

Information Sheet on Ramsar Wetlands

Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.

1. Date this sheet was completed/updated:

October 2002.

FOR OFFICE USE ONLY.

DD	MM	YY

Designation date

--	--	--	--	--	--	--	--

Site Reference Number

2. Country:

Australia.

3. Name of wetland:

Ashmore Reef National Nature Reserve.

4. Geographical coordinates:

Latitude: 12° 20' South; Longitude: 123° 0' East.

5. Altitude:

0 - 3 m above sea level.

6. Area:

Ashmore Reef National Nature Reserve includes an area of approximately 58 300 hectares.

7. Overview:

Ashmore Reef, contained within the Ashmore Reef National Nature Reserve (the Reserve), is one of only three emergent oceanic reefs present within the north-eastern Indian Ocean, and is the only one in this region with vegetated islands.

The Reserve is comprised of numerous marine habitats and consequently supports an important and diverse range of species. The internationally significant sea snake community, the potentially genetically distinct population of Dugong, the highly diverse marine invertebrate fauna, and the numerous endemic species (either to the Reserve or the oceanic reefs in the region) supported by the Reserve are particularly noteworthy. Furthermore, the Reserve includes important seabird and turtle nesting sites and supports large populations of migratory shorebirds and breeding seabirds.

8. Wetland Type:

marine-coastal:	(A)	(B)	(C)	D	(E)	F	(G)	H	I	J	K	Zk(a)
inland:	L	M	N	O	P	Q	R	Sp	Ss	Tp	Ts	
	U	Va	Vt	W	Xf	Xp	Y	Zg	Zk(b)			
man-made:	1	2	3	4	5	6	7	8	9	Zk(c)		

Ranked from the most to the least dominant:

A, G, B, C, E.

9. Ramsar Criteria:

① ② ③ ④ ⑤ ⑥ 7 ⑧

Please specify the most significant criterion applicable to the site:
5 and 6.

10. Map of site included? Please tick *yes* -or- *no*

11. Name and address of the compiler of this form:

Suzanne Ferguson
Marine and Water Division
Environment Australia
GPO Box 787, Canberra, ACT, 2601
AUSTRALIA
Ph: +61 2 6274 1879
Fax: +61 2 6274 1771
E-mail: suzanne.ferguson@ea.gov.au

12. Justification of the criteria selected under point 9, on previous page.

Criterion 1 (*contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate bioregion*).

Ashmore Reef, together with Cartier Island and Hibernia Reef, represent the only emergent reefs in the north-eastern Indian Ocean. Ashmore Reef is the only one of these reefs with vegetated islands. The Reserve includes a biologically diverse reef system representative of Australia's North West Shelf and the Oceanic Shoals Bioregion, described in the *Interim Marine and Coastal Regionalisation for Australia: an Ecosystem-based Classification for Marine and Coastal Environments* (IMCRA Technical Group 1998). Ashmore Reef is included on the World Conservation Union (IUCN) list of Coral Reefs of International Significance.

The geographical location, seasonal oceanographic conditions, naturally occurring hydrocarbon inputs, and diverse benthic habitat in the Ashmore region supports a distinct assemblage of benthic and pelagic communities. Ashmore Reef is located in a transition zone between algal dominated assemblages to the north, and coral dominated assemblages to the south (Glenn and Opdyke 1997). Ashmore Reef includes a variety of marine habitats including extensive seagrass meadows (marine subtidal aquatic beds), intertidal sand flats, coral reef flats and lagoons (permanent shallow marine waters). Consequently, these areas are able to support the greatest number of species of any area in north-western Australia (Russell and Hanley 1993). Ashmore Reef National Nature Reserve supports the greatest number of reef building coral species recorded for any reef area on the Western Australian coast (Veron 1993).

Criterion 2 (supports vulnerable, endangered or critically endangered species or threatened ecological communities).

The Reserve supports a significant population of approximately 10,000 nesting and immature feeding Green Turtle *Chelonia mydas* (Guinea 1995), small populations of nesting and feeding Hawksbill Turtle *Eretmochelys imbricata* and feeding Loggerhead Turtle *Caretta caretta*. These three species are recognised as being threatened at both the international and national scales. All three species are listed on the 2000 IUCN Red List of Threatened Species, are listed under the *Convention on the International Trade of Endangered Species of Wild Animals* (CITES) and *Convention on Migratory Species* (CMS) and are protected nationally under the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBC) Act 1999. The Green Turtle is recognised as endangered and vulnerable under IUCN Red List and EPBC Act categories, respectively. The Hawksbill Turtle is categorised as critically endangered and vulnerable, and the Loggerhead Turtle as endangered under both the IUCN Red List and EPBC Act categories, respectively.

Seagrass beds located within the Reserve provide important habitat that supports a small population of Dugong *Dugong dugon*. Dugong are categorised as vulnerable under the IUCN Red List of Threatened Species and are also protected as a listed migratory and marine species under the EPBC Act. Preliminary DNA studies indicate that this population may be genetically distinct from any other Australian population (Whiting 1999).

Furthermore, the Reserve provides important habitat that supports more than 40 bird species listed on the Japan-Australia and China-Australia Migratory Bird Agreements (JAMBA/CAMBA).

Criterion 3 (supports populations of plant and/or animal species important for maintaining the biological diversity of the region).

Ashmore Reef exhibits significant interactions with adjacent ecosystems to the north and south (Simpson 1991). The Indonesian Through Flow current transports genetic material southwards from the biologically diverse reef systems of the Philippines and Indonesia. The reefs and shoals of the North West Shelf, including Ashmore Reef, are the initial recipient in Australian waters of this transported material, and therefore play a primary role in the maintenance of biodiversity in reef systems further to the south.

The marine environments of Ashmore are notable for their high biological diversity. The Reserve supports the greatest number of reef building coral species of any reef area on the Western Australian coast (Veron 1993). There are also particularly high numbers of mollusc and fish species in the Reserve, and the region has particular global significance in terms of its sea snake abundance and diversity.

A number of species have been identified as unique to Ashmore Reef and immediately adjacent seas. Three species of sea snake are considered endemic to the immediate region, *Aipysurus foliosquama*, *Aipysurus apraefrontalis* and *Aipysurus fuscus* (Minton and Heatwole 1975), and three mollusc species are considered endemic to the reef, *Amoria spenceriana*, *Cymbiola baili* and *Conus morrisoni* (Willan 1998). The Dugong population supported by Ashmore Reef are believed to be genetically distinct from any other known Australian population (Whiting 1999).

Ashmore Reef has a high abundance and diversity of sea cucumbers (holothurians), with 45 species recorded (Marsh *et al.* 1993). This is particularly significant as sea cucumber populations of other reefs in the region have been over-exploited and are subsequently found in very low densities (Skewes *et al.* 1999), with some local extinctions likely to occur (Smith *et al.* 2002).

The Ashmore islands support significant and diverse populations of birds. Ninety-three bird species have been recorded in the Reserve plus three additional species sighted at sea outside the Reserve (Milton 1999). These include significant populations of seabirds and shorebirds, including more than 40 species that are listed under JAMBA and CAMBA. Further information is provided under Criterion 4.

Criterion 4 (supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions).

The Reserve is most important to populations of seabirds and migratory shorebirds at critical stages in their lifecycles. It has been estimated that the Reserve supports in the order of 50,000 breeding pairs of seabirds of various species (Milton 1999).

The Reserve provides an important staging point for many migratory shorebirds that use the Reserve's islands and sand cays as feeding and resting areas during their migration. The Grey-tailed Tattler *Tringa brevipes* and the Ruddy Turnstone *Arenaria interpres* (Milton 1999, Swann 2001) have been recorded using the Reserve during their migration, in numbers of international significance (more than 1% of the East Asian –Australasian Flyway population).

Between October-November and March-April flocks of Eastern Curlew *Numenius madagascariensis*, Ruddy Turnstone *Arenaria interpres*, Whimbrel *Numenius phaeopus*, Bar-Tailed Godwit *Limosa lapponica*, Common Sandpiper *Tringa hypoleucos*, Mongolian Plover *Charadrius mongolus*, Red-Necked Stint *Calidris ruficollis* and Tattler *Tringa brevipes* utilise the Reserve during migration between Australia and the Northern Hemisphere (Australian National Parks and Wildlife Service 1989). Flocks of migratory shorebirds at the Reserve have been estimated to total on occasion at least 8,000 birds (Ashmore Reef Patrol Report No. 3 of 1994, Australian National Parks and Wildlife Service 1989). In addition, thirty species of shorebird have been recorded at least once on Ashmore Reef, representing almost 70% of the species that regularly migrate to Australia (Watkins 1993).

The Reserve also comprises important habitats that support large and significant populations of feeding and breeding sea turtles, including Green Turtle *Chelonia myda*, Hawksbill Turtle *Eretmochelys imbricata* and Loggerhead Turtle *Caretta caretta* (Guinea 1995) (see Criterion 2). Each individual turtle may spend several decades feeding in the Reserve, before migrating up to 2,000 kilometres to other reefs for nesting. Adult turtles that have been feeding elsewhere as juveniles return to the Reserve for breeding and nesting. Undisturbed reef flats and sandy beaches are important to support these populations and help to ensure their reproductive success. Preliminary surveys estimate that approximately 11,000 sea turtles feed throughout the year at the Reserve (Guinea, Northern Territory University, pers. comm.).

Furthermore, Ashmore Reef supports a high density and diversity of sea cucumbers (holothurians), with 45 species recorded to date (Marsh *et al.* 1993). The Reserve provides an important refuge, with sea cucumber populations at other reefs in the region being over-exploited and reduced to very low densities (Skewes *et al.* 1999). Local extinctions of some species have been predicted at a number of these other reefs (Smith *et al.* 2002).

Criterion 5 (regularly supports 20,000 or more waterbirds).

The Ashmore islands are regarded as supporting some of the most important seabird rookeries on the North West Shelf. It has been estimated that the Reserve supports in the order of 50,000 breeding pairs of seabirds of various species (Milton 1999). Large colonies of Sooty Tern *Sterna fuscata*, Crested Tern *Sterna bergii*, Bridled Tern *Sterna anaethetus* and Common Noddy *Anous stolidus* breed on the islands. Smaller breeding colonies of Black Noddy and possibly Lesser Noddy also occur on the islands (Australian National Parks and Wildlife Service 1989, Stokes and Hinchey 1990).

The Reserve is an important staging point for many migratory shorebirds. Flocks of migratory waders estimated to total on occasion at least 8,000 birds use the Reserve's islands and sand cays as feeding and resting areas (Ashmore Reef Patrol Report No. 3 of 1994, Australian National Parks and Wildlife Service 1989).

See also Criterion 3 and 4.

Criterion 6 (regularly supports 1% of the individuals in a population of one species or subspecies of waterbird).

The Reserve regularly supports internationally significant numbers (more than 1% of the East Asian-Australasian Flyway population) of Ruddy Turnstone (*Arenaria interpres*) and Grey-tailed Tattler (*Tringa brevipes*) (Milton 1999, Swann 2001). Counts of Ruddy Turnstone have been recorded at up to 1,500, 5.3% of the East Asian-Australasian Flyway population (Swann 2001), and counts of Grey-tailed Tattler have been recorded at 1,631, over 3% of the East Asian–Australasian Flyway population (Milton, 1999).

Criterion 8 (it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend).

Ashmore Reef lies in the path of the Indonesian Through Flow current which carries warm low-saline water from the western Pacific Ocean into cooler, high nutrient, highly saline up-welling water of the Indian Ocean. The southward flowing Leeuwin Current originates in the region and flows southward down the Western Australian coastline. The interactions between these currents and the reefs of the Indo-Pacific play a significant role in the maintenance of the coral reef and algal communities further to the south (Hatcher 1991). Ashmore Reef is considered an important “stepping stone” for the southward distribution of species originating in the Indonesian archipelago. The larvae of species from biologically rich reefs to the north are carried to Ashmore Reef in the prevailing current, establish at Ashmore Reef, and then subsequent generations of larvae are carried to more southerly oceanic reefs (Simpson 1991).

13. General location.

Ashmore Reef is located in the north-eastern Indian Ocean on Australia's North West Shelf. It is approximately 500 nautical miles west of Darwin in the Northern Territory, approximately 380 nautical miles north of Broome in Western Australia, and 70 nautical miles south from the Indonesian island of Roti. The Reserve is located in Australia's External Territory of Ashmore and Cartier Islands and is under the jurisdiction of the Commonwealth Government of Australia.

14. Physical features.

Ashmore Reef is the region's largest emergent reef. The Reserve contains two extensive lagoons, extensive mobile channelled carbonate sand flats, shifting sand cays, an extensive reef flat, and three vegetated islands – East, Middle and West Islands. The reef fronts of the Reserves are punctuated with spur and groove formations and have a high diversity of robust corals. The reef crests are algal dominated and the reef flats are striated with lines of coral rubble. The two lagoons have a total of four northern entrances and are noted for their exceptional coral growth. All three islands at Ashmore have beach rock.

Naturally occurring hydrocarbon seeps have been identified throughout this major hydrocarbon province. Geosciences Australia (formerly the Australian Geological Survey Organisation) is currently investigating the relationships between the seeps and benthic community structure. It is thought that the seeps add significantly to the nutrient content and consequently the biota of the region's waters (Glenn and O'Brien 1999).

The regional oceanic processes of Australia's North West Shelf are influenced by several major factors including monsoons, dominant south-easterly winds, seasonal up-welling from the Indian Ocean, and the Indonesian Through Flow.

The Indonesian Through Flow carries warm low-saline water from the western Pacific Ocean into cooler, high nutrient, highly saline up-welling water of the Indian Ocean. The southward flowing Leeuwin Current originates in the region and flows southward along the Western Australian coastline. This is the only west-coast southern-flowing boundary current in the world. The interactions between these currents and the reefs of the Indo-Pacific play a significant role in the maintenance of coral reef and algal communities further to the south (Hatcher 1991).

Sea surface temperatures vary seasonally with the highest oceanic water temperature recorded at 31 degrees Celsius. Lagoonal water has been recorded up to 35.4 degrees Celsius (Glenn in prep). Tidal ranges for the Reserves exhibit a mean spring tide maximum of 4.75 metres (Flinders Institute for Atmospheric and Marine Sciences 1997).

The Reserve lies north of the Tropic of Capricorn and hence falls in the tropics. The climate is dry (arid tropical), and annual evaporation is twice that of the annual average precipitation of 950 mm. Most rainfall is restricted to the relatively short summer monsoonal period. Prolonged periods of rainfall are rare, and yearly rainfall is 950 mm. Monsoonal conditions dominate from December to May with thunderstorms occurring, on average, 85 days per year (Lavering 1993). Cyclones are common on the North West Shelf with the region experiencing an average of seven per cent of the annual global cyclone total (Pielke 1990). March, October, November and December are the calmest months (Australian National Parks and Wildlife Service 1989).

15. Hydrological values.

Ashmore Reef lies within the East Indian Ocean, where the oceanography is influenced by Indian Ocean upwelling, the Indonesian Throughflow, and seasonal monsoons and trade winds. The semidiurnal tidal cycle ebbs and floods to the north-east/south-west (Glenn 1997) with a maximum range of 4.75 metres (Flinders Institute 1997).

There are large areas of mobile sand flats within the Reserve. Shifting sand cays and sand fans develop from the reef flat and encroach on the lagoons. Fresh water lenses occur on all three islands during the monsoon season, but only on West Island is this water used for drinking. A water pump has been installed near the beach for use by visiting Indonesian fishermen and there is a covered well near the centre of the island.

16. Ecological features.

Marine Habitats

Major marine habitats in the Reserve include the reef front and crest, reef flat, sand flats, and lagoons. The reef front and crest is comprised of hard and soft corals, gorgonians, sponges and a range of encrusting organisms. It provides habitat for a number of fish, crustaceans and echinoderms. The reef flats include areas of sea grass, primarily *Thalassia hemprichii*. Five species of seagrass have been collected from the reef. These are all species known to occur widely in the region. The seagrass beds provide important habitat for a number of species including Dugong and turtles. The sand flat habitats support a range of species including feeding turtles, stingrays, echinoderms, molluscs (including clams), crustaceans and migratory shorebirds. Areas of sandflats that do not dry at low tide also have a sparse cover of soft corals and various algae. The lagoon habitats support a wide range of fish, and predators such as sharks and sea snakes. It is also a feeding area for Dugong and turtles. The lagoons support corals, sponges and a range of holothurians, echinoderms and polychaetes on and beneath the substrate.

Terrestrial Habitats

Terrestrial habitats in the Reserve consist of three vegetated islands (West, Middle and East Islands) and numerous un-vegetated sand cays. The vegetated islands provide important nesting habitat for many species, including marine turtles and a number of seabirds and migratory birds.

A limited range of plant species have been recorded at the Ashmore islands. Evidence suggests an on-going dynamism in terrestrial species. New species may be introduced by ocean currents and human activities, and the loss of species may result from natural events such as cyclones, long dry seasons and beach erosion (Pike and Leach 1997).

West Island has a fringing shrubland community, comprising mainly *Argusia argentea* with isolated examples of *Guettarda speciosa*, *Scaevola sericea* and *Cordia subcordata*. The interior of the island is an open herb land, with *Boerhavia spp*, *Sida pusilla*, *Ipomea spp*, *Sesbania cannabina*, *Spinifex spp* together with a range of grasses. East Island is predominantly grassland, with a species mix that includes *Digitaria marianensis*, *Lepturus repens* and *Sporobolus virginicus*. Middle Island has the vestigial remnants of a fringing shrubland, comprising *Scaevola sericea*, *Argusia argentea* and *Suriana maritima* and an interior herbfield with areas of *Amaranthus interruptus* and *Cleome gynandra* along with a range of grasses similar to that found on East Island (Pike and Leach 1997). The Middle Island shrubs provide the nesting habitat for Great Frigate Birds (*Fregata minor*).

17. Noteworthy flora.

The marine flora of the Reserve is not well studied but there are significant seagrass beds that provide important habitat for a number of marine animal species.

Ashmore Reef is the only known location in Australia where the Asian Beach Spinifex *Spinifex littoreus* has been recorded (Pike and Leach 1997). Other than this, a limited range of plant species have been recorded at the Ashmore islands. Evidence suggests an on-going dynamism in terrestrial species. New species are introduced by ocean currents and human activities, and the loss of species may result from natural events such as cyclones, long dry seasons and beach erosion (Pike and Leach 1997).

18. Noteworthy fauna.

The Reserve provides important habitat for an unusually high abundance and diversity of sea snakes (Hanley and Russell 1993), recognised as internationally significant. Within the Reserve there is estimated to be 40,000 sea snakes representing at least 13 species, the greatest number of sea snake species recorded for any locality in the world (Guinea 1995, Guinea and Pike 1994). Thick sea snakes of the subfamily Aipysurini are abundant, three species of which are endemic to Australia's North West Shelf. Some of these sea snakes have been observed to have extremely limited ranges and diets, depending entirely on very small areas of reef (Guinea, Northern Territory University, pers. comm.). Interestingly, some species of sea snakes present at both Ashmore Reef and the nearby Cartier Island, exhibit morphological differences (Guinea, Northern Territory University, pers. comm.).

The Reserve protects important habitat for feeding and breeding sea turtles, and supports large and significant populations of turtles. The nationally vulnerable Green Turtle *Chelonia myda*, Hawksbill Turtle *Eretmochelys imbricata* and the nationally endangered Loggerhead Turtle *Caretta caretta* are found in the Reserve (Guinea 1995). Preliminary surveys estimate that approximately 11,000 sea turtles feed throughout the year at Ashmore Reef (Guinea, Northern Territory University, pers. comm.).

The Reserve supports a small population of *Dugong dugon* with home ranges that possibly extend to Cartier Island and other submerged shoals in the region (Whiting 1999). Preliminary DNA studies indicate that this population may be genetically distinct from any other Australian population (Whiting 1999). The extent to which this population interacts with populations from the Australian or Indonesian coasts is not known.

The Reserve has a high diversity of marine invertebrates, including three endemic molluscs, *Amoria spenceriana*, *Cymbiola bailsi* and *Conus morrisoni* (Willan 1998). It is extremely unusual for such a range of endemic species to be found in such a small area of coral reefs. Importantly, the molluscan fauna found at Ashmore differ considerably from that of the Western Australian coast (Wells 1993).

The Ashmore islands are regarded as supporting some of the most important seabird rookeries on the North West Shelf. It has been estimated that the Reserve supports in the order of 50,000 breeding pairs of seabirds of various species (Milton 1999). Large colonies of Sooty Tern, Crested Tern, Bridled Tern and Common Noddy breed on the islands. Smaller breeding colonies of Black Noddy and possibly Lesser Noddy also occur on the islands (Australian National Parks and Wildlife Service 1989). Many of the bird species present in the region are listed under JAMBA and CAMBA.

The Reserve is an important staging point for many migratory shorebirds. Thirty species of shorebird have been recorded at least once on Ashmore Reef. This represents almost 70% of the species that regularly migrate to Australia (Watkins 1993). Flocks of migratory shorebirds estimated on occasion to total at least 8,000 birds use the Reserve's islands and sand cays as feeding and resting areas (Ashmore Reef Patrol Report No. 3 of 1994, Australian National Parks and Wildlife Service 1999). Two of these species occur in numbers of international significance (more than 1% of the East Asian-Australasian Flyway population). These are the Grey-tailed Tattler *Heteroscelus brevipes* and the Ruddy Turnstone *Arenaria interpres*.

19. Social and cultural values.

Ashmore has been regularly visited and fished by Indonesians since the early eighteenth century (Fox 1988, Stacey 1999). Early travellers to Ashmore included the Bajo, migratory sea peoples originating from the coastline of Sulawesi and islands to the south, and fishers from the island of Roti (Fox 1988). The reef features in the songs and mythology of the Rotinese fishing villagers (Ashmore Reef Patrol

Reports No 3 of 1994 and No. 1 of 1998). Some initial investigative work into the archaeological status of Ashmore regarding its association with Indonesian traditional fishermen has been carried out by the Northern Territory Museum (Clark 1998 and Clark 2000). Indonesian artefacts identified in the Reserve include ceramics, graves, ballast rocks and what could be a trepang (holothurian) cooking site. There are indications that future research into archaeological sites on West Island may cast light on the history of the Reserve.

Activities between 1850 and 1875, when a guano extraction industry was exploiting deposits on West Island, has been poorly recorded. Additional research on the islands may add to the knowledge of this period.

A 1974 Memorandum of Understanding between Australia and Indonesia sets out arrangements by which traditional fishers can access resources in the region. This allows traditional Indonesian fishers access to the Reserve for shelter and fresh water. Access is permitted to West Island Lagoon and part of West Island. Traditional fishers are also allowed to catch fish for immediate consumption, and to visit graves on all islands.

The reef has high potential and value for scientific research as it is a relatively pristine site and plays an important role as a biological ‘stepping stone’ for marine and terrestrial species. Researchers regularly visit the Reserve in accordance with permits that are issued under the EPBC Act, considered on a case-by-case basis.

Tourism and recreation in the Reserves is mainly limited to West Island Lagoon and part of West Island. Most visitors arrive by private yacht. A few commercial bird watching tours occur each year. Historically there have been few visitors to the Reserve, and this is likely to continue due to its isolation.

20. Land tenure/ownership.

The Territory of Ashmore Reef and Cartier Island is administered by the Commonwealth of Australia.

21. Current land use.

The islands, reef and surrounding waters to a boundary approximately following the 50 m bathymetric contour have been declared the Ashmore Reef National Nature Reserve. The Reserve is managed under the EPBC Act by the Director of National Parks, with the assistance of Environment Australia. Priority is given to the protection of the natural features of the Reserve. Commercial exploitation such as commercial fishing, mining or oil exploration is prohibited within the Reserve. Other commercial activities such as commercial tourism may only be carried out upon a permit being issued by the Director of National Parks. Access to most of the Reserve is closed to all members of the public by a determination in force under the EPBC Act. Fishing for immediate consumption is permitted in West Island Lagoon of the Reserve.

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

(a) Within the Reserve

Natural events such as cyclones have the potential to inflict considerable damage on both the terrestrial and marine environments of the Reserve, and have done so in the past. El Niño events in the Pacific can generate pulses of heated oceanic currents that can damage or kill coral formations and have a deleterious effect on other marine organisms (Ashmore Reef Patrol Report No. 1 of 1998).

Feral introductions also present a current and potential threat. In the past rodents were introduced to the three islands in the Reserve. *Rattus rattus* was present in large numbers on West Island when the Reserve was declared. A protracted baiting program began in 1983 and is believed to have eradicated these rodents from the island. However, the possibility of rats being re-introduced from visiting Indonesian fishing vessels remains. Middle and East Islands have fluctuating populations of Mice *Mus musculus*.

The activities of Indonesian fishers present a continuing issue for the management of the Reserve. Under the terms of the Memorandum of Understanding signed by the Australian and Indonesian Governments in 1974, traditional Indonesian fishers may call in at Ashmore Reef for shelter and to obtain supplies of fresh water from West Island. The MOU requires that they anchor only in the West Island Lagoon, where they may fish using hand lines.

In the past it was traditional practice for visiting fishermen to take turtles, seabirds and eggs for food and commerce and to collect marine shells and sea cucumbers (holothurians) to meet demand from Asian markets. Although such activities are now prohibited in the Reserve, there is a continuing level of illicit forays, with fishers targeting trochus shell and sea cucumbers. Strategies to combat this illegal fishing include continued cooperation with the Indonesian Government, continuing educational activities directed at the fishers, and a high level of surveillance. If necessary, prosecution measures will be enforced to ensure the protection of the Reserve.

Over the past decade Ashmore has been a destination for vessels transporting illegal migrants. Large numbers of vessels near reef and lagoon environments have the potential to cause damage to ecosystems.

(b) Surrounding Area

The areas of sea bed opened to oil exploration are creeping closer to the Reserve. Potentially, an oil spill from an off-shore petroleum platform or a bulk oil carrier could inflict damage on Ashmore Reef's fragile ecosystems. There are no resources available at Ashmore Reef to deal with even a minor oil spill, and it would take some time to move the necessary equipment to the site from the Australian mainland.

23. Conservation measures taken.

Ashmore Reef National Nature Reserve was declared in 1983. The Reserve is managed under the EPBC Act. Most of the Reserve is closed to the general public in order to protect the biological resources of the Reserve. The current management plan for the Reserve came into effect on 26 June 2002 under the EPBC Act. This plan will be in force for 7 years.

Currently, on-site management of the Reserve is provided by the Australian Customs Service, which is present at the Reserve for nearly 12 months a year.

24. Conservation measures proposed but not yet implemented.

A new management plan for the Reserve came into effect on 26 June 2002 under the EPBC Act. There are many management strategies in this Plan to protect the environmental values of the Reserve, including commitments to develop an introduced pest prevention and mitigation strategy, an anchoring and mooring strategy and a performance assessment framework for monitoring the management of the Reserve. The new management plan commits to the development of a research plan that will identify gaps in scientific knowledge relating to the management of the Reserve, outline research priorities for the Reserve and encourage appropriate research.

25. Current scientific research and facilities.

Researchers are encouraged to carry out investigations in the Reserve where activities will contribute to the knowledge and management of the Reserve, and it can be clearly demonstrated that there will be no significant impact on the values of the Reserve. Sea snake, turtle, mollusc, insect, fish and coral populations in the Reserve have been studied in recent years. A preliminary survey of archaeological sites on the islands was carried out in 1996. A handbook on the terrestrial vegetation of the Reserve was published in 1997.

The new management plan commits to the development of a research plan that will identify gaps in scientific knowledge relating to the management of the Reserve, outline research priorities for the Reserve and encourage appropriate research.

26. Current conservation education.

Information on the Reserve is provided on the Environment Australia Internet site. A brochure explaining the management of the Reserve and providing background information on the flora, fauna and historical and cultural associations of the area is being updated and will be distributed to Reserve users by the Customs Service on-site managers, and to interested members of the public by Environment Australia.

Crews of visiting Indonesian fishing boats are played taped messages in Indonesian by Australian Customs Service on-site managers. These tapes explain the reasons for the establishment of the Ashmore Reef Nature Reserve, and the limits of access and restrictions on activities. Brochures in Indonesian will shortly be developed explaining restrictions and values of the Reserve. These will be given to Indonesian fishers accessing the Reserve.

27. Current recreation and tourism.

This is limited to perhaps an average of one or two visits per year by a commercial tourist boat with up to 20 passengers. Such visits are subject to permit conditions to protect the Reserve from impacts. Yachts also visit the Reserve. This usually comprises 40 to 50 vessels per annum, and visits are usually only of several days.

28. Jurisdiction.

The Territory of Ashmore and Cartier Islands is administered by the Commonwealth Department of Transport and Regional Services. Ashmore, along with Cartier, is a Commonwealth reserve, and is subject to the provisions of the Commonwealth EPBC Act.

29. Management authority.

The Reserve is managed by the Director of National Parks under the provisions of the EPBC Act. The management of the Reserve is delegated to Environment Australia.

30. Bibliographical references.

- ANPWS. (1989) Ashmore Reef National Nature Reserve. Plan of Management. Australian National Parks and Wildlife Service, Canberra. 65p.
- Clark, P. *Ashmore Reef; Preliminary Archaeological and Ethnographic Field Report 1996*. (Unpublished report prepared for Parks Australia North 1998).
- Clark, P. (2000) Ashmore Reef: Archaeological Evidence of Past Visitation. *Bulletin of the Australian Institute for Maritime Archaeology* 24:1-8.
- Flinders Institute for Atmospheric and Marine Sciences. 1997. National Tide Facility, the Flinders University of South Australia.
- Fox, J. (1988) Reef and Shoals in Australia-Indonesian Relations: Traditional Indonesian Fisherman, in *Australian in Asia: Episodes*, eds, Milner and Quilty, Oxford University Press, Melbourne.
- Glenn, K. (1997) *Aspects of the Geological Development of Ashmore Reef, North West Shelf, Australia*. Unpublished thesis submitted to Faculty of Science, Australian National University.
- Glenn, K. and O'Brien, G. (1999) Biodiversity and Holocene Development, Ashmore Reef, North West Shelf, Australia. Abstract in *Fourth International Conference on Asian Marine Geology*. Institute of Oceanography, Chinese Academy of Sciences, Qingdao, China.
- Glenn, K. and Opdyke, B.N. (1997) The use of Landsat TM and shallow water mapping at Ashmore Reef. Star Proceedings. SOPAC, Fiji.
- Guinea, M. L. (1995) *The Sea Turtles and Sea Snakes of Ashmore Reef National Nature Reserve*. Unpublished report prepared for the Australian Nature Conservation Agency, March 1995.
- Guinea, M.L. and Pike, G.D. (1994) A Field Key to the Sea Snake Species of the Territory of Ashmore and Cartier Islands – draft version. Australian Nature Conservation Agency, Darwin.
- Hanley, J.R. and Russell, B.C. (1993) Conservation Status in *Marine Biological and Heritage Values of Cartier and Hibernia Reefs, Timor Sea*. eds. B.C. Russell and J.R. Hanley. Northern Territory Museum of Arts and Sciences, Darwin.

- Hatcher, B.G. (1991) Coral Reefs in the Leeuwin Current: an ecological perspective. *Journal and proceedings of the Royal Society of Western Australia*, v 74, 115-127.
- IMCRA Technical Group (1998) Interim Marine and Coastal Regionalisation for Australia: an ecosystem-based classification for marine and coastal environments. Version 3.3. Environment Australia, Canberra.
- Lavering, I.H. (1993) Quaternary and modern environments of the Van Diemen Rise, Timor Sea, and potential effects of additional petroleum exploration activity. *Journal of Australian geology and geophysics*, 13, 281-292.
- Marsh, L.M., Vail, L.L., Hoggett, A.K. and Rowe, F.W.E. (1993) Echinoderms of Ashmore Reef and Cartier Island in *Marine Faunal Surveys of Ashmore Reef and Cartier Island, North-western Australia* ed P.F. Berry, Western Australian Museum, Perth.
- Milton, D. A. (1999). Birds of Ashmore Reef National Nature Reserve: an assessment of its importance for seabirds and waders. Unpublished report prepared 1999.
- Minton, S. A. and Heatwole H. (1975). Sea snakes from three reefs of the Sahul Shelf in *The Biology of Sea Snakes*, Dunson, W. A. (Ed), University Park Press, Baltimore.
- Patrol Reports - Ashmore Reef - unpublished reports submitted to Australian National Parks and Wildlife Service, Australian Nature Conservation Agency and Parks Australia North officers 1983 to 1998.
- Pielke, R. A. (1990) *The Hurricane*. Routledge, London.
- Pike, G. D. and Leach, G. J. (1997). *Handbook of the Vascular Plants of Ashmore and Cartier Islands*. Parks and Wildlife Commission of the Northern Territory and Parks Australia, Canberra.
- Russell, B.C. and Hanley, J.R. (1993) History and Development, in *Survey of the Marine Biological and Heritage Values of Cartier and Hibernia Reefs, Timor Sea*. Northern Territory Museum of Arts and Sciences, Darwin.
- Simpson, C.J. (1991) Mass spawning of corals on Western Australian reefs and comparisons with the Great Barrier Reef, in *The Leeuwin Current: an Influence on the Coastal Climate and Marine Life of Western Australia*. *Journal of the Royal Society of Western Australia* Vol 74, 85-91.
- Skewes, T.D., Dennis, D.M., Jacobs, D.M. Gordon, S.R., Taranto, T.J., Haywood, M., Pitcher, C.R., Smith, G.P., Milton, D. and Pointer, I.R. (1999). *Survey and Stock Size Estimates of the Shallow Reef (0-15m deep) and Shoal Area (15-50 m deep) Marine Resources and Habitat Mapping within the Timor Sea MOU 74 Box. Volume 1: Stock Estimates and Stock Statuses*. A study funded by RFRRF and Environment Australia. CSIRO Division of Marine Research, Canberra.
- Smith, L., Rees, M., Heyward, A. and Coloquhoun, J. (2002) *Stocks of Trochus and beche-de-mer at Cartier Reef: 2001 Surveys*. Australian Institute of Marine Science, Townsville.
- Stacey, N.E. (1999) *Boats to Burn: Bajo Fishing in the Australian Fishing Zone*. Unpublished PhD thesis, Northern Territory University.

- Stokes, T. and Hinchey, M. (1990). *Which Small Noddies Breed at Ashmore Reef in the Eastern Indian Ocean? Emu* 90, 269-271.
- Swann, G. (2001). *Ornithological Report of Ashmore Reef – November 2001*. Unpublished report to Environment Australia.
- Veron, J.E.N. (1993) Hermatypic Corals of Ashmore Reef and Cartier Island in *Marine Faunal Surveys of Ashmore Reef and Cartier Island, North-western Australia*, ed P.F. Berry. Western Australian Museum, Perth.
- Watkins, D. (1993) A National Plan for Shorebird Conservation in Australia. Australasian Wader Studies Group, Royal Australasian Ornithologists Union and World Wide Fund For Nature. RAOU Report No. 90, Melbourne.
- Wells, F.E. (1993) Molluscs of Ashmore Reef and Cartier Island, in *Marine Faunal Surveys of Ashmore Reef and Cartier Island, North-western Australia*, ed. P.F. Berry. Western Australian Museum, Perth.
- Whiting, S. D. (1999) Use of the remote Sahul Banks, North-western Australia by dugongs including nesting females. *Marine Mammal Science* Vol 15 No.2, 609-615.
- Willan, R. C. (1998). *Molluscs of Ashmore Reef: Field Report*. Unpublished report prepared for Parks Australia North 1998.

Other reference material

- Allen, G. R., Larsen H. K. and Russell, B. C. (1988) *Draft List of Fishes of Ashmore Reef - Cartier Island, Timor Sea*. Unpublished Report of the Northern Territory Museum.
- Berry, P. F. (Ed) (1986) Faunal Surveys of the Rowley Shoals, Scott Reef and Seringapatam Reef, north-western Australia, *Records of the Western Australian Museum*, Supplement No 25.
- Done, T. J., Williams, D. McB., Speare, P., Turak, E., Davidson, J., DeVantier, L. M., Newman, S. J., and Hutchins, J. B. (1994). *Surveys of Coral and Fish Communities at Scott Reef and Rowley Shoals*. (Australian Institute of Marine Science: Townsville, Australia).
- Griffith J. K. (1998) *The Corals Collected During September/October 1997 at Ashmore Reef, Timor Sea - A report to Parks Australia*. (Unpublished report prepared for Parks Australia North 1998).
- Morgan G. J. and Berry, P. F. (1990) Decapod Crustacea of Ashmore Reef and Cartier Island. In *Marine Faunal Surveys of Ashmore Reef and Cartier Island North Western Australia* (Ed. P. F. Berry.) Records of the Western Australia Museum, Supplement No. 44, 1993.
- Russell, B. C. and Vail, L. L. (1988). *Report on Traditional Indonesian Fishing Activities at Ashmore Reef Nature Reserve*. ANPWS Research and Surveys Program (unpublished report).
- Short, J. (1998). Unpublished report to Parks Australia North on the status of Decapod crustacea in the Ashmore Reef National Nature Reserve.

Vail, L. L. and Hoggett, A. (1989) *Draft list of Northern Territory Museum Records of Echinoderms from Ashmore Reef*. (Unpublished report to ANPWS).

Woodroffe, C. D. (1984). *The Geomorphology of Ashmore Reef and Cartier Island*. Preliminary Report on a visit on 15-17th June 1984. North Australia Research Unit, ANU (Unpublished Report).

