Mapping & Monitoring Rocky Reef Biota

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NSW Dept of Primary Industries

NSW Fisheries Management Act 1994

- To conserve fish stocks, aquatic biodiversity & fish habitats for current & future generations
- To ensure sustainable fishing & aquaculture
- To promote enjoyment of the sea & rivers

MER
'An evolving juggernaut with an uncertain trajectory'?

MARINE:
- By 2015, there is no decline in the condition of marine waters & ecosystems

ESTUARIES:
- By 2015, there is an improvement in the condition of estuaries and coastal lake ecosystems

Present indicators (marine)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of Algal Blooms</td>
<td>As an indicator of pelagic algal biomass (determined from measures of ocean colour)</td>
</tr>
<tr>
<td>(developmental work needed)</td>
<td></td>
</tr>
<tr>
<td>Rocky Reef biota</td>
<td>Spatial extents of: kelp beds/urchin barrens, Caulerpa filiformis and Pyura stolonifera</td>
</tr>
<tr>
<td>(developmental work needed)</td>
<td>Other potential indicators (eg harvested species, reef fish, corals)</td>
</tr>
<tr>
<td>Beachwatch</td>
<td>As an indicator of recreational water quality</td>
</tr>
<tr>
<td>(existing program)</td>
<td>As an indicator of coastal environment managed to protect marine biodiversity (by habitat)</td>
</tr>
<tr>
<td>Marine Protected Areas</td>
<td>(easily adapted from previous work)</td>
</tr>
</tbody>
</table>

Indicator 1: Beachwatch

- Samples collected weekly by council or DECC staff
- Standard microbiological analysis
- Data synthesised on Beachwatch website

Beachwatch Partnership Program

- NSW coast
  - 153 swimming locations
  - Samples collected by 12 local councils (red)
  - Quality assurance by Beachwatch
Indicator 2: Algal blooms (CHL)

Solitary Islands Marine Park

- Zoning plan in effect 2002
  - 86.5 km² in sanctuary
  - 390 km² in habitat protection
- Plan being reviewed in 2008
- Better habitat maps will assist review process
- Extent of protection by habitat will inform MER indicator

Other ocean colour products (?)

Mapping aquatic habitats & species

- Indicator for MER Estuaries (extent of seagrass)
- Indicator for MER Marine (extent of kelp beds)
- Indicator for MER Invasive Species (extent of Caulerpa)
- Is an ongoing activity for DECC & DPI
- NHT II funding for Seabed Mapping project in 2008/09
- Mapping provides opportunity to integrate MER themes

Bioregional assessment units for MPAs

Broad scale marine environmental classification

Part Stephens Canal Lakes Marine Park Zone

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>General Use Zone</th>
<th>Habitat Protection Zone</th>
<th>Special Purpose Zone</th>
<th>Sanctuary Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ha)</td>
<td>Percent</td>
<td>Area (ha)</td>
<td>Percent</td>
</tr>
<tr>
<td>Beach</td>
<td>302.66</td>
<td>80.56</td>
<td>115.58</td>
<td>16.86</td>
</tr>
<tr>
<td>Rocky/nudibranch</td>
<td>4.77</td>
<td>1.31</td>
<td>11.59</td>
<td>1.65</td>
</tr>
<tr>
<td>Shallow Reef (0-20m)</td>
<td>170.19</td>
<td>46.27</td>
<td>139.71</td>
<td>46.27</td>
</tr>
<tr>
<td>Deep Reef (20-200m)</td>
<td>12.78</td>
<td>11.78</td>
<td>19.38</td>
<td>11.78</td>
</tr>
<tr>
<td>Saltern</td>
<td>2.15</td>
<td>1.00</td>
<td>18.54</td>
<td>8.95</td>
</tr>
<tr>
<td>Mangroves</td>
<td>87.67</td>
<td>22.78</td>
<td>30.75</td>
<td>16.46</td>
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<tr>
<td>Posidonia</td>
<td>36.17</td>
<td>9.64</td>
<td>11.43</td>
<td>3.05</td>
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<tr>
<td>Driftwood</td>
<td>12.14</td>
<td>3.29</td>
<td>3.29</td>
<td>0.84</td>
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<tr>
<td>Dunal</td>
<td>81.96</td>
<td>21.64</td>
<td>16.75</td>
<td>4.25</td>
</tr>
<tr>
<td>Ruppia</td>
<td>28.43</td>
<td>7.39</td>
<td>26.43</td>
<td>7.39</td>
</tr>
<tr>
<td>Algal</td>
<td>2.71</td>
<td>0.07</td>
<td>2.71</td>
<td>0.07</td>
</tr>
<tr>
<td>Bluff</td>
<td>3926.92</td>
<td>97.75</td>
<td>431.46</td>
<td>11.44</td>
</tr>
<tr>
<td>Hard sand</td>
<td>6389.55</td>
<td>62.35</td>
<td>1197.17</td>
<td>18.86</td>
</tr>
<tr>
<td>Patch sand</td>
<td>1962.95</td>
<td>19.12</td>
<td>980.17</td>
<td>15.46</td>
</tr>
<tr>
<td>Granite</td>
<td>1382.01</td>
<td>13.54</td>
<td>726.17</td>
<td>11.44</td>
</tr>
<tr>
<td>Slab Sand</td>
<td>1249.22</td>
<td>12.14</td>
<td>819.23</td>
<td>12.14</td>
</tr>
<tr>
<td>Total</td>
<td>4571.34</td>
<td>44.26</td>
<td>2770.23</td>
<td>43.86</td>
</tr>
</tbody>
</table>

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Mapping aquatic habitats & species

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Continued Estuarine mapping

- Fill in gaps in macrophyte extent from CCA. Now virtually complete.
- Develop framework for characterising seagrass condition
- Include other habitat features – rocky reefs, bathymetry, sediments
- Link with offshore habitats
- Link to MER estuarine program

Estuarine foreshore categorisation

Estuarine rocky reefs

Estuarine habitat mapping; aerial photos + ground-truthing (DPI component of Seabed Mapping project)
Indicator 4: Rocky Reef Biota

- No clear guidelines on what this should be ('species abundance in rocky reef communities')
- Needs to be a suite of species that:
  - can be readily measured across the state (eg by remote sensing, ie linked to habitat mapping)
  - has some clear role within rocky reef communities
  - has some predicted linkages to possible pressures
- Could be:
  - algal species
  - invertebrate species/assemblages
  - fish species
  - intertidal and/or subtidal

‘Obvious’ subtidal candidates

There are ‘fishery independent’ survey data for these harvested species

- Abalone
- Crayfish

Sampling options:

- Field sampling using quadrats or transects
  - resource intensive (time, money), spatial scale too small, dangerous
- Remote sampling (satellite)
  - satellite imagery/spectral analysis problematic for subtidal (absorption of wave lengths) & intertidal (breaking waves)
  - few species can be distinguished
- Remote sampling (photographic)
  - aeroplane fine for shallow subtidal (cf seagrass), problematic for intertidal

Target species - intertidal

↑ with ↑ pollution  ↓ with ↑ humans & storms  ↓ with ↑ pollution

Target species - subtidal

↓ with ↑ pollution & storms  ↑ with ↓ kelp  ↓ with ↑ barrens
shift south w’ ↑ temp  shift south w’ ↑ temp
Photographic options

Helicopter sampling

- R22 helicopter ($485 per hr)
- Camera: Nikon D3, 12 megapixels
- 24 mm or 35 mm lens
- 13 MB files

When conditions are better ......

- Note generally clear oceanic water

Trialled early in 2008 ............

............... in less than ideal conditions !!

Caulerpa filiformis in HCR CMA

- Presence recored during 2008 helicopter pilot
- Historical data are only anecdotal
- Trend assessment is speculative

Possible indicator of increased pollution

Historical data are only anecdotal
**Subtidal Reef Habitats in Hunter region**

- Analysis of aerial photos (1998)
- Field sampling 2005 – limited area

**Regional monitoring of rocky reefs**
- MPA
  - Baited video counts for reef fish; all parks but for varying periods
  - UW visual census for fish and some invertebrates
- Universities
  - SCU, UNE, Newcastle, UTS, Sydney, Wollongong
- Community Groups
  - SURG, PURG, URG, etc
- Research Institutions
  - CSIRO

**Likely sampling locations**

**MARINE PRESSURE INDICATORS**
- Fishing (but could also be ‘condition’)
- Climate change (eg temperatures)
- Nutrient/sediment input via estuaries
- Sewage discharge
- Sheer people pressure

**Yellowfin Bream (Acanthopagrus australis)**

- Standard and scientific names
- Exploitation status with traffic-light colour coding
- Summary of species included in reporting group
- Background information on the biology and ecology of this species or species
- Latest Fisheries Resource Assessment on DPI website
**Overall 'Condition Indicator'**

Trend in the Exploitation Status of all Key Species

- **Uncertain or Undefined**
- **Overfished**
- **Growth Overfished**
- **Fully Fished (or less)**

**Number of Species**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001/02</td>
<td>40</td>
</tr>
<tr>
<td>2002/03</td>
<td>50</td>
</tr>
<tr>
<td>2003/04</td>
<td>60</td>
</tr>
<tr>
<td>2004/05</td>
<td>70</td>
</tr>
<tr>
<td>2005/06</td>
<td>80</td>
</tr>
</tbody>
</table>

**Another new data collecting tool: SEACAMS**

- 70 listening stations at sites from the Qld to Vic. borders in 10-30 m depth
- Established to determine movement patterns of sharks (esp. GNS)
- Temperature loggers now on all listening stations
- Will provide clues to climate change

**MARINE MER – Ongoing challenges**

- Reliably measuring condition indicators
- Further development of additional indicators
- Identifying & measuring pressure indicators
- Integrating with other themes (estuaries)
- Establishing regional programs with CMAs
- Establishing local programs with community groups
- Finalising report cards