Environment Australia

Department of the Environment and Heritage

Coringa-Herald National Nature Reserve & Lihou Reef National Nature Reserve




M A N A G E M E N T P L A N

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This is the second Management Plan prepared for the Coral Sea National Nature Reserves

Coringa-Herald National Nature Reserve and Lihou Reef National Nature Reserve (Commonwealth Waters)

Environment Australia

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Cover images

INSETS FROM LEFT TO RIGHT:

1. Hermit Crab (courtesy of Environment Australia. Photographer, Mark Hallam)
2. Coral Reef (courtesy of Great Barrier Reef Marine Park Authority)
3. Red-footed Booby (courtesy of Environment Australia. Photographer, Barry Baker)
4. South East Magdelaine Cay (courtesy of Environment Australia. Photographer, Mark Hallam)

MAIN PHOTOGRAPH:

Green Turtle (courtesy of Precision Images)

BACKGROUND IMAGE:

Turtle Tracks (courtesy of Environment Australia. Photographer, Mark Hallam)

Foreword

The Coringa-Herald and Lihou Reef National Nature Reserves (collectively known as the Coral Sea National Nature Reserves) were proclaimed by the Commonwealth Government on 16 August 1982. Located approximately 440km east of the far north-east coast of Australia, the Reserves protect parts of the Coral Sea Islands Territory that contain near pristine and internationally significant reef ecosystems, cays, breeding seabirds, and important undisturbed habitat for nesting green turtles. Environment Australia is the Commonwealth Government's managing authority for the Reserves.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires the Plan to provide for the protection and conservation of the Reserves. The Reserves are to be managed as strict nature reserves — World Conservation Union (IUCN) category Ia. Such reserves are primarily for scientific research to ensure habitats, ecosystems, and native species are preserved in as undisturbed state as possible.

The Reserves are part of the National Representative System of Marine Protected Areas (NRSMPA). The primary goal of the NRSMPA is to establish and manage a comprehensive, adequate and representative system of marine protected areas, to contribute to the long term ecological viability of marine systems, to maintain ecological processes, and to protect Australia's biological diversity at all levels. Accelerated development of the NRSMPA is a specific action of *Australia's Oceans Policy* launched by the Commonwealth Government in December 1998.

Management planning for the Coral Sea National Nature Reserves is designed to conform to the *Best Practice in Performance Reporting in Natural Resource Management* (ANZECC, 1997) with an emphasis on goals, strategies, performance measures, targets and monitoring. The performance assessment framework will also generally follow that set out in the *Strategic Plan of Action for the National Representative*

System of Marine Protected Areas: A Guide for Action by Australian Governments (ANZECC 1999).

The preparation of this Plan began under the *National Parks and Wildlife Conservation Act 1975* (NPWC Act) and has been completed in accordance with the EPBC Act. All comments that were received during the public comment period have been given due consideration. As required by the EPBC Act, the Plan will cease to have effect seven years after a notice of its operation has been published in the Commonwealth Gazette. The Plan itself may only be altered following the same statutory process and consultative processes used in its preparation.

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Acknowledgments

Environment Australia is grateful to those organisations and individuals representing industry, conservation, indigenous, scientific, and government interests that assisted in the drafting of this management plan for the Coringa-Herald and Lihou Reef National Nature Reserves. The contributions of those groups and individuals that provided input into the consultation process formed the basis for the initial drafting of this Plan.

Contents

Some Abbreviations for Frequently Used Terms

AFMA	Australian Fisheries Management Authority
AIMS	Australian Institute of Marine Science
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment and Conservation Council
CAMBA	Agreement between the Government of Australia and the Government of China for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment.
Bonn Convention	Convention on the Conservation of Migratory Species of Wild Animals
Coastwatch	An inter-agency cooperative program of the Australian Customs Service providing coastal surveillance flights and surface patrols utilising resources of the Australian Customs Service, Royal Australian Navy, and contract aerial surveillance services.
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Director	Director of National Parks, a statutory position established by the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Regulations	*Environment Protection and Biodiversity Conservation Regulations 2000* made under the EPBC Act

GBRMPA	Great Barrier Reef Marine Park Authority established by the *Great Barrier Reef Marine Park Act 1975*; a statutory authority within the Environment and Heritage Portfolio
IMO	International Maritime Organization
IUCN	International Union for the Conservation of Nature and Natural Resources (World Conservation Union)
JAMBA	Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment.
NNR	National Nature Reserve
NPWC Act	*National Parks and Wildlife Conservation Act 1975* (Commonwealth)
NRSMPA	National Representative System of Marine Protected Areas
RAN	Royal Australian Navy
RGSQ	Royal Geographical Society of Queensland
The Reserves	Coringa-Herald and Lihou Reef National Nature Reserves, referred to collectively as the Coral Sea National Nature Reserves
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
VMS	Vessel Monitoring Systems

A definition of Biodiversity

Under section 528 of the *Environment Protection and Biodiversity Conservation Act 1999*, "biodiversity" means the variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part) and includes: (a) diversity within species and between species; and (b) diversity of ecosystems.

Summary

Introduction

The Coral Sea National Nature Reserves comprise the Coringa-Herald National Nature Reserve (Coringa-Herald NNR) and Lihou Reef National Nature Reserve (Lihou Reef NNR). Located more than 440km off the north-east coast of Australia, the Reserves lie to the east of the Great Barrier Reef Marine Park in a remote oceanic environment within the Coral Sea Islands Territory.

The Reserves have national and international significance due to their near pristine condition, regionally representative shelf-edge oceanic reef, spectacular and unusual underwater topography, internationally significant populations of breeding seabirds, and undisturbed habitat for nesting green turtles *Chelonia mydas*.

Management Framework

The Coral Sea National Nature Reserves were declared on 16 August 1982 and the first plans of management prepared under the *National Parks and Wildlife Conservation Act 1975*, came into effect in 1989. The Plan contained within this document replaces the first plans of management.

The primary objective of the Coral Sea National Nature Reserves is to maintain ecological processes and systems and to protect the habitats and biodiversity of the Reserves from the pressures associated with human use. As part of this objective the Reserves are assigned by this Plan to IUCN (World Conservation Union) protected area management category Ia — strict nature reserve: a protected area managed primarily for scientific research to ensure habitats, ecosystems, and native species are preserved in as undisturbed state as possible.

The Marine and Water Division, Environment Australia, manages the Reserves on behalf of the Director of National Parks (the Director).

A number of other agencies assist in management of the Reserves, including the Australian Customs Service through their Coastwatch program and the Royal Australian Navy (RAN).

Strategic Objectives

The strategic objectives for the Coral Sea National Nature Reserves are to:

- Protect, preserve, and manage the natural and cultural values of the Reserves, including the marine and terrestrial wildlife, and objects and sites of biological, historical, palaeontological, archaeological, geological and geographical interest from human induced damages.
- Protect key breeding and nesting habitat for listed species such as green turtle and seabirds.
- Manage the Reserves as a reference site for scientific research and long-term monitoring.
- Allow for limited public access to the Reserves for education and enjoyment, in a way that does not interfere with the natural and cultural values, or key breeding sites for nesting species within the Reserves.
- Manage the Reserves as part of a comprehensive, adequate, and representative system of marine protected areas to contribute to the long-term ecological viability of marine and terrestrial systems.

Description of the Coringa-Herald NNR and Lihou Reef NNR

The Coral Sea National Nature Reserves are located in the tropical waters of the Coral Sea Islands Territory and they enclose an extensive area of open water, reefs and a number of coral cays and islets. The Coringa-Herald NNR covers approximately 8,860 square kilometres, and includes three pairs of islets and cays that rise from separate platform reef systems. Covering some 8,440 square kilometres, Lihou Reef NNR and its associated sandy coral cays and islets encompass the largest reef structure in the Coral Sea.

The reef habitats support marine benthic flora and fauna that are distinct from those of the Great Barrier Reef. A diverse range of marine algae, sponges, soft and hard corals, crustaceans, starfish, sea urchins, sea cucumbers, and fish have been recorded within the Reserves. The green turtle, *Chelonia mydas,* breeds in the Reserves and a number of species of dolphins and whales are known to occur in the area.

Five islets in each of the Reserves are vegetated, predominantly by widespread tropical shoreline plants of the Indo-Pacific Region. The *Pisonia grandis* forest ecosystem, which occurs on two islets within Coringa-Herald NNR, has intrinsic conservation significance and it is important habitat for nesting seabirds.

The Reserves contain extensive and regionally significant seabird colonies, and many of the species recorded from the Reserves are listed under the Japan–Australia and China–Australia Migratory Bird Agreements (JAMBA and CAMBA). The buff-banded rail, *Gallirallus philippensis subsp.*, and the purple swamphen, *Porphyra porphyra,* are the only species of land bird breeding within the Reserves.

Several well-documented wrecks, and a number of wrecks whose origins have not yet been established, are located on Lihou Reef. One historic shipwreck, the *Coringa Packet* (1845), is located off Chilcott Islet within Coringa-Herald NNR.

The Coral Sea National Nature Reserves are a valuable reference site for scientific research and monitoring of marine ecosystems, seabirds and turtles. They are also an internationally renowned destination for diving, snorkeling and bird watching.

An automatic weather station and a solar powered navigation beacon have been established within Lihou Reef NNR. No permanent structures have been established in Coringa-Herald NNR.

Pressures on the Coral Sea National Nature Reserves

The main pressures on the values of the Coral Sea National Nature Reserves comprise those associated with human visitation, human influences outside of the Reserves, natural environmental

perturbations, and global change. This Plan focuses on pressures that are linked to human activities and can therefore be influenced by management, including:

- marine pollution;
- impacts of anchoring and diving;
- disturbance to wildlife behaviour and wildlife habitat;
- harvesting and collection of wildlife and wildlife products;
- introduction of exotic organisms;
- disturbance or collection of cultural artifacts and relics;
- conduct of research and monitoring; and
- visitor impacts on wilderness character, natural and cultural values.

Management of the Coral Sea National Nature Reserves

The Coral Sea National Nature Reserves will be primarily managed to maintain ecological processes and systems and to protect the habitats and biodiversity of the Reserves from the pressures associated with human use.

A summary of management goals for the Reserves

- Protect important breeding habitat for seabirds and turtles.
- Reduce marine pollution, including debris from shipping and fishing activities in the area.
- Encourage and develop research and monitoring programs that will provide information for management and increase knowledge of the natural and cultural values of the Reserves.
- Allow limited use of the Reserves for tourism and recreation activities that are consistent with the strategic objectives for the Reserves.
- Protect the Reserves from petroleum and mineral exploration and from development activities.
- Protect the Reserves from commercial fishing and bio-prospecting activities.

A summary of main management strategies for the Reserves

- Develop cooperative arrangements with research organisations to conduct research and monitoring activities that will increase knowledge, enhance management, and which are consistent with the management objectives for the Reserves.
- Apply permit conditions to ensure tourism and recreation use is maintained at a level and type that is consistent with the management objectives for the Reserves.
- Minimise, through education and regulation, the risk of damage to the values of the Reserves from human use.
- Monitor and collect for disposal any debris found on the islands within the Reserves to target education about pollution and to reduce debris within the Reserves.
- Prohibit extractive commercial activities, such as mineral and petroleum exploration and development, commercial fishing, and bio-prospecting.
- Encourage, through liaison with other relevant agencies, enforcement of legislation and permit conditions associated with human use activities in the vicinity of the Reserves.
- Maintain cooperative arrangements with Coastwatch and the RAN for the conduct of surveillance and enforcement activities.

Reviewing this Plan

This Plan presents elements of a performance assessment framework including the legislative framework, strategic objectives, management goals and management strategies. Detailed actions, performance indicators, targets and monitoring programs will be further developed from these elements.

The Plan will operate for seven years unless revoked or amended sooner. It will be reviewed approximately two years before its expiry. The results of the review will be used in the development of the next management plans for the Coral Sea National Nature Reserves.

1. Introduction

Coringa-Herald National Nature Reserve (Coringa-Herald NNR) and Lihou Reef National Nature Reserves (Lihou Reef NNR) are collectively known as the Coral Sea National Nature Reserves (the 'Reserves'). They are located within the Coral Sea Islands Territory to the east of the Great Barrier Reef Marine Park (Figure 1). The Reserves lie in a remote oceanic environment on the Coral Sea Plateau, which is separated from the Great Barrier Reef by an area of deep water known as the Queensland Trough. The Coringa-Herald NNR and Lihou Reef NNR (Figures 2 and 3) cover approximately 8,860 and 8,440 square kilometres respectively and they are separated from each other by approximately 100km of open ocean waters.

The Coral Sea National Nature Reserves were declared under the *National Parks and Wildlife Conservation Act 1975* (NPWC Act) on 16 August 1982 (Attachment A). The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) replaced the NPWC Act on 16 July 2000. Accordingly, while the first plans of management for the Reserves were prepared under the NPWC Act, this Plan has been prepared under the EPBC Act. Given the close proximity of the Reserves, the similar nature of the threats they face and their management arrangements, the second management plans for the Reserves have been combined into one document (the 'Plan'). This is consistent with section 367(5) of the EPBC Act that allows for management plans for different reserves to appear in the one document.

The Reserves have national and international significance due to their near pristine condition, regionally representative shelf-edge oceanic reef, spectacular and unusual underwater topography, breeding seabirds, and undisturbed habitat for nesting green turtles, *Chelonia mydas*. The Reserves encompass extensive reef systems (covering up to 300 hectares) with twenty-four sandy islets and cays that have developed on shallow shelves of the Plateau. As well as protecting the waters and seabed, the Reserves protect the subsoil and reefs to a depth of 1000 metres below the seabed.

Because the Coral Sea Islands Territory is situated in a remote oceanic environment, it is isolated from the effects of coastal influences. The result is that the waters often have a very high visibility of up to 60 metres. The reef systems of the Reserves support a rich range of coral assemblages that do not have a recorded history of disturbance by the crown-of-thorns starfish *Acanthaster planci*, the predatory marine snail *Drupella cornis*, or other coral predators.

The marine flora and fauna of the Reserves are distinct from those of the Great Barrier Reef. In particular, the sessile benthic community is quite variable and it is not dominated by hard corals. Benthic communities prominent in the Reserves include *Halimeda* (a calcified algae of warm seas), sponge gardens, and coralline substrate with encrusting coralline and turf algaes — communities that are uncommon in the shallower water of the Great Barrier Reef (ANPWS 1989a, b; Byron *et al*., in press).

The primary objective of the Coral Sea National Nature Reserves is to maintain ecological processes and systems, and to protect the habitats and biodiversity of the Reserves from the pressures associated with human use. Secondary objectives are to encourage research and monitoring and to allow for appropriate recreational opportunities that are consistent with the primary objective.

The key conservation values of the Reserves are:

- the near pristine marine ecosystems that have been protected from human-induced impacts, including marine pollution, by their isolation from the mainland;
- the regionally representative examples of rich, shelf-edge oceanic reef;
- the internationally significant populations of breeding seabirds, including migratory species listed under international agreements;
- the undisturbed and important habitat for nesting green turtles, *Chelonia mydas*;

– the *Pisonia grandis* forest ecosystem, which is relatively uncommon within Australia and has been subject to widespread destruction and disturbance throughout most of its Indo-Pacific distribution;
– the diversity and abundance of marine sponges, which in places form spectacular sponge gardens; and
– fish and decapod crustacean fauna that is distinct from that of the Great Barrier Reef.

The Management Plan assigns the Reserves to an IUCN (World Conservation Union) category Ia — strict nature reserve: to be managed primarily for scientific research to ensure habitats, ecosystems and native species are preserved in as undisturbed a state as possible. Public access will be limited to the extent that is consistent with the reserve management principles that apply to this reserve management category.

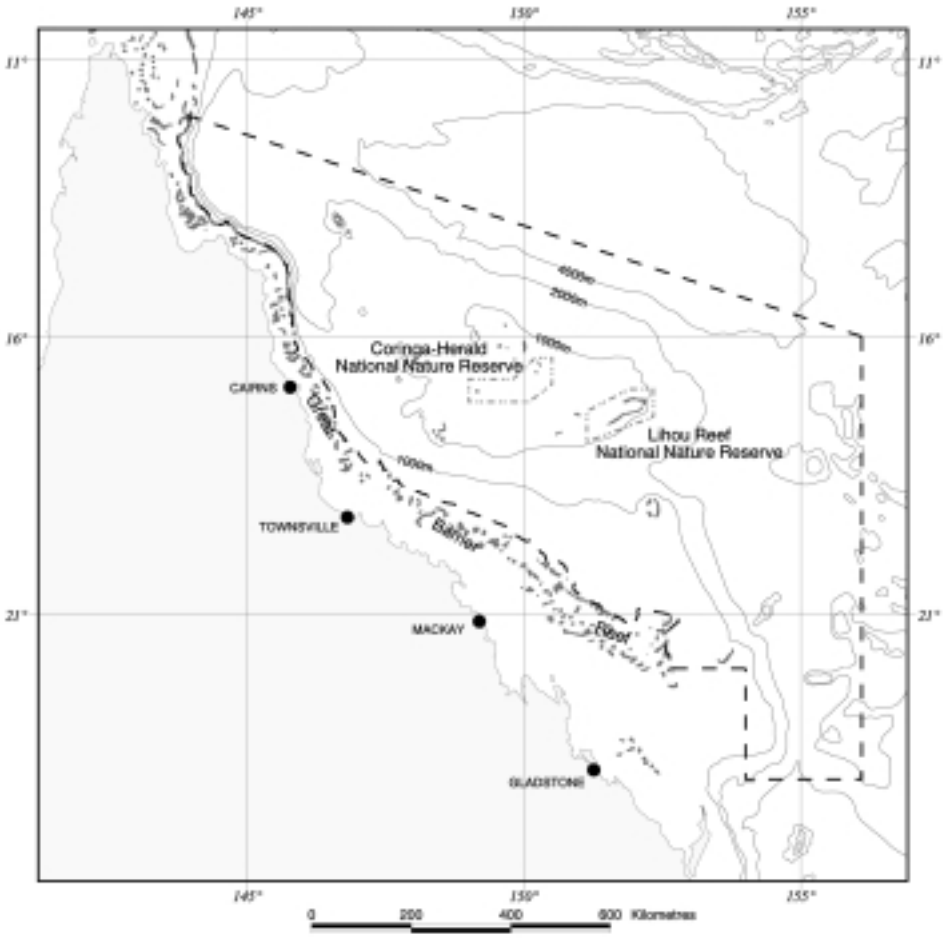

Figure 1: Location of Coringa-Herald and Lihou National Nature Reserves

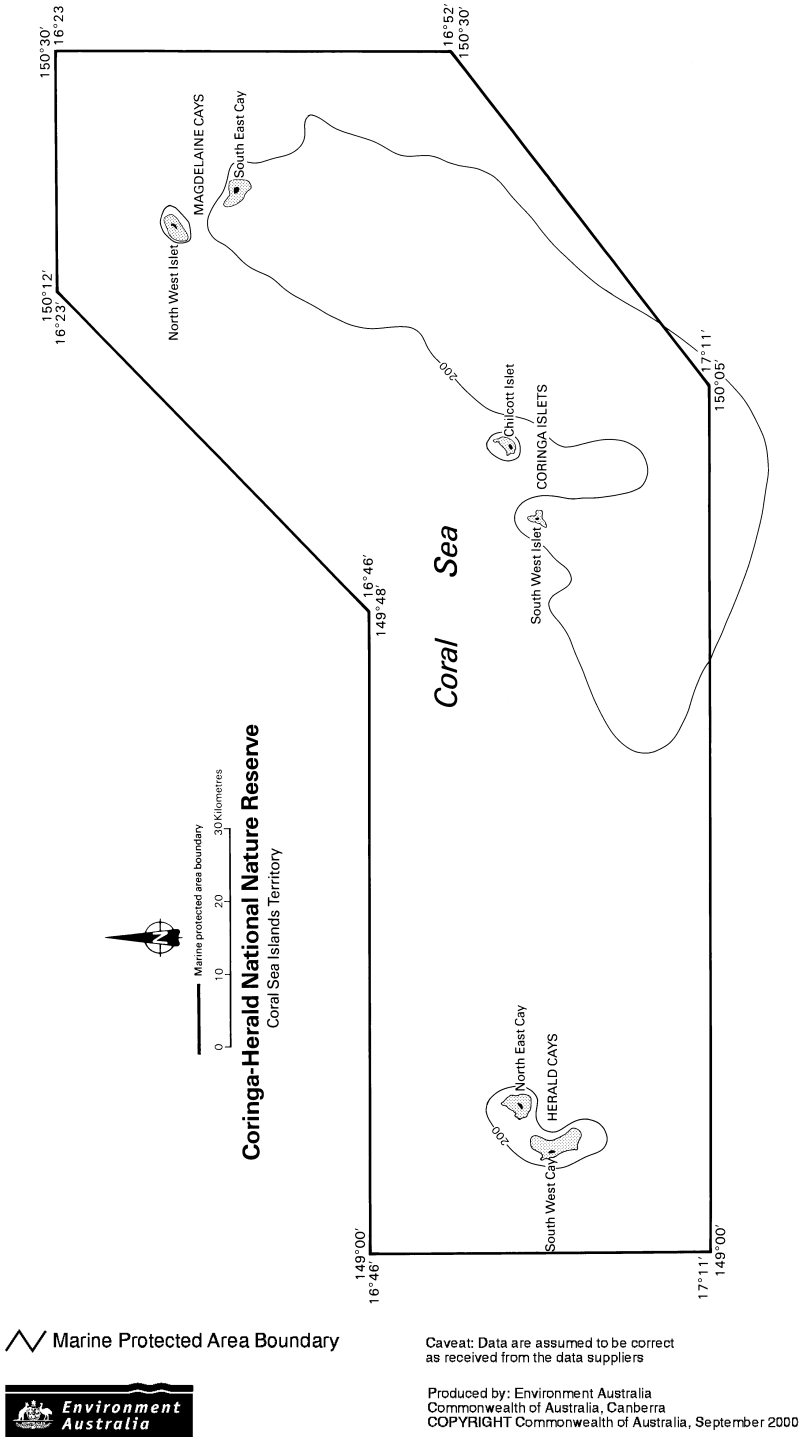

Figure 2: Coringa-Herald National Nature Reserve
(source: Coringa-Herald National Nature Reserve Plan of Management, 1989).

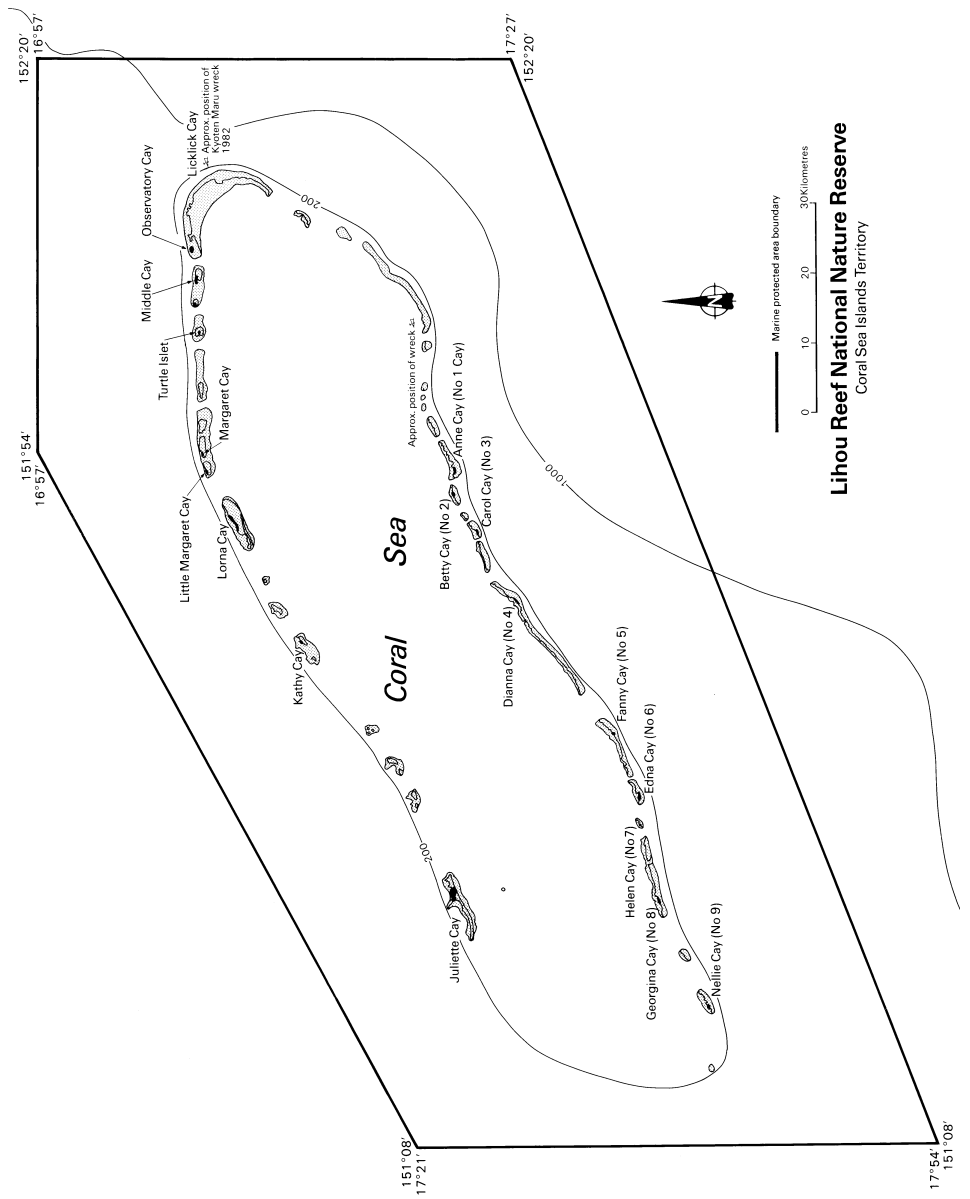

Figure 3: Lihou Reef National Nature Reserve
(source: Lihou Reef National Nature Reserve Plan of Management, 1989).

2. Management Framework

2.1 National and International Context

The Reserves are part of the National Representative System of Marine Protected Areas (NRSMPA). The NRSMPA aims to establish and manage a comprehensive, adequate and representative system of marine protected areas, to contribute to the long-term viability of marine systems, to maintain ecological processes and systems, and to protect Australia's biological diversity at all levels (ANZECC 1998). Other secondary goals of the NRSMPA are to provide for the special needs of threatened species, migratory species, and species vulnerable to disturbance. Marine protected areas within the NRSMPA have been established especially for the conservation of biological diversity and they have a secure status.

The Commonwealth Government's commitment to the NRSMPA was reaffirmed through *Australia's Oceans Policy* (Commonwealth of Australia, 1998), which identifies the need to protect marine biodiversity through marine protected areas. The NRSMPA is being implemented cooperatively by Commonwealth, State and Northern Territory Governments, through the Australian and New Zealand Environment and Conservation Council, under the Intergovernmental Agreement on the Environment.

This Plan is consistent with Australia's obligations under the *United Nations Convention on the Law of the Sea 1982* (UNCLOS), which came into force in November 1994. UNCLOS provides a framework to regulate all aspects of the uses of the sea and the conservation of marine environment.

Establishing the Reserves assists Australia to meet its obligations under the *Convention on Biological Diversity 1992*. The Convention requires parties to pursue the conservation of biological diversity and the sustainable use of its components. A key feature of the Convention is the establishment of a system of protected areas where special measures need to be taken to conserve biological diversity.

The management goals and strategies outlined in this Plan are consistent with Australia's obligations toward the conservation of migratory species listed on the Appendices of the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention). Parties to this convention have agreed to: protect migratory species; and negotiate and implement agreements for the conservation and management of migratory species with other range states including cooperation and support of research relating to migratory species. In fulfilling its commitment to the Bonn Convention, Australia has negotiated bilateral migratory bird agreements with the Governments of Japan and China (JAMBA and CAMBA respectively). The management of the Reserves will help to protect listed migratory species by providing refuge areas where breeding, foraging, and migration regularly occur.

Australia also has obligations as a member of the International Whaling Commission and is a Party to the *International Convention for the Regulation of Whaling*. Some of these obligations include providing for the proper conservation of whale stocks through the complete protection of certain species and designation of specified areas as whale sanctuaries, and through promoting relevant research. This management plan contributes to Australia's fulfillment of these obligations by fully protecting all whales in the Reserves.

2.2 Legislative Context

The Coral Sea National Nature Reserves are "Commonwealth reserves" under the EPBC Act. Administration, management and control of Commonwealth reserves are a function of the Director of National Parks. The Director's functions and powers in relation to the Coral Sea National Nature Reserves and other Commonwealth marine reserves have been delegated to the First Assistant Secretary of the Marine and Water Division, Environment Australia.

The EPBC Act requires the Director to prepare management plans for Commonwealth reserves. When prepared the plans are given to the Minister for the Environment and Heritage for approval. A management plan is a 'disallowable instrument', and when

approved must be tabled in each House of the Commonwealth Parliament. Either House of the Parliament may disallow a plan within 15 sitting days. A management plan for a Commonwealth reserve has effect for seven years, subject to being revoked or amended earlier by another management plan for the reserve.

The EPBC Act (s. 368 (3)) specifies matters that must be taken into account in preparing a management plan. So far as relevant to the Coral Sea National Nature Reserves, these matters include:

- the regulation of the use of the Reserves for the purpose for which they were declared (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); and
- the protection of the special features of the Reserves, including objects and sites of biological, historical, geological and geographical interest; and
- the protection, conservation and management of biological diversity and heritage within the Reserves; and
- the protection of the Reserves against damage; and
- Australia's obligations under agreements between Australia and one or more other countries relevant to the protection and conservation of biological diversity and heritage.

The EPBC Act (s. 354) imposes a range of controls and restrictions on activities in Commonwealth reserves. Certain acts are prohibited except in accordance with a management plan. These acts are:

- kill, injure, take, trade, keep or move a member of a native species; or
- damage heritage; or
- carry on an excavation; or
- erect a building or other structure; or
- carry out works; or
- take an action for commercial purposes.

Mining operations are also prohibited unless the Governor-General has approved them and they are carried out in accordance with a management plan.

As noted earlier in this Plan, the Coral Sea National Nature Reserves were proclaimed under the NPWC Act, which was replaced by the EPBC Act on 16 July 2000. The EPBC Act has also replaced four other Commonwealth Acts. They were the *Environment Protection (Impact of Proposals) Act 1974*, *Endangered Species Protection Act 1992*, *Whale Protection Act 1980*, and *World Heritage Properties Conservation Act 1983*. These other parts of the EPBC Act will also be relevant to the management of the Coral Sea National Nature Reserves and the taking of actions in and in relation to the Reserves.

In particular, actions that would or are likely to have a significant impact on a specified matter of "national environmental significance" will be subject to the assessment and approval provisions of the EPBC Act. The matters of national environmental significance are:

- World Heritage properties;
- wetlands of international importance (Ramsar wetlands);
- listed threatened species and communities;
- listed migratory species;
- nuclear actions;
- the marine environment; and
- such further actions as are prescribed by the EPBC Regulations under the Act.

The Reserves are "Commonwealth marine areas" for the purposes of the Act. The taking of an action in a Commonwealth marine area (including the airspace above it) that will or is likely to have a significant impact on the environment, or the taking of an action outside a Commonwealth marine area that will or is likely to have a significant impact on the environment in a Commonwealth marine area, will be subject to the assessment and approvals provisions of the EPBC Act. The person proposing to take the action must refer proposed actions that may require approval from the Commonwealth Environment Minister.

The EPBC Act also contains provisions that prohibit and regulate actions in relation to threatened species, migratory species, cetaceans (whales and dolphins), and other (listed) marine species. Civil and criminal penalties may be imposed for breaches of the EPBC Act.

2.3 Management of the Coral Sea National Nature Reserves

Under section 367 of the EPBC Act, and in accordance with the Australian IUCN reserve management principles outlined in Schedule 8, Part 2 of the EPBC Regulations, the Reserves are assigned by the Plan to IUCN category Ia — strict nature reserve: protected area managed primarily for scientific research or monitoring. The provisions of a management plan for a Commonwealth reserve must not be inconsistent with the Australian reserve management principles for the IUCN category to which the reserve is assigned by the plan. The reserve management principles under the EPBC Regulations that apply to the management of the Reserves are as follows:

- habitats, ecosystems and native species should be preserved in as undisturbed a state as possible;
- genetic resources should be maintained in a dynamic and evolutionary state;
- established ecological processes should be maintained;
- structural landscape features or rock exposures should be safeguarded;
- examples of the natural environment should be secured for scientific studies, environmental monitoring and education, including baseline areas from which all avoidable access is excluded;
- disturbance should be minimised by careful planning and execution of research and other approved activities; and
- public access should be limited to the extent that is consistent with these principles.

3. Strategic Objectives

The strategic objectives for the Coral Sea National Nature Reserves are designed to comply with the EPBC Act, the *Strategic Plan of Action for the National Representative System of Marine Protected Areas: A Guide for Action by Australian Governments* (ANZECC 1999), the *Guidelines for Protected Areas Management* (IUCN 1994) and the Australian IUCN Reserve Management Principles. They form the basis of this Plan and are presented below.

- Manage the Reserves as part of a comprehensive, adequate and representative system of marine protected areas to contribute to the long-term ecological viability of marine and terrestrial systems.
- Protect, preserve and manage the natural and cultural values of the Reserves, including the marine and terrestrial wildlife, and objects and sites of biological, historical, palaeontological, archaeological, geological and geographical interest from human induced damages.
- Protect key breeding and nesting habitat for listed species such as green turtle and seabirds.
- Manage the Reserves as a reference site for scientific research and long-term monitoring.
- Allow for limited public access to the Reserves for education and enjoyment, in a way that is consistent with the above objectives.

4. Description of the Coral Sea Nature Reserves

4.1 History

It is not known when or by whom the Coral Sea islands were first encountered, but their existence was known to navigators in the early 1800s (Burmester, 1983). The Coringa Islets were named after the cargo ship *Coringa Packet*, wrecked there in 1845, and the Herald Cays were named after HMS *Herald*, which carried out hydrographic surveys in the Coral Sea between 1849 and 1861. Lihou Reef was named after Captain Lihou of HMS *Zenobia*.

In the 1960s three scientific parties visited many of the islands and reefs within the Coral Sea Islands Territory (McMichael and Yaldwyn 1965). In an assessment of the conservation status of coral islands and reefs, McMichael and Talbot (1969) advocated total protection of a sample of islands in the Coral Sea. After consultations with relevant government departments the Reserves were declared in 1982.

Since 1979, a number of scientific surveys have been conducted on a primarily opportunistic basis in conjunction with the regular Coral Sea National Nature Reserves management patrols (see section 4.6) and monitoring activities. In June 1997, a multi-disciplinary scientific expedition organised by the Royal Geographic Society of Queensland visited the Herald Cays and surrounding reef. The aim of the expedition was to study the natural resources of North-East Herald Cay in order to contribute to the area's conservation and management.

4.2 Climate

Due to the Reserves' tropical location and the oceanic influence there is little variation in daily or annual temperatures (ANPWS, 1989a, b). The Bureau of Meteorology operates eight automatic weather stations within the Coral Sea Islands Territory, one of which

is located on Turtle Islet within Lihou Reef NNR. However, more reliable weather records dating back to 1921 are available from the manned station on nearby Willis Islets, approximately 50km north-west of Magdelaine Cays in Coringa-Herald NNR (ANPWS, 1989a, b; Neil and Jell, in press a).

Mean annual rainfall at Willis Islets is 1,094mm, with 68% of rainfall falling from January to April (Bureau of Meteorology website; Neil and Jell, in press a).

Mean daily temperatures during the two hottest months range from a minimum of 25.3°C for December and 25.6°C for January to a maximum of 30.7°C for both months. The mean daily minimum and maximum during August, the coldest month, are 21.9°C and 26.4°C respectively (Bureau of Meteorology website).

Wind energy and direction have a critical influence on sediment transport dynamics, cay location on reefs, and the distribution and growth of flora (Neil and Jell, in press a). South-east winds predominate over the Coral Sea from March to November and the north-west monsoon prevails from December to February (ANPWS, 1989a).

4.3 Geography and Geomorphology

Coringa-Herald NNR is located in the central part of the Coral Sea Plateau, approximately 440km east of Cairns. The reserve boundary encloses extensive reefs and six cays ranging from 16 to 37 hectares in size.

The islets and cays of Coringa-Herald NNR rise steeply from three separate platform reef systems, each representing a distinct stage in reef formation. The reefs support three separate islet/cay groups: the Herald Cays, comprising South West and North East Cays; the Coringa Islets, comprising South West and Chilcott Islets; and the Magdelaine Cays, comprising North West Islet and South East Cay. Each of the cays has a fringing coral reef that is fully exposed to the influences of oceanic currents and swells.

Lihou Reef, a south-easterly facing horseshoe-shaped reef with 18 small sand cays along its perimeter, is the largest reef structure in the Coral Sea. It is located approximately 575km east south-east of Cairns and 100km south-east of Coringa-Herald NNR.

4.4 Ecological Values

4.4.1 Marine Habitats, Flora and Fauna

MARINE HABITATS

The marine habitats present in the shallower areas of both Reserves are (see also figure 4):

- front (windward) reef slopes;
- exposed reef crest/reef rim;
- reef flat, back (leeward) reef crest;
- back reef slope, reef shoals;
- and inter-reef channels.

In addition, Lihou Reef NNR has a lagoon habitat formed within the U-shaped structure of the reef system. Detailed information on the habitats and communities of the deeper areas is not available. In general, however, the abundance and variety of the biota progressively decrease below the depth of the thermocline (at approximately 200m depth).

MARINE FLORA

Algae are an important component of the Reserves' marine flora, frequently covering a greater area than the corals (ANPWS, 1989a,b). During the 1997 preliminary survey of marine algae of North East Herald Cay, Millar (in press) recorded a total of 66 species, which is expected to be only a fraction of the total present. Forty-one species of red algae, 23 of green algae and 2 of brown algae were recorded. Halimeda, a calcified algae of warm seas, is a prominent feature of the benthic habitat. The near absence of brown algae is unusual for what appears to be a typical reef environment (Millar, in press).

INVERTEBRATE MARINE FAUNA

Sponges (family Spongiidae) form an important part of the reef fauna and, in marked contrast to the shallow reefal areas of the Great Barrier Reef, they are often more abundant than coral, in places forming large and spectacular sponge gardens. The commonly occurring sponges include; *Thorecta n. sp.*, *Polyfibrospongia flabellifera*, *Phyllospongia n. subsp.*, *Carteriospongia lamellosa, C. n. sp.*, and *C. pennatula*. *Phyllospongia pennatula*, which had not been collected since 1889, was found to be common at Chilcott Islet, within Coringa-Herald NNR, and East Diamond Islets near Lihou Reef NNR (Ayling and Ayling, 1984).

The hard corals in the Reserves do not appear to be especially abundant or diverse. They cover a relatively small proportion of reef area compared to the hard corals of the Great Barrier Reef and other sites in the western Pacific, with average maximum estimates ranging from 19.2% (Ayling and Ayling, 1984) to 25.9% (Byron *et al*., in press). The dominant hard corals are *Acropora palifera*, *A. humilis* and *Poecilopora spp*. (ANPWS, 1989a,b). Ayling and Ayling (1984) suggest that hard coral cover may previously have been higher and that some unknown agent (possibly natural) may have caused extensive coral death on the Coral Sea reefs sometime between Done's 1980/81 survey (Done, 1982) and their survey in 1984.

Soft corals tend to be more important in sheltered areas, such as the deeper reef slope areas and deep reef flats (ANPWS, 1989a). They provide approximately 3.5% of the total cover at North East Herald Cay (Byron *et al*., in press) and primarily comprise *Sarcophyton sp*.

The marine molluscan fauna is moderately rich and represents a subset of a more widely distributed tropical molluscan fauna. The 1997 survey (Loch, in press) of North East Herald Cay yielded 717 species of marine molluscs, and an additional 28 species were recorded from earlier surveys of the area. These species represented some 118 families, comprising: 87 families of gastropod molluscs, 21 of bivalve molluscs, four of cephalopod molluscs, three of scaphopod molluscs and one of amphineurid molluscs (Loch, in press). No species found were endemic to North East Herald Cay. However, two species recorded during the survey, *Rissopsis typica* and *Cypraea childreni*, were quite common despite being rare over much of the rest of their range.

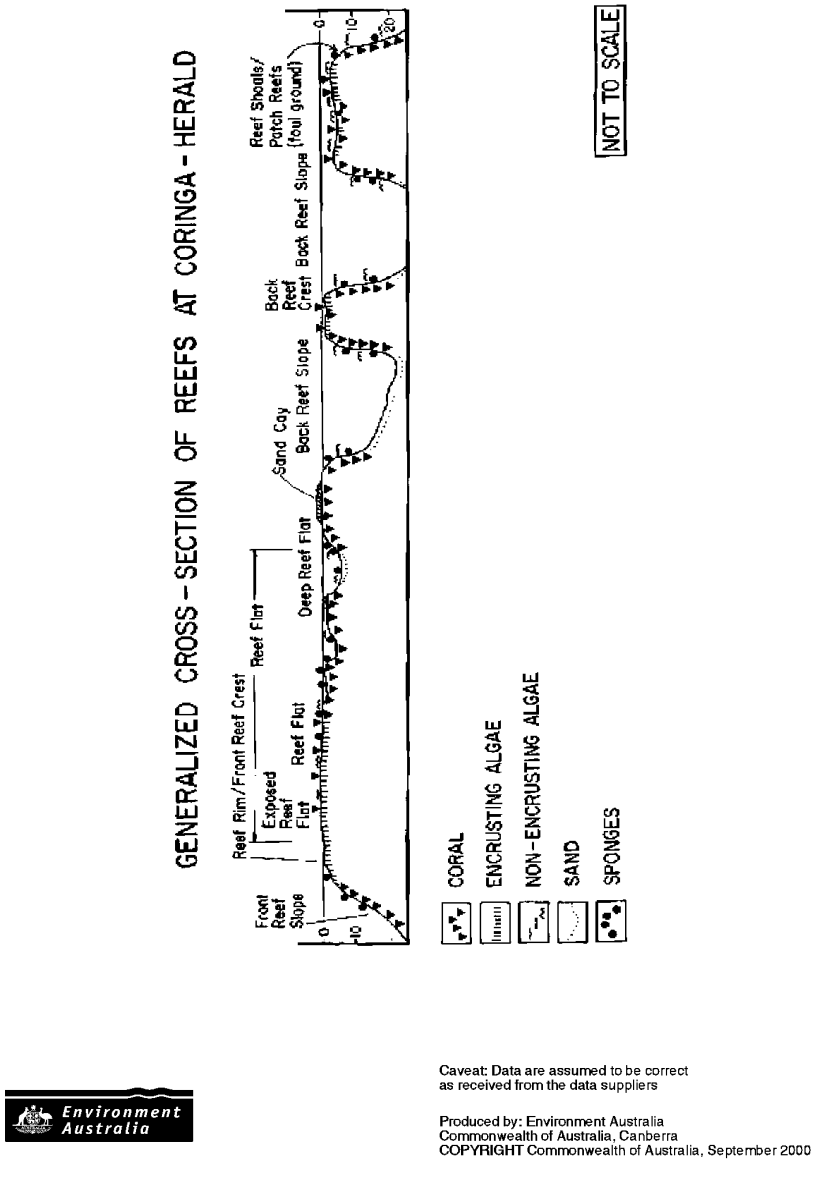

Figure 4: Generalised Cross-Section of a Reef
(source: Coringa-Herald National Nature Reserve Plan of Management, 1989).

Interestingly, sponge feeding mollusc families, such as Triphoridae and Cerithiopsidae, were not abundant despite the presence of extensive sponge gardens (Loch, in press).

The decapod crustacean fauna is relatively rich. One hundred and twenty-eight species of marine, semi-terrestrial and terrestrial decapod crustacea were recorded during the 1997 survey of North East Herald Cay (Davie and Short, in press). Nine of these species appear to be undescribed and 17 are new records for Australian waters. The marine crustacea tended to be inconspicuous and relatively low in abundance while the semi-terrestrial and terrestrial species were both conspicuous and abundant. The species recorded were predominantly of wide-ranging Indo-West Pacific distribution, however, many species that are common and widely distributed on the Great Barrier Reef were absent from North East Herald Cay or recorded from only a few individuals (Davie and Short, in press).

Preker (in press) described the hydroid fauna as being remarkably rich compared with that of other reefal areas. The 1997 survey of North East Herald Cay revealed 55 species representing 14 families, and additional species are likely to be present. Eleven of these species were new records for Queensland reefal waters and nine were new records for Australian waters.

Starfish, brittle stars, feather stars, sea urchins, sea cucumbers and other invertebrate groups have been observed within the Reserves, but systematic surveys of their diversity and abundance have yet to be undertaken. Several crown-of-thorns starfish *Acanthaster planci*, have been observed within the Reserves, however they do not currently occur in numbers sufficient to cause disturbance to the indigenous reef fauna.

VETERBRATE MARINE FAUNA

Surveys by Ayling and Ayling (1984) and Byron *et al*. (in press) suggest that there are fewer species of fish in the Reserves than in the Great Barrier Reef. Furthermore, few of those fish found in the Reserves, if any, are endemic. It is, however, distinct because some species of fish that are common in the Coral Sea Reserves are rare or absent from the Great Barrier Reef, and *vice versa* (Ayling and Ayling, 1984; Allen, 1988; Byron *et al*., in press).

In their preliminary survey of the Reserves, Ayling and Ayling (1984) recorded 322 species of fish. In 1997, Byron *et al*. (in press) recorded 356 species from 54 families on the reefs of North-East Herald Cay. Of these, 42 species were new records for the Coral Sea, most of which were rare with only one or a few individuals sighted. In both surveys, the six families represented by the most number of species were the Labridae (wrasses), Pomacentridae (damselfishes), Acanthuridae (surgeonfishes), Chaetodontidae (butterfly fishes), Serranidae (cods and coral trout), and Scaridae (parrotfishes) (Ayling and Ayling, 1984; Byron *et al*., in press).

The green turtle, *Chelonia mydas*, is listed as vulnerable under the EPBC Act and is the only species of marine turtle recorded mating and nesting within the Reserves. Under the draft Recovery Plan for Marine Turtles in Australia (Environment Australia, 1998), research and monitoring are important components to ensuring the recovery and conservation of Australia's green turtle populations. Genetic studies have shown that the nesting population within the Reserves is of the same genetic stock as the green turtles in the Great Barrier Reef and Torres Strait. The Reserves contain important nesting sites that are almost totally free from disturbances such as lighting, beach use, pollution, feral animals, and boat traffic compared to nesting sites throughout the Great Barrier Reef. These Reserves therefore provide reference areas to determine the impacts of such disturbances on breeding success within the population.

Green turtles are also listed as endangered on the ICUN Red List and protected under the *Convention on the International Trade of Endangered Species of Wild Animals* (CITES) to which Australia is a Party. The conservation and monitoring of green turtles within the Reserves contributes to Australia's obligations as a Party to the IUCN and CITES.

Opportunistic monitoring of green turtles in the Reserves was undertaken between 1979 and 1991. A more systematic tagging program in collaboration with the Queensland Parks and Wildlife Service was established in 1991 and has continued to the present. The monitoring program has two components:

1. monitoring nesting activity, tagging and measuring green turtles; and

2. determining the hatching success of the stock from the previous nesting survey.

The life history of turtles is such that impacts on populations can only be determined from long-term monitoring (20+ years). With a nesting interval of four to eight years, inter-season tag returns are just becoming apparent, and additional years of monitoring are required to obtain results from the effort expended in previous years (Armstrong 2000 unpub).

Hawksbill turtles, *Eretmochelys imbricata,* also listed as vulnerable under the EPBC Act, have been sighted within the Reserves, but they have not been observed nesting.

There have been no sightings of sea-snakes within the Reserves.

A number of cetaceans have a range that includes the Coral Sea Islands Territory. A pilot whale, *Globicephala macrorhynchus*, was washed up on North-East Herald Cay in 1989 (M. Hallam, pers. comm.). Other whales and dolphins likely to occur in the area include: humpback whales *Megaptera novaeangliae*, sperm whales, *Physeter macrocephalus*, spinner dolphins, *Stenella longirostris*, striped dolphins, *S. coeruleoalba*, spotted dolphins, *S. attenuata*, common dolphins, *Delphinus delphis*, bottlenose dolphins, *Tursiops truncatus*, and Risso's dolphins, *Grampus griseus* (ANPWS, 1989a, b).

4.4.2 Terrestrial Habitats, Flora and Fauna

TERRESTRIAL HABITATS

Most of the islets and cays are composed of sand, rocks and coral rubble, that rise no higher than five metres above sea level. The terrestrial habitats common to both Reserves are beachrock, sandy beach, coral rubble, grassland, and herbfield. Some islets in Coringa-Herald NNR also have shrubland and forest habitats. All cays of the Coringa-Herald NNR except North-West (Magdalaine) Cay are vegetated, while only five of the 18 cays in the Lihou Reef NNR are vegetated — Turtle Islet and Georgina, Nellie, Lorna and Anne Cays (ANPWS, 1989a, b).

TERRESTRIAL FLORA

The flowering terrestrial plants recorded for the Reserves are primarily widespread tropical shoreline plants of the Indo-Pacific Region (ANPWS, 1989a,b; Telford, 1993). The exception is *Digitaria ctenantha*, a grass native to northern Australia (Batianoff, in press). Twenty-three terrestrial plant species have been recorded from Coringa-Herald NNR and seven from Lihou Reef NNR (ANPWS 1989a, b; Batianoff, in press). The limited number of species is thought to be influenced by a number of factors, including island isolation (Batianoff, in press), weather patterns, island size, absence or temporary nature of a freshwater lens beneath the cays and possibly a low frequency of "washover" events to deposit seeds high enough on the islands to become viable (Waterhouse, pers. comm.). Attachment B provides a list of terrestrial plant species recorded from the Coral Sea National Nature Reserves.

The vegetated islets in Coringa-Herald NNR are fringed with the shrub *Argusia argentea* and have a grassy understorey dominated by *Lepturus repens*, *Stenotaphrum micranthum* and *Sporobolus virginicus* (ANPWS, 1989a,b). There are no *A. argentea* shrubs in Lihou Reef NNR.

Pisonia grandis forest occurs on two cays in Coringa-Herald NNR — North-East Herald Cay and South East Magdelaine Cay. The *P. grandis* forest ecosystem is relatively uncommon, both in Australia and globally, despite having an extensive Indo-Pacific distribution. Throughout much of its range, *P. grandis* forests have been cleared for subsistence agriculture and guano mining. Remaining examples of *P. grandis* are known from only 44 of about 950 islands within the Great Barrier Reef region and the species is rare on reef islands in the north of this region where it does not generally form monospecific stands. In this context, the *P. grandis* forests of Coringa-Herald NNR are of intrinsic value as well as playing a significant role as habitat for nesting seabirds (Neil and Jell, in press b). *P. grandis* does not occur in Lihou Reef NNR.

There are reports of cyclonic activity damaging areas of *P. grandis* forest within the Coringa-Herald NNR during the 1980s and the forest on South West Coringa Islet was extensively damaged by an outbreak of the scale insect *Pulvinaria urbicola* in 1991 (Batianoff, in press). The 1999 August patrol reported that South West Coringa Islet continued

to show signs of degradation, with large areas of once dense forest now reduced to herbland from a heavy infestation of scale insect. Only a small patch of *P. grandis* forest remains and that appeared to be without any new regrowth (Hallam *et al*., 1999b).

A number of beach washed seeds from various islets and sand cays in the Reserves collected during the June 1991 patrol were identified. Species include: *Barringtonia asiatica*, *Heritiera littoralis*, *Calophyllum inophyllum*, *Terminalia catappa* and *Entada phaseoloides* (Weston *et al*., 1991). These seeds are commonly spread throughout the tropical seas by tides and currents or trade winds and are considered prime 'invader' species, where the seeds wash up on beaches with suitable environmental conditions for germination. Their effects or success in establishing new plant colonies on islets and cays in the reserves has so far been benign.

In their 1997 survey of North East Herald Cay, Neil and Jell (in press b) found that the windward beach was actively eroding, leading to destabilisation of the fringing *Argusia* shrubland that provided a windbreak for the *P. grandis* forest. Some forest areas have already been destroyed and a likely outcome is the gradual replacement of forest with grassland, which would have implications for the terrestrial ecology of the cay, particularly the composition of the nesting seabirds, the hatching success and sex ratios of green turtles.

INVERTEBRATE TERRESTRIAL FAUNA

The composition of the terrestrial invertebrate fauna of the Reserves is not well known, although preliminary surveys suggest that it is not particularly rich. Of the four cays surveyed within Coringa-Herald NNR, North-East Herald Cay had the greatest invertebrate diversity (ANPWS, 1989a; Gunn, undated), with insects the dominant group and probably the dominant terrestrial herbivore (Hinchey and Stokes 1987). Mites, spiders, spring tails, ants, flies and beetles were the most commonly recorded groups (Gunn, undated).

Within Lihou Reef NNR, only Turtle Islet has been surveyed in any detail and the greatest diversity was for spiders, beetles and flies. Of particular scientific interest is a species of Pseudoscorpion belonging to the genus *Nannochelifer*, which was previously known

from a single species from Kenya. A related species, *N. paralius*, was recorded in the intertidal and spray zones of Turtle Islet and appeared restricted to that locality (ANPWS, 1989b).

VERTEBRATE TERRESTRIAL FAUNA

The Reserves contain extensive seabird colonies of great significance to the ecological balance of the Coral Sea region. Scientific surveys and regular patrols to the Reserves (see section 4.6) indicate that 14 seabird species use the cays of the Reserves for breeding. While some of these species (such as the red-footed booby *Sula sula*, least frigatebird *Fregata ariel*, great frigatebird *Fregata minor*, and red-tailed tropicbird *Phaethon rubricauda*) have an extensive distribution outside of Australian waters, they are uncommon within Australia and the Reserves contain a significant proportion of the region's breeding populations (Baker *et al*., 2000). Attachment C provides a list of bird species recorded from Coringa-Herald NNR and Lihou Reef NNR.

Prior to proclamation of the Reserves, isolation of the area constrained ornithological exploration. Early post-proclamation visits concentrated on the inventory of seabirds for each islet/cay and investigation of seabird breeding cycles. From 1979 to 1991, opportunistic surveys and population assessments were conducted as part of annual patrols to the area and an ornithological database was established. Obtaining accurate and precise estimates of birds breeding in remote localities poses significant logistical and resource challenges. Following a review of the monitoring program in 1992 (Martin, 1994), a design and estimation methodology for this project has been adopted in subsequent patrols that is scientifically rigorous and unique (Welsh *et al*., 2000). The monitoring program, which is essential to enable assessment of impacts on the stability of the region's seabird populations, focuses on the following species: least frigatebird, great frigatebird, red-footed booby, brown booby *Sula leucogaster*, masked booby *Sula dactylatra*, black noddy *Anous minutus*, and red-tailed tropicbird.

Breeding of red-footed boobies, red tailed tropicbirds and frigatebirds is largely seasonal on North-East Herald Cay, although eggs and chicks can be found at any time. Most breeding commences at the end of the cyclone season in March-April and

continues during the cooler months. The red-footed booby population has remained relatively stable at about 150 pairs in *Argusia* shrubland and 1000 pairs in the *Pisonia/Cordia* forest. Lower counts of frigatebirds in recent years may represent poor seasons or just reflect an earlier than usual breeding season with most of the chicks already fledged (Baker *et al.,* 2000). In a nest survey of red-tailed tropicbirds on North East Cay in June 1997, 367 active nests were recorded. The number of nests recorded makes this the largest known population of this species in the Coral Sea and the second largest in Australia (after Christmas Island, Indian Ocean) (James, in press a).

The buff-banded rail *Gallirallus philippensis subsp.* and the purple swamphen are the only known land birds that breed in the Reserves (ANPWS, 1989a,b; James, in press b). A further 22 sea and land bird species are recorded as regular or vagrant non-breeding visitors to the Reserves (ANPWS, 1989a, b; Weston *et al*. 1991).

A total of 17 of the 28 species of birds recorded from Coringa-Herald NNR and 16 of the 24 species recorded from Lihou Reef NNR are listed in the JAMBA and CAMBA agreements (ANPWS 1989a,b; Weston *et al*., 1991).

There are no known native terrestrial mammals within the Reserves. The black rat, *Rattus rattus*, which was believed to have been introduced by mariners in the mid-20th century, persisted on South West Coringa Islet for many years (ANPWS 1989a). Australian National Parks and Wildlife Service personnel established a rat eradication program in 1985. In June 1991 an intensive baiting program was carried out to eradicate rats from the Islet (Weston *et al*., 1991) and no evidence of rats has been found in subsequently (Hallam *et al*., 1999a, b).

Geckos *Gehyra mutilata* are common on South West Coringa Islet (Weston *et al*. 1991).

4.5 Cultural Values

Early explorers had to negotiate the treacherous reefs of the Coral Sea using inadequate navigation charts. Lihou Reef appears to have

been the site of more shipwrecks than the Coringa-Herald cays. There are several well-documented wrecks on Lihou Reef, including the *Elizabeth* (1892), the S.S. *Queen Cristina* (1899) and the *Kyoten Maru* (1982). In addition, the superstructures of a number of post-1900 wrecks whose origins have not yet been established are visible on Lihou Reef.

There is one known historic shipwreck in the Coringa-Herald NNR, the *Coringa Packet*, which foundered off Chilcott Islet in 1845.

Shipwrecks located within the Reserves are protected under the *Historic Shipwrecks Act 1976* if they are more than 75 years old. The Minister for the Environment and Heritage can also declare historically significant wrecks, articles, and relics that are fewer than 75 years old to be protected historic shipwrecks or historic relics.

Relics of guano mining remain on Chilcott Islet in Coringa-Herald NNR (ANPWS, 1989a). Officially, the only licence to mine guano at Chilcott Islet was issued in 1877 and was valid for seven years (Coleman, 1992).

The remains of two beach rock slab constructions were found during the 1991 survey of Georgina Cay in Lihou Reef NNR. The constructions were thought to resemble Chinese graves (Weston *et al*., 1991).

4.6 Social and Economic Values

Due to their remote location, access to the Reserves can be made only by private vessels, charter tours, or in conjunction with Environment Australia patrols on RAN and Coastwatch vessels. However, with the advent of new technology, such as Global Positioning Systems, visitation to the Reserves may increase in the future. Estimated numbers of visitors to the Reserves have ranged from 100 to 200 per year over the last decade, with no discernible upward trend.

4.6.1 Research and Monitoring

Environment Australia runs a monitoring program within the Reserves targeted at seabird species, green turtles, vegetation and

marine debris. Special research projects outside of this monitoring program are undertaken on an ad-hoc basis. The objectives of the monitoring program in are to:

- monitor seabirds and vegetation, in a way that is consistent with the management objectives of the Reserves, to allow for interpretation of population trends and species type and density in relation to environmental factors, particularly human disturbance (see Section 4.4.2);
- monitor nesting green turtle populations in a way that is consistent with the management objectives of the Reserves, and as recommended in the draft recovery plan for marine turtles (see Section 4.4.2);
- record, collect, and remove marine debris;
- monitor presence/outbreaks of scale insect attack on the *Pisonia* forest; and
- check visitor log books and record details of visitation.

Despite the importance of baseline studies for future management, the remoteness of the Reserves has limited the level of scientific research conducted and many aspects of the marine and terrestrial environment are yet to be adequately researched. The monitoring program and other survey work, such as the 1997 Royal Geographical Society of Queensland expedition, have made a substantial contribution to the scientific knowledge of the Reserves and to their national and international significance as a breeding and nesting site for green turtles and seabirds. Continuation of seabird and marine turtle monitoring programs is a high priority to derive indicators of the status of these populations and to assist in their conservation. The monitoring program also provide an important undisturbed reference point for regional stock assessment of these species.

4.6.2 Tourism and Recreation

The reefs of the Reserves, with their spectacular and unusual topographic features, great variety of marine life and world-renowned reputation for extreme clarity of water, are a prime diving venue. However they can be difficult and expensive to visit. Organised dive

tours and charter fishing (catch and release) were the only commercial activities permitted in the Reserves under the previous plans of management. Camping in the Reserves is not allowed, however, landings of small parties on islets and cays is allowed. All fishing is now prohibited within the Reserves, as is fish feeding.

4.6.3 Facilities/Installations

Only two facilities/installations have been established in the Reserves, both within the Lihou Reef NNR. A Bureau of Meteorology unmanned, automatic weather station located on Turtle Islet collects climatic data. An Australian Maritime Safety Authority (AMSA) unmanned, solar powered navigation beacon was installed in June 1999 off the eastern tip of Lihou Reef to provide a warning for vessels and to mark a turning point on a major shipping route.

4.6.4 Shipping Activities

Some established shipping routes pass through Diamond Passage near the western boundary of the Lihou Reef NNR and recently established routes pass in proximity to the Reserve's eastern boundary.

4.6.5 Commercial Fishing

The Australian Fisheries Management Authority (AFMA) manages the Coral Sea Fishery and the Eastern Tuna and Billfish Fishery in the vicinity of, but not within, the Reserves.

The Coral Sea Fishery is a multi-species and multi-method fishery which, in June 2000, had 13 permit holders endorsed to fish in one or more of the following categories: finfish trawl (one permit); crustacean (prawns and bugs) trawl (two permits); drop line and demersal longline fishing (for red emperor, snapper, coral bream, coral trout, blue eye trevally and jobfish) (nine permits); hand collection (lobster, trochus and beche-de-mer, including black and white teat fish, lollyfish and prickly redfish) (four permits); and aquarium fish collection (three permits).

The Eastern Tuna and Billfish Fishery targets tuna and tuna-like species using pelagic longline, purse seine, pole and line, trolling and

other line methods. The most commercially important component of the fishery is yellowfin tuna, bigeye tuna and broadbill swordfish taken by pelagic longlining.

4.6.6 Mineral and Petroleum Exploration and Development

Guano mining was conducted on Chilcott Islet in Coringa-Herald NNR from 1877 for a period of up to seven years (Coleman, 1992).

Both the Coringa-Herald NNR and the Lihou Reef NNR lie on the Queensland plateau, which is flanked on its western and southern sides by the Queensland, Halifax and Townsville basins. There has been no active petroleum exploration within these basins, although there appears to be reasonable prospects for petroleum generation and entrapment. The Reserves lie geologically higher and beyond the boundaries of these basins, however, there is a possibility that if petroleum has been generated, some may have migrated into structures within the area of the Reserves. To date there has been no known petroleum exploration or extraction drilling within either of the Reserves and the potential for oil and/or gas reserves is unknown.

5. Pressures on the Conservation Values

Any natural area subject to human use is exposed to existing or potential pressures from human impacts. In addition, there are potential pressures from natural perturbations, such as cyclones, and global phenomena, such as increased seawater temperatures and coral bleaching. The Plan focuses on the existing and potential pressures that are caused by human activities and can therefore be influenced by management.

To date, the remoteness of the Coral Sea National Nature Reserves has, to a large degree, protected these areas from the effects of human visitation, disturbance and commercial exploitation. However, continued and possibly increasing interest in the area, and new technology has the potential to place further pressure on the natural and cultural values of the Reserves.

Table 1 summarises the existing and potential pressures on the conservation values of the Reserves and links them to human use activities in and around the Reserves. The main pressures are elaborated on below.

5.1 Marine Pollution

Solid wastes discarded from passing ships, commercial fishing vessels operating nearby, and boats visiting the Reserves are common visual blights to fringing reef, shoreline and beach areas. Such wastes pose a hazard to other boats, divers and marine fauna. Marine debris, such as discarded fishing lines and packaging, is known to harm and kill wildlife that becomes entangled or ingest plastics (whales and turtles) (Jones, 1994).

Oil spills in the region have the potential to significantly impact on the Reserves' flora and fauna. Release of sewage from boats can reduce water quality and may have the localised effect of increasing nutrient levels, with a consequent adverse impact on coral health.

The petroleum industry in Australia is recognised as having a good environmental record and it is strictly regulated regarding environmental protection. As a result, the risk to the offshore environment from petroleum operations is low. However, there can be potentially significant effect on the marine environment from this activity. These impacts can include: accidental leakages and spillage, increased turbidity due to disturbance of bottom sediments during rig and/or pipeline positioning and decommissioning, disposal of drill cuttings and fluids, and discharge of liquid and putrescible wastes.

The capacity to manage marine pollution within the Reserves is limited. The nature of marine debris and other pollution is that it travels with currents from areas that may be large distances from the Reserves.

5.2 Anchoring and Diving

Visiting yachts, charter vessels and other vessels seeking shelter tend to anchor at specific sites on only a few reefs with cays. The localisation of anchoring activity puts these reefs and cays at greater risk of physical damage to fringing coral reefs and bommies. In addition, there is the potential for divers to damage fragile corals, either through deliberate or accidental contact. However, in general, current visitation rates are extremely low and therefore damage is kept to a minimum. If visitation were to increase significantly, damage minimisation strategies may need to be put in place, such as the installation of moorings.

5.3 Disturbance to Wildlife Behaviour and Habitat

Human visitation has the potential to adversely impact on wildlife behaviour and habitat, in particular on seabird breeding and feeding and turtle nesting activities. Activities known to cause disruption to seabird breeding include approaching and handling wildlife, trampling of vegetation, nests/burrows and coral reefs, light from anchored boats, noise, and fire. These impacts may lead to decreased juvenile recruitment or increased mortality due to nest desertion, delayed breeding, increased predation, exposure, and stress. Noise and bright lights are known to disrupt turtle behaviour (GBRMPA, 1997).

Fishing can reduce the abundance and structure of targeted communities, disturb fish behaviour, and damage habitat.

5.4 Harvesting and Collection of Wildlife and Wildlife Products

Fishing has the potential to negatively impact on targeted marine fauna such as fish, crustaceans, and benthic dwellers such as sea cucumbers (beche-de-mer). Commercial fishing by any means is not allowed within the Reserves. There have been no reports of illegal fishing activity, however it is suspected that beche-de-mer has been removed from the Reserves at different times.

Commercial fishing has been shown in some cases to decrease both species abundance (Roberts, 1995; Roberts and Polunin, 1993; Alcala, 1988; Buxton and Smale, 1989) and diversity (McClanahan and Kaundra-Arara, 1995) amongst target species. There are potentially similar impacts on bycatch species. The structure of marine ecosystems may also be altered through decreases in the size or biomass of target species that result from commercial fishing (McClanahan and Kuand-Arara, 1995; Roberts, 1995; Alcala, 1988; Roberts and Polunin, 1993). Such changes in the ecological systems within the Coral Sea National Nature Reserves would be inconsistent with their status as ICUN category Ia — strict nature reserves.

The main recreation and tourism activities in the Reserves have been diving and 'catch and release' gamefishing. Interest in the Reserves for both activities is increasing. The impacts of 'catch and release' gamefishing on target species is unknown. Given that there is no data or research to confirm that 'catch and release' gamefishing does not increase mortality or morbidity of target or bycatch species, a precautionary management approach excluding this activity is warranted. Illegal collection of wildlife and wildlife products such as shells (live or empty) and eggs by tourists and divers may also threaten the environment and biota of the Reserves and are therefore prohibited.

Scientific tourism, for which groups of people with a specialised interest visit an area, is expected to increase. The recent visit by the Queensland Royal Geographic Society is an example. The area is

highly regarded by these special interest groups and tour operators. Research activities may adversely impact on wildlife and habitats through site marking and manipulation, and over-collection of wildlife and wildlife products.

5.5 Introduction of Exotic Species

Human visitation to the Reserves carries with it a risk of accidental or deliberate introduction of foreign organisms. Introduced organisms, such as the black rat, *Rattus rattus*, have the potential to disturb or damage the unspoilt wildlife resources and ecosystems of the area. Introduced ant species are believed to be associated with infestation of scale insects, *Pulvinaria urbicola* that can extensively damage and even destroy *Pisonia* forest.

The black rat (refer to Section 4) was thought to prey on seabird eggs and nestlings, including the ground dwelling buff-banded rail.

The introduction of marine pests can occur through exchange of ballast water by ships. Under r.12.14 of EPBC Regulations, it is prohibited to release liquid or gaseous material in a Commonwealth reserve if the release is likely:

- to pollute the air, soil water or a watercourse; or
- to be harmful to native species; or
- to be harmful or offensive to another person.

TABLE 1:
Existing and potential pressures of human use on the values of the Coral Sea National Nature Reserves

VALUES ►	BROAD NATURAL AND CULTURAL VALUES	CORAL REEFS	SEABIRDS AND TURTLES
USES ▼			
Research and monitoring	– marine pollution – anchoring damage – disturbance of wildlife habitat by fires and trampling – introduction of exotic species and disease organisms – disturbance or collection of artefacts and relics	– over-collection of corals – anchoring and diving damage – introduction of exotic species and disease organisms – disturbance of coral reef habitat from reef-walking, diving and collection methods	– disturbance of seabird behaviour and turtle behaviour from noise and human approach – disturbance of wildlife habitat – introduction of exotic species and disease organisms
Tourism and recreation	– marine pollution – anchoring damage – disturbance of wildlife habitat by fires and trampling – introduction of exotic species and disease organisms – disturbance or collection of artefacts and relics – loss of wilderness values – noise from boats	– marine pollution – anchoring and diving damage – disturbance of coral reef habitat from reef-walking and diving – introduction of exotic species and disease organisms	– marine pollution and entanglement in marine debris – disturbance to wildlife behaviour from noise and human approach – over-collection of seabird and turtle eggs and shells – introduction of exotic species and disease organisms
Facilities/ installations	– loss of wilderness values due to visual impacts of built structures	– marine pollution – anchoring damage	– marine pollution and entanglement in marine debris – disturbance of wildlife behaviour due to noise and human approach during maintenance and from presence of built structures
Shipping activities	– marine pollution, including oil spills and debris – introductions of pest species in ballast	– marine pollution – introductions of pest species in ballast	– marine pollution and entanglement in debris – noise from boats – introductions of pest species in ballast
Commercial fishing*	– loss of wilderness values	– marine pollution – anchoring damage – over-collection and over-harvesting of fish, sea cucumbers and other marine fauna – disturbance to fish behaviour	– marine pollution and entanglement in debris – noise from boats
Mineral and petroleum exploration and development*	– loss of wilderness values due to visual impacts of built structures	– pipeline damage – marine pollution	– marine pollution – noise from boats

*These activities prohibited within the Reserves for the life of this Management Plan

6. Management of the Coral Sea National Nature Reserves

The Coral Sea National Nature Reserves will be managed to maintain ecological processes and systems, and to protect the habitats and biodiversity of the Reserves from pressures associated with human use. Secondary objectives are to encourage research and monitoring, and to allow for appropriate recreational opportunities that are consistent with the primary objective. This Plan assigns the Reserves to an IUCN category Ia — strict nature reserve: to be managed primarily for scientific research to ensure habitats, ecosystems and native species are preserved in as undisturbed a state as possible. Public access will be limited to the extent that is consistent with the reserve management principles (Section 2.3) that apply to this reserve management category (see Section 6.2).

Many of the pressures identified, such as marine pollution and disturbance of wildlife, are common to more than one use of the Reserves. The prescriptions below have been organised on the basis of use to enable Environment Australia to better focus on developing cooperative arrangements with user groups.

The general requirements applying to use of the Reserves are as follows:

– Under the EPBC Regulations, Environment Australia will administer a permit system for relevant activities . In particular, all commercial and scientific activity that is allowed by the Plan will require the issue of a permit under the Regulations. Permits will be issued subject to strict conditions to protect the natural and cultural values of the Reserves. Permitted activities must also be carried on in accordance with any other relevant and applicable Commonwealth, State or Territory legislation.

- Permits may be cancelled or suspended, or the permit conditions revoked or varied, if there has been a change in any matter that the EPBC Regulations requires to be taken into account in deciding whether to issue a permit. Examples of relevant matters are: consistency with the management plan for the Reserves; and the activity must not be likely to unduly interfere with the preservation or conservation of biodiversity in the Reserves.
- Under r.12.14, of the EPBC Regulations, a person must not discharge or leave a substance such as minerals, mineral waste and any other soild waste, any noxious, offensive or polluting substance in a Commonwealth reserve other than in an area approved or provided for the purpose by the Director. In addition, a person must not release liquid or gaseous material in a Commonwealth reserve if the release is likely:
  - to pollute the air, soil, water or a watercourse; or
  - to be harmful to native species; or
  - to be harmful or offensive to another person.

6.1 Research and Monitoring

The Reserves are remote from the Australian coast which makes research and monitoring costly, both in terms of time and resources. The cooperation of the RAN and Coastwatch in providing access to the Reserves has increased opportunities for research and monitoring. There is also considerable opportunity to develop cooperative arrangements for scientific research and monitoring with a number of research organisations and agencies including the Australian Institute of Marine Science (AIMS), the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Cooperative Research Centre for Reef Research, the Queensland Parks and Wildlife Service, and interested non-government groups such as the Indo-Pacific Sea Turtle Conservation Group.

Research and monitoring will focus on the primary conservation values in the Reserves, mainly seabird and marine turtle presence and breeding activity, marine ecology and dynamics, and the impacts of human visitation on these values.

Management goals

- Conduct and encourage research and monitoring that will increase knowledge of the natural and cultural environments of the Reserves, provide information to enhance management, and measure management success.
- Ensure that research activities are appropriate and will not adversely impact on the conservation values of the Reserves.
- Protect the Reserves from extractive commercial research, such as bio-prospecting (the activity of searching in the wild for commercially valuable genetic and biochemical material), that is inconsistent with the strategic management objectives for the Reserves.

Management strategies

- Non-intrusive research activities (including biological, ecological, geological, geographical and oceanographic studies) may be allowed in accordance with a permit from the Director.
- For the purposes of section 354(1)(a) of the EPBC Act, under this Plan, killing, injuring, taking, keeping or moving a member of a native species may be allowed for the purposes of permitted research. The research must be consistent with the strategic objectives for the Reserves outlined under section 3 and/or contribute to the knowledge and management of the Reserves.
- Commercial research activities including bio-prospecting will not be allowed within the Reserves.
- Research conducted for environmental monitoring during patrols to the Reserves (including current bird and green turtle survey programs) will be allowed. Annual reports on the monitoring programs must be provided to the Director.

6.2 Tourism and Recreation

All visitors currently arrive by boat and most of these are associated with dive charters. Crews of RAN patrol boats and Coastwatch vessels are known to visit occasionally. Visitor numbers are currently limited by isolation of the Reserves and the difficulty and expense involved in accessing the area. Should monitoring of visitor impacts indicate that

visitor numbers are exceeding the carrying capacity of the Reserves then visitor access will be restricted.

Controls on tourism and recreation activities within the Reserves include r.12.28 (camping), r.12.30 (lighting of fires) of the EPBC Regulations and section 354(1)(a) of the EPBC Act (killing, injuring, taking, trading, keeping or moving a member of a native species in a Commonwealth reserve). The ways in which the Director will exercise powers under the EPBC Act and Regulations are outlined in the management strategies below.

Management goals

- Protect the natural and cultural values of the Reserves from the adverse impacts of tourist and recreational visitation.
- Allow limited use of the Reserves for passive tourism and recreational activities that are consistent with the strategic objectives for the Reserves.

Management strategies

- Visitor numbers will be managed through a limit on the number of commercial operators permitted to operate within the Reserves. For each Reserve, up to ten commercial tours with a maximum capacity of 30 passengers per tour will be permitted per year. This limit on visitor numbers will ensure that management is not inconsistent with the strategic objectives of the Reserves.
- Camping, except that necessary for management, will not be allowed within the Reserves.
- The Director will not provide or approve any fireplaces within the Reserves. Fires are only allowed in a portable barbecue or stove.
- Fishing (including charter fishing, game fishing including 'catch and release' fishing or fishing for immediate consumption) will not be allowed in the Reserves.
- No members of native species (including fish) may be killed, injured, taken, traded, kept or moved for any recreational activity.
- Liaison with commercial tour operators to foster a sense of ownership and responsibility for the Reserves and to cooperatively develop a code of practice for permitted activities within the Reserves will be continued.

- Monitoring of the visitor impacts on biodiversity values of the Reserve will be continued. This will include monitoring for the need for moorings. If required, moorings will be installed.
- Minimisation of the risk of damage to the Reserves from tourism and recreation activities will be enhanced through development and distribution of educational material on best environmental practices.
- Signs, information, and visitor logbooks to provide basic interpretative information for visitors to the Reserves, and to monitor use, will be maintained.
- EA will liaise with the Civil Aviation Authority to ensure that hydroplanes, seaplanes, helicopters (rotary wing) and aircraft (recreational and commercial), except for Coastwatch or similar flights, do not fly over the islands and cays at altitudes less than 1500 feet or within 1000 metres laterally.
- Permitted visitors to the Reserves will be required to report on the number of visits, duration of stay, number of passengers, mooring/anchoring locations and activities carried out.

6.3 Facilities and Installations

There are currently two facilities/installations in Lihou Reef NNR: a Bureau of Meteorology unmanned automatic weather station on Turtle Islet, and an AMSA unmanned solar powered navigation beacon off the eastern tip of Lihou Reef. The weather station is serviced twice a year, involving cleaning and servicing the equipment by two engineers. The AMSA navigation beacon is serviced once a year around April. Travel into the Reserves for the servicing of both structures is by boat.

There are no facilities or installations within Coringa-Herald NNR and no proposals for new facilities or installations are anticipated for either of the Reserves during the life of this Plan.

Management goals

– Protect the natural and cultural values of the Reserves from environmental impacts that may result from the establishment, operation, and maintenance of facilities and installations.

Management strategies

– Cooperative arrangements with the Bureau of Meteorology and AMSA will be maintained to ensure activities associated with the operation and maintenance of the weather station and navigation beacon in Lihou Reef NNR do not adversely impact on the Reserve.

– AMSA and its representatives are authorised to access the navigation aid for routine maintenance and defect rectification without prior approval, keeping the Director informed.

– Construction or alteration of any existing or new facility, navigation aid or installation may only be carried out in accordance with a permit issued by the Director.

– Liaison will be continued with the Bureau of Meteorology regarding the possible removal of the automatic weather station from Turtle Islet, within Lihou Reef NNR, and co-location with the AMSA navigational beacon on the eastern end of Lihou Reef.

6.4 Shipping Activities

Australia is a member of the International Maritime Organization (IMO) and is party to five IMO conventions addressing pollution from ships, including the *Convention for the Prevention of Pollution from Ships* (MARPOL 73/78). These conventions are given effect in Australia by a package of Commonwealth 'Protection of the Sea' legislation, which includes the *Protection of the Sea (Prevention of Pollution by Ships) Act 198*3, and complementary State/Territory legislation.

The National Plan to Combat Pollution of the Sea by Oil was implemented in 1973 to protect the marine environment from oil pollution and to minimise the effects of oil spills (AMSA, 1996). However, the capacity of the National Plan to control oil spills in remote areas within the Australian Exclusive Economic Zone is

limited. The opening of the outer shipping lane has implications in this regard due to increased traffic.

Under r.12.14 of the EPBC Regulations, a person must not discharge or leave minerals, mineral waste and any other soild waste, or any other noxious, offensive or polluting substance. Also, a person may not release liquid or gaseous material in a reserve if it is likely to pollute the air, soil, water or a watercourse, to be harmful to a native species, or to be harmful or offensive to another person. An offence against r.12.14 is a strict liability offence.

Management goals

– To protect the Reserves from marine pollution, including debris and oil spills, associated with shipping activities in the area.

Management strategies

– EA will liaise with Department of Transport and Regional Services and AMSA regarding shipping practices and enforcement of relevant legislation within the vicinity of the Reserves.
– EA will investigate the feasibility of proposing the Reserves be declared as a "Particularly Sensitive Sea Area" through the Marine Environment Protection Committee of the IMO.
– Recording, collecting and removal of debris will be continued.

6.5 Commercial Fishing

AFMA manages the Coral Sea Fishery and the Eastern Tuna and Billfish Fishery that operates within the Coral Sea Islands Territory but outside of the Reserves. The Reserves are potentially threatened by any intrusions of commercial fishing vessels into the Reserves. The Queensland Fisheries Service now requires Vessel Monitoring Systems (VMS) on all fishing vessels operating in Queensland territorial waters. While some of the fishers in Commonwealth waters also have State concessions and will therefore be required to install VMS, others do not. There are currently no Eastern Tuna and Billfish operators making reports to AFMA through VMS.

Management goals

– To protect the Reserves from extractive commercial activity that is inconsistent with the strategic objectives for the Reserves.

Management strategies

– No commercial fishing will be allowed in the Reserves.

– Coastwatch, Queensland Fisheries Service, AFMA, and other stakeholders will continue to be engaged for assistance in surveillance, enforcement and compliance activities and to monitor the level of fishing and vessel activity in the Reserves and in the vicinity of the Reserves.

– Negotiations with AFMA to implement VMS on fishing vessels operating in the Coral Sea will be pursued.

– A management and surveillance presence as part of the annual patrol program will continue.

6.6 Mineral and Petroleum Exploration and Development

The Department of Industry, Science and Resources is responsible for granting permits for mineral and petroleum exploration and extraction. Guano was mined historically, but there has been no known petroleum exploration or extraction in the area. The status of the Reserves' petroleum potential will be reviewed in the process of developing the third management plan for the Reserves.

Management goals

– To protect the Reserves from extractive commercial activity that is inconsistent with strategic objectives for the Reserves.

Management strategies

– Mineral and petroleum exploration and development will not be allowed within the Reserves.

6.7 Surveillance and Compliance

Ensuring the compliance of users with the management prescriptions for remote reserves is a challenge, both in terms of costs involved and the impracticality of traditional methods of reserve surveillance and compliance. These activities will be pursued on an opportunistic basis and more regularly through the cooperation of the RAN and Coastwatch to support the patrol program and to provide ongoing surveillance and enforcement of activities within the Reserves on behalf of Environment Australia.

Management goals

– Protect the conservation values of the Reserves by ensuring compliance with management prescriptions and EPBC Regulations.

Management strategies

– Cooperative arrangements with Coastwatch and the RAN to conduct surveillance and enforcement activities within the Reserves and to report on compliance will be maintained.

– Regular patrols to the Reserves will be continued to maintain a management presence, to record, collect and remove marine debris, to maintain signs, and check on overall activity and impacts within the Reserves.

– Liaison with Coastwatch and the RAN will continue to ensure that surveillance and compliance activities do not adversely impact on the conservation values of the Reserves.

– Liaison with users of the Reserves, relevant government agencies, industry groups and other stakeholders will be undertaken to prepare and distribute educational and interpretative material to raise compliance with management prescriptions for the Reserves and awareness of its conservation values.

7. Reviewing this Plan

A performance assessment framework is provided in the *Strategic Plan of Action for the National Representative System of Marine Protected Areas: A Guide for Action by Australian Governments* (ANZECC 1999) and *Best Practice in Performance Reporting in Natural Resource Management* (ANZECC 1997).

The performance assessment program for the Coral Sea National Nature Reserves will be based on:

- legislative framework;
- strategic objectives;
- analysis of impact of existing and potential pressures on conservation values;
- management goals; and
- management strategies.

Performance of management of the Reserve will be assessed through development and implementation of:

- management actions;
- performance measures;
- data collection techniques; and
- data analyses.

A mechanism by which the results of the performance assessment are fed back into the process of making ongoing management decisions will be a key component of this program.

The first elements of the performance assessment program are dealt with in detail in this Plan, particularly in Sections 5 and 6. The performance measures, targets and monitoring programs will be further developed from these primary elements of the performance assessment program.

Management plans are legal documents, intended to be in force for a period of up to seven years. Performance assessment results will be used to undertake a review of this Plan commencing at about two years before its termination date. The results of the review will be used in the development of the subsequent management plan for the Reserves.

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Attachment A:

Proclamations of the Coral Sea National Nature Reserves

Commonwealth of Australia Gazette

No. S 171, Monday, 16 August 1982
Published by the Australian Government Publishing Service, Canberra

SPECIAL

PROCLAMATION

Commonwealth of Australia
N. M. STEPHEN
Governor-General

By His Excellency the Governor-General of the Commonwealth of Australia

WHEREAS it is provided by sub-section (2) of section 7 of the *National Parks and Wildlife Conservation Act* 1975 that, amongst other things, the Governor-General may, by Proclamation, declare an area specified in the Proclamation to be a reserve and assign a name to that reserve.

AND WHEREAS it is provided by sub-section (11) of that section that the Governor-General shall not make a Proclamation under that section, other than a Proclamation in relation to certain land or sea in the Northern Territory of Australia referred to in sub-section (11A) of that section, except after consideration by the Federal Executive Council of a report by the Director of National Parks and Wildlife in relation to the matter dealt with by the Proclamation.

AND WHEREAS the Federal Executive Council has considered a report by the Director of National Parks and Wildlife in relation to the declaration of the area specified in the Schedule to be a reserve.

NOW THEREFORE I, Sir Ninian Martin Stephen, the Governor-General of the Commonwealth of Australia, acting with the advice of the Federal Executive Council, hereby

(a) declare the area specified in the Schedule to be a reserve;

(b) assign to that reserve the name 'Coringa-Herald National Nature Reserve'; and

(c) for the purposes of paragraphs (6) (a) and (c) of that section, specify a depth of 1,000 metres.

SCHEDULE

Coringa-Herald National Nature Reserve

The area of the boundary which

(1) commences at the point of Longitude 150°5' East Latitude 17°11' South;

(2) runs thence west along the parallel of Latitude 17°11' South to its intersection by the meridian of Longitude 149° East;

(3) runs thence north along the last-mentioned meridian to its intersection by the parallel of Latitude 16°46' South;

(4) runs thence east along the last-mentioned parallel to its intersection by the meridian of Longitude 149°48' East;

(5) runs thence north-easterly along the geodesic to the point of Longitude 150°12' East Latitude 16°23' South;

(6) runs thence east along the parallel of Latitude 16°23' South to its intersection by the meridian of Longitude 150°30' East;

(7) runs thence south along the last-mentioned meridian to its intersection by the parallel of Latitude 16°52' South; and

(8) runs thence south-westerly along the geodesic to the point of commencement.

(L.S.) GIVEN under my Hand and the Great Seal of Australia on 3 August 1982.

By His Excellency's Command,

D. T. McVEIGH

Minister of State for
Home Affairs and Environment

GOD SAVE THE QUEEN!

(Ex. Min. No. 57)

PROCLAMATION

Commonwealth of Australia
N. M. STEPHEN
Governor-General

By His Excellency the Governor-General of the Commonwealth of Australia

WHEREAS it is provided by sub-section (2) of section 7 of the *National Parks and Wildlife Conservation Act* 1975 that, amongst other things, the Governor-General may, by Proclamation, declare an area specified in the Proclamation to be a reserve and assign a name to that reserve.

AND WHEREAS it is provided by sub-section (11) of that section that the Governor-General shall not make a Proclamation under that section, other than a Proclamation in relation to certain land or sea in the Northern Territory of Australia referred to in sub-section (11A) of that section, except after consideration by the Federal Executive Council of a report by the Director of National Parks and Wildlife in relation to the matter dealt with by the Proclamation.

AND WHEREAS the Federal Executive Council has considered a report by the Director of National Parks and Wildlife in relation to the declaration of the area specified in the Schedule to be a reserve.

NOW THEREFORE I, Sir Ninian Martin Stephen, the Governor-General of the Commonwealth of Australia, acting with the advice of the Federal Executive Council, hereby –

(a) declare the area specified in the Schedule to be a reserve;

(b) assign to that reserve the name 'Lihou Reef National Nature Reserve'; and

(c) for the purposes of paragraphs (6) (a) and (c) of that section, specify a depth of 1,000 metres.

SCHEDULE

Lihou Reef National Nature Reserve

The area the boundary of which

(1) commences at the point of Longitude 151°8' East Latitude 17°54' South;

(2) runs thence north along the meridian of Longitude 151°8' East to its intersection by the parallel of Latitude 17°21' South;

(3) runs thence north-easterly along the geodesic to the point of Longitude 151°54' East Latitude 16°57' South;

(4) runs thence east along the parallel of Latitude 16°57' South to its intersection by the meridian of Longitude 152°20' East;

(5) runs thence south along the last-mentioned meridian to its intersection by the parallel of Latitude 17°27' South; and

(6) runs thence south-westerly along the geodesic to the point of commencement.

(L.S.) GIVEN under my Hand and the Great Seal of Australia on 3 August 1982.

By His Excellency's Command,

D. T. McVEIGH

Minister of State for
Home Affairs and Environment

GOD SAVE THE QUEEN!

(Ex. Min. No. 57)

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Attachment B:

Terrestrial Plant Species Recorded from the Coral Sea National Nature Reserves

(X = Present)

SPECIES	CORINGA-HERALD NNR	LIHOU REEF NNR
NYCTAGINACEAE		
Pisonia grandis	X	
Boerhavia tetranda	X	X
Boerhavia albiflora var. albiflora	X	
Boerhavia mutabilis	X	
Boerhavia spp.	X	
AMARANTHACEAE		
Achyranthes aspera	X	X
PORTULACACEAE		
Portulaca oleracea	X	X
MALVACEAE		
Abutilon indicum	X	X
PLUMBAGINACEAE		
Plumbago zeylanica	X	
BRASSICACEAE		
Coronopus integrifolius	X	
ZYGOPHYLLACEAE		
Tribulus cistoides	X	X
OLACACEAE		
Ximenia americana	X	
CHENOPODIACEAE		
Suaeda australis	X	
CONVOLVULACEAE		
Ipomoea macrantha	X	
Ipomoea pes-caprae	X	
BORAGINACEAE		
Argusia argentea	X	
BORAGINACEAE		
Cordia subcordata	X	
POACEAE		
Lepturus repens	X	X
Stenotaphrum micranthum	X	X
Sporobolus virginicus	X	
Digitaria ctenantha	X	
Thuarea involuta	X	
FABACEAE		
Canavalia rosea	X	

Sources: ANPWS 1989a, b; Batianoff in press

Attachment C:

Bird Species Recorded from the Coral Sea National Nature Reserves

(* Species listed under the JAMBA and/or CAMBA Agreements)
(B = Breeding, X = Present but not breeding, – = Not recorded)

SPECIES	CORINGA-HERALD NNR	LIHOU REEF NNR
Herald petrel *Pterodroma arminjoniana*	–	X
*Wedge-tailed shearwater *Puffinus pacificus*	B	B
*Red-footed booby *Sula sula*	B	B
*Masked booby *Sula dactulatra*	B	B
*Brown Booby *Sula leucogaster*	B	B
*Great frigatebird *Fregata minor*	B	X
*Least frigatebird *Fregata ariel*	B	B
Sacred ibis *Threskiornis aethiopica*	–	X
Red-tailed tropicbird *Phaethon rubricauda*	B	–
Buff-banded rail *Gallirallus philippensis subsp*	B	B
Purple swamphen *Porphyrio porphyrio*	B	–
*Lesser golden plover *Pluvialis dominica*	X	X
*Grey-tailed tattler *Tringa incana*	X	X
*Great knot *Calidris tenuirostris*	–	X
*Bar-tailed godwit *Limosa lapponica*	X	–
(indeterminate) tattler *Tringa spp.*	–	X
*Eastern reef egret *Egretta sacra*	X	–
*Sharp-tailed sandpiper *Calidris acuminata*	X	–
*Ruddy turnstone *Arenaria interpres*	X	X
*Wimbrel *Numenius phaeopus*	X	X
*Little wimbrel *Numenius minutus*	–	X
Silver gull *Larus novaehollandiae*	–	X
*Black-naped tern *Stema sumatrana*	X	B
Sooty tern *Stema fuscata*	B	B
*Bridled tern *Sterna anaethetus*	X	–
Crested tern *Sterna bergii*	B	–
*Little tern *Sterna albifrons*	–	B
Fairy tern *Sterna nereis*	X	–
*Common noddy *Anous stolidus*	B	B
Black noddy *Anous minutus*	B	B
Tree martin *Cecropus nigricans*	X	–
Welcome swallow *Hirundo neoxena*	X	X
Pelican *Pelicanus conspicillatus*	–	X
Black-faced cuckoo-shrike *Coracina novaehollandiae*	X	–
Australian magpie-lark *Grallina cyanoleuca*	X	–
Sacred Kingfisher *Halycon sancta*	X	–

Source: ANPWS 1989a,b; Weston et al. 1991.