



U.S. Fish & Wildlife Service

# Rose Atoll National Wildlife Refuge

Rose Atoll is located at 14° 32' S and 168° 08' W, approximately 130 nautical miles east-southeast of Pago Pago Harbor, American Samoa, and is the easternmost Samoan island. It is the southernmost unit of the National Wildlife Refuge System and shares the distinction with Jarvis Island of being the only National Wildlife Refuge located south of the equator.

Rose Atoll is nearly square, with the ocean-side slopes about 1.5 miles in length. It is one of the smallest atolls in the world, consisting of two low sandy islets, Rose and Sand. Each is located on a coralline algal reef enclosed by a lagoon. A single channel 8 feet deep links the lagoon to the sea. The lagoon is about 1.2 miles wide and up to about 65 feet deep. Rose and Sand Islands cover areas of about 14 and 7 acres respectively. The submerged lands and waters within the Refuge (out to 3 nautical miles) include approximately 39,066 acres.

Rose Atoll is part of the Territory of American Samoa and was established as a National Wildlife Refuge by cooperative agreement between the Government of American Samoa and the Bureau of Sport Fisheries and Wildlife on July 5, 1973. Public notice in the Federal Register was published April 11, 1974. On February 1, 1975, President Gerald Ford, by Proclamation No. 4347, exempted Rose Atoll from a general conveyance of submerged lands around American Samoa to the American Samoa government. He stated the submerged lands out to 3 nautical miles around Rose Atoll would

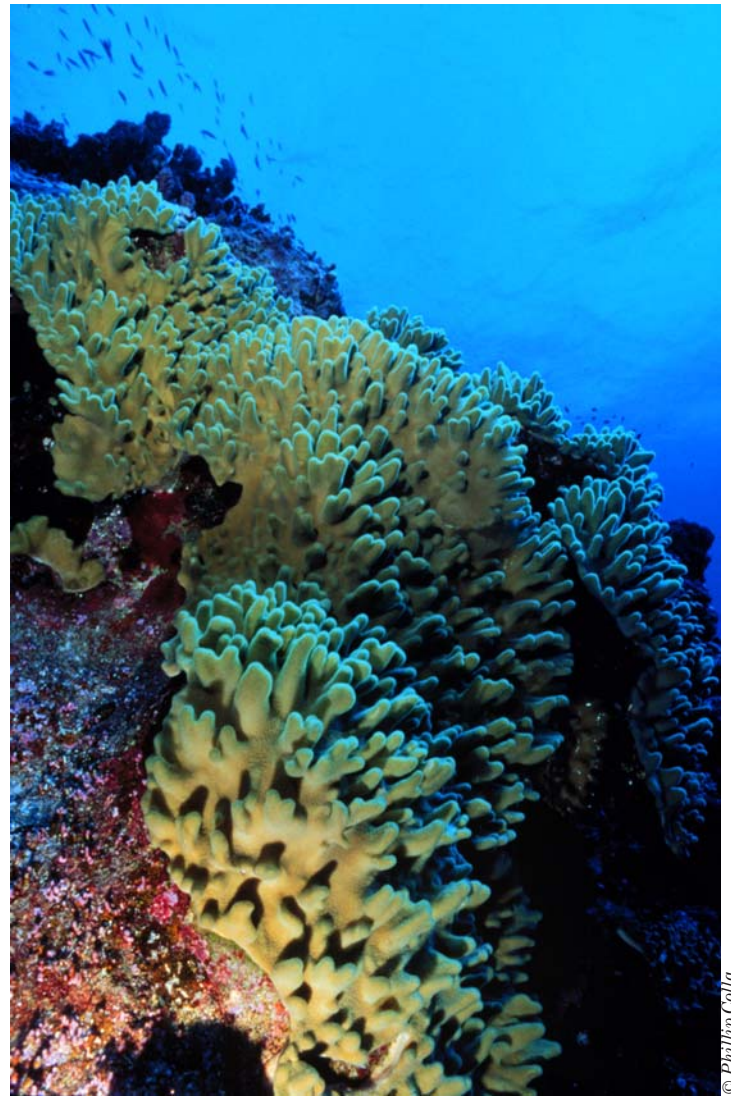
be under the joint jurisdiction of the Department of Commerce and the Department of the Interior.

The Samoan Islands are part of a chain of volcanic seamounts that extend more than 1,000 miles along a west-northwest to east-southeast axis. Unlike the more mature volcanic islands and flat banks to the west, Rose lacks wide offshore banks, possibly indicating an older history of volcanic subsidence.

The lagoon floor has an undulating sandy bottom, much of which is covered with algae and more than a dozen isolated patch reefs. The upper surface of the atoll perimeter reef is a hard, smooth floored flat, awash at low tide and covered with vigorous growths of *Porolithon* coralline algae that form connected patches and ridges of a rich pink color up to 3 feet wide or more.

## Human History

The early Polynesians of Samoa likely visited the atoll periodically over the past millennium or more, and the atoll has a Samoan name “Motu o Manu,” literally meaning “island of seabirds.” The first European to see the atoll was Jacob Roggeveen on July 13, 1722. He named the atoll Vuyle Eyland, which translates roughly to “Foul or Dirty



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Island.” Captain Louise de Freycinet later christened the isle “Rose” on October 21, 1819, after his wife who was unlawfully traveling with him at the time.

The first scientist to land on the island was probably Dr. Charles Pickering, a physician naturalist who explored the atoll when the ships the *Porpoise* and the *Vincennes* of the U.S. Exploring Expedition (1838-1842) met there in 1839. Rose Atoll has been the subject of approximately 300 papers and reports over the last century. These describe the geology, geography, biology, meteorology, and history of the area.



Rose Island has sustained only brief human habitation in recent history. In the 1860s, a short-lived attempt was made by a German firm to establish a fishing station/coconut plantation at Rose Atoll. A house was built and coconut trees were planted. After the Germans abandoned the station as unprofitable, a Samoan family stationed on Rose as caretakers continued to live there for a few years. Sand Island is a shifting sand bank and could not support human habitation. Rose Atoll was also chosen as a dive-bombing practice range during World War II. It is unclear whether or not this was implemented.

In October 1993, a 120-foot Taiwanese longline fishing vessel, the *F/V Jin Shiang Fa*, ran hard aground and broke up within weeks on the reef on the southwest arm of the atoll. As a result of the grounding, the entire 100,000 gallons of diesel fuel aboard the vessel was discharged into the marine environment. During subsequent weeks, the fuel spread across the reef flat into the lagoon and down the seaward slope. Physical damage to the reef was also caused by wreckage and vessel debris. Supported by the ship's insurance, limited salvage operations were attempted within a month and were successful in removing the bow section of the wreck. However, the rest of the wreck deteriorated quickly, and dissolved iron from the wreckage stimulated invasive blue-green algae and

prevented natural recovery of coralline algae within the grounding area. Then in April 1994, a massive bleaching event killed off most corals to a depth of about 65 feet off the ocean facing reef slopes. In 2007, the last remaining debris was removed from the atoll, and monitoring of reef recovery will continue into the future.

Existing uses are limited to research and monitoring activities carried out by the Fish and Wildlife Service, National Marine Fisheries Service, and the American Samoa government. Because Rose Atoll is one of the most unique and least visited areas of the world, its marine and terrestrial communities provide a unique opportunity for research and afford an invaluable scientific baseline for biological and geological studies of the low Pacific islands.

Access to the atoll is restricted by the Fish and Wildlife Service, and entry into the lagoon or onto the island is prohibited without prior approval. In order to prevent the introduction of alien



*Rose Island*

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building species at the atoll in shallow depths. Rose Atoll is the only atoll in Samoa and in the National Wildlife Refuge System dominated by crustose coralline algae at shallow depths rather than stony corals.

Rose Atoll's outer reef slope is located on the seaward side of the atoll and consists of an irregular and often steep slope down to a depth of more than 650 feet, and presently dominated by mixed corals and coralline algae to depths of 150 feet. In some areas, a shallow reef terrace is located on the upper slope before the reef plunges almost vertically to deeper waters. Spur and groove formations occur on the shallow reef terrace in some locations. The reef flat is hard consolidated substratum that is exposed during monthly spring tides.

species to the island and lagoon, Refuge staff maintain a rigid entry permit application and review process.

#### *Marine Resources*

One of the most striking features of Rose Atoll is the pink hue of the fringing reef, caused by the dominance of a crustose coralline algae that is also the primary reef-

The lagoon is almost entirely enclosed by shallow perimeter reefs, except for a narrow channel on the northwest side. The inner edge or shallow back-reef of the reef crest alternatively slopes down to a shallow shelf or terrace or steeply sloping deposits of coral rubble periodically carried over the reef crest by large waves. About 15 patch reefs reach the lagoon sea surface from depths of 20 to 50 feet and are concentrated on the southwestern half of the lagoon. The lagoon floor is sandy with a few isolated *Acropora* table-coral patches on the bottom and scattered around the perimeter of the flat-topped, steep-sided pinnacles that extend up to the surface. Wave exposure is low in all lagoon habitats and high on the outer



James Maragos/USFWS

*Netting and scrap metal from the F/V Jin Shiang Fa in 2004, later removed from the reef*

James Maragos/USFWS



*Pocillopora* corals on southwest forereef

reef slope and reef flat. Hurricanes in 2004 and especially 2005 passed close to or over Rose, causing erosion to the islets and injury to vegetation and reef communities.

Coral communities at Rose presently include about 100 species and are distinctive and quite different from those of the other islands in Samoa. Coral cover, abundance, species richness, and diversity are low compared to other reefs in the archipelago, but high compared to the Hawaiian Islands. Dominant corals at Rose include *Favia*, *Acropora*, *Porites*, *Montipora*, *Astreopora*, *Montastrea*, and *Pocillopora*.

About 30 coral species and 6 genera observed in 1994 at Rose were not seen during 2002, perhaps due to a combination of a bleaching event, shipgrounding, and other factors (crown-of-starfish predation, hurricanes, tsunami waves, etc.). More recent surveys from 2002 to 2007 reveal that recovery is now proceeding rapidly.

The crustose coralline algae and fleshy and filamentous algae species present at Rose are typical of atolls in the central Pacific, although diversity appears to be somewhat low. In studying the effects of the grounding of the *Jin Shiang Fa*, phycologists identified only about 22 species of fleshy and coralline algae, including one species of blue-green algae, seven species of green algae, four species of brown algae, and ten species of red

algae. This low diversity may be due to the lack of seasonal collecting.

Despite its small size, Rose supports the largest populations of giant clams, nesting sea turtles, nesting seabirds, and rare species of reef fish in American

Samoa. In 2002, fish densities at Rose Atoll were higher than at other American Samoa islands, but only about half those found in the Northwestern Hawaiian Islands. The most recent 2008 surveys reveal declines in edible fish species. Giant clams are most abundant on the bottoms of the pinnacles in the lagoon.

The fish communities at Rose are also distinct from others in the Samoan Archipelago. Fish density is very high and species diversity is moderately high at Rose Atoll. However, fish biomass is relatively low due to the dominance of small, planktivorous species. The fish assemblages at Rose also differ from the rest of the archipelago by having a much lower density of herbivorous fishes (especially parrotfishes and damselfishes) and a high density of planktivorous and carnivorous fishes (especially unicornfishes and snappers).

To date, about 270 species of fish have been recorded and surveys have indicated little change in the reef fish composition in the past 15 years. Pelagic fish species found outside the lagoon include various species of tuna, mahimahi, billfish, barracuda, and sharks. A new species of cardinal fish was collected

and described from the lagoon at Rose in 2006. Deep diving submersible surveys in 2005 sponsored by the Hawaii Undersea Research Laboratory and FWS revealed a plethora of species and life forms not observed at shallow depths including tunicates, stalked crinoids, many fish, and unusual sea stars.

The two islands at Rose Atoll are important nesting sites for the threatened green sea turtle in American Samoa. Satellite tags attached to the nesting green sea turtles at Rose have shown that these turtles migrate between American Samoa and other Pacific island nations (i.e., Fiji and French Polynesia). In addition to the migratory breeding population of turtles at the atoll during the nesting season (August to February), a small apparently resident population of juveniles lives on the atoll. Endangered hawksbill turtles have also



James Maragos/USFWS

*Ostorhinchus leslie*, a new cardinal fish species described from Rose Atoll in 2006.



James Maragos/USFWS

*Goatfishes* in the lagoon

been seen in the lagoon, although it is not known if they nest on the islands.

The southern subspecies of the endangered humpback whale, which feeds in Antarctic waters, is frequently seen in the waters around Rose Atoll. Bottle nosed dolphins are also common.

#### *Terrestrial Resources*

Rose Island is located on the eastern corner of the atoll. It is roughly oval and has a maximum elevation of about 10 feet. It consists of raised reef rock and soft limestone composed of worn

tropical storms and hurricanes cause severe damage in the forest.

Sand Island is a small sand bank located on the lagoon side of the reef due east of the channel opening. It also is oval in shape and approximately the



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*Rose Island*

fragments of reef building organisms. The phosphatic soil is rich in humus that has developed on the substrate beneath a previously large grove of *Pisonia* trees.

Rose Island has been vegetated throughout recent history, but older studies indicate that it was home to only one or two species of vascular plants. The current flora of Rose Island is more complex perhaps as a result of the Service's successful eradication of introduced rats in 1993.

The only *Pisonia* forest community remaining in Samoa is found on Rose Island. Alien species of ants and scale insects have attacked the *Pisonia* forest during the past decade, leaving only a few healthy trees still alive and standing. Aside from this, vegetation at Rose is luxuriant due to the high annual rainfall and perennial growing season. Frequent

caterpillars, gnats, flies, crickets, ants, beetles, scale insects, and earthworms have been observed. Two species of land hermit crabs occur in high densities on both Rose and Sand Islands.

Alien ants are particularly numerous and are likely attacking the islands' biota.

same height as Rose Island. It has been vegetated in the past with at least two species of vascular plants. Currently, however, the bank is swept clean of vegetation, probably due to recent hurricanes.

Insect fauna at Rose Atoll are poorly known. Sphinx moth

Rose Atoll is the most important seabird colony in the region, since approximately 97 percent of the seabird population of American Samoa resides on Rose. The two islands provide important nesting and roosting habitat for 12 species of federally protected migratory seabirds.

Only 1 year after removal of rats, two species of shearwaters landed on Rose Island, the first record of any Procellariiform bird since ornithological observations began. Additionally, five species of federally protected migratory shorebirds and one species of forest bird, the long-tailed cuckoo (a migrant from New Zealand), use the atoll for feeding, resting, and roosting.



*Juvenile sooty tern (Sterna fuscata)*

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