

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

Available for download from [http://www.ramsar.org/ris/key\\_ris\\_index.htm](http://www.ramsar.org/ris/key_ris_index.htm).

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

## Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.
2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework and guidelines for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2<sup>nd</sup> edition, as amended by COP9 Resolution IX.1 Annex B). A 3<sup>rd</sup> edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.
3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

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

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Designation date

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Site Reference Number

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

March 27, 2008

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### 3. Country:

United States of America

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### 4. Name of the Ramsar site:

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

Palmyra Atoll National Wildlife Refuge

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

This RIS is for (tick one box only):

- a) Designation of a new Ramsar site ; or  
b) Updated information on an existing Ramsar site

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

**a) Site boundary and area**

The Ramsar site boundary and site area are unchanged:

or

**If the site boundary has changed:**

- i) the boundary has been delineated more accurately ; or  
ii) the boundary has been extended ; or  
iii) the boundary has been restricted\*\*

and/or

**If the site area has changed:**

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

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

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

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**7. Map of site:**

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

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

- i) a hard copy (required for inclusion of site in the Ramsar List): ;  
ii) an electronic format (e.g. a JPEG or ArcView image) ;  
iii) a GIS file providing geo-referenced site boundary vectors and attribute tables .

Two .pdf maps are included which clearly demonstrate the refuge boundaries and its location with the Pacific Region.

One .jpg map is included which shows subsurface bathymetry.

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

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

The boundary is the same as the existing boundaries for the National Wildlife Refuge (NWR) area and The Nature Conservancy's Cooper Island Preserve.

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

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

The coordinates for Palmyra NWR are: 05° 52.3' N 162° 06.0' W

**9. General location:**

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

Palmyra Atoll NWR is located at the northern end of the Line Islands in the equatorial Pacific and falls within the United States Fish and Wildlife Service (USFWS) Pacific Region, which includes; California, Washington, Oregon, Pacific Island Territories and U.S. affiliated States. To the southeast of Palmyra NWR are eight Line Islands that belong to the Republic of Kiribati; to the north is Kingman Reef. Palmyra NWR is approximately 960 nautical miles south of Honolulu, HI.

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

Minimum: 0 m, Pacific Ocean

Maximum: 2 m, unnamed location

**11. Area:** (in hectares) : 204,127.2 ha

Emergent land  
275.2 ha (680 ac)

submerged lands  
203,852.0 ha (503,729.3 ac)

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

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

Palmyra Atoll NWR was established in January 2001 by the Secretary of the Interior and includes submerged lands and associated waters out to 12 nautical miles from the atoll. The Refuge includes 204,127.2 ha. (504,409.3 ac) of which 275 ha are terrestrial and 203,852.0 ha are submerged. The terrestrial 130 ha on Cooper-Menge Island are owned by The Nature Conservancy. The atoll, consisting of a ring of interconnected islands and islets surrounding three small sub-lagoons, is at the center of a large shallow coral platform approximately 12 miles long and 3 miles wide.

**13. Ramsar Criteria:**

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

- |                          |   |                                     |   |                          |   |                                     |   |                                     |   |                                     |   |                          |   |                          |   |                          |
|--------------------------|---|-------------------------------------|---|--------------------------|---|-------------------------------------|---|-------------------------------------|---|-------------------------------------|---|--------------------------|---|--------------------------|---|--------------------------|
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**14. Justification for the application of each Criterion listed in 13 above:**

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

**Criterion 2:**

Of all Pacific islands under U.S. control, Palmyra Atoll is unique in terms of latitude and vegetation. Its high rainfall and complex vegetation structure make it very different from all of the other seabird colonies within the National Wildlife Refuge System. Its *Pisonia grandis* equatorial forest is considered to be a globally imperilled ecosystem and is one of only two such forest communities under U.S. jurisdiction in the Pacific. The Mapou tree of Seychelles (*Pisonia grandis*) is found most often on small islands that have seabird colonies, where it is often the dominant forest tree and provides favoured nesting sites for terns and noddies.

There are three species designated as threatened or endangered by the Endangered Species Act (ESA) of 1973 that have been documented at Palmyra Atoll. The critically endangered (IUCN 2010) Hawaiian monk seal (*Monachus schauinslandi*) is occasionally seen off Palmyra NWR. Also, sperm whales (*Physeter macrocephalus*) classified as vulnerable on the IUCN Red list and bottlenose dolphins (*Tursiops sp.*), Spinner dolphins (*Stenella longirostris*) are occasional visitors at Palmyra NWR. In addition, pods of an undescribed species of beaked whale are offshore residents (Dalebout et al, October 2007).

The Palmyra Atoll has been noted as a significant foraging habitat for the Green Sea Turtle (*Chelonia mydas*), and the Hawksbill turtle (*Eretmochelys imbricata*) has also been observed in the atoll's waters, although nesting activity at Palmyra is thought to be rare. Under the US Endangered Species Act green sea turtles are listed as Threatened except where they are Endangered (nesting colonies in Florida and Pacific Mexico), and hawksbill sea turtles are listed as Endangered. In addition, sea turtles are listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and green sea turtles are listed as Endangered, while hawksbills are Critically Endangered, on the World Conservation Union's IUCN Red List of Threatened Species. These species are threatened worldwide due to harvest, fisheries interactions, habitat loss, climate change, pollution, disease, and other factors.

The Bristle-thighed Curlew (*Numenius tahitiensis*) is registered as Vulnerable by Birdlife International and the IUCN Red List, Yellow by the Audubon Watchlist, and Yellow by the American Bird conservancy.

**Criterion 4:**

Bristle-thighed Curlews (*Numenius tahitiensis*) regularly use Palmyra Atoll for two critical stages of their lives. Birds first use the Atoll after having fledged in northern areas like Alaska. The fledglings fly to Palmyra and stay on the atoll for a year or more as they mature to adulthood. Adult birds then return annually to Palmyra to overwinter the northern winter season. Up to five percent of the known population of Bristle-thighed Curlews (*Nemenius tahitiensis*) uses Palmyra for these purposes.

**Criterion 5**

Palmyra NWR is an important marine feeding ground for seabirds since it is the only nesting area available within 450,000 square miles of ocean (Flint 1992). Located on the boundary

between the North Equatorial Countercurrent and other ocean currents in the vicinity, more than a million nesting seabirds visit the atoll.

Palmyra NWR supports the third largest Red-footed Booby (*Sula sula*) colony in the world. The atoll also supports healthy populations of Brown Noddy (*Anous stolidus*) and Brown Booby (*Sula leucogaster*).

Palmyra shelters approximately 20,000 black noddies (*Anous minutus*), the largest nesting colony in the central Pacific (USFWS 2001a).

The sooty tern (*Onychoprion fuscata*), commonly found throughout the tropical Pacific Ocean, is an abundant resident of Palmyra Atoll. Evidence suggests that sooty terns may have two breeding seasons on Palmyra. An estimated 260,000 birds and 126,000 nests were reported in 1987. A 1993 survey estimated a total of 750,000 sooty tern nests at Palmyra. The most recent seabird survey in 2002 found 139,734 sooty terns. The high density of introduced nest-predating rats greatly reduces ground nest success and fledging rates of sooty terns at Palmyra.

Other seabird nesters include the Great Frigatebird (*Fregata minor*), Sooty Tern (*Onychoprion fuscatus*), White Tern (*Gygis alba*), Red-tailed Tropicbird (*Phaeton rubricauda*), and Masked Booby (*Sula dactylatra*).

Despite the recent decline of *Pisonia* atoll forests, White-tailed Tropicbirds still nest at Palmyra.

#### **Criterion 6**

Palmyra Atoll supports up to five percent of the known population of Bristle-thighed Curlews (*Numenius tahitiensis*). A total of 227 Bristle-thighed Curlews were counted at Palmyra in 1992, a high number considering that the Pacific population totals only 7,000 birds.

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

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

#### **a) biogeographic region:**

Within the region stretching from the Red Sea east to the central Pacific Ocean, Ekman (1953) proposed a bio-geographic region for warm water fauna, termed the Indo-west Pacific marine faunal region. Within the Pacific Ocean, Ekman identified four sub-regions based upon endemism and distribution patterns of key fauna: 1) the islands of the Central Pacific excluding Hawaii, 2) Hawaii, 3) subtropical Japan, and 4) Australia. The dramatic west-to-east attenuation in the diversity of shallow water stony corals across the Pacific Ocean was further quantified by Stehli and Wells (1971) and Veron (1986; 1993; 2000). Stoddart (1992) compiled similar diversity attenuation patterns for several other groups of reef biota and wetland vegetation, and proposed several geological provinces to further characterize and explain the regional biogeography of the tropical Pacific. The largest of these provinces is the **Pacific geological province of low reef islands and atolls** that stretches from Micronesia in the northwestern tropical Pacific to French Polynesia in the southeastern tropical Pacific. The Line and Phoenix Islands (including Palmyra NWR) lie near the middle of this geological province at the geographic center of the Pacific Ocean, straddling the Equator and just east of the International Dateline. The two chains account for 23 of the approximately 300 atolls and low reef islands within the Pacific Ocean (Bryan 1953; Dahl 1991; Maragos and Holthus 1995).

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

Stoddart DR (1992) Biogeography of the tropical Pacific. Pac Sci 46:276-93

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

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

Palmyra NWR is an elliptical reef 20 km in length with unusual elongated fore reef terraces extending 3- 5 km in breadth off the east and west ends of the atoll from depths of 7-25 m. The central part of the atoll is encircled by shallower perimeter reefs that supported up to 50 islets and three sub lagoons separated by shallow north-south linear reefs before 1940. Beyond the eastern end of the lagoon and ring of islets are three large reef pool complexes (3-15 m deep), one deeper and circular in shape, just east of East Lagoon and the other two elongated depressions further east in the otherwise expansive shallow eastern reef flat (1-5 m depth). No natural deep passes originally connected the lagoons to ocean areas.

Palmyra NWR is located on a broad ridge-like area that is over 1100 km long and up to 280 km wide. Palmyra NWR has a secondary peak rising to less than 1000 m about 3 nautical miles to the west of the atoll. The northern flank of the atoll is extremely steep with canyons cutting into the sides to very shallow depths, but the southern flank is more gradual. Extensive evidence of mass wasting is seen everywhere except on this steep northern flank. Except for areas in depths less than 20 m, there is no evidence of shelves that would indicate previous sea-level stands, on the flanks of either Palmyra NWR or Kingman Reef.

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

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

Climate: equatorial, hot; located within the low pressure area of the Intertropical Convergence Zone (ITCZ) where the northeast and southeast trade winds meet, it is extremely wet with between 4,000-5,000 mm (160-200 in) of rainfall each year.

Geology: The Palmyra atoll was formed by the growth of coral reefs along the rim of an ancient volcano (Cat 2000), and subsequent erosion of volcanic lands. At first, the coral adhered to the volcanic island, forming a fringing reef. As the volcanic lands began to erode, the reef separated from the shore, creating a barrier reef. Finally, the volcano completely submerged leaving only the coral reef, circling a lagoon (Maragos unpublished).

The reef that makes up Palmyra Atoll is constructed of limestone, a sedimentary rock composed largely of calcium carbonate. This chemical compound is secreted as skeletal material by corals and calcareous algae. These corals have a symbiotic relationship with single-celled microalgae, called zooxanthellae, which are found in their body tissues (Buddemeier et al 2004). While the algae supplies a vital photosynthetic food, the coral provides nutrients, protection, and access to light. The symbiosis results in continual coral skeletal growth. The exact depth of the coral reef at Palmyra is unknown (Maragos unpublished).

Each islet has a thin layer of soil and organic material over the limestone base. Under the thin organic plant layer, the brown sandy soil ranges from four to 12 inches thick. The uppermost layer, which is approximately 10 cm thick, is composed of dark gray and very dark gray brown,

silty sand. The second layer is characterized by a pinkish white fine to very fine sand, as well as an abundance of cobbles and coralline gravel (Aronson and Anderson 2000). The organic matter and acidity of the soil varies throughout the atoll (USFWS 2001a).

Early analysis of Holei Islet found that the dark organic soil on the southwestern interior portion had a pH ranging between 5.0 and 6.5. Beneath a shallow layer of damp brown or black mold lies a phosphatized coral hard-pan measuring 10 to 20 cm thick. This hard-pan was found to contain about 30 percent Phosphorus Pentoxide and 28 percent Calcium Oxide (Hutchinson 1950). No phosphatic coral hard-pan was present on the eastern portion of Holei Islet and the soil was alkaline and contained less organic matter (Hutchinson 1950). Above the phosphatized hardpan found on Papala Island, there is a layer of dark brown or black, acidic, peaty mold (Hutchinson 1950). Shoreline erosion is prevalent along the seaward side of the northern islands (Maragos 1988).

**18. Hydrological values:**

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

Although Palmyra receives a high amount of rainfall, the porous surface prevents the occurrence of any freshwater wetlands (Scott 1993). There is no significant groundwater source on any of the islets. Potable water was and is supplied via rainwater catchments (Lyons, personal communication).

**19. Wetland Types**

**a) presence:**

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

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

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

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

**b) dominance:**

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

C. Coral Reef ; A. Permanent shallow marine waters; I. Intertidal forested wetlands

**20. General ecological features:**

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

With an average annual rainfall of more than 4 m, Palmyra is a wet atoll within the Inter-tropical Convergence Zone (Mueller-Dombois and Fosberg 1998). This high rainfall, coupled with high nutrient influx in the form of guano from thousands of resident seabirds and migratory shorebirds, supports thickly vegetated rain forest that is unique even in comparison with nearby, more arid islands such as Kirimati (Wester 1985).

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## 21. Noteworthy flora:

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

Palmyra has one of the largest remaining undisturbed *Pisonia* forests in the Pacific. Increased human population and development has caused this vegetation community to degrade or disappear throughout its historic range. Even *Pisonia* forests in protected areas, such as the Rose Atoll NWR, lack the diversity and moisture present at Palmyra (USFWS 2001a). *Pisonia* trees at Palmyra range between 70 to 100 feet in height (Herbst 1992). Characteristic of *Pisonia* forests elsewhere, the buttresslike roots and spreading canopy create an absence of undergrowth and other tree species (Walker 1991). This community supports several native ferns including bird's nest fern (*Asplenium nidus*) and lau'ae fern (*Phymatosorus scolopendria*), and the introduced sword fern (*Nephrolepis hirsutula*). The *Pisonia* forests are extremely important to the terrestrial and marine ecosystems at Palmyra. Providing nesting and roosting sites for numerous seabirds, they also promote guano fall as a fertilizer source and supply food and nutrients supporting life in the understory (PARC 2004).

Prior to Polynesian occupation, the likely dominant vegetation type at Palmyra was the *Pisonia* forest. Evidence suggests that the forests were probably cleared for firewood or to help establish coconut trees (Flint 1992). Seabirds are the primary dispersal agent of this type of vegetation; anthocarps of *Pisonia grandis* have a sticky resinous substance that binds them to bird feathers or other surfaces (Walker 1991). However, the trees can also spread asexually by vegetative means.

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## 22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 12, Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Research to date has revealed that sea turtles ranging from juveniles to adults occur year-round throughout the waters of Palmyra Atoll (Fefer 1987, Balazs 1995, Depkin 2002, Sterling and Naro-Maciel 2005, 2006a, 2006b, 2006c, 2006d). Green sea turtles were observed most frequently, and hawksbills were seen to a lesser extent. In atoll-wide surveys throughout the year, the mean number of turtles counted depended on weather and visibility conditions, but the maximum number seen during the roughly 2-hour count periods was 112 (Naro-Maciel et al. 2007c; Holmes et al. 2008). During a US government survey in 1987, 40 turtles were observed outside the reef and an additional 10 turtles were seen in the hole east of Eastern Island (Fefer 1987). Most of the Green Sea Turtles were adults foraging on *Collerpa* spp. Three to five nests were reported and one of the nests included approximately 50 eggs. Nesting for the *C. mydas* has primarily been observed on the wide sandy beach of the northwestern portion of Cooper Island. Other islands that comprise the atoll are less conducive to marine turtle nesting activity due to the narrow area and lack of sand during high tide (Fefer 1987). During the FWS visit in 1992 (Flint 1992), 10 to 15 large turtles were seen in a shallow reef pool just east of Eastern Island. Green Sea Turtles are known to have strong nesting site fidelity and often make long distance migrations between resident feeding grounds and nesting beaches (USFWS 2005c).



Listed as endangered in November 1976, the Hawaiian Monk Seal (*Monachus schauinslandi*) has been reported outside Palmyra Atoll on two separate occasions. The most ideal habitat for this species are remote, uninhabited atoll such as Palmyra. Since 1989, the Hawaiian Monk Seal population has declined at approximately 11 percent per year. Between 1,300 and 1,400 monk seals are estimated to reside in the Hawaiian island chain, making this species the most endangered marine mammal in the U.S. Human activities, interactions with fisheries, mobbing of females by males, and shark predation have been identified as the most significant threats to the population (<http://www.fws.gov/pacificislands/wesa/monkhi.html>). This species is also federally protected under the Marine Mammal Protection Act of 1972 (SWCA Environmental Consultants, Inc 33).

A population of melon-headed whales, (*Peponocephala electra*), are resident off Palmyra NWR (Brainard et. al. 2005).

Rare occurrences of the sea cucumber *Holothuria atra*, the echinoid *Echinobrix calamaris*, and the asteroid *Echinaster luzonicus* have been recorded on the fore reef. The holothurians *Holothuria atra*, *Holothuria edulis*, and *Stichopus chloronotus* can be found commonly in restricted shallow habitats in the lagoon.

The giant clam *Tridacna maxima* is present in low numbers on the southern reef and at the southeastern back reef and shallow “coral gardens” pool habitat.

Additional noteworthy species at Palmyra:

When its breeding grounds were finally found, the Bristle-thighed Curlew (*Numenius tahitiensis*) became one of the last North American birds to have its nest and eggs described. Although the species was known to winter and over-summer in scattered small flocks across the Solomon Archipelago out through the central Pacific and up into the northwestern Hawaiian Islands, the nest, eggs, and locality of breeding areas were not described until the late 1940s. We now know that this species nests in remote tundra in two areas of western Alaska and winters (with subadults over-summering before their first breeding season) on atolls and small islands across Oceania. Intensive efforts to study this bird year-round were initiated in the late 1980s. Surveys of suitable habitat in the two breeding areas yielded an estimate of fewer than 3,500 breeding pairs; including subadults that over-summer in Oceania, the total global population is unlikely to exceed 10,000 birds.

All Bristle-thighed Curlews fly at least 4,000 km nonstop between Alaska and the northern end of the winter range in the Northwestern Hawaiian Islands. Studies of marked birds on Laysan Island revealed that curlews wintering in the Central and South Pacific overfly the Northwestern chain during spring and fall migration, making nonstop flights in excess of 6,000 km twice each year. Thus, along with Bar-tailed Godwits (*Limosa lapponica*), Bristle-thighed Curlews make one of the longest nonstop flights known for any bird.

On Palmyra, the Bristle-thighed Curlew (*Numenius tahitiensis*) has a wintering and non-breeding resident presence, numerically second in abundance only to the Pacific Golden Plover (*Pluvialis fulva*) among wading birds recorded from the atoll. The species forages extensively across Palmyra's intertidal systems, including mudflats, sandflats, and back reef areas. The birds roost on the larger of the atoll's islets and tend to move about in conspecific and mixed-species flocks alike.

On Palmyra, surveys of over-summering juveniles have confirmed the importance of the atoll in curlew life history and suggest that more intensive monitoring into the future is imperative. Recent American Museum of Natural History curlew counts ( $\geq 50$  birds on all count days) during the northern breeding season of this species suggest Palmyra is a significant summering area for non-breeding subadult birds that over-summer in Oceania. Counts in similar habitats in the southern Line Islands, Fiji, and the Solomons suggest Palmyra supports relatively high densities of this species. Although its tundra breeding grounds have remained largely undisturbed, the Bristle-thighed Curlew probably suffers from predation by exotic mammals and direct and indirect mortality due to human disturbance on its oceanic wintering grounds. Thus, its numbers may be declining, although data on population trends are lacking.

See Attached Map (appendix 2) red shaded areas represent locations where Bristle-thighed curlews have been observed on Palmyra. Yellow shaded areas represent areas where nesting Masked Boobies have been observed.

Lastly, Dalebout et al (2007) have analyzed two Beaked Whale carcasses collected on Palmyra Atoll. They found that in numerous important areas the specimens did not correlate with any other known species of *Mesoplodon* Beaked Whale. This important new finding further emphasizes Palmyra's significance not only biologically but also as an important protected zone in an otherwise unprotected area of the Pacific.

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### 23. Social and cultural values:

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

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

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

- i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
- iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

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**24. Land tenure/ownership:**

a) within the Ramsar site:

state-owned

U.S. Department of the Interior, Fish and Wildlife Service, c/o

Pacific Remote Islands National Wildlife Refuge Complex,

300 Ala Moana Blvd., Rm 5-231, Box 50167

Honolulu, HI 96850

Attn: Susan White, Project Leader

The Nature Conservancy in Hawaii, c/o

Palmyra Program Director

923 Nuʻuanu Avenue

Honolulu, HI 96817

Attn: Anders Lyons, Director

(Owner of Cooper Island at Palmyra Atoll)

In 2000, TNC purchased Palmyra, and later the U.S. Department of Interior bought all reefs and islands from TNC except for the main island (Cooper), its airfield, and dock.

b) in the surrounding area:

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

a) within the Ramsar site:

Funded by the Gordon and Betty Moore Foundation and built at a cost of \$1.5 million, The Conservancy built a research station on Cooper Island in 2005.

b) in the surroundings/catchment: No documented inhabitants. There is not enough land for permanent long term development.

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

a) within the Ramsar site:

Early visitors characterized the atoll as one of the "Pearls" of the Pacific and Polynesia and a "necklace of emerald islets" (Boddam-Whetham 1876, Bryan 1940, and Wright 1948. Beginning in 1939, the U.S Navy dredged a 9 m deep and 60 m wide ship channel through the shallow perimeter reef between the southwest ocean reef and West Lagoon, dredged the reef separating the West and Center Lagoons to a depth of 3 m for a seaplane runway, and connected all but a few islets by constructing elevated road causeways on the shallow perimeter reefs around most of West and Center Lagoons. East Lagoon, including a north-south road causeway on the elongated reef wall separating West and East Lagoons was completely encircled and cut off from surface water circulation with adjacent reefs. Three small runways were also constructed in Center Lagoon. The main island (Cooper-Menge) was also greatly enlarged to support a larger, 1,800 m long runway, a deep draft dock and other facilities.

Corals, crustose coralline algae, and other typical lagoon reef species are almost entirely absent on lagoon reefs, a lasting legacy of earlier military dredging and filling operations. The most unique and healthy habitats are the two shallowest and easternmost of the reef pools off the southeast and northeast corners of the shallow eastern reef flat. These are dominated by crustose coralline algae and many species of *Acropora*, *Montipora* and *Astreopora* and *Pocillopora*, and are

commonly referred to as the “coral gardens”. Other healthy reef substrates occur along the entire north ocean-facing reef slopes of the atoll where many species of corals, algae, reef fish and invertebrates thrive and were apparently unaffected by the recent coral die-off event.

*Halimeda* sands are prevalent in the fore reef habitats of Palmyra NWR although nearly absent from comparable habitats at Kingman. Stony and soft corals on the southern half of the western reef terrace and southern ocean-facing reef slopes are recovering rapidly from a massive die-off (possibly bleaching, *Acanthaster* predation or storm damage) that occurred between surveys in 1987 and 1998.

*Pisonia grandis* is currently showing signs of canopy loss at Palmyra NWR. This decline is attributed to a severe infestation by a Caribbean scale insect, *Pulvinaria urbicola*. The *Pisonia* forests were originally found to be under attack by a high density of the scale in August of 2001. It is unknown exactly when or how the scale first arrived on the atoll, but studies show its presence is severely affecting tree health (Depkin 2002, Wegmann 2004). *P. urbicola* has a mutualistic relationship with an introduced ant, *Pheidole megacephala*. This ant feeds on the honeydew produced by *P. urbicola*, while the scale obtains protection from natural enemies and movement to new host plants. As a result, the high ant density is facilitating the population explosion of the scale insect. The scale insect is dispersed among the trees on the feathers and legs of seabirds (Walker 1991).

This research estimated a further reduction in *Pisonia* forest coverage, with only 12 percent of the atoll’s vegetated area consisting of *Pisonia* forests. 4,914 *Pisonia* trees were documented on fourteen of Palmyra’s vegetated landmasses (Wegmann 2004). In the 2004 study, approximately 61 percent of the *Pisonia* trees were infected with scale. Of those infested with scale, 94 percent were determined to have a tree condition of 3 (20% < canopy < 50%, a few green leaves) or 4 (canopy < 20%, no green leaves). 33 percent of the trees were reported fallen. About half of the *Pisonia* population had a DBH (Diameter at Breast Height) of less than 20 cm (Wegmann 2004). Similar coralline islands infected by *P. urbicola* have experienced island-wide mortality of *P. grandis* (Smith et al 2004). It is unknown exactly how the scale promotes canopy loss.

This decline has caused dramatic changes in the ecosystem at Palmyra. It is speculated that as the *Pisonia* forest declines, dense undergrowth of fern and sprouting palm nuts may change the microclimate of the forest floor (Pacific Island Fisheries Science Center 2004). The effect of this type of loss on the coral reef and marine ecosystem remains unknown.

b) in the surrounding area:

No documented inhabitants. There is not enough land for permanent long term development.

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## 27. Conservation measures taken:

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

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

Palmyra Atoll is a National Wildlife Refuge (NWR) administered by the U.S. Fish and Wildlife Service.

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

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

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

The Comprehensive Conservation Plan for Palmyra Atoll and Kingman Reef National Wildlife Refuges are currently under development with an estimated completion date of 2012.

d) Describe any other current management practices: Refuge designation closes the sites to all public uses unless the Refuge Manager evaluates each via a permit application and issues a special use permit prior to entry. The permitting process undergoes careful technical and administrative review to determine whether the proposed use or entry is compatible with the original purposes of each Refuge and meets the requirements of a compatibility determination for each. All proposed uses and entries also must comply with the “wildlife first” mandate of the National Wildlife Refuge System Administration and Improvement Acts. Commercial fishing and other commercial activities are prohibited within refuges, and compatible uses normally include non-destructive conservation research, monitoring, birding, wildlife photography, environmental education and other low impact uses. Due to the concern over alien species, all visitors landing at any refuge island must comply with quarantine procedures, since substantial efforts are constantly being made to rid the islands of aliens and undesirable invasive species.

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

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

The Fish and Wildlife Service is currently preparing for the development of a Comprehensive Conservation Plan for Palmyra. The CCP is expected to contain a step-down science plan, and the framework for both forest management and lagoon restoration plans. Service staff participated in The Conservancy’s comparable planning process called a Conservation Action Plan which identified forest management and lagoon restoration plans as important aspects of the initiation of conservation actions on Palmyra. In addition removing rats from the atoll and developing a comprehensive alien species prevention protocol were high priorities. See attached overview of The Conservancy’s CAP for additional details. Implementation of conservation actions will be a comprehensive and joint undertaking between the US Fish and Wildlife Service and The Nature Conservancy.

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

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

In 2005, The Nature Conservancy established a field research station capable of housing up to 20 scientists and staff on Cooper Island which is now maintained by several caretakers.

The Palmyra Atoll Research Consortium (PARC), established in 2005, is a ten member research consortium whose mission it is to: “... undertake collaborative research to understand terrestrial, marine, and climate systems of Palmyra Atoll and the central Pacific that advances the conservation of island and coastal systems worldwide.” At present the American Museum of Natural History, California Academy of Science, Scripps Institution of Oceanography of the University of California (UC) at San Diego, Stanford University, UC at Irvine, UC at Santa Barbara, University of Hawaii, and Victoria University of Wellington, United States Geological Survey and The Nature Conservancy are all members or affiliates of PARC. In addition,

Stanford, Scripps, UC Santa Barbara and other PARC institutions have sponsored recent expeditions to Kingman Reef and neighboring Kiribati islands and atolls in the northern Line Islands (Teraina, Tabuaeran, Kiritimati). The research programs taking place in the site are shown in Appendix 1.

Palmyra's new wood-frame research station has residential facilities in the form of 16 small cottages for up to 32 staff and researchers, a kitchen facility, a separate laboratory complex, a new septic system and diesel-generated electricity. In addition the facility includes a research lab complex, 100,000-gallon fresh water catchment, 24-hour electricity. A 25-foot offshore research boat and a high-volume compressor system were purchased to expand marine research capabilities in August of 2006.

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

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

U.S. Fish and Wildlife Service Coral Fact Sheet - Palmyra Atoll National Wildlife Refuge. -The Nature Conservancy informational website:

<http://www.nature.org/wherewework/asiapacific/palmyra/>

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**31. Current recreation and tourism:**

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

TNC and USFWS staff that are deployed to Palmyra NWR to manage the research station and NWR participate in recreational activities for an average of 0.5-0.75 days per person per week. Detailed logs of all recreational activities in the Refuge (snorkeling, diving, swimming, boating, sport fishing, kayaking and wildlife observation and photography) are maintained by the USFWS.

Palmyra has historically been a popular stopover for yachts sailing in the central Pacific because of safe anchorage and plentiful freshwater. Yachts are still permitted by the NWR to visit Palmyra, but are limited to 7-day stays. Nine recreational yachts visited the Palmyra Atoll NWR in 5 months. Six of these vessels pre-arranged their visits, and 3 were unannounced. The average number of passengers and crew aboard was three per vessel and the average stay was 5 days per vessel. During this 5-month period, a total of 165 visitor use days were recorded on the Refuge from visiting yachts. Visiting yachters also participated in above recreational activities.

The Nature Conservancy also brings staff and Conservancy supporters to Palmyra for conservation and educational purposes. In 2006 this comprised three-five day visits by twelve staff and visitors. Trip participants were accommodated on the Conservancy's Cooper Island and participated in the above recreational activities in the refuge.

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**32. Jurisdiction:**

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

U.S. Department of the Interior, Fish and Wildlife Service, c/o  
Pacific Remote Islands National Wildlife Refuge Complex,  
300 Ala Moana Blvd., Rm 5-231, Box 50167  
Honolulu, HI 96850  
Attn: Don Palawski, Refuge Manager

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### 33. Management authority:

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

1) U.S. Department of the Interior, Fish and Wildlife Service, c/o  
Pacific Remote Islands National Wildlife Refuge Complex,  
300 Ala Moana Blvd., Rm 5-231, Box 50167  
Honolulu, HI 96850  
Attn: Don Palawski, Refuge Manager

2) The Nature Conservancy in Hawaii, c/o  
Palmyra Program Director  
923 Nu'uuanu Avenue  
Honolulu, HI 96817  
Attn: Anders Lyons, Director  
(Owner of Cooper Island at Palmyra Atoll)  
In 2000, TNC purchased Palmyra, and later the U.S. Department of Interior bought all reefs and islands from TNC except for the main island (Cooper), its airfield, and dock.

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



## Appendix 1

Table 1. Research Programs in the Pacific Remote Island Areas, including Palmyra NWR.

Program	Objectives	First Year	Funding	Agencies
Seabird Monitoring	Nesting seabirds, migratory shorebirds	1985	DOI	USFWS
Oceanographic Monitoring	Water chemistry, Circulation patterns Tide and temperature monitoring Educational water sampling & oceanographic measurements	2000	NOAA	PIFSC-CRED
	Carbonate production & water column movement	2006 2006	SEA TNC/FWS	SEA PARC
Coral Monitoring	permanent coral/clam monitoring sites	2000	DOI	FWS
	Microbial diversity & corals	2006	NOAA	PIFSC-CRED
	Benthic dynamics	2006	TNC/FWS	PARC
	Coral recovery mechanisms	2006	TNC/FWS	PARC
	Octocoral diversity	2006	TNC/FWS	PARC
Habitat Mapping	Produce moderate depth habitat maps	2001	NOAA	PIFSC-CRED
	Algae monitoring	2003	NOAA	PIFSC-CRED
Marine Mammal & Reptile Monitoring	Monitor and assess populations	2006	NOAA	PIFSC
	Sea turtle assessments	2006	DOI TNC/FWS	USFWS PARC
Fisheries Monitoring	Monitor and assess fisheries stocks	1950	NOAA	PIFSC
	Reef fish monitoring	2000	NOAA	PIFSC-CRED
	Blacktip shark monitoring	2006	TNC/FWS	PARC
	Dynamics of larval fish	2006	TNC/FWS	PARC
	Compare fish populations	2006	TNC/FWS	PARC
	Apex predators & reef ecosys.	2006	TNC/FWS	PARC
	Production and energy flow of fishes	2006	TNC/FWS	PARC
	Mullet and gobi diversity	2006	TNC/FWS	PARC
	Bonefish diversity & post-release stress	2006	TNC/FWS	PARC
Other biological studies	Opisthobranch mollusk recovery	2006	TNC/FWS	PARC
	Octopus and stomatopod diversity	2006	TNC/FWS	PARC
	Bottom dwelling diversity	2006	TNC/FWS	PARC
	Barnacle diversity	2006	TNC/FWS	PARC
	Polychaete diversity	2006	TNC/FWS	PARC
	Echinoderm diversity	2006	TNC/FWS	PARC
Geological studies	Palmyra lagoon changes due to WWII	2006	TNC/FWS	PARC

Numbers of corals, densities, mean diameters, generic diversity, and % coral cover reported at 13 rapid ecological assessment sites at Palmyra Atoll National Wildlife Refuge in March 2006.

PAL REA site #	Palmyra coral populations 2006													totals/ genus	% of total
	25	10	19	26	11	5	9	1	21	12	20	16P	15P		
Atoll locale	E	SE	SW	SW	W	NW	SW	S	N	N	N	SW	E		
mean diam	22.7	18.2	19.9	24.4	17.2	14.8	14.7	12.5	16.1	14.6	15.7	13.7	24.3		
Frequency	12.6	13.5	19.2	11.8	11.3	10.2	8.5	4.1	11.3	27.4	18.8	4.5	11.6		
# of genera	24	26	23	22	20	22	18	11	21	21	24	7	10		
<b>coral genera</b>															
<i>Acropora</i>	3	2	1	1		2	3		1	14	3	14	208	<b>252</b>	3.1
<i>Astreopora</i>				4		1							33	<b>38</b>	0.47
<i>Cladiella</i>		3				1			21		2			<b>27</b>	0.33
<i>Cycloseris</i>			3	2										<b>5</b>	0.061
<i>Fungia</i>	29	56	30		52		8	37	13	28	225	20	6	<b>506</b>	6.2
<i>Stereonephthya</i>	5	1		23		15								<b>44</b>	0.54
<i>Distichopora</i>					1									<b>1</b>	0.012
<i>Echinophyllia</i>		1								2				<b>3</b>	0.036
<i>Favia</i>	26	57	38	22	11	8	27	8	17	66	41	4	6	<b>331</b>	4.1
<i>Favites</i>	1	11	25	14	4	11	17		3	50	23			<b>159</b>	1.96
<i>Gardineroseris</i>		8	1				1							<b>10</b>	0.12
<i>Halomitra</i>	3													<b>3</b>	0.036
<i>Herpolitha</i>		1	1	1	4	1			1	4	3			<b>16</b>	0.2
<i>Heteractis</i>	1													<b>1</b>	0.012
<i>Hydnophora</i>	8	8	21	18		6	21		4	20	10			<b>116</b>	1.43
<i>Leptastrea</i>	4	7	8	2	3	10			3	18	10		21	<b>86</b>	1.06
<i>Leptoseris</i>	13	16	9	1		4	2	1	10	16	13			<b>85</b>	1.05
<i>Lobophyllia</i>	8	42	5		1		1	15			39			<b>111</b>	1.37
<i>Millepora</i>											1			<b>1</b>	0.012
<i>Montastrea</i>	2	4	12	22	1	15	8	1	1	54	9		3	<b>122</b>	1.5
<i>Montipora</i>	9	13	15	24	27	13	13	1	8	16	21	41	275	<b>476</b>	5.9
<i>Pachyclavularia</i>									39	54				<b>93</b>	1.14
<i>Palythoa</i>	9	12	8	9		10	3		23	16	2			<b>92</b>	1.13
<i>Pavona</i>	43	81	71	69	133	23	61	20	62	120	121	7	8	<b>819</b>	10.1
<i>Platygyra</i>	4	1	15	5	2	3			1	28	6			<b>65</b>	0.8
<i>Pocillopora</i>	28	92	126	96	83	66	137	58	49	80	211	140	53	<b>1219</b>	15
<i>Porites</i>	194	131	228	189	91	109	68	58	87	222	83		2	<b>1462</b>	18
<i>Psammocora</i>	1	7	9		2	5	3	3	15	8	8	1		<b>62</b>	0.76
<i>Rhodactis</i>					4									<b>4</b>	0.049
<i>Sandalolitha</i>			1											<b>1</b>	0.012
<i>Sarcophyton</i>	34	22	11	15		70	16		34	264				<b>466</b>	5.7
<i>Stylaster</i>	24	4		6	15		2				4			<b>55</b>	0.68
<i>Stylophora</i>	13	2			68						1			<b>84</b>	1.03
<i>Turbinaria</i>	35	10	151	53	5	28			19	32	21			<b>354</b>	4.36
<i>Lobophytum</i>	97	85	171	13	60	111	37	4	153	266	83			<b>1080</b>	13.3
<b>totals per site</b>	<b>502</b>	<b>676</b>	<b>960</b>	<b>591</b>	<b>567</b>	<b>512</b>	<b>428</b>	<b>206</b>	<b>564</b>	<b>1368</b>	<b>940</b>	<b>227</b>	<b>582</b>	<b>8123</b>	<b>101</b>
<b>% coral cover</b>	<b>49.4</b>	<b>31.4</b>	<b>66.7</b>	<b>65.5</b>	<b>33.6</b>	<b>20.2</b>	<b>18.1</b>	<b>6.3</b>	<b>21.3</b>	<b>71.5</b>	<b>35.2</b>	<b>5.81</b>	<b>54.4</b>	<b>mean</b>	<b>36.8%</b>