*Tava'e'ula (red-tailed tropicbird).* Kelsie Ernsberger/USFWS

# Chapter 2. Refuge Management Direction

## 2.1 Overview

During development of the CCP, the Service reviewed and considered a variety of resource, social, economic, and organizational aspects important for managing the Refuge. As is appropriate for a national wildlife refuge, resource considerations were fundamental in designing alternatives. House Report 105-106 accompanying the Improvement Act states "… the fundamental mission of our System is wildlife conservation: wildlife and wildlife conservation must come first." American Samoa and Federal agencies, elected officials, local villages, and non-profit organizations were contacted by the planning team to ascertain priorities and problems as perceived by others. Public scoping in American Samoa occurred during 2009 and over 60 people participated in the public meetings. This helped us to further identify issues and priorities. Further details of public involvement and participation can be found in Appendix J.

## 2.2 General Guidelines

General guidelines for implementing the CCP follow. To reduce the length and redundancy of the descriptions for individual strategies, common features are presented below.

**Implementation subject to funding availability.** After the CCP is completed, actions will be implemented over a period of 15 years as funding becomes available. Project priorities and projected staffing/funding needs are included in Appendix D.

**Access.** The Refuge is closed to general public use and access in accordance with the Administration Act. The specific planned uses of the Refuge are described in Appendices B and C. Specific requests to access the Refuge associated with planned uses will be evaluated on a case-by-case basis and authorized through issuance of a Refuge Special Use Permit (SUP) by the Refuge/Monument Manager.

**Biosecurity measures.** Refuge visitation protocols will continue to include strict biosecurity measures to prevent nonnative introductions (e.g., rats, ants, scale insects, etc.) and impacts from reactive materials (e.g., iron). Anyone entering the Refuge for management activities or under SUP will be required to follow the written aquatic and terrestrial quarantine procedures used for all uninhabited refuges in the Pacific Reefs NWRC. Restrictions are designed to remove or kill pest species that may be in clothes or gear before they are taken to the Refuge. Additional information can be found in Appendix L (Best management practices for visitors to Rose Atoll).

**Threatened and Endangered Species Protection and Recovery.** Protection of threatened and endangered species is common across all alternatives. It is Service policy to give priority consideration to the protection, enhancement, and recovery of these species on national wildlife refuges. The protection of federally listed species is mandated through the Endangered Species Act of 1973 (ESA). Section 7 of the ESA, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. To ensure adequate protection, the Refuge is required to review all activities, programs, and projects occurring on lands and waters of the Refuge to determine if they may affect listed species. If the determination is that an action may adversely affect an endangered species, then the Refuge conducts a formal review, known as a consultation, to identify those effects and means to mitigate those effects.

**Cultural and historic resource protection.** Cultural and historic resources on refuges receive protection and consideration in accordance with Federal cultural resources laws, Executive orders, and regulations, as well as policies and procedures established by the Department of the Interior (DOI) and the Service. Actions with the potential to affect cultural and historic resources will undergo a thorough review before being implemented, as is consistent with the requirements of cultural resource laws. All ground-disturbing projects will undergo a review (including but not limited to archaeological and cultural surveys) under Section 106 of the NHPA. The Service will provide our Regional Historic Preservation Officer (RHPO) a description and location of all projects and activities that affect ground and structures, including project requests from third parties. Information will also include any alternatives being considered. We will also coordinate and consult with the American Samoa Historic Preservation Office (ASHPO) and the Office of Samoan Affairs (OSA) and seek assistance from the Manu'a people on issues related to cultural resource education and interpretation, special programs, and the NHPA. We will expand Refuge cultural resource management by working with the ASHPO, OSA, and other partners to conduct archaeological surveys at Rose Atoll, integrate cultural resources into interpretation and environmental education (EE), and improve dialogue with Manu'a villages. We will also work with local officials to facilitate appropriate cultural practices.

**Law enforcement.** The service will continue to work with NOAA to identify the Refuge on U.S. nautical charts and other official marine information products. To deter ship groundings, we will develop targeted outreach materials and work within the international maritime community (e.g., International Maritime Organization), through appropriate U.S. agencies, to designate the Refuge as "area to be avoided." Also, the Service will reinstall signage at the Refuge and improve outreach

materials to educate the sailing community that the Refuge is closed. This information will be made available to yachtsmen and other mariners at regional embarkation points (e.g., harbors in Samoa and French Polynesia). These points are where boaters may depart from, en route to other destinations, and may pass by the Refuge.

**Adaptive management.** Based on 522 Departmental Manual (DM) 1 (Adaptive Management Implementation policy), Refuge staff shall utilize adaptive management for conserving, protecting, and, where appropriate, restoring lands and resources. Within Title 43 of the CFR 46.30, adaptive management is defined as a system of management practices based upon clearly identified outcomes, where monitoring evaluates whether management actions are achieving desired results (objectives). Adaptive management accounts for the fact that complete knowledge about fish, wildlife, plants, habitats, and the ecological processes supporting them may be lacking. Adaptive management emphasizes learning while doing based upon available scientific information and best professional judgment considering site-specific biotic and abiotic factors on refuge lands and waters. Part of measuring the success of adaptive management in the Refuge also includes 5-year reviews and a 15-year revision of the CCP, which will be initiated by the Service.

*Tava'e'ula chick.* Tracy Hart/USFWS

**Integrated pest management (IPM).** In accordance with 517 DM 1 and 569 FW 1, an IPM approach will be used, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on refuges. IPM will involve using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to non-target species and the refuge environment. Pesticides may be used where physical, cultural, and biological methods or combinations thereof are impractical or incapable of providing adequate control, eradication, or containment. If a pesticide is needed on refuge lands or waters, the most specific (selective) chemical available for the target species will be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage will be further restricted because only pesticides registered with the U.S. Environmental Protection Agency (EPA) in full compliance with FIFRA and as provided in regulations, orders, or permits issued by EPA may be applied on lands and waters under refuge jurisdiction.

Environmental harm by pest species refers to a biologically substantial decrease in environmental quality as indicated by a variety of potential factors including declines in native species populations or communities, degraded habitat quality or long-term habitat loss, and altered ecological processes. Environmental harm may be a result of direct effects of pests on native species including preying and feeding on them; causing or vectoring diseases; killing their young or preventing them from reproducing; out-competing them for food, nutrients, light, nest sites, or other vital resources; or hybridizing with them so frequently that within a few generations few, if any, truly native individuals remain. Environmental harm also can be the result of an indirect effect of pest species. For example, decreased seabird reproduction may result from a pest killing native plants that provide nesting habitat.

Environmental harm may involve detrimental changes in ecological processes. For example, cyanobacterial infestations can inhibit the growth of CCA which is a very important reef builder.

This can lead to a situation where reef growth does not keep up with reef erosion, lowering the reef elevation and threatening the islands with ocean inundation. Environmental harm may also cause or be associated with economic losses and damage to human, plant, and animal health. Predator management is aimed at minimizing entry of nonnative predators using quarantine protocols, exclusion, habitat modification, control, and eradication. For example, live trapping and use of bait stations could be used to eradicate illegally introduced rats and mice. Predator and pest management will be conducted by Service personnel or contractors.

See Appendix G for the Refuge's IPM program documentation to manage pests for this CCP. Along with a more detailed discussion of IPM techniques, this documentation describes the selective use of pesticides for pest management on refuges, where necessary. Throughout the life of the CCP, most proposed pesticide uses on the Refuge will be evaluated for potential effects to biological resources and environmental quality. Pesticide uses with appropriate and practical best management practices for habitat management will be approved for use where there likely will be only minor, temporary, and localized effects to species and environmental quality based upon non-exceedance of threshold values in Chemical Profiles. However, pesticides may be used where substantial effects to species and the environment are possible (exceed threshold values) in order to protect human health and safety.

**Outreach, interpretation, and environmental education (EE).** Refuge staff will provide outreach and interpretation opportunities and develop an EE program for American Samoa schools. We will develop programs to inform elected officials, students, and the general public of American Samoa about the ecology of Rose Atoll and the mission of the Service. We will work closely with our partners to develop complementary interpretive displays for visitor centers.

**Partnerships.** Partnerships are critical components in refuge management, including maintaining and restoring resources, conducting inventories and surveys, providing for cultural uses, and coordinating education and outreach opportunities. These important partnerships typically involve joining forces with the ASG as well as other Monument partners, other Federal partners, villages, businesses, and non-governmental organizations in meeting common mission objectives. Some current examples of valued partnerships the Service will maintain include:

The Service will maintain regular discussions with the ASG to coordinate management of the Refuge. The Service will work with the DMWR to continue research, monitoring, education, outreach, interpretation, law enforcement, and management activities at the Refuge. We will continue to work with the Office of Samoan Affairs (OSA) to facilitate and maintain appropriate relationships with people in the villages in Manu'a and Tutuila. The Service will also keep the ASDOC and the DMWR informed of activities through regular discussions and common forums such as the Coral Reef Advisory Group and the Rose Atoll Marine National Monument Intergovernmental Committee.

The Service will maintain its partnership with NOAA through its National Ocean Service, NMFS's Marine National Monument Program (MNMP), and Pacific Islands Fisheries Science Center (PIFSC) and its Coral Reef Ecosystem Division (CRED). The CRED provides intensive oceanography, water quality, habitat, biological population, and acoustic data as well as benthic habitat mapping as part of their Reef Assessment Monitoring Program (RAMP). The RAMP missions to the Refuge took place every 2 years between 2002-2012; however, due to decreased funding, NOAA has scaled back missions to every 3 years after 2012. The most recent CRED trip to Rose occurred in 2012, with the next one scheduled in 2015. The Service has also worked closely with DMWR since the creation of the Refuge for conducting biological monitoring and habitat restoration projects. The Service will

also maintain its partnership with the U.S. Coast Guard (USCG). The USCG has provided a law enforcement presence by having vessels patrol the area, and through overflights of the Refuge.

Additionally we have partnerships with the National Park Service (NPS), Office of National Marine Sanctuaries (ONMS), U.S. Geological Survey, and the ASDOC. NPS provides the Service office space and will assist with biological monitoring and habitat restoration projects in the future. We will also work closely with NPS on interpretation, EE, and outreach (e.g., Refuge display in their visitor center). Management of the Monument involves many partners. The Service has management responsibility for the Monument in consultation with NMFS. Additionally, the Muliava Unit of the National Marine Sanctuary of American Samoa overlays the marine areas of the Monument outside of the Refuge. The Service is building a partnership with ONMS and ASDOC regarding management of the Sanctuary/Monument overlay area.

**Response capacity.** Within 5 years, we will create response capacity to minimize trespass and poaching using outreach, education, remote sensing, law enforcement, and other methods (e.g., evaluate the possibility of enforcement officers from American Samoa patrolling the Refuge, formalize partnership with USCG for surveillance).

**Vessel.** The Service will seek to acquire a vessel, part ownership in a vessel, or long-term vessel charter contract to assist with management actions, law enforcement, and monitoring.

**Wildlife and habitat.** Implementing the CCP's management direction will enhance protection and management of resources with improved monitoring, law enforcement, and an enhanced understanding of the atoll. More frequent visits (at least twice annually) will allow for the collection of year-round data which will aid management decisions, improve information for law enforcement (e.g., documentation of unauthorized entry into the Refuge), and provide a presence to deter illegal activity. A remote sensing system (e.g., automated camera) will be set up to monitor nesting seabirds, turtles, and other wildlife.

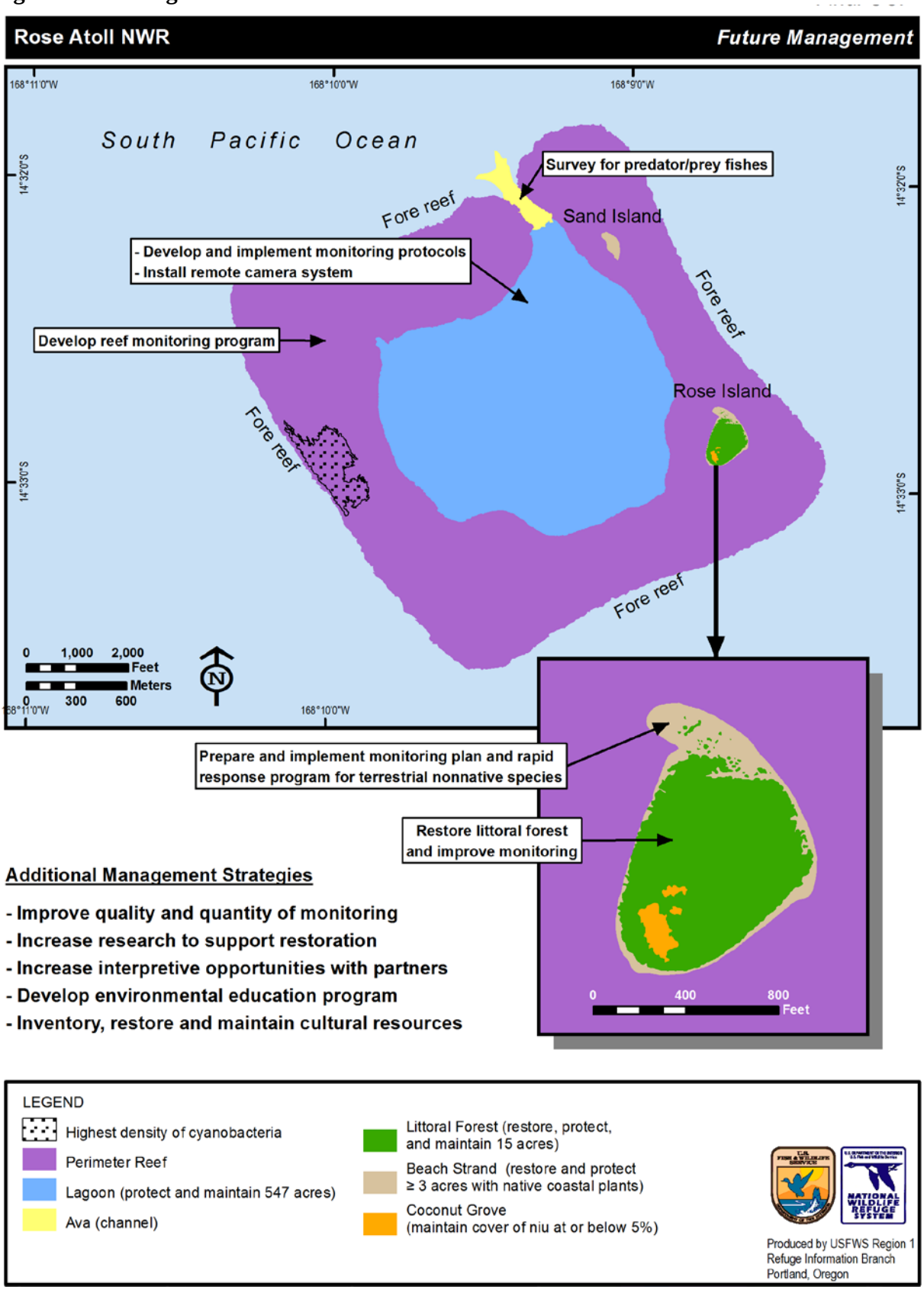
We will explore restoration of the littoral forest on Rose Island by extirpating the introduced scale insect (*Pulvinaria urbicola*) and propagating native forest trees. Other pest species will be detected and controlled or eradicated with regular monitoring and a rapid response program. We will continue the restoration effort from the 1993 ship grounding through consistent surveying of the wreck site, removal of any debris, and continued monitoring.

*Young pu'a vai.* Frank Pendleton/USFWS

**Table 2-1. Summary of Management Direction**

| Key Themes | Objectives | Management Direction |
|---|---|---|
| **Lagoon Habitat** | 1.1 Protect and maintain the lagoon habitats | Work with partners to continue collecting data on bathymetry, water quality, and species diversity. Develop and implement monitoring protocols for fish, corals, other invertebrates, and marine pests to manage populations as needed. Install remote sensing system (e.g., camera) to monitor resources and document illegal boat traffic. |
| **Perimeter Reef** | 2.1 Restore, protect, and maintain the perimeter reef | Monitor cyanobacterial cover which greatly increased in response to the 1993 shipwreck, continue to remove debris. Continue and expand reef monitoring program. |
| **Ava** | 3.1 Protect and maintain the ava | Work with partners to continue collecting data on water flow and bathymetry. Survey for predator and prey fish species. |
| **Beach Strand** | 4.1 Restore, protect, and maintain the beach strand | Restore tamole (*Portulaca lutea*). Prepare and implement a monitoring plan and rapid response program for terrestrial nonnative species. |
| **Littoral Forest** | 5.1 Restore, protect, and maintain littoral forest | Monitor seabirds and control niu (*Cocos nucifera*). Restore native littoral forest and improve monitoring of seabirds, vegetation, and pest species. |
| **Inventory, Monitoring, and Research** | 6.1 Conduct high priority inventory and monitoring (survey) activities and scientific assessments | Work with partners to continue monitoring water quality, bathymetry, species distribution, and habitat associations. Improve the quality and quantity of monitoring efforts by monitoring more often, creating standardized protocols, and management databases. |
| | 6.2 Conduct high priority research | Increase research as part of restoration efforts for habitats and wildlife populations. |
| **Outreach, Interpretation, and Environmental Education (EE)** | 7.1 Enhance and expand interpretation and outreach | Maintain website. Participate in community events. Develop more interpretive opportunities with our partners. |
| | 7.2 Develop EE | Develop an EE program. |
| **Cultural Resources** | 8.1 Protect and perpetuate cultural resources related to Rose Atoll | Work with partners to create information materials. Inventory, restore, and maintain cultural resources and work with local representatives to facilitate appropriate cultural traditions related to Rose Atoll, and regularly meet with OSA and Manu'a village councils |

**Figure 2-1. Management direction.**



**The back sides of maps are blank to improve readability.**

# 2.3 Rose Atoll NWR Management

Goals, objectives, and strategies are the unifying elements of successful refuge management. They identify and focus management priorities, resolve issues, and link to refuge purposes, Service policy, and the Refuge System mission. The goals for the Refuge are presented on the following pages followed by the objectives that pertain to it. Some objectives pertain to multiple goals and have simply been placed in the most appropriate spot. Similarly, some strategies pertain to multiple objectives. The goal order does not imply any priority in this CCP. Priority actions are identified in the staffing and funding analysis (see Appendix D).

*Goatfish in lagoon.* Jim Maragos/USFWS

**Readers, please note the following:** Below each objective statement are the strategies that could be employed in order to accomplish the objectives. Symbols used in the following tables include:

~ Approximately;
% Percent;
> Greater than;
< Less than;
≥ Greater than or equal to; and
≤ Less than or equal to.

## 2.3.1 Goal 1. Protect and maintain the lagoon habitats to meet the life-history needs of native species in this community.

**Objective 1.1 Protect and maintain the lagoon habitats.**

Protect and maintain lagoon reef habitats to provide the following attributes:

- 547 acres of shallow (<100 feet) water lagoon habitat to meet life-history requirements of all existing native members of the lagoon community. See Appendix A for species listings;
- Natural flow of marine water with quality measures of pH, salinity, temperature, nutrients, chlorophyll-*a*, that are appropriate to maintain native organisms in the lagoon community;
- Benthic bottom cover of sand interspersed with patch reefs, limestone blocks, and pinnacles providing a variety of substrates and rugose structure to provide habitat for lagoon species;
- Species diversity including algae, fish, turtles, and invertebrates including reef-building corals and reef-building crustose coralline algae;
- Lagoon free of debris; and
- Minimal human disturbance.

| ***Strategies Applied to Achieve Objective*** |
|---|
| Work with partners to collect bathymetry data every 10 years in order to document changes in the lagoon, reef, or ava that could affect hydrography or habitat characteristics |
| Work with NOAA's CRED and other partners to collect oceanographic and water quality data in order to track changes that could affect the reef or wildlife |
| Work with partners to conduct Rapid Ecological Assessment (REA) to document habitat associations and species distribution, density, and diversity in marine habitats |
| Identify, prioritize, and implement restoration needs such as debris removal in lagoon habitats affected by anthropogenic impacts such as iron contamination from shipwrecks |
| Within 5 years, develop and implement monitoring protocols to track populations of focal lagoon species, including fish, corals, faisua, other invertebrates, and marine pests to determine abundance, density, and biomass of each at selected sites |
| Within 10 years, characterize nutrient budgets and dynamics at Rose Atoll and evaluate them relative to data from other similar reef sites to identify possible stressors and the positive effects of healthy seabird colonies adjacent to living reefs |
| Within 4 years, install remote sensing system (e.g., camera) to document boat traffic in the lagoon |

***Rationale*:** In the middle of an ocean that is mostly over 10,000 feet deep, the lagoon provides 547 acres of shallow water habitat (< 100 feet deep). The reef protects this lagoon from the large swells of the open ocean, and light is able to penetrate to the bottom so corals and other sea life can thrive. While the deepest part of the lagoon has a simple sand bottom, sections on the edge have coral pinnacles which grow up close to the surface providing excellent habitat for faisua (*Tridacna maxima*). This shallow lagoon hosts a unique assemblage of fish and the largest population of faisua in American Samoa. These faisua are listed under the Convention on International Trade in Endangered Species (CITES) and have suffered serious depletion throughout their range due to over-harvesting. While it can provide larval fish recruitment for the other Samoan Islands, the small size of the lagoon and its limited fish and invertebrate community make it particularly susceptible to fishing pressure.

Monitoring fish and invertebrate abundance and biomass as well as abiotic factors is critical so we can assess whether the Service is maintaining BIDEH of the lagoon (see Goal 6). Monitoring is key to refining the metrics in the attributes (which currently reflect how little is known at present about this habitat). Ongoing restoration efforts emphasize removal of debris and monitoring the cyanobacteria bloom. A remote sensing system (e.g., camera) will document unauthorized boat traffic in the lagoon since such traffic could involve unregulated fishing or damage other Refuge resources.

## 2.3.2 Goal 2. Restore, protect, and maintain the perimeter crustose coralline algal reef to meet the life-history needs of native species in this community.

| **Objective 2.1 Restore, protect, and maintain the perimeter crustose coralline algal reef.** |
|---|
| Restore, protect, and maintain the perimeter crustose coralline algal reef to support habitats and species with the following attributes:<br>• Healthy living reef dominated by CCA (*Porolithon* spp.) in a mosaic with corals forming a network of pools and raised areas that provide habitat for reeftop organisms;<br>• Geomorphic structure intact with elements of rugosity and a mosaic of microhabitats;<br>• Tuitui (boring sea urchins / *Echinometra, Echinostrephus* spp.) are present in at least 50% of available holes along the entire seaward margin of the perimeter reef;<br>• Holes that can be occupied by tuitui are present at a density of at least 1/m² in the "urchin zone" along the entire seaward margin of the perimeter reef;<br>• CCA are present in 80% of sampling sites and occupy >25% of total solid substratum;<br>• Cyanobacteria (*Lyngbya, Oscillotoria, Symploca, Calothrix* spp.) are rare (<5% total cover);<br>• The erect coralline alga *Jania adherens*, and the mat-forming green alga *Codium* spp., are rare (i.e., present in < 5% of sample sites);<br>• CCA characterized as eroded is not a prominent cover type and the proportion of this type does not fluctuate significantly between surveys;<br>• Variation in cover of CCA is primarily due to reef position (i.e., fore, mid, or inner reef),<br>• reflecting the wave energy and structural gradients across the reef flat; and<br>• 100% removal of manmade debris including fishing gear and metallic debris from shipwrecks. |
| ***Strategies Applied to Achieve Objective*** |
| Continue monitoring abundance and distribution of the cyanobacterial community |
| Within 5 years, work with partners to continue and expand the reef monitoring program, including rate of growth, elevation change, chemical composition and other variables related to reef growth and the atoll's ability to maintain itself in an anticipated environment of climate change and ocean acidification |
| Within 5 years, develop and implement monitoring protocols to track abundance and distribution of focal perimeter reef species including eels and urchins to determine abundance, density, and biomass of each at selected sites |
| Monitor benthic succession of the reef which was damaged due to the 1993 shipwreck |
| Within 2 years, establish systematic marine debris removal program |

***Rationale*:** The reef crest of Rose Atoll has a pink hue because it is primarily composed of CCA. It varies between 1,000–3,000 feet wide and has a single ava connecting the inner lagoon with the open ocean. Waves can break hard over the reef crest, but during low tides it can be completely exposed. Several of the dominant species of algae on this reef (*Porolithon onkodes, P. craspedium,* and *P. gardineri*) are reef-building organisms that form a strong and resilient reef platform upon which all the other shallow water organisms depend. Two other cover types on the reef platform are a coralline red algae *Jania* spp. that

forms turfs rather than a crust, and areas of eroded and dead coralline algae that are bare reef matrixes without macroscopic algae present.

*Grounded vessel.* USFWS

In 1993 a fishing vessel ran aground on the southwest arm of the reef and broke apart. The vessel released roughly 100,000 gallons of fuel, 500 gallons of oil, and 2,500 pounds of ammonia into the environment. This killed a large area of CCA, and facilitated a population explosion of cyanobacteria and non-reef building algae. Major salvage operations began 6 weeks after the wreck and continued until 2007 due to the large tonnage of metal and the difficulty of working on a remote atoll. The ship rocking back and forth in the waves physically damaged the reef by grinding it away.

Because iron is a limiting nutrient at remote oceanic atoll locations, the increased iron levels led to a drastic increase in several species of cyanobacteria (*Symploca* spp., *Oscillatoria* spp., *Lyngbia* spp., and *Calothrix* spp.) and turf forming coralline algae near the shipwreck site. These species are not reef building organisms, and in places where they grow in thick mats, reef building corals and CCA cannot compete, so the reef can begin to erode. These cyanobacterial species initially formed a carpet, covering large sections of the reef near the wreck. It is vital to control them in order to maintain the reef.

Though the vast majority of the ship has been removed and the area is recovering, there are likely scattered pieces on the fore reef continuing to release iron into the water and promoting the growth of cyanobacteria. This, combined with the acute effects of the initial spill and the physical destruction of the reef by the ship, has seriously damaged the CCA near the shipwreck site and recovery efforts will be ongoing. It is vital to maintain the living coralline algae on these perimeter reefs because they form a growing platform that is resistant to physical and bio-erosion upon which all the shallow water and terrestrial organisms at the Refuge depend. The focal species of urchins serve as indicators of the state of the reef on areas least affected by the shipwreck and areas where subsequent urchin mortality resulted from spilled fuel and cyanobacterial overgrowth. Densities of peppered morays foraging on the reef flat also are an indication of the productivity and health of that habitat.

*Reef crest spillway.* Jim Maragos/USFWS

## 2.3.3 Goal 3. Protect and maintain the natural state of the ava (channel) to protect all other Refuge habitats and the hydrology of the lagoon.

| **Objective 3.1 Protect and maintain the ava.** |
|---|
| Protect and maintain the natural state of the ava to support habitats and species with the following attributes:<br>• Unobstructed water flow between the lagoon and the ocean;<br>• Geomorphology that supports the hydrology of the atoll; and<br>• Species diversity and biomass of reef builders and reef dwellers, including large predator and prey fishes, remains high. |
| **Strategies Applied to Achieve Objective:** |
| Within 5 years, work with partners to monitor water flow rate and direction in the ava using archival pressure and flow rate instruments that can be downloaded at every visit in order to document any changes in flow through the ava |
| Work with partners to collect bathymetry data every 10 years in order to document changes in the lagoon, reef, or ava which could affect hydrography or habitat characteristics |
| Within 5 years, develop and implement monitoring protocol to track abundance and biomass of fish, including predator and prey fish species, around the opening of the ava to detect any changes in structure or function of this important geological feature for large predators in the Refuge |
| Work toward the inclusion of better warnings about the hazard to mariners of waters in and near the ava to prevent vessel groundings, and improve public communications about the Refuge being closed |

***Rationale*:** The ava is a small, direct connection between the lagoon and the open ocean. As ocean water spills into the lagoon over the sides of the reef, it is released out through the ava. Though water usually flows out the ava, tides and waves occasionally create a situation where water flows into the lagoon. The elevation of the ava controls the water movement out of the lagoon, and plays a major role in the layering of lagoon water by temperature and salinity. Additionally, the shape and location of the ava is an important factor in the location and longevity of the islands on the atoll. Water movement inside the atoll creates currents that remove sand from some areas and deposit it in other areas. This sediment transport regime has created and maintained Rose and Sand Islands as islands dynamic in size and shape but in roughly the same location since Captain Rantzau mapped Rose Atoll in 1873 (Rodgers et al. 1993).

The ava is also the major passageway for fish and other organisms in and out of the lagoon, where species that require more shelter from rough water to breed or live may concentrate. Sharks and other predators congregate at the mouth of the ava waiting for prey. For these reasons, it is vital to protect and maintain the ava because it is fundamental to the functioning of many systems in Rose Atoll. Though there are currently no known threats to the ava and it is stable, given potential climate change impacts, constant alertness to changing conditions is important. As identified in Figure 1-2 in Chapter 1, the ava where this work will occur is the exterior boundary of the Refuge where the boundary line is extended between the extreme low waterlines on each side of the channel.

## 2.3.4 Goal 4. Restore, protect, and maintain the beach strand habitat to meet the life-history needs of native species in this community.

| **Objective 4.1 Restore, protect, and maintain beach strand habitat for shorebirds, ground-nesting seabirds, and nesting turtles.** |
|---|
| Restore, protect, and maintain ≥3 acres of the beach strand on Sand and Rose Islands to support habitats and species with the following attributes:<br>• Open ground maintained, with native plants (e.g., tamole) occupying the edge between beach strand and littoral forest;<br>• Free of terrestrial nonnative predators and other nonnative animals; and<br>• Free of pest and nonnative plants. |
| **Strategies Applied to Achieve Objective:** |
| Within 2 years, use GPS to map the perimeter of the islands at high and low tide on each visit to the Refuge and obtain any available satellite imagery for incorporation into GIS in order to document changes in island size, shape, and location |
| Within 15 years, restore and protect native coastal plants using best available information about the original indigenous ecosystem. Restore native tamole (*Portulaca lutea*; a native yellow purslane) population that was extirpated on Rose Atoll by introduced rats (*Rattus exulans*) but survived on an offshore coral block. Monitor survivorship, growth, and maturation of planted tamole |
| Within 10 years, investigate the ecological relationships between marine gastropods such as turban shells (*Turbo* spp.) and land hermit crabs (*Coenobita perlatus* and *C. brevimanus*). Evaluate factors affecting crab populations, including observed reduction in availability of shells to crabs at the Refuge and what management may improve mollusk shell availability to the *Coenobita* spp. which are important scavengers and herbivores on both islands |
| Within 5 years, work with universities and other partners to evaluate the geomorphology, hydrology, and sediment budget of Rose Atoll to understand the processes that have maintained the islands as dynamic units |
| Within 6 months, revise existing biosecurity measures to comprehensively address prevention of introducing nonnative pest species to the atoll |
| Within 2 years, prepare and implement a monitoring plan and rapid response program for terrestrial nonnative species and respond immediately if detected |
| Within 2 years, working with NOAA/NMFS, DMWR, and other partners, develop and implement monitoring protocol to track turtle abundance and movements using field counts, tagging, remote sensing (e.g., camera), and satellite telemetry |
| Within 5 years, working with NOAA/NMFS and other partners, develop a cooperative management plan with Fiji to protect shared stocks of threatened green turtles that migrate between Rose Atoll (to nest) and Fiji (to feed). Meet with appropriate Fiji managers as needed |

***Rationale*:** Beach strand is a very dynamic habitat that is constantly being reshaped by the wind, waves, currents, and tides. Likely this will be exacerbated by climate change with more frequent storms, changes in sea level, and coral calcification. All of Sand Island can be classified as beach strand, as can the sandy section of Rose Island between the water and the vegetation. During a storm,

beach strand habitat can change dramatically, but when conditions are right, it reforms quickly and is stable in the long run. This is the case with the beach strand habitats of the Refuge. After any given storm the islands may change size and shape, but since the area was mapped by Rantzau in 1873 (Rodgers et al. 1993) the location and total area of the islands has remained surprisingly stable.

Because the Refuge provides beach strand habitat free of predators since the 1993 eradication of Polynesian rats (*Rattus exulans*) and is far from human populations, it is ideal foraging habitat for wintering shorebirds and nesting habitat for seabirds and i'a sa, and possibly hawksbill turtles. The beach strand is used extensively by nesting gogosina (sooty terns), gogo (brown noddies), fua'o (brown boobies), and i'a sa (green turtles). The Refuge provides the only known rat-free area in American Samoa for several of these ground-nesting species. Part of enhancing this habitat for these birds and fulfilling BIDEH is restoring previously extirpated plants such as the tamole, a rare plant that used to exist on the beach strand habitat.

Ghost crabs (*Ocypoda* spp.) forage and dig their burrows in the beach strand as well. The land hermit crabs *Coenobita perlatus* and *C. brevimanus* are numerically and ecologically important in the terrestrial ecosystem of Rose Atoll, serving as the dominant herbivores and scavengers of the system. Densities of these two species have decreased markedly since 1991 and biologists visiting the Refuge have noticed a change in the condition and type of the marine gastropod shells that the crabs are using for their homes. There seem to be fewer of the preferred shells in the genus *Turbo* and those that are being used have more damage and wear. Substitutes such as the partridge tun (*Tonna perdix*) shells are more fragile and presumably offer less protection.

Tagging data demonstrates that Rose Atoll and Fiji share a common stock of i'a sa. After nesting at Rose Atoll, the turtles tagged in the 1990s migrated directly to Fiji to feed on extensive seagrass beds there (there is little seagrass in American Samoa). A comprehensive recovery plan requires protection at both its nesting and feeding destinations of this species. While turtle harvesting is prohibited in Fiji, enforcement there is difficult due to the hundreds of small islands and remote villages, thus poaching is considered a serious threat. I'a sa are a threatened species with a very small population size at Rose Atoll (est. 24-36 nesting females).

*Satellite tagged i'a sa*. Frank Pendleton/USFWS

In order to maintain the beach strand as a naturally occurring dynamic habitat which benefits many species, we will control any plant or animal pest species, and monitor the size and shape of the islands to determine if they are maintaining themselves under changing climatic conditions.

## 2.3.5 Goal 5. Restore, protect, and maintain littoral forest to meet the life-history needs of native species in this community including plants, seabirds, shorebirds, landbirds, waterbirds, reptiles, and land crabs.

| **Objective 5.1 Restore, protect, and maintain littoral forest.** |
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| Restore, protect, and maintain 15 acres of the littoral forest with the following attributes:<br>• Forest species composition includes a mixture of pu'a vai (*Pisonia grandis*), taukanave (*Cordia subcordata*), tausuni (*Tournefortia argentea*), fotulona (*Hernandia nymphaeifolia*), talie (*Terminalia samoensis*), fao (*Neisosperma oppositifolium*), fau (*Hibiscus tiliaceus*), and all other indigenous species that recruit through natural means and resemble comparable islands in the region that have not been previously affected by rats;<br>• <5% introduced niu cover of total vegetated area;<br>• Free of introduced terrestrial nonnative predators and other nonnative animals; and<br>• Free of pest and nonnative plants. |
| ***Strategies Applied to Achieve Objective*** |
| Within 2 years, prepare a monitoring and rapid response program for terrestrial nonnative species and respond immediately if detected |
| Maintain cover of introduced niu at or below 5% using mechanical removal or direct application of herbicides as appropriate |
| Within 2 years, review existing vegetation community distribution data and develop GIS database of terrestrial and marine habitats and update them regularly |
| Within 3 years and working with experts, prepare a restoration design that identifies which desired species will require active propagation and outplanting and which will recruit naturally now that rat herbivory has been eliminated. Part of this strategy will be to work with universities and other partners to investigate composition and structure of terrestrial communities on Rose Island prior to the introduction of rats to inform ecological restoration activities |
| Within 4 years, review available vegetation data and develop and implement a monitoring protocol to track changes in numbers, cover, and basal area of different species |
| Within 5 years, implement restoration design and begin outplanting vegetation if required |
| Within 3 years, develop and implement a monitoring protocol to track seabird abundance, nesting rates, and feeding territories. Include remote sensing (e.g., cameras) observations to improve future monitoring efforts |
| Within 10 years, eradicate the scale insect (*Pulvinaria urbicola*) and any other nonnative insects, specifically focusing on eradicating introduced ant species that facilitate scale growth and spread |

***Rationale*:** The tropical wet littoral forest ecotype has become very rare in the Pacific Islands due to the value of mesic coastal sites for human habitation. There are no records of the species composition of the forest on Rose Island prior to the introduction of Polynesian rats. When first described, Rose Island had a native plant community made up of only pu'a vai, tamole, and ufi'atuli (Mayor 1921, Setchell 1924, Satchet 1954) and the introduced niu. Presently, the forest is dominated by tausuni but this is a recent

change in forest community. Tausuni was not recorded on Rose Island until 1970 (Swerdloff and Needham 1970).

Tausuni is indigenous to the Pacific and provides habitat for tree-nesting seabirds. Since rats were eradicated at the Refuge in 1993, the plant community has been released from this source of seed and seedling herbivory so propagules that wash ashore are now able to survive, increasing the total number of species present to at least eight. Factors leading to the decline of the pu'a vai forest and subsequent dominance of tausuni include hurricane damage from six significant storms since 1987, and the introduction of the scale insect. In March 2011, there were only three very unhealthy large pu'a vai trees remaining on Rose Island but a number of seedlings and saplings survive.

The littoral forest on Rose Island provides nesting habitat for the majority of seabird species in the Refuge as well as the Pacific reef heron. Various seabirds nest in different parts of the forest with some nesting in the trees and others nesting on the ground. Niu have been planted on Rose Island on several occasions (Satchet 1954). While early attempts to establish niu failed (perhaps due to the presence of the rat), there is presently a thriving population that is spreading rapidly. If no efforts are made to control the niu, it is very possible they will become the dominant vegetation on Rose Island. This would be highly detrimental to seabird populations since the straight trunks of nui do not provide places to build nests, and falling coconuts can crush birds. While eradication of nui is a possibility, it is desirable to maintain a small nui grove due to their importance in Samoan culture.

Invasive ants, including *Pheidole megacephala* and *Tetramorium bicarinatum*, are severely disrupting the ecology of the atoll, including facilitating an outbreak of *Pulvinaria urbicola*, an invasive scale insect responsible for killing pu'a vai trees. These aggressive, predatory ants are also likely reducing numbers of arthropods native to the atoll. Once ants are removed, natural enemies of the scale, such as predaceous beetles and parasitic wasps that may now be prevented from attacking the scale by the ants, may increase in number and reduce scale abundances to a level better tolerated by pu'a vai. Pu'a vai trees are declining throughout their range, and the eradication of ants will facilitate the removal of *Pulvinaria* scale and help in the recovery of the pu'a vai forest.

*Fua'o nesting in pu'a vai.* USFWS

## 2.3.6 Goal 6. Gather scientific information (inventories, monitoring, assessments, and research) to support adaptive management decisions under objectives for Goals 1-5.

| **Objective 6.1 Conduct high priority inventory and monitoring (survey) activities and scientific assessments.** |
|---|
| Conduct inventory and monitoring activities that evaluate resource management activities to facilitate adaptive management. These surveys contribute to the enhancement, protection, preservation, and management of wildlife populations and their habitats on and off Refuge lands. Specifically, they can be used to determine if we are meeting resource management objectives identified under Goals 1-5. These surveys have the following attributes:<br>• Data collection techniques will have zero to minimal animal mortality or disturbance and zero to minimal habitat destruction;<br>• Collect minimum number of samples (i.e., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) to meet statistical analysis requirements for identification and/or experimentation in order to minimize long-term or cumulative impacts;<br>• Studies will be designed to statistically detect early stages of habitat changes that would minimize long-term or cumulative impacts;<br>• Use proper cleaning of investigator equipment and clothing as well as quarantine methods, where necessary, to minimize the potential spread or introduction of pest species;<br>• Projects will adhere to scientifically defensible protocols for data collection, where available and applicable; and<br>• Annual and cumulative reports will be completed for all inventory, monitoring, and research activities to document results and provide comprehensive analyses. |
| ***Priority inventory and monitoring activities*** |
| Finalize Memorandum of Understanding (MOU) with DMWR to coordinate data collection and management activities at the Refuge |
| Work with partners to deploy an Ecological Acoustic Recorder (EAR) in the ava to collect biological data that may improve monitoring of behavior and abundance of marine organisms |
| Within 5 years, begin to monitor climate change variables including sea level, temperature (air/water/substrate), water quality (pH, conductivity, dissolved oxygen, nitrogen, photosynthetically available light (PAR), phosphorus, iron), the frequency and duration of extreme storm events, and biological responses (phenological, developmental, physiological) |
| Work with partners to monitor status and trends of focal communities (hard corals, algae), including the incidence and severity of coral and algal disease and bleaching |
| Within 5 years, monitor the growth and survival rate of coral colonies at different depths |
| Work with partners to conduct REA to document habitat associations and species distribution, density, and diversity in marine habitats |
| Work with NOAA's CRED and other partners to collect oceanographic and water quality data in order to track changes that could affect the reef or wildlife |

| ***Priority inventory and monitoring activities (continued)*** |
|---|
| Within 5 years, develop and implement monitoring protocols to track populations of focal lagoon species, including fish, corals, faisua, other invertebrates, and marine pests to determine abundance, density, and biomass of each at selected sites |
| Work with partners to collect bathymetry data every 10 years in order to document changes in the lagoon, reef, or ava which could affect hydrography or habitat characteristics |
| Within 5 years, develop and implement monitoring protocols to track abundance and distribution of focal perimeter reef species including eels and urchins to determine abundance, density, and biomass of each at selected sites |
| Continue monitoring abundance and distribution of the cyanobacterial community which became dominant on a section of the southwest arm of the atoll following the 1993 shipwreck |
| Monitor benthic succession of the reef which was damaged due to the 1993 shipwreck |
| Within 5 years, work with partners to expand the reef monitoring program, including rate of growth, elevation change, chemical composition, and other variables related to reef growth and the atoll's ability to maintain itself in an anticipated environment of climate change and ocean acidification |
| Within 5 years, work with partners to monitor water flow rate and direction in the ava using archival pressure and flow rate instruments that can be downloaded at every visit in order to document any changes in flow through the ava |
| Within 5 years, develop and implement monitoring protocol to track abundance and biomass of fish, including predator and prey fish species, around the opening of the ava to detect any changes in structure or function of this important geological feature for large predators in the Refuge |
| Conduct study to determine if aquifer exists at Rose Atoll. If found, within 5 years begin monitoring the lens to document extent and changes |
| Within 2 years, working with NOAA/NMFS and other partners, develop and implement monitoring protocol to track turtle abundance and movements using field counts, tagging, remote sensing, and satellite telemetry |
| Within 2 years, use GPS to map the perimeter of the islands at high and low tide on each visit to the Refuge and obtain any available satellite imagery for incorporation into GIS in order to document changes in island size, shape, and location |
| Monitor survivorship, growth, and maturation of outplanted tamole |
| Within 2 years, prepare and implement a monitoring plan and rapid response program for terrestrial nonnative species and respond immediately if detected |
| Within 2 years, review existing vegetation community distribution data and develop GIS database of terrestrial and marine habitats and update them regularly |
| Within 4 years, review available vegetation data and develop and implement a monitoring protocol to track changes in numbers, cover, and basal area of different species |
| Within 3 years, develop and implement a monitoring protocol to track seabird abundance, nesting rates, and feeding territories. Include remote sensing (e.g., camera) observations to improve future monitoring efforts |
| Install weather station for long-term monitoring of weather data |

***Rationale*:** The Administration Act requires us to "monitor the status and trends of fish, wildlife, and plants in each refuge." Surveys will be used to track populations and abiotic variables in order to assess progress toward achieving refuge management objectives (under Goals 1-5 in this CCP) derived from the Refuge System mission, refuge purposes, and maintenance of BIDEH (601 FW 3). Determining resource status and evaluating progress toward achieving objectives is essential to implementing adaptive management on DOI lands and waters as required by policy (522 DM 1). Specifically, results of surveys will be used to refine management strategies over time in order to achieve resource objectives. Surveys will provide the best available scientific information to promote a transparent decision-making process for resource management on refuge lands and waters.

Monitoring data will help us track the effects of climate change and ocean acidification on the Refuge. As a living reef, built and maintained by CCA, corals, and other calcifying organisms, Rose Atoll will be particularly susceptible to sea level rise and ocean acidification. As the sea rises, the reef will need to grow faster to maintain the same elevation in relation to sea level. At the same time, the concentration of carbonate ions (needed by calcifying organisms to build the reef) will be declining due to ocean acidification. Coral bleaching will also become more common as the ocean warms. Monitoring the growth of the reef and abiotic factors will help us understand what is happening to the reef and predict and plan for future conditions.

In accordance with DOI policy for implementing adaptive management on refuge lands (522 DM 1), appropriate and applicable environmental assessments are necessary to determine resource status, promote learning, and evaluate progress toward achieving objectives whenever using adaptive management. These assessments will provide fundamental information about biotic (e.g., vegetation data layer) as well as abiotic processes and conditions (e.g., soils, topography) that are necessary to ensure that implementation of on-the-ground resource management achieve resource management objectives identified under Goals 1-5.

*Monitoring* Porites lutea *at Rose Atoll.*
Jim Maragos/USFWS

**Objective 6.2 Facilitate high priority research at the Refuge to directly support management objectives and guide management decisions.**

Facilitate research projects that provide the best science for habitat and wildlife management on and off the Refuge. Scientific findings gained through these projects will expand knowledge regarding life-history needs of species and species groups as well as identify or refine habitat and wildlife management actions. These research projects have the following attributes:

- Focus wildlife population research on assessments of species-habitat relationships. Develop models that predict wildlife response to management;
- Design and conduct issue-driven (problem-driven) research unlikely to be reliably addressed using long-term monitoring;
- Promote Refuge research and science priorities within the broader scientific community. Ensure that cooperative research focuses on meeting information needs identified in biological goals and objectives;
- Assign a high priority to the collection of information that will help managers predict, understand, and address the effects of climate change and ocean acidification on fish, wildlife, and their habitats at all spatial scales in the Refuge;
- Data collection techniques will have zero to minimal animal mortality or disturbance and zero to minimal habitat destruction;
- Collect minimum number of samples (i.e., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) to meet statistical analysis requirements for identification and/or experimentation in order to minimize long-term or cumulative impacts;
- Annual and cumulative reports will be completed for all inventory, monitoring, and research activities to document results and provide comprehensive analyses.
- Follow quarantine and cleaning protocols to avoid or minimize the potential spread or introduction of nonnative and pest species; and
- Often result in peer-reviewed articles in scientific journals or symposium publications.

***Priority research needed***

Characterize nutrient budgets and dynamics at Rose Atoll and evaluate them relative to data from other similar reef sites to identify possible stressors and the positive effects of healthy seabird colonies adjacent to living reefs

Evaluate the geomorphology, hydrology, and sediment budget of Rose Atoll to understand the processes that have maintained the islands as dynamic units

Investigate the ecological relationships between marine gastropods such as turban shells (*Turbo* spp.) and land hermit crabs (*Coenobita perlatus* and *C. brevimanus*). Evaluate factors affecting crab populations, including observed reduction in availability of shells to crabs at the Refuge and what management may improve mollusk shell availability to the *Coenobita* spp., which are important scavengers and herbivores on both islands

Investigate composition and structure of terrestrial communities on Rose Island prior to the introduction of rats to inform ecological restoration activities

Investigate food habits of seabirds breeding at Rose Atoll using stable isotopes and stomach samples

Correlate reproductive performance indicators and breeding chronology variation in Rose seabird populations with oceanographic conditions and location of migratory fish schools relative to the atoll

***Rationale*:** Rose Atoll is unique in the Samoan Archipelago in being a coralline algal atoll. Research projects on Refuge lands and waters will address a wide range of natural resource questions. Examples of research projects include habitat use and life-history requirements for particular species, practical methods for habitat management and restoration, extent and severity of environmental contaminants, techniques to control or eradicate pest species, effects of climate change, and ocean acidification on environmental conditions and associated habitat and wildlife response, identification and analyses of paleontological specimens, wilderness character, and modeling of wildlife populations. Projects may be species-specific, Refuge-specific, or evaluate the relative contribution of the Refuge to larger landscape (e.g., archipelago, regional, Pacific, global) issues and trends.

*Pu'a vai research.* USFWS

As with monitoring, results of research projects will expand the best available scientific information and potentially reduce uncertainties to promote transparent decision-making processes for resource management over time on the Refuge and other protected areas. In combination with results of surveys, research will promote adaptive management on the Refuge. Scientific publications resulting from research on the Refuge will help increase the understanding of the Refuge System for resource conservation and management in the larger science realm.

## 2.3.7 Goal 7. Strengthen resource conservation and the public's shared stewardship of the ecological, geologic, and cultural richness of the Refuge by providing outreach, interpretation, and environmental education opportunities.

### Objective 7.1 Enhance and expand interpretation and outreach.

Provide high quality interpretation and outreach that supports a knowledgeable public who are aware of the conservation provided by the Refuge. The public is informed about the Refuge's complex ecosystem, cultural connections, geologic history, and management challenges by focusing on "bringing the Refuge to the people, instead of the people to the Refuge." Interpretation and outreach associated with the Refuge will have the following attributes:

- People are exposed to at least one of the four key interpretive themes regarding Ecology; Geology; Samoan Culture; and/or the NWRS;
- Products and messages engage a diverse audience from American Samoa and across the United States and Oceania;
- Outreach and interpretation use standard media as well as social media and evolving technologies; and
- Supports the Service's "Connecting People with Nature" emphasis.

| ***Strategies Applied to Achieve Objective*** |
|---|
| Install minimal signage on Rose Island to inform people of Refuge boundary and regulations |
| Maintain Refuge website and update at least annually with current information such as species lists, interactive tools, management updates, news releases, science reports, etc. |
| Develop brochures, Website, and utilize social media and other outreach tools specifically designed to communicate Refuge protection and safety issues and make these available to mariners |
| Develop outreach messages using social media such as blogs or interpretive videos online to "bring the Refuge to the people" |
| Develop virtual fieldtrip to Rose Atoll with link on Website by 2016 |
| Explore opportunities and community interest for supporting the development of a Refuge "Friends" group to help with interpretation, outreach, and other Refuge needs |
| Develop a Refuge volunteer program to provide local and national stewardship opportunities and assist in Refuge management activities |
| Work with partners (especially within the Manu'a Islands) to develop multi-lingual interpretive displays and print materials to provide outreach messages at visitor centers as well as mobile displays for traveling exhibits |
| Participate in community meetings and local events to educate people about the Refuge, especially within the Manu'a Islands |
| Enhance law enforcement through the production of interpretive brochures for distribution in American Samoa and to the yachting community |
| Collaborate with the USCG and NOAA for law enforcement |
| Work with partners to deploy an EAR in the ava to collect data on boat entry into the lagoon |

***Rationale*:** The fundamental purpose of Service outreach is to build understanding, trust, and support from a variety of groups by helping them understand what the Service does and why we do it. Because the Refuge is closed to the general public, our interpretation and outreach program will be based on "bringing the Refuge to the people," instead of bringing the people to the Refuge. We will work with our partners to establish Refuge displays for visitor centers in American Samoa, and develop outreach materials and social media capacity to provide other interpretive opportunities for people in American Samoa and around the world. Virtual field trips are alternatives to more costly real-world field trips. In addition to being inexpensive in consideration with the number of students who can be reached, they are engaging to students because they enable students to make connections between themselves and wide-ranging environments they can explore on-line.

The Service did not have staff stationed in American Samoa prior to 2011, so outreach messages describing how Rose Atoll NWR fits in the Refuge System need to be developed for the local communities. Good communication with elected officials is essential for the Service to be effective and responsive to the American Samoa public. Conservation groups have a great interest in resource management, and their support can influence others. Businesses can be a source of funding or support through partnerships. Other Federal agencies, as well as American Samoa and village governments, can help give momentum to the Service's outreach initiatives, and their support can enhance a project's likelihood of success.

| **Objective 7.2 Develop environmental education products and programs to perpetuate and enhance knowledge and appreciation of wildlife, habitats, and their importance to American Samoa culture and the world.** |
|---|
| Provide a high quality Rose Atoll EE program with the following attributes:<br>• Focuses on students in American Samoa from pre-K through college;<br>• Aligns with the American Samoa Department Of Education Learning Management System;<br>• Involves local teachers to ensure program is relevant to local students and curricula;<br>• Incorporates measurable learning objectives and uses audience-appropriate curricula; and<br>• Supports and complements the Service's mission, and the Refuge's purposes and goals. |
| ***Strategies Applied to Achieve Objective*** |
| Create Rose Atoll EE materials such as DVDs and posters for use with school groups |
| Work with partners to develop EE curricula and classroom materials that introduce students to American Samoa wildlife, protected areas, and conservation of natural resources, especially in relation to effects from man-made climate change |
| Partner with schools and universities to conduct surveys and/or relevant research |
| Explore appropriate on-site EE opportunities (<once every 3 years) to allow a small group of teachers and students (<10 people) to visit the Refuge for specific EE purposes developed with the Refuge's EE program |
| Develop a brief, picture-oriented presentation describing the ecology of the Refuge and present this to three American Samoa schools each year |
| Develop a student intern program with the Refuge office to introduce students to protected areas and wildlife management |

***Rationale***: American Samoa is a rapidly changing society which is in the process of enhancing EE in the schools' curriculum. This creates an excellent opportunity for the Service to play a role in helping to develop EE programs. As a small Refuge with a small staff, working with our partners will be vital to the success of any EE program. Because we manage a coral and crustose coralline algal atoll in American Samoa, the Service is in a position to educate people about the effects of climate change and ocean acidification.

In the past, the Service has had a very limited EE program. There have been rare trips to the Refuge for teachers and students, but these trips are very expensive, can only be done with strict biological restrictions in place to avoid disturbance, and only reach a handful of students. We will be able to reach many more students offsite through outdoor programs, classroom presentations and activities, and internship programs. We can include people outside of American Samoa with an improved presence on the Internet and the development of classroom materials for downloading.

## 2.3.8 Goal 8. Identify, protect, preserve, and interpret the Refuge's Samoan cultural resources and facilitate, where appropriate, cultural practices.

| **Objective 8.1 Encourage and facilitate identification, protection, and perpetuation of Samoan cultural resources, practices, and traditions related to Rose Atoll.** |
|---|
| Increase identification, monitoring, and protection of cultural resources, while increasing staff and public support and appreciation. These efforts will focus on accomplishing the following:<br>• Expand knowledge of the Samoan cultural resources related to Refuge; and<br>• Facilitate Refuge-appropriate cultural practices. |
| ***Strategies Applied to Achieve Objective*** |
| Research the history of Samoan names for Rose Atoll and consider changing Refuge name accordingly |
| Work with the American Samoa Historical Preservation Office to conduct an archaeological survey at Rose Atoll |
| Consult with the OSA and local villagers to understand and perpetuate Refuge-appropriate traditional cultural practices related to Rose Atoll |
| Work with partners to collect and compile oral histories from village leaders |
| Work with partners to create bilingual education materials such as videos, reports, and pamphlets regarding cultural uses and the oral history of Rose Atoll |
| Restore the cement monument erected on Rose Island during the Governor's 1920 visit |

***Rationale*:** During public meetings held in 2009, people expressed the desire that the oral history and cultural resources and traditions of Rose Atoll be preserved. There was also the desire that the Samoan people be allowed some access to the Refuge for cultural practices. The Service recognizes that observing and perpetuating cultural practices and resources is an essential part of 3000 years of a unique Samoan heritage and we will work closely with the OSA and villages to protect these resources and manage the Refuge consistent with *fa'asamoa* (the Samoan way).