



## 2. Methodology

This methodology is set out to explain the methods and criteria used by NPA for the selection of marine protected areas. These areas will be set out in Part II of this report. The methodology is set out in Part I to critique the existing marine protected area system of NSW marine waters and show the overall progress towards a comprehensive, adequate and representative system of marine protected areas in the NSW marine jurisdiction.

### 2.1. Integrated Marine and Coastal Regionalisation of Australia (IMCRA)

The Integrated Marine and Coastal Regionalisation of Australia (IMCRA) is an ecologically-based spatial framework that classifies Australia’s marine environment into biogeographic regions (bioregions). IMCRA provides the first layer in a broad ecological planning framework within which more detailed information on ecosystems, communities and/or species distributions must be used to assist decision-making across or within a bioregion.

Marine protected areas within all bioregions are a prerequisite for protection of biodiversity.<sup>99</sup> It is generally accepted that representing all the different bioregions in a protected area network should be a core conservation objective because assemblages of species will be distinct in each.<sup>100</sup> The presence of representative species or habitats and the presence of species at their range boundaries relate directly to, and are incorporated in, bioregional representation criteria. There may also be bioregional patterns in the distribution of habitats.<sup>100</sup> Regardless of whether conservation effort is focused on species or habitats, protection in all bioregions must be provided.<sup>100</sup>

**Table 3: Area of Marine Bioregions with area of NSW marine jurisdiction.**

| Bioregion        | Total (ha) | NSW section (ha) | NSW section (%) |
|------------------|------------|------------------|-----------------|
| Tweed-Morton     | *4,325,093 | 235,134          | 5               |
| Manning Shelf    | 983,785    | 261,354          | 28              |
| Hawkesbury Shelf | 948,254    | 200,968          | 22              |
| Batemans Shelf   | 736,830    | 225,615          | 29              |
| Twofold Shelf    | *3,230,614 | 62,671           | 1               |
| Lord Howe        | 45,400,565 | 46,890           | 0.1             |

\* Including Commonwealth and other State components of these Bioregions.

There are three entire marine bioregions – Manning, Hawkesbury and Batemans Shelf – and parts of a further two - Tweed-Moreton (Qld/NSW) and Twofold Shelf (NSW/Vic) - adjacent to the NSW coastline. These bioregions extend to the edge of the Continental Shelf. However, the NSW marine jurisdiction (just over 1 million ha) extends only three nautical miles (nm) or about 5 five kilometers (km) seaward from the coastline and offshore islands. The NSW marine jurisdiction also extends three nautical miles from the coastline of Lord Howe Island which falls with the IMCRA bioregion of the Lord Howe Province.

By far the greatest proportion of these six marine bioregions is in adjacent Commonwealth managed waters within the Australian Exclusive Economic Zone (200nm).

<sup>99</sup> Roberts *et. al.*, 2003



## 2.2. NSW Marine Protected Area Macro Gap Analysis

NPA has conducted a reserve gap analysis to prioritise poorly-protected bioregions and to evaluate the comprehensiveness and representativeness of the existing marine protected area system in conserving adequate samples of each marine ecosystem and the habitats they harbour.

Determination of adequacy is inherent in the assessment of comprehensiveness. Currently, there is no way of quantifying adequacy, since the proportion of an ecosystem's total area requiring reservation to guarantee its long-term ecological viability is currently not known. While percentage area targets have been suggested for various terrestrial systems in NSW (eg 15% of pre-European forest cover), no such targets have yet been applied to NSW marine ecosystems. Currently there is no way of determining adequacy, as the paucity of fine-scale data prohibits an assessment of the requirements, or indeed the distribution, of all marine organisms in the NSW marine jurisdiction. However, a number of modelling studies have suggested protecting 20%–50% of the sea from fishing is necessary to adequately conserve biodiversity,<sup>100</sup> and to protect the long-term viability of populations of marine species.<sup>101</sup>

The IUCN recommended that between 20% and 30% of each habitat be included in strictly protected areas (IUCN Category Ia sanctuaries) by 2012.<sup>102</sup> The IUCN recommendation was adapted by a technical advisory body to the Convention on Biological Diversity in 2003, recommending a target of 10% effective protection globally, with a longer term goal of 20–30% of each habitat type protected within effectively managed protected areas.<sup>103</sup> Effective protection is defined here as strictly protected IUCN Category Ia sanctuaries. This Report uses a target of 20% - 30% of each habitat and ecosystem in marine sanctuaries by 2020, and a minimum 10% by 2011.

A rationale for protecting 20% comes from a fishery model indicating that recruitment overfishing can be avoided by maintaining stocks – both targeted and untargeted – at or above 20% of their unfished biomass.<sup>104</sup> Research and modelling indicates that even this level of protection may not provide sanctuary for all species of a given area, which may require about 40% sanctuary protection of all habitats.<sup>105</sup>

Spatial data for the NSW marine jurisdiction are poor. While broad habitat and ecosystem mapping provides consistency for identification of some of the more obvious high conservation priorities, fine scale mapping is unavailable across State waters. Fine scale habitat spatial data are available for small areas (e.g. Sydney Harbour and parts of existing Marine Parks) and species point occurrence data are available for some invertebrates and fish, but these data are patchy and inconsistent. There are almost no spatial data available for Commonwealth waters off the NSW coastline. A great deal more mapping and data collection must be undertaken to determine fine scale gaps in the marine protected area system. Data collection for the NSW marine jurisdiction must become the focus of responsible government agencies before a fully comprehensive, adequate, representative and effective marine reserve system can be completed.

---

<sup>100</sup> Roberts & Hawkins, 2000; IUCN 2003; UK Royal Commission on Environmental Pollution 2004; Pew Institute 2005; Schubert *et al.*, 2006

<sup>101</sup> Ponder *et al.*, 2002

<sup>102</sup> IUCN, 2003, Rec. 22

<sup>103</sup> UNEP, 2003, Item 7

<sup>104</sup> Goodyear *et al.*, 1993; Bohnsack, 1999

<sup>105</sup> Ward *et al.*, 1999; Roberts & Hawkins, 2000



The NSW jurisdiction includes all estuarine and marine waters out to 3 nautical miles from the NSW coast. This analysis is restricted to the NSW components of the five bioregions. The Queensland section of the Tweed-Moreton Bioregion, the Victorian section of the Twofold Shelf Bioregion and the adjacent Commonwealth waters out to the continental shelf are not analysed in detail in this project.

The bioregions of NSW defined in the Broadscale Biodiversity Assessments<sup>106</sup> have been used in this analysis.

Currently, about 6.6% of the NSW marine jurisdiction is included within established marine sanctuaries (including 'no-take' Aquatic Reserves, National Park marine extensions, and Marine Park sanctuary zones).

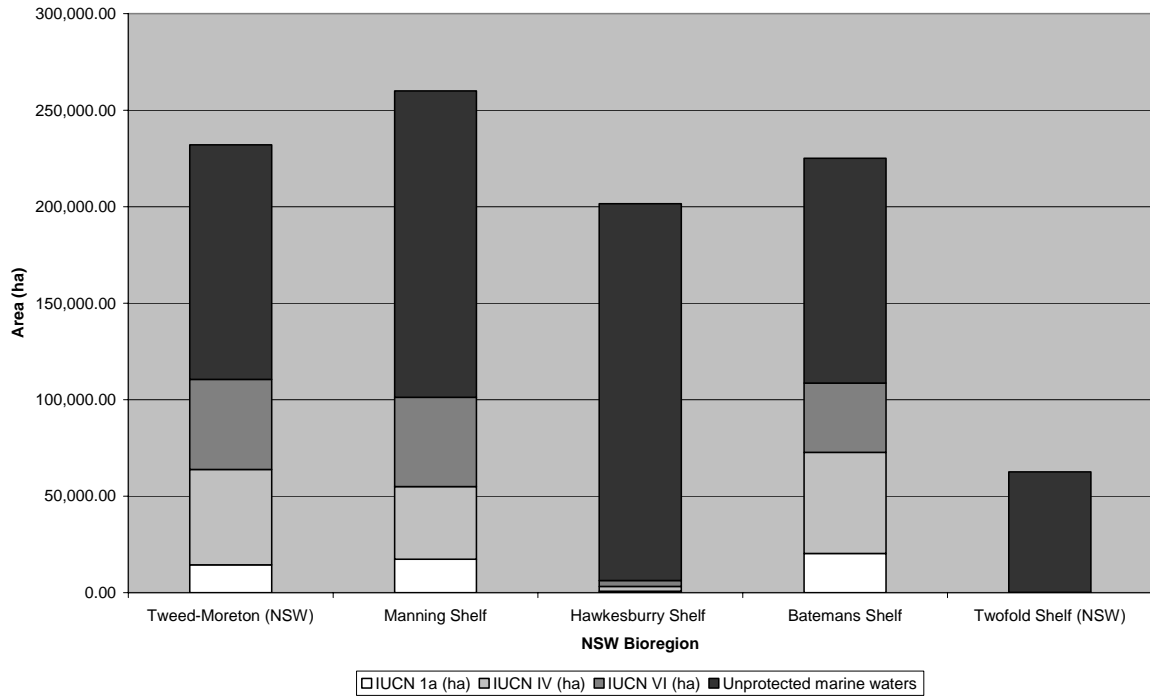
**Table 4: NSW Bioregions conservation status**

| Bioregion                       | NSW (ha)       | IUCN Ia #  | IUCN Ia (ha)  | IUCN Ia (%) |
|---------------------------------|----------------|------------|---------------|-------------|
| Tweed-Moreton (NSW)             | 235,134        | 22         | 14,391        | 6.1         |
| Manning Shelf                   | 261,354        | 39         | 17,162.4      | 6.6         |
| Hawkesbury Shelf                | 200,968        | 7          | 789.6         | 0.4         |
| Batemans Shelf                  | 225,615        | 59         | 20,356        | 9           |
| Twofold Shelf (NSW)             | 62,671         | 0          | 0             | 0           |
| Lord Howe Island Province (NSW) | 46,890         | 1          | 12,660        | 27          |
| <b>Total</b>                    | <b>985,742</b> | <b>128</b> | <b>65,359</b> | <b>6.6</b>  |

There are currently no Marine Parks within the Hawkesbury and Twofold Shelf Marine Bioregions. About 3% of the Hawkesbury Shelf is established in existing Aquatic Reserves and National Park marine extensions; however, only 0.4% is included in established IUCN Category Ia sanctuaries. No IUCN Category Ia sanctuaries exist in the NSW component for the Twofold Shelf Bioregion; however, about 190 ha of NSW marine waters are included in National Park marine extensions.

Lord Howe Island Province has reached the target of between 20% and 30% of the area within IUCN Category Ia sanctuaries. No attempt however, has been made to assess the representativeness of the habitats and ecosystems of the Lord Howe Island Marine Park, as data is unavailable to us for this Province.

<sup>106</sup> Breen, Avery & Otway, 2004, 2005a and 2005b



**Fig. 8:** Area of existing MPAs in NSW sections of marine bioregions.



## 2.3. Methods and Criteria

In 1999, ANZECC endorsed the *Strategic Plan of Action for the National Representative System of Marine Protected Areas: a guide for action by Australian governments*.<sup>107</sup> The NSW System for Representative Marine Areas document (Nov 2001) incorporates much of the Commonwealth's Strategic Plan which defines comprehensiveness, adequacy and representativeness (the CAR principles) as the three principles that underpin the establishment, planning, management and performance assessment of MPAs in the National Representative System of Marine Protected Areas (NRSMPA).

The CAR principles are defined as;

**Comprehensiveness:** The NRSMPA will include the full range of ecosystems recognised at an appropriate scale within and across each bioregion.

**Adequacy:** The NRSMPA will have the required level of reservation to ensure the ecological viability and integrity of populations, species and communities.

**Representativeness:** Those marine areas that are selected for inclusion in MPAs should reasonably reflect the biotic diversity of the marine ecosystems from which they derive.

Scale is an important consideration for the application of these CAR principles. For the NRSMPA, the agreed hierarchy against which the principles are applied is bioregion; ecosystem; habitat; community/population; individual/species.<sup>108</sup>

Part I of this report identifies macro-scale gaps in the NSW marine protected area network. Part II identifies meso- and micro-scale gaps within each bioregion and recommends obvious high conservation value areas that are required to be protected to meet the criteria set out for the NRSMPA.

The identification criteria used are set out in the ANZECC Guidelines,<sup>108</sup> and the Guidance for the NRSMPA is set out by the Peer Review Panel.<sup>109</sup> These criteria and guidelines are used in conjunction with spatial data of biodiversity surrogates that are consistent for the entire NSW marine jurisdiction.

The surrogates used here include:

### 1. Estuarine ecosystems

- Wave dominated barrier estuaries
- Tide dominated drowned river valleys
- Intermittent lagoons and creeks
- Brackish barrier lakes and lagoons

Freshwater lakes

### 2. Ocean ecosystems

- 0-20m depth range
- 20-60m depth range
- 60-200m depth range

---

<sup>107</sup> ANZECC TFMPA, 2000

<sup>108</sup> ANZECC, 1998

<sup>109</sup> SERP, 2006



### 3. Estuarine Habitats

- Seagrass beds
  - *Halophila* sp
  - *Ruppia* sp
  - *Zostera* sp
  - *Posidonia australis*
- Mangroves
  - *Avicennia marina* (grey mangrove)
  - *Aegiceras corniculatum* (river mangrove).
- Saltmarsh

### 4. Coastal Habitats

- Sandy beaches
- Islands and rocks
- Intertidal rocky shores
- Subtidal reef (>20m depth)
- Subtidal sand

Additional criteria used includes natural rarity, vulnerability, spatial heterogeneity and functional connectivity such as MPA configuration, edge to area ratios, distances between MPAs, and ease of compliance by MPA users. Data used to meet these additional criteria include small least disturbed estuaries, upwelling zones, important wetlands, records of wading birds and grey nurse shark aggregation sites, as well as other values that are deemed as being necessary for representativeness.

Broad ecosystem surrogates are used alone to help identify representative areas where habitat mapping does not currently exist, such as ocean ecosystems of >20m depths. Representativeness could be significantly improved with the aid of further fine-scale habitat and benthic mapping of offshore areas.

Where possible, recommended areas are selected that are contained within or abut terrestrial National Parks and reserves, and other terrestrial areas that are inferred as least disturbed from aerial photographs and terrestrial vegetation mapping. Additional data have been used to identify areas less suitable for inclusion in recommended MPAs such as high density human settlements, boat ramps, wharfs and other maritime structures, sewage outfalls, known infestations of *Caulerpa taxifolia*, and aquaculture leases.

The datasets used were incorporated into an ARCVIEW 3.3 geographic information system (GIS) and analysed against the established criteria.

An attempt is made to provide broad functional ecological connectivity by minimising spatial gaps between MPAs and edge to area ratios, and ensuring adequate MPA transects reach the 3nm limit.