

# Information Sheet on Ramsar Wetlands (RIS) – 2009-2012 version

*Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8<sup>th</sup> Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX.22 of the 9<sup>th</sup> Conference of the Contracting Parties (2005).*

Completed in accordance with the *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*, and using further guidance in the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 14, 3rd edition). (4th edition of the Handbook available in 2009).

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**1. Name and address of the compiler of this form:**

Wetlands International – Oceania.

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Designation date

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Site Reference Number

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**2. Date this sheet was completed/updated:**

Updated at April 2009

Replaces the original RIS prepared by Wetlands International – Oceania in June 2002

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**3. Country:**

Australia

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**4. Name of the Ramsar site:**

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Elizabeth and Middleton Reefs Marine National Nature Reserve (Elizabeth and Middleton Reefs)

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**5. Designation of new Ramsar site or update of existing site:**

Elizabeth and Middleton Reefs Ramsar site was originally designated on 21<sup>st</sup> October 2002.

**This RIS is for** (tick one box only):

a) Designation of a new Ramsar site ☐; or

b) Updated information on an existing Ramsar site ☒

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**6. For RIS updates only, changes to the site since its designation or earlier update:**

**a) Site boundary and area**

The Ramsar site boundary and site area are unchanged: ☐

or

**If the site boundary has changed:**

i) the boundary has been delineated more accurately ☐; or

ii) the boundary has been extended ☐; or

iii) the boundary has been restricted\*\* ☐

and/or

**If the site area has changed:**

- i) the area has been measured more accurately ☒; or
- ii) the area has been extended ☐; or
- iii) the area has been reduced\*\* ☐

**\*\* Important note:** If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

**b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:**

The site still meets the criteria which it met on the date of Ramsar listing, plus an additional one (Criterion 7) which was omitted in the original nomination. There appear to be no changes to ecological character of the Site since Ramsar listing – the date of the previous RIS (2002).

**7. Map of site:**

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

**a) A map of the site, with clearly delineated boundaries, is included as:**

- i) a **hard copy** (required for inclusion of site in the Ramsar List): ☒;

A hardcopy map is appended to this RIS.

- ii) an **electronic format** (e.g. a JPEG or ArcView image) ☒;

The electronic boundary map has been developed by the Australian Government, The Department of Environment, Water Heritage and the Arts.

- iii) a **GIS file providing geo-referenced site boundary vectors and attribute tables** ☐.

**b) Describe briefly the type of boundary delineation applied:**

e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The Site boundary corresponds to the boundaries of Elizabeth and Middleton Reefs Marine National Nature Reserve (**Figure 2**). The boundary of Elizabeth and Middleton Reefs Marine National Nature Reserve is described as all of that area within the Pacific Ocean contained within and bounded as follows:

- i. commencing at the point of latitude 29 degrees 21.000 minutes south, longitude 158 degrees 59.000 minutes east;
- ii. then east along the parallel of latitude 29 degrees 21.000 minutes south to its intersection with the meridian of longitude 159 degrees 14.000 minutes east;
- iii. then generally south-southwest along the geodesic to the point of latitude 30 degrees 03.000 minutes south, longitude 159 degrees 10.000 minutes east;
- iv. then west along the parallel of latitude 30 degrees 03.000 minutes south to its intersection with the meridian of longitude 158 degrees 55.000 minutes east;
- v. then generally north-northeast along the geodesic to the point of commencement.

The Sanctuary Zone and Habitat Protection Zone within the Reserve are separated along the parallel of latitude 29 degrees 53.000 minutes south

\* All geographic coordinates are expressed in terms of the Geographics Datum of Australia 1994 (GDA94, effectively WGS84).

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**8. Geographical coordinates** (latitude/longitude, in degrees and minutes):

Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

Elizabeth Reef (approximate centre): Latitude 29° 56' S and Longitude 159° 05' E.

Middleton Reef (approximate centre): Latitude 29° 27' S and Longitude 159° 07' E.

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**9. General location:**

Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

Elizabeth and Middleton Reefs Marine National Nature Reserve is located in the northern Tasman Sea, in Australia's East Marine Region (**Figure 1**). It is 630 km east of Coffs Harbour (population 26,000), New South Wales, and 690 km east-south-east of Brisbane (population over 1.6 million), Queensland. It lies outside those States, yet is within the Australian Exclusive Economic Zone and is administered by the Commonwealth of Australia.

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**10. Elevation:** (in metres: average and/or maximum & minimum)

Wetlands within the Site are situated at, and several metres below, mean sea level. A lone temporary sand cay (islet) within the Site has a (variable) elevation of only one or two metres.

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**11. Area:** (in hectares)

The area enclosed by the Site boundary (Elizabeth and Middleton Reefs Marine National Nature Reserve) is 187,726 hectares. The area of reef wetland within the Reserve has not been accurately determined but is estimated to be approximately 8000 ha of which 3500 ha is at Elizabeth Reef and 4500 ha is at Middleton Reef. In each case, the area of wetland which is enclosed by the coral atoll includes some water more than 6.0 metres deep at low tide.

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**12. General overview of the site:**

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

Elizabeth and Middleton Reefs are remote coral reef atolls that occur atop isolated, oceanic sea mounts. They are the most southerly open ocean platform reefs in the world and their coral reef communities are influenced both by tropical and temperate ocean currents. The Reefs support a diverse marine fauna and coral reef communities that are distinct from others in Australia's East Marine region. These include uncommon and undescribed fishes, several endemic molluscs and several species at or near their northern or southern limits of distribution. They support healthy stocks of two apex predators – the Galapagos Reef Shark *Carcharhinus galapagensis* and the Black Cod *Epinephelus daemeli*. The reefs offer protection for several other species of commercially valuable pelagic and demersal fish, and many species of conservation significance, including numbers of migratory marine turtles and seabirds. They provide the only habitat for many of these species in a vast area of deep ocean.

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**13. Ramsar Criteria:**

Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

1 • 2 • 3 • 4 • 5 • 6 • 7 8 • 9  
☒ ☒ ☒ ☒ ☐ ☐ ☒ ☒ ☐

#### 14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

The site still meets the criteria which it met on the date of Ramsar listing (2002) plus an additional one (Criterion 7) which was omitted in the original nomination.

**Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.**

Elizabeth and Middleton Reefs may each be considered as both rare and representative examples of coral reef wetland in the Lord Howe Province marine bioregion as they are among the few, and largest, present. Furthermore, these reefs are distinctive in occurring atop oceanic sea mounts, and are the southernmost open ocean platform coral reefs in the world (DEWHA 2009). Their location, where tropical and temperate ocean currents meet, contributes to an unusual and diverse assemblage of marine species. They represent an environment which is not present anywhere else in waters associated with the Australian continent, and support unique coral reef and fish communities (ANPWS 1992, pp. xvii, 111, Oxley *et al* 2004).

**Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.**

Sixteen species known or considered to occur at the site are listed as threatened under the IUCN Red List and/or Australia's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999). These include cetaceans, marine turtles, seabirds and fish (Director of National Parks 2006). It is likely that other species of threatened status may occur at the site.

Green Turtle *Chelonia mydas* occurs in low abundance at the Reefs (ANPWS 1992). Green Turtle is listed as Vulnerable under Australian national legislation (EPBC Act), is classified as Endangered in the IUCN Red List, and is protected under the Convention on the International Trade of Endangered Species of Wild Animals (CITES) to which Australia is a Party.

The reefs support healthy populations of black cod *Epinephelus daemeli*, listed as "near threatened" on the IUCN Redlist (Shuk Man and Ng Wai Chuen 2006). This is the largest reported standing stock and one of the few remaining strongholds, of the species in Australian waters.

These species are listed under the following categories of the IUCN Red List and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (**Table 1**):

**Table 1. Threatened species at Elizabeth-Middleton Reefs Marine National Nature Reserve.**

Species	IUCN Red List	EPBC Act 1999
<b>Mammals</b>		
Blue Whale <i>Balaenoptera musculus</i>	Endangered	Endangered
Southern Right Whale <i>Eubalaena australis</i>	Least Concern	Endangered
Sei Whale <i>Balaenoptera borealis</i>	Endangered	Vulnerable
Fin Whale <i>Balaenoptera physalus</i>	Endangered	Vulnerable
Humpback Whale <i>Megaptera novaeangliae</i>	Least Concern	Vulnerable
<b>Reptiles</b>		

Green Turtle <i>Chelonia mydas</i>	Endangered	Vulnerable
Leatherback Turtle <i>Dermochelys coriacea</i>	Critically Endangered	Vulnerable
<b>Seabirds</b>		
Wandering Albatross <i>Diomedea exulans</i>	Vulnerable A4bd	Vulnerable
Antipodean Albatross <i>Diomedea antipodensis</i>	Vulnerable D2	Vulnerable
Campbell Albatross <i>Thalassarche impavida</i>	Vulnerable D2	Vulnerable
Gibson's Albatross <i>Diomedea gibsoni</i>	not listed	Vulnerable
Shy Albatross <i>Thalassarche cauta</i>	Near Threatened	Vulnerable
White-bellied Storm Petrel <i>Fregatta grallaria grallaria</i>	Least Concern	Vulnerable
Kermadec Petrel (western) <i>Pterodroma neglecta neglecta</i>	Least Concern	Vulnerable
<b>Fish</b>		
Black Cod <i>Epinephelus daemeli</i>	Near Threatened	-
Great White Shark <i>Carcharodon carcharias</i>	Vulnerable	Vulnerable

***Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.***

In view of the rarity of reef habitat in this oceanic region and the moderately large number of marine animal species and diversity of faunal groups recorded at the Site (ANPWS 1992), clearly the Reefs are 'hotspots' of biological diversity (Ramsar Convention 2002) in the region. At least 322 fishes belonging to 174 genera and 75 families are known at these Reefs, compared to only half or less of this number of species at Norfolk Island (Choat *et al* 2006, Oxley *et al* 2004, ANPWS 1992, p. 90). This includes seven undescribed and thus potentially endemic fishes (ANPWS 1992, pp. 92-3). Scientific investigations to date have yielded approximately 122 species of corals, 122 crustaceans, 240 molluscs and 74 echinoderms (ANPWS 1992), but further surveys would be expected to yield much higher numbers of species. Of the mollusc species collected, 3% are endemic and many of these are numerically dominant at the Site (ANPWS 1992).

***Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.***

A small population of Green Turtle *Chelonia mydas* uses the reefs primarily for food and shelter (ANPWS 1992). There is insufficient sand habitat for nesting by this species at the Site, so these animals are likely to migrate to other locations to nest. At least 12 species of migratory waterbirds use the Reefs as resting places. These are mostly terns such as Sooty Tern *Sterna fuscata* and boobies such as Masked Booby *Sula dactylatra*, and some shorebirds (Ruddy Turnstone *Arenaria interpres*) have been recorded (ANPWS 1992, p. 93). A small breeding colony of 30 pairs of Common Noddy *Anous stolidus* has been documented on a shipwreck on Middleton Reef. Conceivably, the reefs provide shelter and feeding areas for juvenile stages of species which have more open water adult stages, and also provide rare shelter for other species during severe storms.

***Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.***

Thus far, 322 indigenous fish species belonging to 174 genera and 75 families have provisionally been recorded at the Reefs (Choat *et al* 2006, Oxley *et al* 2004, ANPWS 1992). They include a highly

diverse range of morphologies, reproductive types and life strategies, including benthic, demersal, pelagic, herbivorous, omnivorous, predatory, planktivorous, scavenging, excavating, symbiotic, live-bearing, egg-releasing, hermaphroditic protogyny and protandry. These fish communities in turn support a diverse and complex range of other ecosystem components and processes, such as multiple food webs, re-cycling and breakdown of coralline materials, algal grazing, symbiotic relationships, etc.

The fish communities include seven undescribed and thus potentially endemic fishes (ANPWS 1992, pp. 92-3) and a number of species with specialised habitats and relatively restricted geographic distributions. The Elizabeth and Middleton Reefs populations of the Galapagos reef shark *Carcharhinus galapagensis* form a single genetic stock, which is distinct from the only other Australian population, 173km further south at Lord Howe Island (van Herwerden *et al* 2008).

**Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.**

Although fish species larvae may at times recruit to this remote location from other areas, it appears that most reef fish populations within the Site must complete their entire life cycle on these reefs (Oxley *et al* 2004). Two key apex predators, the black cod *Epinephelus daemelli* and the Galapagos reef shark *Carcharhinus galapagensis*, complete their life cycle on these reefs. The reefs support the largest reported standing stock, and are among the last few remaining strongholds, of the black cod in Australian waters (Choat *et al* 2006). Once common along the New South Wales (NSW) coast, the black cod is now extremely rare and is protected under Commonwealth and NSW legislation. The predominance of immature Galapagos reef sharks in the lagoons suggests that these habitats are important nursery habitat for the species (Oxley *et al* 2004).

Several other fish species of commercial and recreational value complete their life cycle on these reefs. It can be assumed that the productive shallow waters of the Reefs are also a significant nursery area for fishes that have open-water adult stages (Ramsar Convention 2002). The Rosy Job Fish *Aprion virescens*, which is commercially harvested on shallow sea-mounts in the Tasman Sea, may depend upon the reef system (ANPWS 1992, p. 110). Migratory Big-eye Tuna *Thunnus obis* also aggregate near reefs of this region.

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**15. Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

**a) biogeographic region:**

The Elizabeth-Middleton Reefs Ramsar Site lies within the Lord Howe Province, in Australia's East Marine Region (**Figure 3**).

**b) biogeographic regionalisation scheme** (include reference citation):

Integrated Marine and Coastal Regionalisation of Australia Version 4.0. (Commonwealth of Australia, 2006), and National Benthic Marine Bioregionalisation (Heap *et al* 2005).

**Note:** The "Marine Ecoregions of the World" (MEOW) classification system roughly adopts Australia's IMCRA Version 4.0 regionalisation. Australia's IMCRA "Lord Howe Province" however forms only a part of the larger MEOW "Lord Howe and Norfolk Islands" ecoregion, which is grouped into the "Lord Howe and Norfolk Islands" Province, which is part of the "Central Indo-Pacific" Realm (Spalding *et al* 2007).

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**16. Physical features of the site:**

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Elizabeth and Middleton Reefs are both coral atolls, forming open ocean platform reefs, and are the southernmost reefs of this type in the world. The Reefs are 50 km apart, separated by deep ocean, and are situated atop separate volcanic sea mounts that rise steeply from the Lord Howe Rise. Though more than 20 volcanic peaks are known from the Tasman Sea, only Lord Howe Island and Elizabeth and Middleton Reefs are presently near sea level. It is thought that volcanic activity occurred from the Eocene to Miocene times and that reefs have existed on the two peaks for some time (Environment Australia 2002). The two reefs are similar in size and eight geomorphological categories have been roughly mapped on each.

Elizabeth Reef is roughly oval in shape, and measuring 8.2 x 5.5 km. Its lagoon is considerably in-filled by reticulated reefs which occupy much of the central part, forming a mesh reef complex with sandy bottom. Sediments are derived from biogenic (calcium carbonate) shell origins in-situ. Water depths of 20-30 metres are common in the lagoon, while the western end is generally shallower (2-3 metres). Along the southern inner margin of the reef, a reticulated reef flat has developed, and this grades into the generally smooth pavement of the outer reef flat. In places, the outer reef flat is dotted with large boulders which have likely been thrown up from the reef slope where there is an extensive high-energy and erosive surf zone with well developed and extensive surge channels, gutters, sink holes and groove-spur development. The reef slopes show little leeward/windward differentiation, suggesting that winds do not predominate from any particular direction (ANPWS 1992).

Middleton Reef is a kidney-shaped coral atoll measuring approximately 8.9 x 6.3 km. Its lagoon is structurally complex with areas of relatively deep water in the centre and at the eastern end of the main lagoon. Isolated patch reefs with a high percentage of fragile, living corals occur at the western end of the lagoon. The lagoon floor consists of very fine silt, indicating that minimal tidal flushing occurs. Towards the south of the lagoon, patch reefs become increasingly reticulated, finally fusing to form a pavement-like inner reefal margin of coralline algae. This margin forms the boundary of the outer reef flat which is bisected by a moat in which occurs a porous, fragile 'pie crust' of live coral. Sand patches occur towards the eastern end of the moat. The seaward margin of the reef flat is formed by a hard algal ridge. Both algal ridge and reef flat are exposed at low tide. At the only entrance to the lagoon, on the northern side of the reef, a back reef environment has developed, characterised by large patch reefs which are dominated by *Acropora* and *Seriatopora* coral species (ANPWS 1992).

The Lord Howe marine biogeographic region is in a zone of warm temperate waters (Heap *et al* 2005). In summer, the Reefs receive southerly flowing warm tropical water from the East Australian Current, which apparently sustains the reef growth. Although the Reefs remain continually in the path of the Tropical Convergence, in winter, cooler water from the Southern Ocean reaches the Reefs via the dominant West Wind Drift. Coral growth and erosion thus are probably seasonal and delicately balanced.

Both Reefs have a low sand cay – the largest is on Elizabeth Reef. At low tide much of the reef flat is exposed, and at high tide both reefs are completely inundated - apart from the Elizabeth Reef sand cay. Tides are semi-diurnal, modified by local wind and currents; monthly maxima range from 1.8-2.6 m and minima range from 0.0 to 0.2 m (ANPWS 1992). Surface seawater temperatures vary seasonally from 19°C to 25°C (ANPWS 1992).

There are no rainfall data for the Site but data from Lord Howe Island (150 km to the south)—despite presence of mountain peaks—may broadly indicate conditions at Elizabeth and Middleton Reefs. Monthly averages at Lord Howe range from 108 mm in February to 184 mm in July. Air temperatures

range from maxima of 25°C in summer to minima of 14°C in winter. Prevailing winds are north-easterly in summer and south-easterly in winter, with no dominant direction influencing the Elizabeth and Middleton Reefs. The Reefs lie at latitudes just within the southern-most zone of influence of destructive tropical cyclones.

### 17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

The site is located in the western Pacific Ocean, and lies at the boundary of tropical and temperate oceanic waters, but is in a marine bioregion that is considered warm temperate waters (Heap *et al* 2005). The site mostly receives warm oceanic waters from the southerly flowing East Australian Current (EAC), which is strongest in summer. Climate and weather conditions are sub-tropical and below the influence of most cyclones. One of the break-off currents from the East Australian Current flows eastward in this area, as part of the Tasman Front – a convergence of warm Coral Sea waters with cooler Tasman Sea waters. Large eddies also form as the eastward currents interact with seamounts in the region. Areas of mixing associated with the Tasman Front, and oceanic eddies influenced by the seamounts, accumulate nutrients and biological materials, producing productive plankton-based food chains that support tuna and other pelagic fish of the Eastern Tuna and Billfish Fishery (Brewer *et al* 2007).

### 18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

As isolated oceanic wetlands with no permanent dry land, the Reef perimeters provide the only buffer to high-energy impacts of ocean swells and waves, and thus provides for remote sheltered wetland habitats within a vast region of oceanic waters of the western Pacific Ocean. The wetland shape is characterised by central inner lagoons where water exchange is limited, contributing to trapping and accretion of finer biogenic carbonate materials. On top of seamounts, the reefs also influence local eddies of the East Australian Current, which in turn enhance local food web and fisheries productivity in reef and pelagic ocean waters.

### 19. Wetland Types

#### a) presence:

Circle or underline the applicable codes for the wetland types of the Ramsar “Classification System for Wetland Type” present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp • Ts • U • Va •  
Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

#### b) dominance:

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

Although geomorphological categories have been coarsely mapped, those categories do not equate to these wetland types, and the order of dominance in wetland types can only be estimated as C (Coral Reef) > A (Permanent shallow marine - lagoon - waters) > E (Sandy islet).

### 20. General ecological features:



Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

Apart from a small, temporary sand cay on Elizabeth Reef, both reefs are entirely submerged at high tide and do not support terrestrial plant communities. Reef building corals and (thallus, encrusting or turf) algae are the major contributors to the overall reef structure, and also form the dominant components of habitat complexity and ecological features of the Site. Biogenic carbonate material (corals, coralline algae, mollusc and crustacean shells) is also the primary contributor to reef top and lagoon sediments. The high diversity of geomorphological zones and habitat types enables high species richness and diversity of benthic and fish communities, which also enhances the capacity for ecosystem stability.

The site is characterised by a mix of tropical and temperate oceanic influences and by its remoteness from sources of larval recruitment. It thus supports several species at or near their northern or southern limits of distribution, and species which can self-recruit to the same reef. The Site also includes species with relatively restricted distributions (Oxley *et al* 2004). A number of species occur in low abundance and may be more susceptible to adverse changes in ecological conditions. However the remoteness of the site and its current protected status have helped to ensure relatively stable benthic communities, species richness, fish populations and ecosystem health overall, with healthy populations of holothurians, black cod and Galapagos reef shark more recently (Oxley *et al* 2004, Choat *et al* 2006, Hobbs & Feary 2007).

Hard coral cover is moderate overall, and encrusting and turf algae dominate the reef slope and crests at both reefs, which is expected under such exposed oceanic conditions (Hobbs & Feary 2007). The major algal grazers here appear to be the numerically dominant temperate herbivorous fishes (Choat *et al* 2006). Exposure to large ocean swells presents a high disturbance regime which, in combination with at least one previous occurrence of crown-of-thorns starfish, suggests that high abundance of *Acropora* corals on the reef perimeter is likely to be a rare event (Oxley *et al* 2004). Crown-of-thorns starfish have previously caused substantial coral mortality at both reefs (ANPWS 1992), and may still occur at places in high densities, however the corallivorous mollusc, *Drupella*, does not appear to be a threat to these reefs (Hobbs & Feary 2007).

Seagrass occurs only as scattered plants on the sheltered sandy lagoons, at both reefs. The sheltered lagoons of each reef, and Blue Holes areas in particular, support much higher abundance of branching *Acropora* corals, black cod, Galapagos reef shark, several other fish species and holothurians (Choat *et al* 2006, Hobbs & Feary 2007). Several ecosystem services of the Site are detailed within item 14 above, and these values also support unique recreational diving experiences and restricted forms of recreational fishing.

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## 21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14, Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

No terrestrial plants occur at present (see item 16), though there is evidence that the sandy cay was vegetated with grass in the recent past (ANPWS 1992). Marine algae are not well studied at the site, though likely to be very diverse. A preliminary survey revealed 18 taxa, and the remoteness of the Site suggests a high potential for genetic uniqueness. Turf and coralline forms are predominant and green thallus algae such as *Halimeda* are common and contribute substantially to carbonate sediments in the lagoons. The only seagrass recorded is *Halophila ovalis* as scattered plants at both reefs (ANPWS 1992, p. 97).

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## 22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

The fish communities include seven undescribed and thus potentially endemic fishes (ANPWS 1992, pp. 92-3) and a number of species with specialized habitats and relatively restricted geographic distributions. Species which are highly valued in commercial aquarium fisheries occur here as remote populations. These include some species in small numbers and some as large populations, and are thus highly recommended for protection (Hobbs & Feary 2007). The endemic white snout anemone fish *Amphiprion mcchullochi* occurs in low abundances that are of some concern (Hobbs & Feary 2007). The Elizabeth and Middleton Reefs populations of the Galapagos reef shark *Carcharhinus galapagensis* form a single genetic stock, which is distinct from the only other Australian population, 173km further south at Lord Howe Island (van Herwerden *et al* 2008).

Holothurians (sea cucumbers) are high in species number and abundance at both reefs (Oxley *et al* 2004). Three mollusc species are endemic to the site (Anabathridae *Amphithalamus* sp. nov.; Retusidae *Decorifer elisa*; Mytilidae *Musculus nubilis*) and seven are endemic to the group of islands in this part of the Tasman Sea. Most of these endemic species are abundant on both reefs, yet many of the species with much wider geographic distribution are rare at the Site (ANPWS 1992), indicating a strong degree of specialisation by these faunal groups to local conditions.

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### 23. Social and cultural values:

a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

At least 30 ships have been recorded wrecked on the Reefs, dating back to the earliest years of European settlement in Australia in the late 18th Century, making the area of considerable marine archaeological significance. Except for the remains of more recent wrecks, which are a conspicuous feature of the Site, the majority of wrecks have not been accurately located. Shipwrecks located within the Reserves are protected under the *Historic Shipwrecks Act 1976* if they are more than 75 years old.

The wreck *Fuku Maru* on Middleton Reef supports a small breeding colony of sea terns; due to lack of suitable dry land, the colony otherwise would not occur at the Site.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

No.

If Yes, tick the box ☐ and describe this importance under one or more of the following categories:

- i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

- iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

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**24. Land tenure/ownership:**

**a) within the Ramsar site:**

The Site is a National Nature Reserve owned by the Commonwealth Government of Australia.

**b) in the surrounding area:**

Oceanic waters surrounding the Reserve are within the Economic Exclusion Zone (EEZ) of Australia.

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**25. Current land (including water) use:**

**a) within the Ramsar site:**

Nature conservation and scientific research; also limited recreational diving and restricted forms of recreational fishing under permits; no resident human population on the Site or in surrounding areas. Main users are Lord Howe Island residents, some from New South Wales (NSW) ports and some passing yachts. Australian commercial fishing vessels sometimes use the reserve for protected anchorage only.

**b) in the surroundings/catchment:**

Surrounding areas are part of the Eastern Tuna and Billfish fishery and also support commercial, demersal long-line fisheries based on Blue-eyed Trevella *Hyperglyphe antarctica* and Rosy Job Fish *Aprion virescens* (Brewer *et al* 2007).

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**26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:**

**a) within the Ramsar site:**

Despite its protected status and remoteness from human population centres, the Site has experienced previous impacts from human use, and could again in the future. Recreational and commercial fishing at the Site has in the past impacted the black cod populations. Currently only restricted recreational fishing by permit approval in the Habitat Protection Zone is allowed, however illegal or uncontrolled fishing would be a serious threat to apex predators such as the black cod and the Galapagos reef shark, as was experienced in Hawaii (Choat *et al* 2006, van Herwerden *et al* 2008, 2009). Although the Site is remote, any occurrence of illegal aquarium fish collection would present a serious threat to the populations of a number of highly valued aquarium trade species.

The Reefs have apparently no exotic species and only occasional and largely benign visitation by humans. However introduction of exotic species via vessel hulls or ballast water remains a potential threat. Under present management plans, a number of potentially detrimental activities are not permitted, but potential impacts can still include ship groundings, oil spills, anchoring on corals and diving.

The Crown-of-Thorns starfish *Acanthaster planci* has been quite common and widespread on both reefs on previous occasions and responsible for reductions in live coral cover here at times, as it has on the Great Barrier Reef (ANPWS 1992, Hobbs & Feary 2007).

Elevated sea surface temperatures that caused widespread coral bleaching at other Australian tropical coral reefs in 1998 and 2002 did not appear to occur at these higher latitude reefs (Oxley *et al* 2004). Nevertheless, the ongoing potential for change in ocean currents, sea temperature and other climatic regimes represents a potential threat to the corals and other benthic communities at these reefs.

**b) in the surrounding area:**

Shipping accidents and oil spills close to the Site would represent a threat if they have the potential to reach the coral reef communities. Impacts of global climate change have not been evidenced to date, but are considered a potential threat.

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**27. Conservation measures taken:**

**a)** List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

Elizabeth and Middleton Reefs Marine National Nature Reserve was proclaimed in December 1987 and is subject to provisions of the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is a Category 1a Nature Reserve under the IUCN classification, meaning the reefs are managed primarily for scientific research, environmental monitoring and benign uses.

In the current plan the Reserve is divided in to two zones. A 'Sanctuary Zone' managed as a 'strict nature reserve' (corresponding to the international IUCN category Ia) and a 'Habitat Protection Zone' managed as a 'National Park' (corresponding to IUCN category II). The Reserve is assigned to the category 'strict nature reserve' which corresponds to the international IUCN category Ia.

**b)** If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ☒; Ib ☐; II ☐; III ☐; IV ☐; V ☐; VI ☐

**c)** Does an officially approved management plan exist; and is it being implemented?:

The first management plan for the reserve came into effect in March 1994 and was applied for ten years (Environment Australia 2002). The second management plan titled *Elizabeth and Middleton Reefs Marine National Nature Reserve Management Plan 2006–2013* is in effect until 2013.

The main objectives of the Reserve Management Plan are:

- The preservation of the area in its natural condition, and
- The encouragement and regulation of the appropriate use, appreciation and enjoyment of the area by the public (Director of National Parks 2006).

Activities such as scientific research and monitoring, recreational diving and fishing and other commercial activities are managed by use of permits (Director of National Parks 2006). Management patrols to the Reserve are undertaken by staff within the Department of the Environment, Water, Heritage and the Arts under delegation of the Director of National Parks, generally using Customs vessels or privately chartered vessels for transport and support. This is often combined with research or monitoring activity. Royal Australian Navy patrol boats also patrol the Reserve on an ad hoc basis.

Commercial fishing and operations for the recovery of minerals are not permitted during the period of the current Plan.

**d)** Describe any other current management practices:

Nil

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**28. Conservation measures proposed but not yet implemented:**

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No other measures are proposed at present.

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**29. Current scientific research and facilities:**

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

The Reefs have been visited by a number of scientific expeditions, notably that of the Australian Museum in December 1987 (ANPWS 1992), and more frequent research and monitoring studies since 2003. Due to the remote oceanic location and lack of permanent dry land, research opportunities are limited and no permanent field station exists at the Reefs, however staff from The Department of Environment, Water, Heritage and the Arts, Australia, undertake observations on key features during management patrols to the Reserve and are implementing a formal research and monitoring program for some habitat parameters and species, including benthic communities, black cod and Galapagos reef shark.

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**30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:**

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

Due to the remote oceanic location and lack of permanent dry land, the Reefs are not suitable for visitor education programs or static educational displays. Detailed information on the Reefs, including the Management Plan and photographs, and a brochure, is available on the internet (DEWHA 2009). Interpretation signs placed on Lord Howe Island contain information about the Reefs.

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**31. Current recreation and tourism:**

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Due to the remote oceanic location and lack of permanent dry land, the Reefs are not convenient or popular destinations for recreation or tourism. Restricted recreational fishing and diving occurs under permit, mostly based from Lord Howe Island and some mainland ports. Charter tours and cruise ships have visited the Reefs in the past; however, no permits for commercial activities in the Reserve have been requested of, nor issued by, The Department of Environment, Water, Heritage and the Arts in recent times.

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**32. Jurisdiction:**

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

The Reserve is within the Australian Exclusive Economic Zone which is under the jurisdiction of the Commonwealth Government of Australia; functional jurisdiction lies with the Director of National Parks, The Department of Environment, Water, Heritage and the Arts, Canberra. The Director of National Parks has delegated his powers and functions under the EPBC Act (s.515) to the Assistant Secretary, Marine Division, Department of the Environment, Water, Heritage and the Arts.

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**33. Management authority:**

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

The Reserve is managed by the Temperate East Marine Conservation Section, Marine Division, Department of the Environment, Water, Heritage and The Arts, Australia, GPO Box 787, Canberra ACT 2601, Australia.

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**34. Bibliographical references:**

Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

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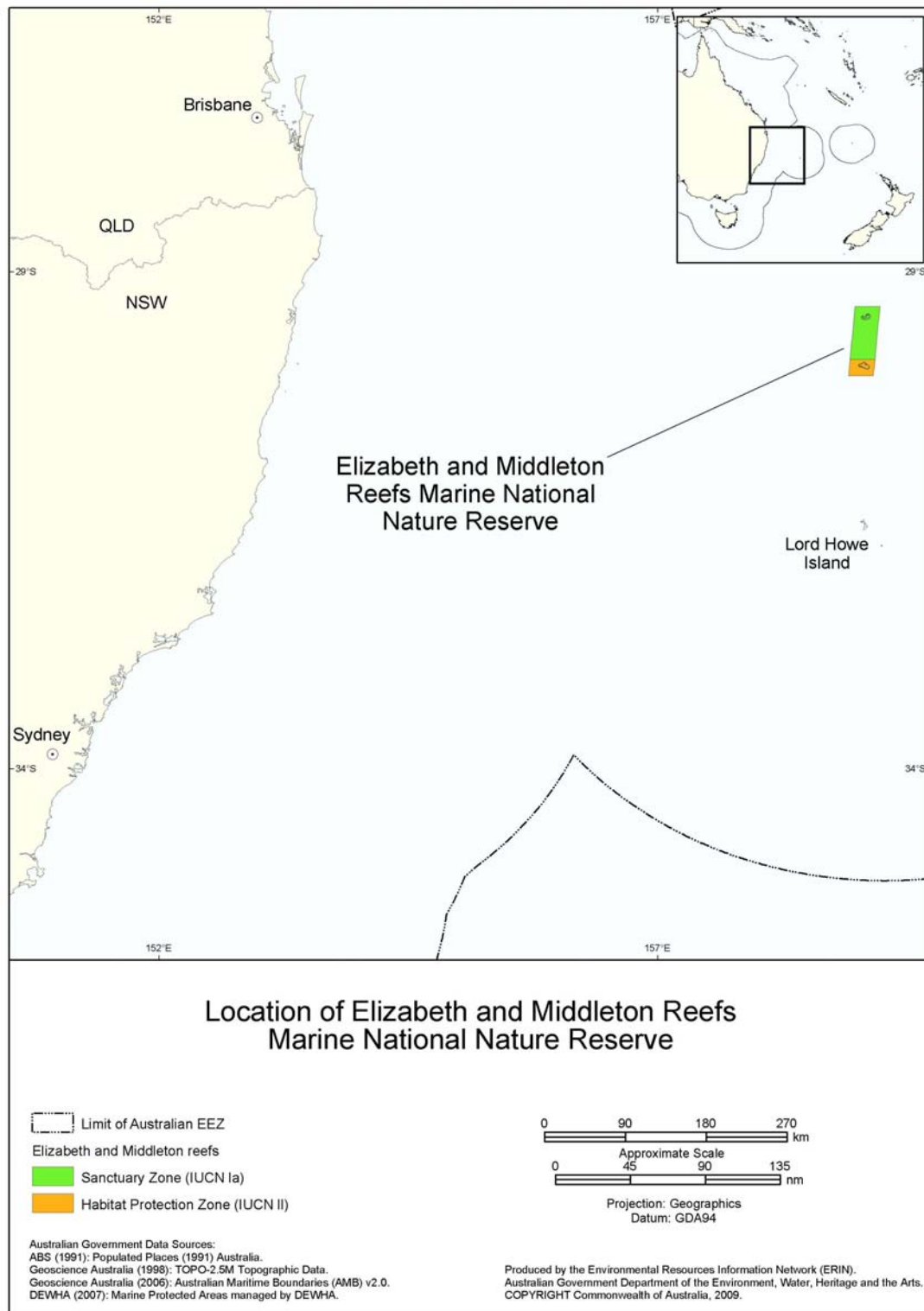
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## Appendix 1. Location and site maps of Elizabeth & Middleton Reefs Marine National Nature Reserve, Australia.

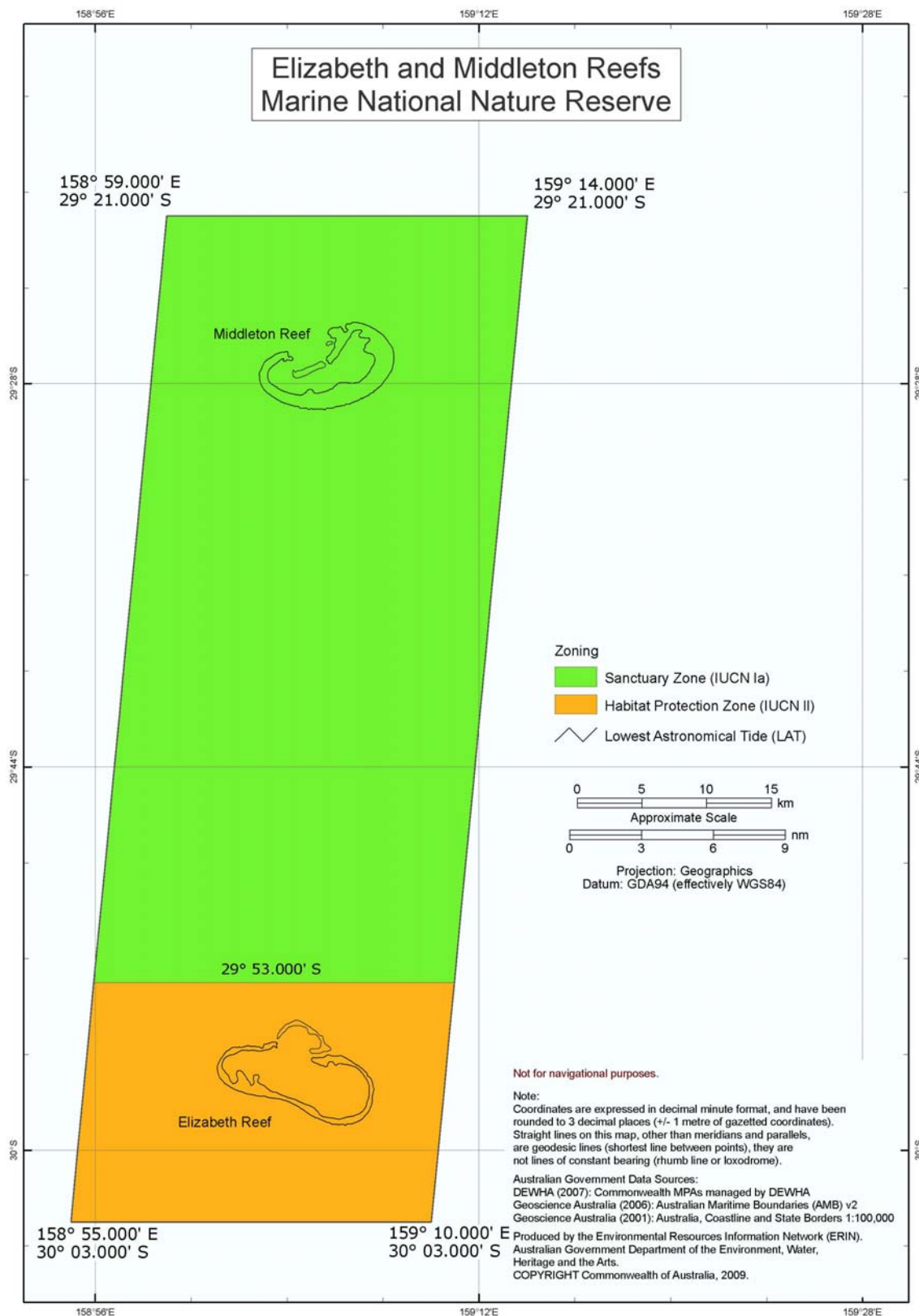


**Figure 1: Location of Elizabeth and Middleton Reefs Marine National Nature Reserve**

**Source:** Department of the Environment, Water, Heritage and the Arts, Australian Government

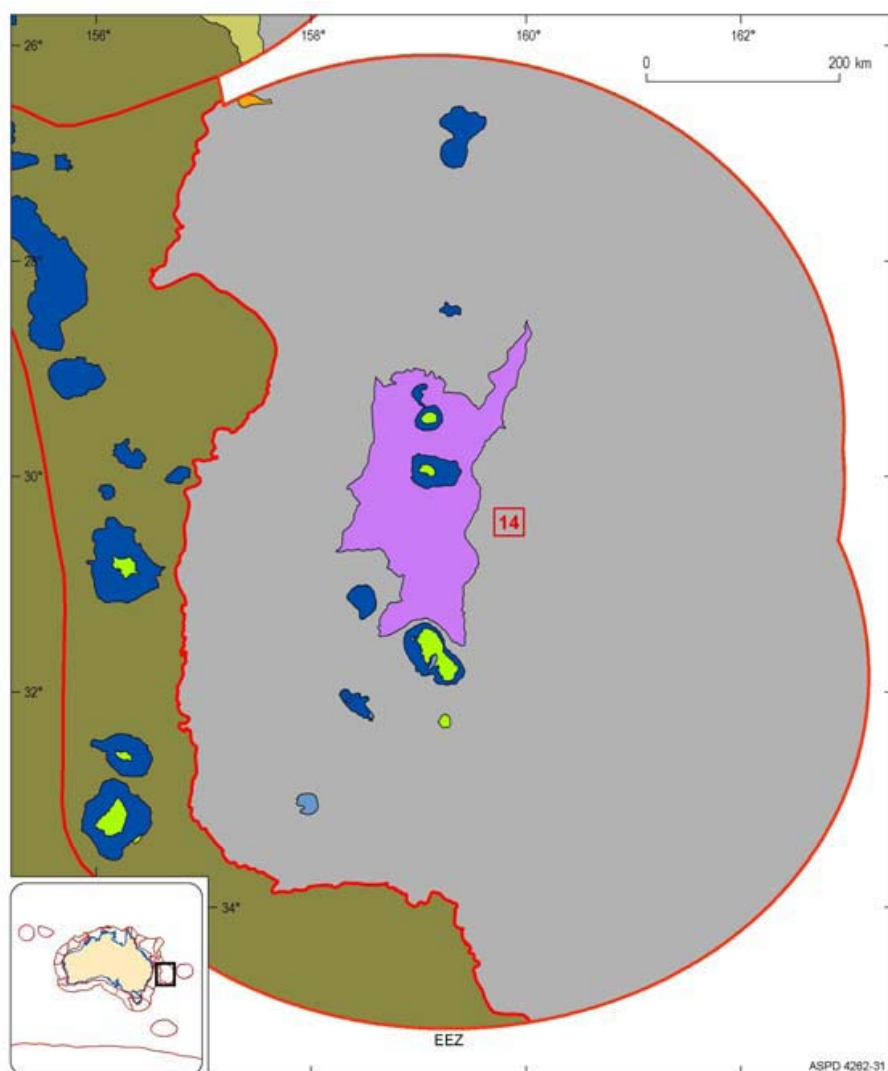
(<http://www.environment.gov.au/coasts/mpa/elizabeth/maps/index.html>)





**Figure 2: Boundaries of the Elizabeth and Middleton Reefs Marine National Nature Reserve and Ramsar site**

**Source:** Department of the Environment, Water, Heritage and the Arts, Australian Government (<http://www.environment.gov.au/coasts/mpa/elizabeth/maps/index.html>)



**Figure 3. Boundaries of *Lord Howe Province* (Bioregion 14) with map of Geomorphic Units. Red lines are Provincial Bioregion boundaries. (from Heap *et al* 2005)**