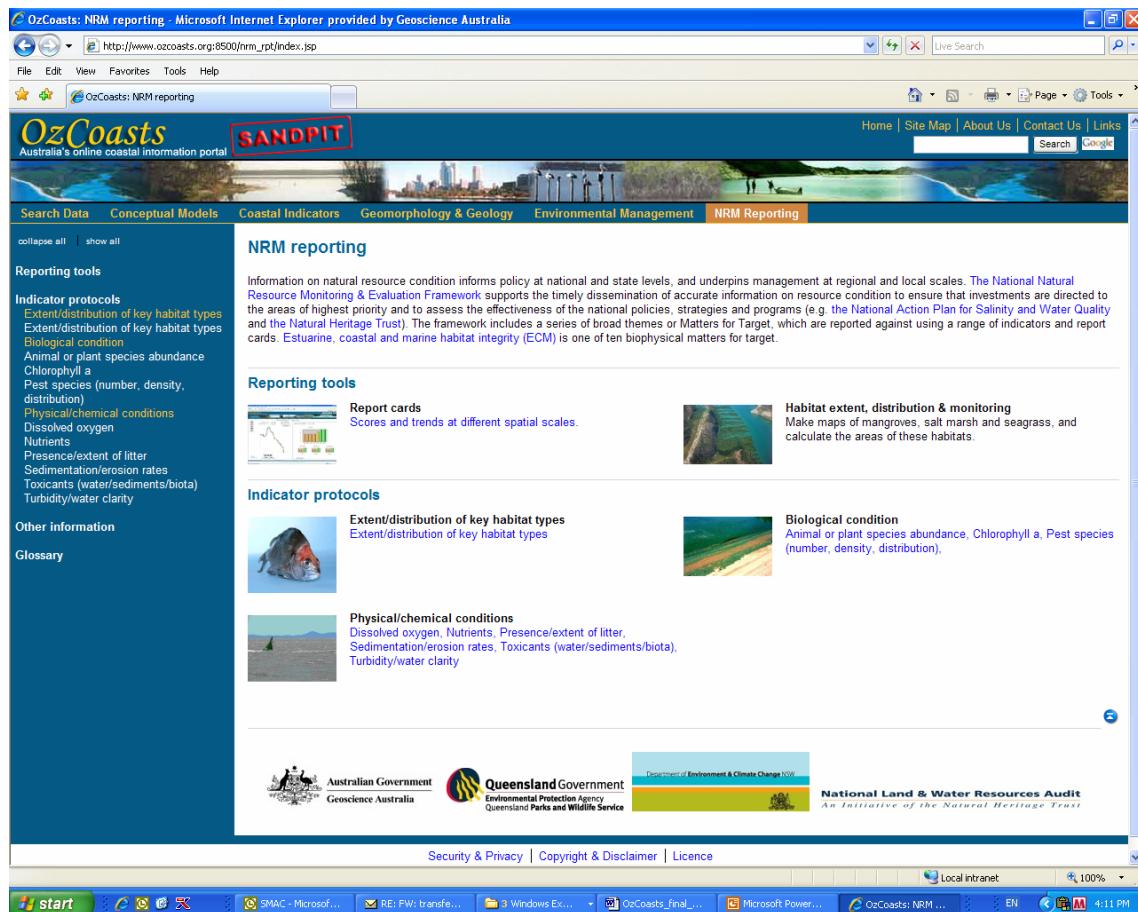


Figure 1. Screen dump of front end of NRM module.

2.2 ECM REPORT CARD TOOL

2.2.1 Background

The Audit has a role in delivering national level assessments on the broad ecological integrity of estuaries and the marine environment based on the NRM M&E Framework. The National Estuarine Environmental Condition Assessment Framework (NEECAF) (Arundel and Mount 2007) and a National Marine Environmental Condition Assessment Framework (NMECAF) (Arundel and Mount 2008) were developed to assist with this process. The NMECAF and NEECAF were based on a more generic Environmental Condition Assessment Framework (ECAF), which was designed to be

used in other thematic areas (Mount 2008a). Two National ECAF Round Tables (estuarine and then marine) were held in the period from Oct 2007 to March 2008. Attendees at both meetings agreed that the ECAF is consistent with usual management practices and thus is a useful platform for generating NRM reports.

A national workshop was held in March 2008 to explore the potential for developing a national best practice framework for NRM ECM Report Carding using ECAF as the basis. The objectives of the National NRM ECM Report Carding BPF workshop were to: (i) identify the structure and core components of an NRM ECM Report Carding Best Practice Framework (BPF); and (ii) to identify the requirements for a NRM ECM Report Carding BPF (Mount, Arundel and Auricht, 2008). The intent of a national report card BPF is to assist the ECAF to deliver consistent assessments of broad resource condition at the national level to all parties interested in national scale reporting. These parties include national policy makers, politicians, natural resource managers, scientists, a wide range of industrial and national stakeholders and the general public.

The outcomes of the workshop provide a guide to the structure and content of NRM report cards (Mount and Auricht, 2008) as follows:

1. Report Cards need to have a tiered structure with:
 - A very simple high level summary, including a score (where possible)
 - A summary of contributing information and its quality
 - Access to summary reports of contributing information and methods
 - Access to detailed source data
2. Where practical, national scoring should use a 5 class scale
3. Contributing reports which may include:
 - Descriptive or foundation data
 - Conceptual models and flow charts
 - Susceptibility (or vulnerability reports)
 - Pressure reports
 - Degree of modification reports
 - Risk assessment reports
 - Current condition reports

2.2.2 Description

The ECM *Report Card Reporting* tool allows users to view aggregated (“national”) report scores and trends (if available) against year, at a range of different spatial scales including national, states, regional (CMA’s, NRM zones and LGA’s) and bioregional (IMCRA and Marine Planning regions), and to get a statistical breakdown of the scores for the area selected (Figure 2). The map interface shows the reporting regions (estuaries) as dots with a colour coding that matches that of the condition assessment in the pie chart. The dialogue box in the bottom right of the screen (entitled monitoring sites) provides hyperlinks to more detail on the report cards and other information behind the assessments. The report cards for the NLWRA 2000 assessments are available in OzCoasts, however those from future assessments may be found at state or regional websites. The assessment level of a report card is found adjacent to the hyperlinks. There are three assessment levels in the ECAF framework: first pass (supporting understanding), second pass (supporting prioritising) and third pass (supporting adaptive

management) (Mount, 2008b). The condition classification dataset from the first NLWRA (NLWRA, 2002) comprises the first year of data in the tool, and has been used for the proof of concept. Current (2008) data are also available for the Burnett Mary region, Queensland. These data differ from the first NLWRA data in the respect that the condition classification has five levels (A-E).

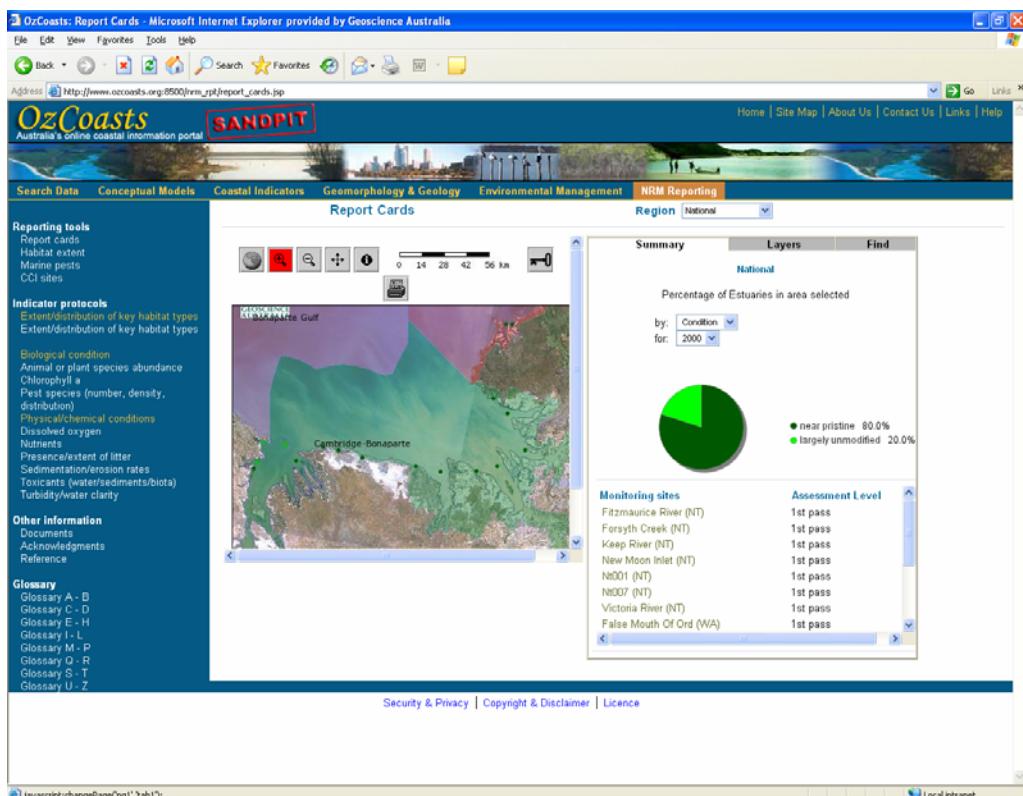


Figure 2. Example screen dump of report card product, showing the statistical break-down of condition scores of estuaries found in the Kimberly IMCRA region in the year 2000.

There are also interactive tools to capture the more individualistic approaches of the States or regional groups to report carding and monitoring (Figure 3). For example, the Burnett Mary region (QLD) reports against condition and risk using a range of different stressors (Scheltinga and Tilden, 2008). The functionality in OzCoasts allows users to view the distribution and statistical breakdown of the scores for each of the different stressors listed in both the condition and risk fields. More detailed information about the indicator results behind the stressors will be made available at the Burnett Mary website constituting the second tier in the web-reporting process (Scheltinga and Tilden, 2008). If adopted more widely, the Burnett Mary approach would allow users to develop a view (state and national) of the risk imposed by a given stressor on assets, management objectives or intrinsic ecosystem values.

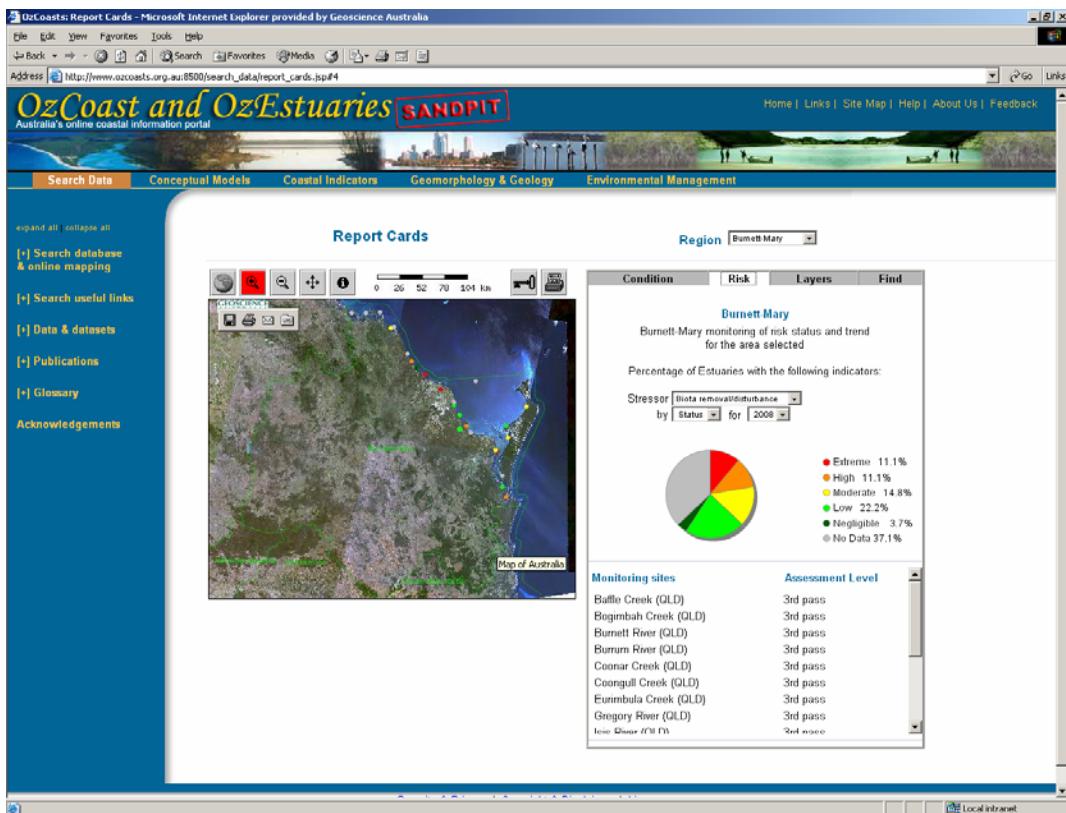


Figure 3. Example screen dump of a report card screen showing the statistical break-down of scores indicating the ‘risk’ imposed by the “biota removal/disturbance” stressor to estuaries found in the Burnett-Mary NRM region for the year 2008.

2.3 HABITAT EXTENT, DISTRIBUTION AND MONITORING REPORTS

The Habitat Extent, Distribution and Monitoring interface comprises high spatial resolution polygons as mapped by the state agencies and thematically attributed with the recently agreed National Intertidal/Sub-tidal Benthic (NISB) Habitat Classification scheme (Mount, Bricher and Newton, 2007). The NISB classification scheme was developed as part of a collaborative project between the Department of Climate Change (DCC) and the NLWRA to address the need for both a: (i) a first pass vulnerability assessment of the whole Australian coastline; and (ii) national extent and distribution mapping of key estuarine, coastal and marine habitats to support the development of marine ‘ecoregions’ or bioregional subregions. Prior to NISB, there was no consistently-classified coastal habitat mapping of the entire Australian coastline, except at scales that were too coarse to be of practical use in a vulnerability assessment. The habitat classes occur between the location of the outer limit of the photic benthic zone (approximately at the 50-70 m depth contour) and the approximate position of the highest astronomical tide mark (HAT), and include: coral reef, rock dominated habitat, sediment dominated habitat, mangroves, saltmarsh, seagrass, macroalgae and filter feeders (e.g. sponges). An account of the process for developing the map series and the resulting scheme are provided in Mount, Bricher and Newton (2007).

There are national, state and regional summaries that comprise vector polygon layers of 10 and 50 km grid cells with a colour coding that indicates whether a habitat is present, absent or

unknown within a given grid cell (Figure 4: Mount and Bricher, 2008). The grid cells have 50 km grid spacings at the National scale, and 10 km spacings at the state and regional levels. The summary maps are designed to help users to visualize the occurrence of the habitats around the continent because the high spatial resolution NISB Habitat Maps are difficult to see when displayed at National and State scales. These maps also serve the purpose of depicting the nature of data availability around the continent. The national, state and regional summary maps will be made available through the ARO website via a web-map service. The actual habitat maps from some states (NT, TAS, SA, WA and most of QLD) are also accessible to users at scales <50km². Data licensing issues currently preclude display of the actual polygons other states.

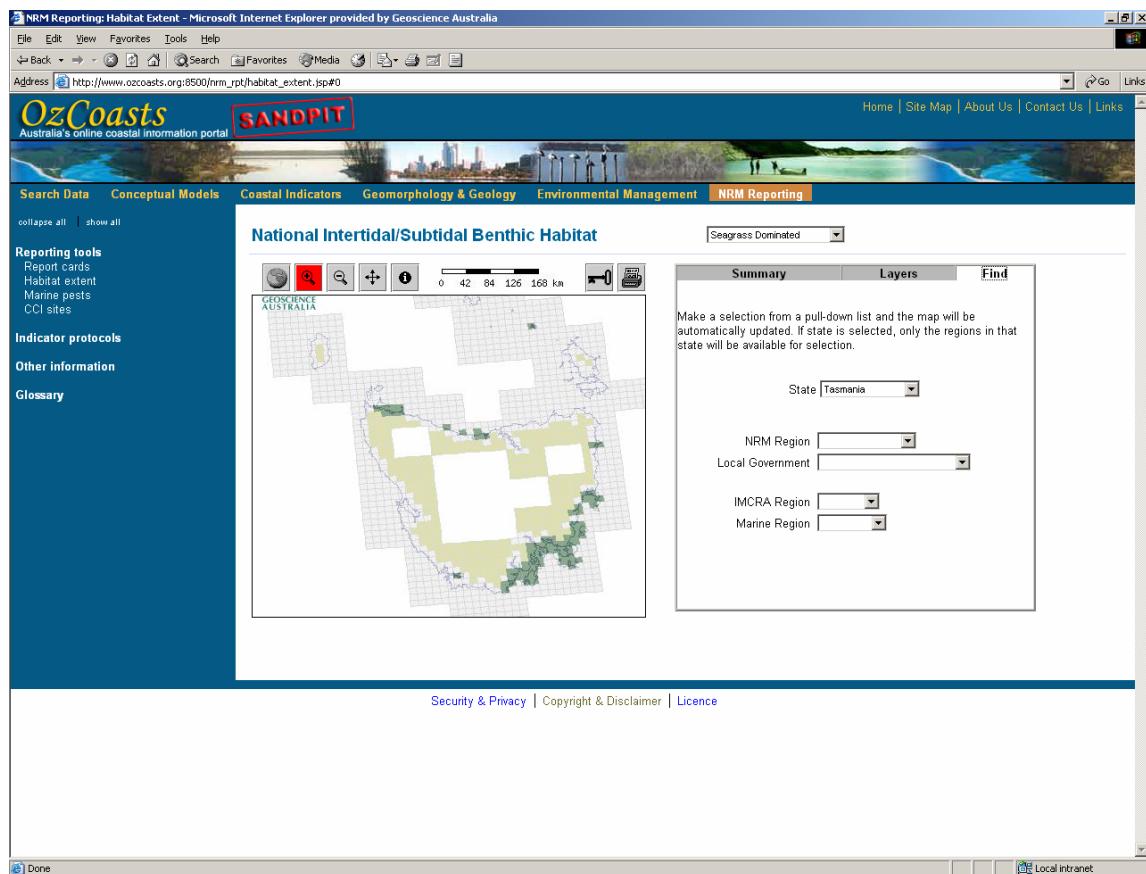


Figure 4. Screen dump of habitat mapping product illustrating the presence and absence of seagrass-dominated habitats in 10 km grid cells in Tasmania.

2.4 INDICATOR PROTOCOLS

A set of resource condition indicators was developed for the National NRM M&E Framework in 2003 to provide information on how to assess each Matter for Target. A Users Guide to these documents (Scheltinga et al, 2004) describes the national framework and provides lists of stressors and of indicators to measure the affect of the stressors on ecosystem condition (physicochemical and biological) and habitat extent. The content of this document was reviewed at a national workshop convened in Hobart in February 2006 and 19 nationally agreed indicators were identified (Souter and McKenzie 2006). A smaller set of indicator protocols is

currently awaiting endorsement by the Audit Advisory Council (AAC). They will be made available in OzCoasts under the broad headings Extent and distribution of key habitats, biological condition and physical and chemical conditions (Figure 1). The content of these documents will be linked with the indicator fact sheets and other content of the website (where applicable).

2.5 REDESIGN OF SEARCH MODULE

The OzCoast search facility has been both expanded and simplified and now includes three different search options (Figure 5). The original (“OzEstuaries”) estuary search has been retained in an essentially unaltered format, with the exception that the query options are no longer displayed alongside the map search. The map search now stands alone and has been upgraded with the addition of new query options and map layers including IMCRA regions, Marine Planning regions, NRM regions and local government areas. In addition, the zoom to a region functions now bring the region of interest (political or bioregional) into full view in the map field. There is also now a new basic coastal search. This search enables users to query all coastal data holdings by name, political region or bioregion or by decimal latitude and longitude.

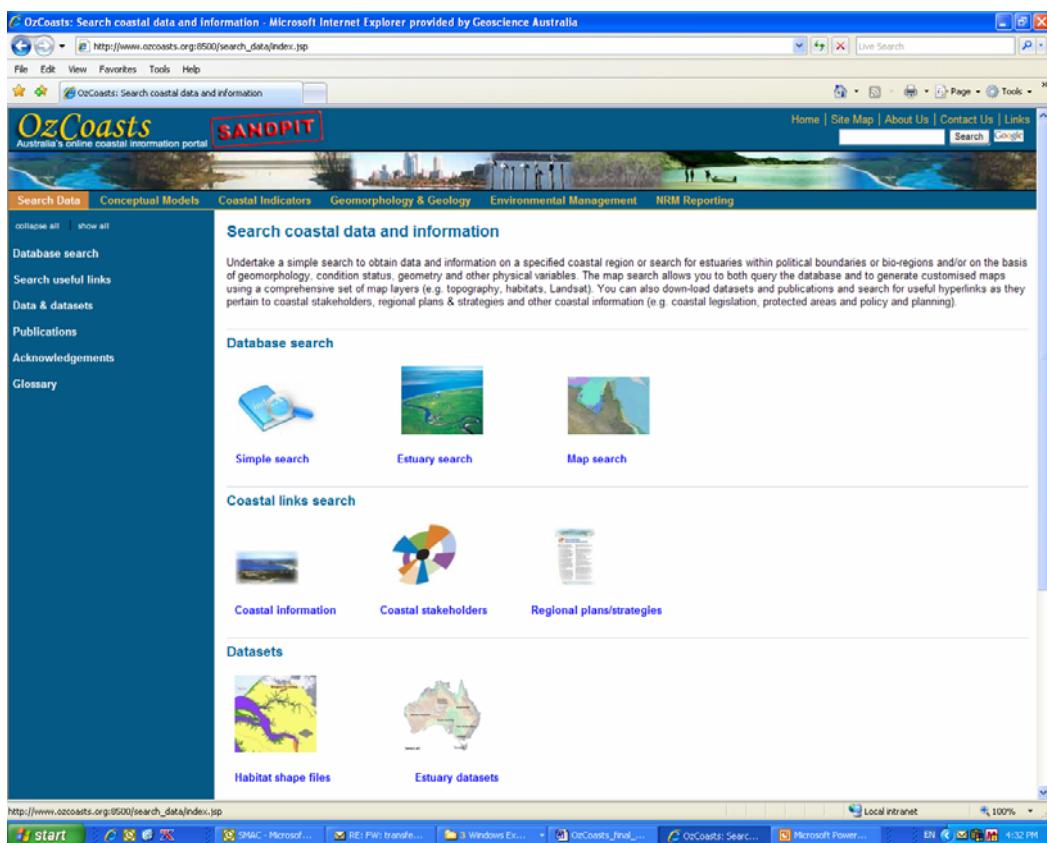


Figure 5. Screen dump of opening page of new search facility showing the 3 options now available: simple search, estuary search and map search.

2.6 NEW LOOK AND FEEL

Changes have been made to the home page and the opening pages of the different modules to enhance the usability of the website. The new layout (Figure 6) is in accordance with best practise rules as outlined in Kaiser (2006). For example, the sentence and paragraph structure of these pages is now shorter and more precise than in previous versions of the website (i.e. OzEstuaries and OzCoast and Ozestuaries), and shortcuts are now provided in the home page to key information and the most frequently visited pages. There is also a “what’s new” section for fresh content.



Figure 6. Screen dump showing the proposed layout and look and feel of home page of the OzCoasts website.

3. Recommendations for the Future

3.1 IMPROVEMENTS TO NRM REPORTING MODULE

3.1.1 Report Cards: Interrogate sections of pie chart

Figure 7 provides an example of the kind of report that could be generated if a user were able to drill-down into a specific slice of pie in the report card reporting statistical output to obtain further information about a group of estuaries belonging to a given condition class. In this hypothetical example, the report provides a geomorphic breakdown of estuaries assigned an “E” score in the format of a bar chart. In addition to providing a break-down of estuaries according to this national “geomorphic” classification scheme (Heap et al., 2001), estuaries belonging to a given condition class may be interrogated on the basis of other attributes. These attributes may include for example state-based classification schemes, hydrodynamic attributes (e.g. tidal length, wave height etc), pressure/risk/vulnerability/liability ratings and foundational data (e.g. entrance opening, entrance works, land use, licensed discharges etc).

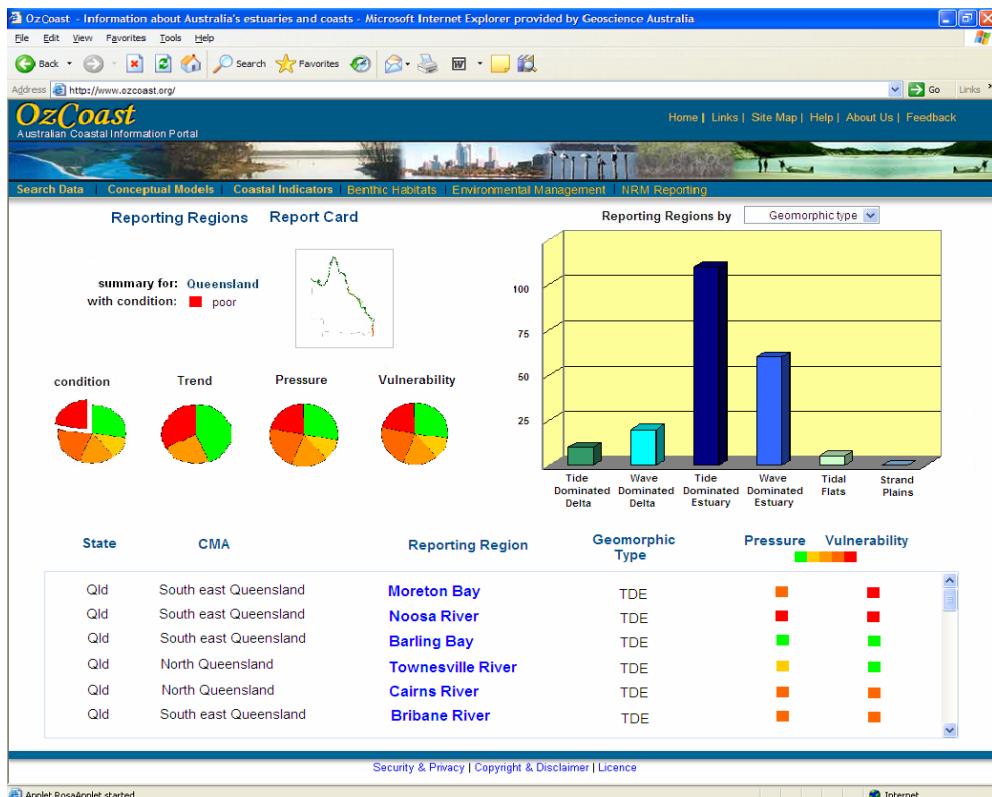


Figure 7. Mock-up layout of proposed facility whereby users may interrogate different condition classes (slices of pie charts) to get more information on the estuaries.

3.1.2 Habitat Mapping: Tool to view time series habitat data

Figure 8 provides a hypothetical example of some additional functionality that could enhance the Habitat Extent, Distribution and Monitoring Exploration Tool. This functionality would allow users to drag a toggle on a sliding date scale to view changes in the areas of a given habitat over time. The estuaries for which time series data are available would appear on the map. This functionality would be accessed via hyperlinks on the map and in the dialogue box.

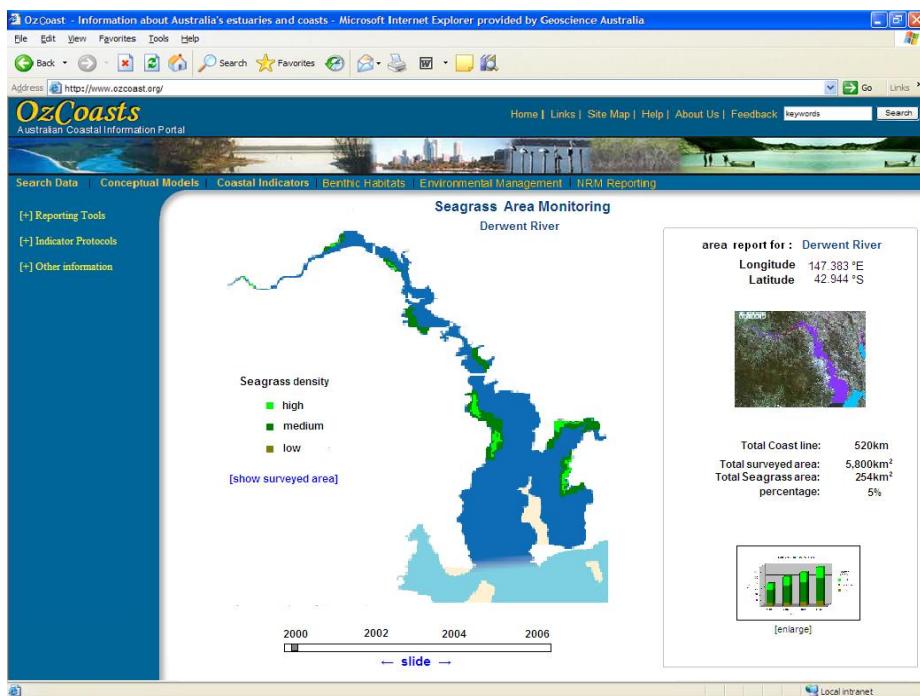


Figure 8. Mock-up layout of proposed facility whereby users may drag a toggle across the years to view changes in habitat areas over time.

3.2 NEW LINEAR FEATURES REPORTING TOOL

DCC and the Department of Environment, Water and Heritage (DEWHA) are working with the states and territories through ICAAG to assess Australia's coastal vulnerability to climate change, including impacts on coastal habitats and infrastructure. DCC and Geoscience Australia signed a Collaborative Heads of Agreement for Australia Government Agencies to contribute to the Coastal Vulnerability Assessment Project to provide fundamental datasets that will support decision-makers in identifying areas in Australia's coastal zone where potential impacts may be rated as high, medium and low. As part of the assessment GA contracted the University of Tasmania (UTAS) to conduct a National Shoreline Geomorphic and Stability Mapping Project which will form the foundation for the first pass national coastal vulnerability to climate change assessment. The project includes the preparation of a nationally-consistent geomorphic map of the entire Australian coastline in the format of a GIS-based segmented line (Figure 9). Each line segment will include multiple attribute fields that describe important aspects of the geomorphology. This line map format has been termed a "Smartline", and is based on the approach that has been used in Tasmanian and expanded to incorporate the broader range of

coastal landforms found around Australia (Sharples, 2006). Interactive Smartline maps and query functions will be delivered through OzCoasts via a module dedicated to Coastal Sensitivity. Three Smartline maps have already been scoped for development in 2008-2009:

- Smartline geomorphology (simple);
- Smartline Geomorphology (advanced); and
- Smartline Sensitivity.

The Smartline sensitivity map is based on an assessment of the geomorphology data and includes potential impacts of climate change and sea level rise, including shoreline erosion. The sensitivity map will also be made accessible through the NRM Reporting module so that it may be used in the context of NRM.

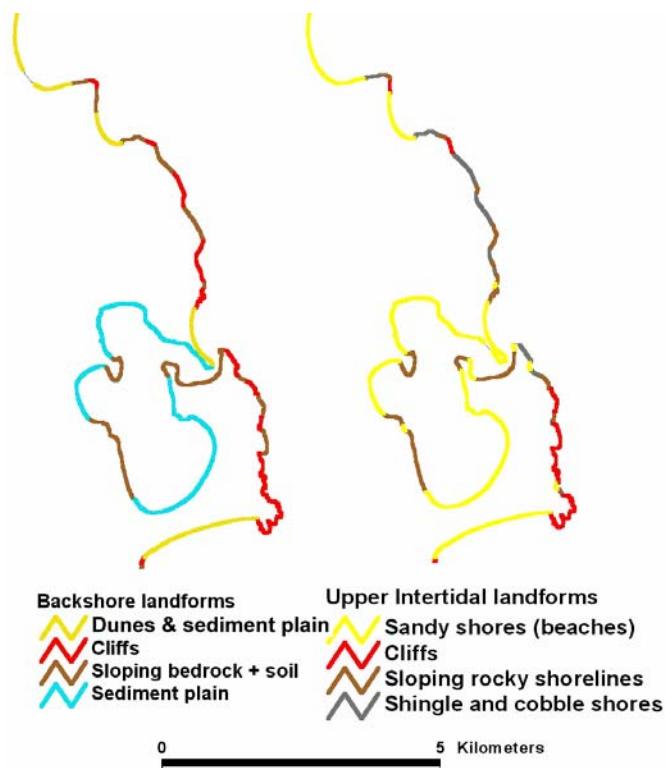


Figure 9. Example “smartline” geomorphology map. Each line segment includes multiple attribute fields that describe important aspects of the geomorphology of the coast as illustrated in the first two figures (from Sharples, 2006).

Concurrently with this work GA are developing a national approach to coastal geomorphological mapping, especially the classification of Australian Quaternary coastal depositional environments to overcome current inconsistencies in nomenclature. Once accepted this classification scheme will be used in the development of a comprehensive, nationally consistent GIS of Australia’s coastal geomorphological units. This will provide one of the fundamental datasets to enable a more detailed and rigorous coastal vulnerability assessment.

3.3 PRODUCTS FROM NATIONAL REMOTE SENSING PROJECT

A project entitled Remote Sensing for Coastal Habitat Extent, Condition and Trend Assessment was initiated in November 2007 after the NLWRA secured additional funds from NHT. The project was divided into two components:

1. Coastal Fieldwork to support remote sensing based condition and trend assessments; and
2. Coastal habitat, extent, condition and trend assessment.

Some deliverables in the project were destined for public access via OzCoasts. These deliverables include from amongst the:

- Field data;
- High resolution imagery;
- Habitat extent and some coastal water condition information products for priority areas; and
- Products based on high temporal resolution (e.g. algal blooms, river plumes and trends in seagrass or coral reef gains/losses)

It is currently undecided as to whether these deliverables will reside in the NRM reporting module or be incorporated in a new module which would be dedicated to remote sensing, and which would share related components with the NRM module.

Other potential features of a remote sensing module include:

- A Library of ‘clean’ ALOS images of Australia’s coast and islands and ALOS DEM products (including zoomable image online plus download function of moderate resolution TIFF/DEM grid).
- Library of MODIS products that may show long-term seasonal averages and high magnitude/low frequency events in primary productivity for: (i) the entire AMJ; (ii) Marine bioregions; and (iii): Smaller regions selected by user. Zoomable plus (again with download function for moderate resolution TIFF and grid).
- Incorporation of CSIRO’s *Environment Land and Marine Observation via the Web website* (ELMOW) or some version of it.

ELMOW demonstrates how remotely sensed satellite data can be captured daily and made available to Coastal and Ocean resource managers.

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