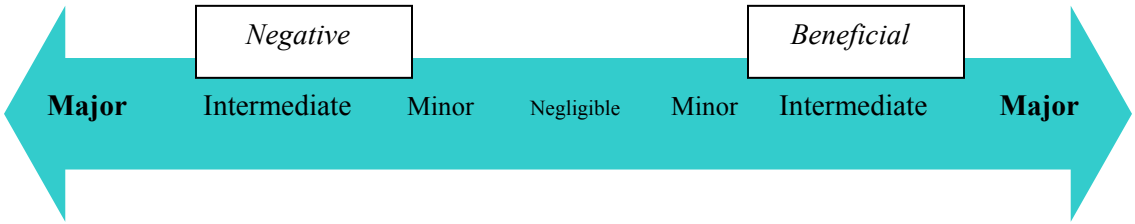
# Chapter 6. Summary of Effects

This chapter provides an analysis of the environmental consequences of implementing the alternatives described in Chapter 2. Impacts are described for the main aspects of the environments described in Chapters 3-5, including physical, biological, cultural, and socio-economic resources. The potential effects to these resources as a result of implementing the strategies described under each alternative were then assessed. In addition to Chapters 3-5, Refuge staff experience, existing databases and inventories, relevant plans, studies, and past and current research were used for this analysis. We also used public scoping during 2009 to assess effects.

The alternatives are compared "side by side" under each topic, and both the positive and negative effects of implementing each alternative are described. Table 6-1 provides an overview of the effects under each alternative by indicator. Alternative B (Preferred Alternative) is compared to Alternative A (the No Action Alternative), which presents current management strategies. Effects are described in terms of the change from current conditions. Therefore, the consequences of implementing Alternative A usually result in negligible effects as they already reflect current conditions.

For the most part, boundaries for analysis (direct, indirect, cumulative) were at the Refuge level, but for the socio-economic resources, nearby communities (e.g., Manu'a Islands), were included and some biological resources took into account species ranges as they can move beyond the Refuge. Subheadings (e.g., habitat, research, cultural resources) have been included to guide the reader in understanding which types of management strategies are likely to affect each resource. However, not all management strategies affect each resource so only relevant subheadings are identified for each resource. Cumulative impacts, including impacts to Refuge resources from reasonably foreseeable events and impacts resulting from interaction of Refuge actions with actions taking place outside the Refuge, are addressed in the final section of this chapter.

Effects were assessed for scope, scale, and intensity of impacts. Although the analysis shows that neither of the alternatives would be expected to result in significant effects, some positive (beneficial) or negative (adverse) effects are expected. The terms intermediate, minor, and negligible are used to describe the magnitude of the effect. To interpret these terms, intermediate is a higher magnitude than minor, which is of a higher magnitude than negligible. The word negligible is used to describe a neutral or unnoticeable effect compared to the current situation.




Scope, scale, and intensity can be defined on a range from negligible to major.

- **Negligible.** Resources would not be affected, or the effects would be at or near the lowest level of detection. Resource conditions would not change or would be so slight there would not be any measurable or perceptible consequence to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource.

- **Minor.** Effects would be detectable but localized, small, and of little consequence to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource. Mitigation, if needed to offset adverse effects, would be easily implemented and successful.
- **Intermediate.** Effects would be readily detectable and localized; with consequences to a population, wildlife, or plant community, recreation opportunity, visitor experience, or cultural resource. Mitigation measures would be needed to offset adverse effects and would be extensive, moderately complicated to implement, and probably successful.
- **Major (significant).** Effects would be obvious and would result in substantial consequences to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource within the local area and region. Extensive mitigating measures may be needed to offset adverse effects and would be large scale in nature, very complicated to implement, and may not have a guaranteed probability of success. In some instances, major effects would include the irretrievable loss of the resource.

Time and duration of effects have been defined as follows.

- **Short-term or Temporary.** An effect that generally would last less than 1 year or season.
- **Long-term.** A change in a resource or its condition that would last longer than a single year or season.

**Table 6-1. Summary of Effects under CCP Alternatives**

| | Alternative A (No Action) | Alternative B (Preferred) |
|---|---|---|
| **EFFECTS TO PHYSICAL ENVIRONMENT** | | |
| **Effects to Soils** | Negligible | Negligible to minor, long-term, and beneficial |
| **Effects to Water Quality** | Minor, beneficial | Negligible to minor, beneficial |
| **Effects to Air Quality** | Negligible | Negligible |
| **EFFECTS TO WILDLIFE AND HABITATS** | | |
| **Effects to Ava** | Negligible | Negligible |
| **Effects to Lagoon** | Negligible | Negligible |
| **Effects Perimeter Reef** | Negligible | Long-term, beneficial minor to intermediate |
| **Effects to Beach Strand** | Minor, beneficial | Minor, beneficial |
| **Effects to Littoral Forest** | Negligible | Negligible to intermediate, short-term negative, long-term beneficial |
| **Effects to Federally Listed** | Negligible | Beneficial, long-term, minor |

| | Alternative A (No Action) | Alternative B (Preferred) |
|---|---|---|
| **Effects to Seabirds** | Negligible | Beneficial, negligible to minor, long-term |
| **Effects to Shore, Wading, and Land Birds** | Negligible | Beneficial, negligible to minor, long-term |
| **Effects to Invertebrates** | Negligible | Negligible to minor, beneficial, long-term |
| **Effects to Reef Building Species** | Negligible | Negligible to minor, beneficial, long-term |
| **Effects to Fish** | Negligible | Negligible |
| **Effects to Pest Species** | Negligible | Negligible |
| **EFFECTS TO CULTURAL AND HISTORIC RESOURCES** | | |
| **Effects to Cultural and Historic Resources** | Negligible | Negligible |
| **EFFECTS TO SOCIAL AND ECONOMIC RESOURCES** | | |
| **Effects to Quality Environmental Education** | Negligible | Beneficial, intermediate, long-term |
| **Effects to Quality Interpretation** | Negligible | Beneficial, intermediate, long-term |
| **Effects to Illegal Use** | Negligible | Beneficial, intermediate, long-term |
| **Effects to Environmental Justice** | Negligible | Negligible |
| **Effects to Economics** | Negligible | Beneficial, long-term, but negligible |
| **ADDITIONAL EFFECTS** | | |
| **Effects to Adjacent Lands** | Negligible | Negligible |

| | Alternative A (No Action) | Alternative B (Preferred) |
|---|---|---|
| **Effects to Nearby Residents** | Negligible | Beneficial, minor, long-term |
| **Cumulative Effects** | Negligible | Negligible |

## 6.1 Effects Common to All Alternatives

**Integrated Pest Management (IPM).** Potential effects to the biological and physical environment associated with the proposed site-, time-, and target-specific use of pesticides (Pesticide Use Proposals [PUP]) on refuge lands are evaluated using scientific information and analyses documented in "Chemical Profiles" (see Appendix G). These profiles provide quantitative assessment/screening tools and threshold values to evaluate potential effects to species groups (birds, mammals, and fish) and environmental quality (water, soil, and air). The PUP (including appropriate best management practice [BMP]) would be approved where the Chemical Profiles provide scientific evidence that potential impacts to refuge biological resources and its physical environment are likely to be only minor, temporary, or localized in nature. Along with the selective use of pesticides, a PUP would also describe other appropriate IPM strategies (biological, physical, mechanical, and cultural methods) to eradicate, control, or contain pest species in order to achieve resource management objectives.

The effects of these non-pesticide IPM strategies (e.g., mechanical control or removal of an unnatural nutrient source exacerbating the growth of an undesirable species) to address pest species on Refuge lands and waters would be similar to those effects described elsewhere within this chapter, where they are discussed specifically as habitat management techniques to achieve resource management objectives on the Refuge.

Based on scientific information and analyses documented in "Chemical Profiles," most pesticides allowed for use on refuge lands and waters would be of relatively low risk to non-target organisms as a result of low toxicity or short-term persistence in the environment. Thus, potential impacts to Refuge resources and neighboring natural resources from pesticide applications would be expected to be minor, temporary, or localized in nature.

## 6.2 Effects to the Physical Environment

Topics addressed under the physical environment section include effects (direct and indirect) to water quality, air quality, and soils.

Continuing the current management (Alternative A) generally has negligible, if any, effects because little or no change to current conditions is proposed. The effects for Alternative B are described in terms of the change from current conditions and given the increased management level is more beneficial than Alternative A.

## 6.2.1 Effects to Soils

**Effects from Habitat Management Strategies:** Under Alternative A and B, several habitat management strategies involve monitoring. Depending on the type of monitoring conducted, there could be effects to soils from the equipment used and its installation, both terrestrially on the two islands and to the sandy bottom of the lagoon. Examples of such equipment that may disturb soils include the stakes used to mark out a grid on Rose Island, pitfall traps for insect collection, and anchors that might be used to secure a science buoy in the lagoon. Soils may also be collected. The trampling of soils by those conducting the monitoring (e.g., 6 people for 15 days per year) may also either shift or compact the humus or sand. Such activities (and therefore effects) may be short- or long-term depending on the monitoring objective. However, given similar monitoring activities already conducted at the Refuge and other refuge atolls and that the two islands experience wash overs during storms, it is anticipated that effects to soils would be negligible.

Teams monitoring the terrestrial system and the reef flats need to camp on the island in order to do their work at the appropriate time relative to diel and tidal cycles. Setting up temporary tents may disturb soil with tent stakes but the disruption is minimal and temporary.

*Examples of temporary tents used for field work. USFWS.*

Under Alternative B, restoration of the littoral forest may also have effects to soil through changes in vegetation cover type and input of guano by the birds. The objective of forest restoration is to increase the *Pisonia* population and inhibit the niu population. This increase in vegetation could also lead to more available habitat for nesting seabirds, thereby increasing the amount of guano input into soils.

However, given that historical data show the littoral forest having had larger coverage than it does today, it is anticipated that this would be a beneficial effect that could restore the soil structure to previous conditions (the combination of guano and *Pisonia* growing on coralline substrate produces a rich peat-like acidic humus called phosphatic cay rock [Fosberg 1957]). Additional restoration work could be removal of pest species, such as the patches of non-native grasses that were removed in 1994. Very temporary disturbance of the soil occurs when such plants are removed (e.g., roots uprooted); however, given they were not part of the original habitat, their removal could be beneficial for soils in returning soil chemistry to a previous state. Therefore, effects are anticipated to be minor, but beneficial.

Installation of remote sensing is proposed under Alternative B. Depending on the type of system used, installation of such equipment may affect soils similar to the monitoring activities (e.g., stakes

or poles into the ground for sensors, solar panel, antenna, battery pack, camera, etc.). Installation of the system would be only a temporary disturbance, however, this would be a long-term, beneficial effect as the system would be in use for the duration of the CCP and would help to deter illegal trespass and people trampling on the soils. It is anticipated that the effects to soils would be negligible to minor based on similar technologies already used on the islands of Kaua‘i, O‘ahu, and Maui in Hawai‘i and northern California.

**Effects from Research Management Strategies:** Similar to the monitoring activities identified in the habitat management section above, identified research projects may involve installation of equipment or stakes and soil collection. Research activities may be short- or long-term depending on the research objective. However, these effects are anticipated to be negligible given the experience of staff with similar research projects conducted at the Refuge and other refuge atolls. Additionally, permitted research also undergoes a review of possible impacts before they are issued to help ensure effects are negligible (for further information, see related CD in Appendix C).

**Effects from Cultural Resource, Outreach, and EE Management Strategies:** Under both Alternatives A and B, reinstituting minimal signage is proposed. Soil disturbance would occur related to installation (staking poles into the ground). It is proposed under Alternative B to restore the cement monument erected by the Governor in 1920. Soil disturbance would occur to resurrect this fallen monument as it would need to be placed back into the ground with appropriate structures to keep it upright. Under this alternative, archaeological surveys as well as visits by cultural practitioners may occur. The trampling of soils by those conducting such activities could be experienced. However, given that the restoration would occur in the same area where the monument still exists and where soils are already disturbed and that Refuge-authorized personnel would accompany archaeologists and cultural practitioners to educate on minimizing such impacts, it is anticipated that effects to soils would be negligible.

For EE, it is proposed to bring a small group of teachers and students (<10 people and <once every 3 years) to the Refuge. Similar to management effects already identified, trampling of soils and disturbance of soils either through camping or walking around would be the effects most related to EE. However, similar to the other management effects, Refuge-authorized personnel would accompany this group to educate on minimizing such impacts or the group may be required to stay on the boat rather than camp so it is anticipated that effects to soils would be negligible.

**Conclusion:** Overall effects to soil from commonly proposed management actions under both Alternatives A and B would be negligible. The additional actions proposed under Alternative B (namely littoral forest restoration) effects would be minor, long-term, and beneficial.

## 6.2.2 Effects to Water Quality

**Effects from Habitat Management Strategies:** Under both Alternatives A and B, proposed management actions which may affect water quality are removal of the iron and related cyanobacteria. Cyanobacteria blooms and mats that negatively affect reefs by smothering corals and other invertebrates have been documented in coral reef and seagrass habitats (Richardson 1995, Paul et al. 2005, Kelly et al. 2012) but effective means of removing them have not been developed. It is generally accepted that iron limits primary production by algae and cyanobacteria on central Pacific coral atolls, where sediments consist mostly of calcium carbonate generated through the erosion of calcifying organisms, and that shipwreck-associated iron releases these primary producers from bottom-up controls and enables their proliferation (Kelly et al. 2012). Removing the exogenous

source of the iron (i.e., metallic debris from the shipwreck), is clearly the first management action to be undertaken to control the proliferation, and at Rose Atoll all visible metallic debris was removed by 2007. Nonetheless, effects can be persistent and such "black reefs" can extend large distances from the wreck site, suggesting that the iron is being rapidly complexed and recycled in the marine environment.

Ecological disturbances on reefs can reach critical thresholds resulting in a shift to an alternative stable state ("phase shift"), which is then maintained by self-reinforcing feedback mechanisms. On coral reefs, it has been posited that phase shifts could be irreversible even after a disturbance is resolved (Knowlton 1992, Norstrom et al. 2009). With this caveat, the potential for recovery at Rose Atoll is promising because these remote reefs are spared many anthropogenic impacts, such as overfishing and pollution, and because high densities of coral cover and CCA nearby increase the likelihood of repopulation by stony corals and CCA (Schroeder et al. 2008).

Despite biological sequestration, the amount of iron entering the atoll ecosystem from the shipwreck was likely low, given the mixing effects of waves, tides, and currents. Thus, it is anticipated that effects to water quality from iron removal and related cyanobacteria control would be beneficial but minor.

The use of small boats with outboard motors in the Refuge may affect water quality related oil emissions. However, this would be minimized by requiring all outboard motors be 4-stroke engines.

**Effects from Research Management Strategies:** During post-management of the 1993 ship wreck, it was discovered that the reinforcing bar (rebar) rods used for marking monitoring sites were leaching iron and causing tiny cyanobacteria blooms in halos around each stake. Since then, all research equipment left in the water is required to be made of stainless steel or other non-reactive materials to avoid such incidents. Monitoring for climate change variables is proposed, which would include water quality. It is anticipated that this would be beneficial as it would provide a baseline for water quality monitoring and alert the Refuge staff of any changes where management actions may need to be implemented. Given the very minor water quality work proposed and biosecurity measures currently in place, it is anticipated that effects to water quality from research would be negligible.

**Conclusion:** Overall effects to water quality would be minor and beneficial under both Alternatives A and B due to the continued removal of iron and related cyanobacteria. Water quality effects resulting from the additional monitoring proposed under Alternative B would be negligible.

### 6.2.3 Effects to Air Quality

**Effects from Habitat Management Strategies:** Under both Alternatives A and B, any activities conducted would follow Federal standards of ambient air quality to assess air quality effects. Management strategies that could have air quality effects are mainly related to application of herbicides. Though it is anticipated that any use of herbicides would be directly applied to the target species (e.g., hand application or squirt bottles), should any spraying (e.g., backpack spraying) occur, to avoid spray drift, approved herbicides would be used in accordance with recommendations on the label attached to the product (e.g., applying large droplets for sufficient coverage, avoid application of herbicides on windy days or certain times of day).

Given the lack of data on ambient air quality specific to the atoll, it is difficult to assess the magnitude of effects this action on air quality, especially since tradewinds blow out to sea and dissipate such spray. However, given that we anticipate not using spraying as a primary herbicide use and have protocols in place, it is anticipated the effects would be negligible.

The use of small boats with outboard motors in the Refuge would result in some exhaust being emitted. This would be minimized by requiring all outboard motors be 4-stroke engines.

**Conclusion:** Effects to air quality from proposed management actions under both Alternatives A and B are negligible.

# 6.3 Effects to Wildlife and Habitats

Topics addressed under the wildlife and habitats section include direct and indirect effects to the perimeter reef, ava, lagoon, beach strand, littoral forest and the species supported by these habitats such as CCA, turtles, corals, fish, other invertebrates, birds, and *Pisonia grandis* and other indigenous plant species.

The ESA, MBTA, and related recovery and conservation plans (e.g., green and hawksbill turtles, seabirds, shorebirds) were used to assess thresholds of significance for these analyses.

Unless otherwise stated, continuing the current management (Alternative A) generally has negligible, if any, effects because little or no change to current conditions is proposed. Alternative A continues the beneficial effects of management. The effects for Alternative B are described in terms of the change from current conditions and given the increased management level is more beneficial than Alternative A.

## 6.3.1 Effects to Habitats

### 6.3.1.1 Effects to Ava

**Effects from Habitat Management Strategies:** Monitoring to assess ava health and integrity is proposed under Alternatives A and B. Installation of oceanographic instruments such as current meters would require some small disturbance to the substrate to attach the device. Current anchoring devices used by NOAA CRED for instrumentation to monitor water flow rate and direction in the ava has had no discernible effect on the depth, topography, or other features of the ava; thus, effects are anticipated to be negligible as these activities would not widen or alter the ava in any way.

**Effects from Research Management Strategies:** New research strategies proposed under Alternative B may increase boat traffic going through the ava. However, it is anticipated that this would have negligible effects to the ava as these activities would neither widen nor alter the ava.

**Effects from Cultural Resource and EE Management Strategies:** See previous analysis for research management.

**Conclusion:** Effects to the ava from proposed management actions are negligible.

### 6.3.1.2 Effects to Lagoon

**Effects from Habitat Management Strategies:** Under Alternatives A and B, proposed monitoring to assess climate change variables as well as key focal species in this habitat would be important to assess the overall health of the lagoon. Additionally, under Alternative B, installation of remote sensing equipment may, depending on the system selected, require equipment be anchored in the lagoon and on the sandy bottom. However, it is anticipated that these activities would have negligible effects as they are minimal in scale and would adhere to Refuge protocols concerning use of equipment and habitat/species interactions (see previous sections such as 6.2.1 where examples of monitoring activities are provided).


*Management boats used. USFWS.*

Implementation of Alternative B would involve more frequent visits to the Refuge by staff, researchers, and cultural practitioners and increased use of anchors to hold boats in place while management activities are conducted. Anchors and the anchor chain that are improperly placed in hard-bottom habitat can cause localized damage to corals, faisua, and other sessile organisms when the boat swings on the anchor in response to wind and waves, drags due to insufficient anchor line scope, or fouls when pulled up from the surface. Far less damage is potentially done by anchors on sand and other soft bottom, but such substrates provide poor holding power and the anchor would drag unless there is no wind or water motion affecting the boat. These effects can be mitigated by live-boating (i.e., not using an anchor, but keeping a coxswain aboard to maintain boat position in the vicinity of snorkelers/divers); using a diver to hand-place the anchor; using a diver to clear the anchor from the bottom before it is hauled up; and frequently checking the position of the boat for drift or anchor drag. These practices are already utilized by the Refuge. Additionally, a mooring buoy is also being considered. This would greatly reduce impacts compared to anchoring because the impacted area would be less in size and it would only be in one spot (installing would require sand screws to anchor the mooring in the sand bottom). Mooring buoys have been shown to minimize damage from frequent anchoring in places such as the Florida Keys National Marine Sanctuary and the Molokini Islet off of Maui. Site selection would be based on little to no impact to resources. Based on these measures, effects of securing boats are anticipated to be negligible.

**Effects from Research Management Strategies:** Same as above in habitat management strategies.

**Conclusion:** Effects to lagoon from proposed management actions under both Alternatives A and B are negligible.

### 6.3.1.3 Effects to Perimeter Reef

**Effects from Habitat Management Strategies:** Under Alternative A, the Service would continue to monitor the abundance and distribution of the cyanobacterial community. This monitoring would also occur under Alternative B and similar to the lagoon, various monitoring and survey work is proposed to ensure the continued health and functionality of the reef. Examples of proposed items to be monitored include the reef's growth, elevation, and holes available to sea urchins; the benthic succession as cyanobacteria recede; survey and removal of marine debris; and density and biomass of focal species such as fish, corals, tuitui, and so on. Monitoring the shallow perimeter reef requires reef-walking, which has the capacity for damaging soft-bodied animals (e.g., sea cucumbers) or

breaking the branches of calcified organisms such as corals and the coralline red alga *Jania*. However, selection of careful footing on hard, even substrate such as CCA, barren substrate, or substrate covered with turf algae, serves to protect the safety of the reef-walker as well as the habitat and its living biota. Stakes that may be installed to mark transects or quadrat locations to return to on future monitoring surveys would be stainless steel or other durable material (e.g., PVC), which have been shown in previous work at the Refuge and other atolls to have no impact on the marine environment. Nylon, plastic, or fiberglass transect lines and lightweight quadrats composed of PVC pipe, which are briefly placed to delineate a sample area, are widely used in coral reef survey work throughout the Pacific and have no impact on the substrate or biota. If samples of living biota or abiotic substrate are required for identification or other analytic work, the minimum number of samples necessary for statistical purposes is collected, and the location of samples is spatially dispersed so as to minimize the effect on substrate cover, integrity of the biological community, and reproduction/recruitment processes. Based on similar monitoring already conducted at the Refuge and other atolls, it is anticipated that these activities would have minor effects as they are minimal in scale.

Additional habitat management proposed under Alternative B is the establishment of a systematic marine debris removal program. Derelict fishing gear, fish aggregation devices and other marine debris that snags on reefs can cause substantial damage by breaking corals through wind- and tide-driven water motion, smothering and crushing soft-bodied organisms, and potentially introducing alien marine biota that have grown on or become entrapped within the debris. Careful removal of debris involves application of techniques that do not cause further damage to the reef, e.g., cutting nets that are snagged around corals so the colonies are not broken or snapped off when the net is removed. Marine debris removal, when carefully conducted, would have a minor to intermediate benefit, depending on the quantity and type of debris involved.

**Effects from Research Management Strategies:** Same as above in habitat management.

**Conclusion:** Under Alternative A, the proposed monitoring program would have negligible effects to the perimeter reef. Long-term beneficial minor to intermediate effects are expected from the proposed management actions under Alternative B such as the systematic marine debris removal program.

### 6.3.1.4 Effects to Beach Strand

**Effects from Habitat Management Strategies:** See 6.2.1 effects to soils concerning monitoring activities. Under both Alternatives A and B, restoring native coastal plants is proposed. This action would improve the beach strand habitat by restoring former vegetation which may have been lost or impeded by the presence of rats. Such native coastal plants would also provide habitat for seabirds (e.g., sooty terns and noddies). Additionally, surveying for marine debris (and removing anything found) would help to keep this habitat from becoming degraded. Therefore, effects to beach strand are anticipated to be beneficial and minor.

**Effects from Research Management Strategies:** Same as above in habitat management.

**Effects from Cultural Resources and EE Management Strategies:** See 6.2.1 effects to soils.

**Conclusion:** Effects to beach strand from proposed management actions are beneficial and minor under both alternatives.

### 6.3.1.5 Effects to Littoral Forest

**Effects from Habitat Management Strategies:** Proposed actions under Alternative B that may affect this habitat include increased monitoring of wildlife populations, effectiveness of restoration efforts, climate change effects, effectiveness of pest species eradication and control, outplanting, and the installation of remote surveillance and monitoring equipment. The necessity to camp on the island in order to do many of the surveys that occur at night or at dawn and dusk or during particular parts of the tidal cycle on the reef flat would affect the littoral forest habitat as well by possibly disturbing or trampling vegetation.

Outplantings as part of restoration includes such activities as collection of seeds or immature seedlings and replanting them in identified area. Monitoring of such restoration efforts includes growth and survivorship and could include actions such as installing permanent grid or transect markers. Control of niu populations by mechanical control may result in damage to adjacent trees or loss of branches as coconut trees or nuts are removed. Removal of any undesirable plant species may temporarily affect habitat values by removing cover that could be used by nesting birds. Eradication of introduced scale insects or other insect herbivores or a new infestation of rodents would temporarily increase physical disturbance from injections of systemic pesticides or the use of traps or bait stations but all of these actions would be beneficial to restore the extent and composition of the littoral forest habitat to a state prior to disturbance. Effects are anticipated to be intermediate and beneficial and short- to long-term.

**Effects from Research Management Strategies:** Same as above in habitat management.

**Effects from Cultural Resources and EE Management Strategies:** Archaeological surveys as well as visits by cultural practitioners may occur under Alternative B. The trampling of littoral forest vegetation by those conducting such activities could be experienced. However, given that Refuge-authorized personnel would accompany archaeologists and cultural practitioners to educate on avoiding such impacts, it is anticipated that effects to this habitat would be negligible.

**Conclusion:** Effects to littoral forest would be beneficial, short- to long-term, and negligible and intermediate.

## 6.3.2. Effects to Wildlife

### 6.3.2.1 Effects to Federally Listed Species

Listed species receive special consideration in terms of Refuge management. Federally listed species are trust resources that require additional consultation whenever an activity conducted by or permitted by the Refuge may have an effect on these species or their habitats. Impacts associated with the use of herbicides and pesticides are assessed in the IPM program (Appendix G).

***Effects to Threatened Green Turtle and Endangered Hawksbill Turtle***

**Effects from Habitat Management Strategies:** Under Alternative B, new management related to working with NOAA to develop and implement monitoring protocol to track turtle abundance and movements is proposed. Additionally, instituting rapid response to eradicate pest species once detected would secondarily benefit these species by removing threats that could affect them (e.g., rats eating eggs or newly hatched turtles; pest plants degrading beach strand habitat by removing

available areas for nesting or hampering movement of turtles on the beach and hatchlings making their way to the lagoon). Removing marine debris, which can be potentially hazardous to adults and hatchlings, is also proposed. These actions are beneficial for turtles and are anticipated to have minor effects. Alternative B also calls for additional management visits to the atoll. The artificial lights associated with camping on shore and vessels may cause disorientation to hatchling turtles as they emerge from the nest. Control and minimization of artificial light around the atoll at night would alleviate that concern. Section 7 consultation would be done with NOAA with respect to the monitoring management action if required.

**Effects from Research Management Strategies:** See habitat management above.

**Effects from Cultural Resources Management Strategies:** Archaeological surveys as well as visits by cultural practitioners may occur under Alternative B. The trampling of beach strand habitat and nest disturbance by soil compacting or excavation by those conducting such activities is possible. However, given that Refuge-authorized personnel would accompany archaeologists and cultural practitioners to educate on avoiding such impacts, it is anticipated that effects would be negligible.

**Conclusion:** Effects to threatened green turtle and endangered Hawksbill turtle from proposed management actions are beneficial, long-term, and minor.

#### 6.3.2.2 Effects to Seabirds

**Effects from Habitat Management Strategies:** Under Alternative B, proposed management actions that may affect seabirds include increased activity in the colony while monitoring, installation of remote sensing, and rapid response to eradicate pest species. Secondary effects may occur from proposed habitat restoration of the native vegetation on the beach strand and in the littoral forest and surveying for marine debris. By providing managers with better data for management, enhancing existing habitat used by these species, and addressing potential threats, proposed management actions are beneficial and minor for these species as these activities would support their life-history needs. Negative effects could result from handling the birds for tagging, disturbing nest sites to check for chicks, and accidental damage to or exposure of nest sites during mechanical control of pest species. These actions could result in elevated stress levels or abandonment of nests. However, given the very temporary nature of these disturbances and the level of experience of staff who have previously conducted such activities, it is anticipated that these effects would be negligible.

Additional foot traffic in the beach strand habitat would increase the probability of accidental crushing the very cryptic eggs and chicks of brown noddies (gogo) and sooty terns (gogo uli). Training of field personnel to recognize and avoid nest areas would reduce this risk.

The necessity to camp on shore during management and monitoring work may also cause nest abandonment by boobies and ground-nesting terns if the temporary camp site and activity center is located too close those nests. Artificial light from camp activities may startle tree-nesting boobies and terns and cause them to panic and lose eggs or small chicks from nests. Careful minimization and control of artificial lights in camp and during nocturnal work would reduce this impact.

Increased frequency or duration of vessels standing offshore of Rose Atoll would result in greater incidence of bird collisions with the lighted vessel at night. Especially on rainy nights deck lights can cause birds to become disoriented and crash into the boat causing injury, plumage soiling, or death.

This problem can be minimized by requiring the vessel to steam away from the atoll at night and restricting lighting on board to the minimum running lights required by law.

**Effects from Research Management Strategies:** See habitat management above.

**Effects from Cultural Resources Management and EE Strategies:** Archaeological surveys as well as visits by cultural practitioners and EE groups may occur under Alternative B. The trampling of beach strand and littoral forest habitats and nest disturbance by those conducting such activities could be experienced. Similarly, as mentioned under habitat management, increased frequency or duration of lighted vessels standing offshore at night could increase bird collisions. However, given that Refuge-authorized personnel would accompany archaeologists and cultural practitioners to educate on avoiding such impacts, it is anticipated that effects would be negligible. Night activities should be minimized to reduce artificial light impacts and accidental trampling of nests of seabirds.

**Conclusion:** Effects to seabirds from proposed management actions are beneficial, negligible to minor, and long-term.

### 6.3.2.3 Effects to Shore, Wading, and Land Birds

See effects to seabirds 6.3.2.2 above. Response to an incursion of rodents using rodenticide, live traps, or kill traps may affect migratory shorebirds and landbirds by accidental poisoning if they ingest bait pellets, and injury or death in live traps and kill traps designed for rodents. Mitigation for these effects would include the use of tamper-proof bait stations for rodenticide and for kill traps and careful monitoring of any live-traps deployed.

**Conclusion:** Same as 6.3.2.2.

### 6.3.2.4 Effects to Native Invertebrates

**Effects from Habitat Management Strategies:** Primary species analyzed are for effects include tuitui, marine gastropods, *Turbo* spp., *Coenobita perlatus* and *C. brevimanus*, and faisua. Under Alternative B, new proposed management includes direct monitoring of species and habitat monitoring (e.g., climate change variables, nutrient budget, benthic succession, pest species, etc.). Monitoring activities are typically on the low end of impacts activities as they can usually be conducted without disturbance to species. Typical monitoring of such species could include measuring taxonomic diversity, association with substrate type, spatial distribution, abundance, density, and biomass. Monitoring of these species is a long-term action and beneficial because it would provide managers with data to enhance management as well as address any potential threats. The installation of remote sensing may, depending on the type of system chosen, also include buoys or hydrophones. However, it is anticipated that effects from proposed actions would be beneficial, negligible to minor, and long-term because comparable monitoring activities are undertaken at atolls throughout the world without disturbance to the environment while providing critical information on status and trends of populations.

Eradication of species such as the scale insect or ants could include additional injections of insecticide imidacloprid Imicide ® into the tree or deploying insecticide bait. Use of insecticides comes at the risk of exposure to native arthropods that may also be sensitive to them. These risks can be minimized by employing IPM and careful application.

**Effects from Research Management Strategies:** See habitat management above.

**Conclusion:** Effects to native invertebrates from proposed management actions are beneficial, negligible to minor, and long-term.

### 6.3.2.5 Effects to Coral

**Effects from Habitat Management Strategies:** See 6.3.2.4 related to monitoring. Increased monitoring of all species and habitats in the lagoon, on the reef flat, or in the ava would increase the chances of physical damage to coral by small boats transporting staff, snorkelers, or divers using SCUBA. All participants in these activities would be trained and evaluated by the Refuge/Monument Manager to ensure their skills in boat driving and working in the water would enable them to avoid physical contact with live coral.

**Effects from Research Management Strategies:** See 6.3.2.4 and above.

**Conclusion:** Same as 6.3.2.4.

### 6.3.2.6 Effects to Coralline Algae

**Effects from Habitat Management Strategies:** See 6.3.2.4 related to monitoring.

**Effects from Research Management Strategies:** See habitat management above.

**Conclusion:** Anticipated effects from proposed management actions are beneficial, negligible to minor, and long-term.

### 6.3.2.7 Effects to Fish

**Effects from Habitat Management Strategies:** See 6.3.2.4 related to monitoring. Sharks are cartilaginous fishes whose abundance and biomass, as apex predators, are frequently cited as an indicator of the health status of a coral reef ecosystem (Friedlander and DeMartini 2002, DeMartini et al. 2008, Sandin et al. 2008). The greatest difference between populated areas and largely intact reef systems at extremely remote locations tends to be in the abundance and size of large predatory fishes such as sharks and jacks. Those groups often comprise a large portion of total fish biomass estimated from visual surveys at remote coral reefs, but are infrequently encountered and constitute a small portion of biomass on reefs close to even fairly small human populations (Williams et al. 2011, Nadon et al. 2012). Under Alternative B, predators such as sharks and prey fish species would be visually surveyed around the opening of the ava. Surveys for sharks and other large fish predators have been conducted by the NOAA CRED using SCUBA and small boats along the outer reef and in the lagoon since 2002 without adverse effect. Consequently, the effects of surveys conducted at the mouth of the ava are anticipated to be negligible but would contribute to knowledge of predator and prey fish populations at the Refuge.

**Effects from Research Management Strategies:** Same as above in habitat management.

**Conclusion:** Effects to fish from proposed management actions are anticipated to be negligible.

### 6.3.2.8 Effects to Pest Species

**Effects from Habitat Management Strategies:** Proposed habitat management strategies for all alternatives have components of either controlling or eradicating pest species (both flora and fauna). Control of these pests is critical for recovery of listed species and continuation of other native species at the Refuge. Under Alternative B, new proposed management with regard to pest species includes addressing existing pests such as the cyanobacteria (through iron removal) and introduced scale insects, and using a rapid response system to eradicate any new pests discovered (e.g., plants, rats, etc.). Eradication can involve any number of tools from hand-pulling plants, to traps, to chemicals such as herbicides or rodenticides. The increased level of effort under Alternative B is more beneficial than A. Given that the non-native species were introduced to the Refuge, opportunistic species such as cyanobacteria were not dominant at the Refuge, these species exist outside the Refuge, and an IPM is in place (see previous section 6.1 effects common to all) control or eradication of these species is anticipated to be negligible.

**Effects from Research Management Strategies:** Visits by researchers and related personnel would occur under Alternative B. With increased visitation to the Refuge for these uses, there is potential for pest species to be transported to the Refuge on the boat or on the persons themselves and the equipment/tools brought with them. However, given the existing biosecurity protocols in place, stipulations in the SUP, and the fact that people would be accompanied by a Refuge-authorized agent, it is anticipated that this impact would be negligible.

**Effects from Cultural Resources and EE Management Strategies:** Same as research management strategies.

**Conclusion:** Effects to pest species from proposed management actions are negligible.

## 6.4 Effects to Cultural and Historic Resources

The NHPA, as amended, establishes the Federal government's policy on historic preservation and the programs through which that policy is implemented. An impact to cultural resources would be considered significant if it adversely affects a resource listed in or eligible for listing in the National Register of Historic Places. In general, an adverse effect may occur if a cultural resource would be physically damaged or altered, isolated from the context considered significant, or affected by project elements that would be out of character with the significant property or its setting. Title 36 CFR Part 800 defines effects and adverse effects on historic resources.

At the time of writing this draft CCP/EA, results from an archaeological survey that was conducted in February of 2012 were not complete. However some preliminary information received indicates some sites could be eligible for listing on the National Register of Historic Places. Once the Refuge receives the final report and it confirms eligibility status on identified sites, we would undertake Section 106 for any management actions which may affect these resources.

Currently, no resources are eligible or listed on the National Register of Historic Places at the time of writing, some historical and cultural resources have been identified, and Refuge staff would conduct management activities in a way that appropriate procedures and protocols would be followed to protect the cultural resources. Wherever possible, cultural resources would be avoided or minimized. Minimization options, in addition to site avoidance by relocating activities, would include data recovery, using either collection techniques or *in-situ* site stabilization protection.

Allowing cultural practitioners to access the Refuge for traditional uses would also be beneficial as it would support and perpetuate fa'a Samoa.

**Conclusion:** Effects to cultural and historic resources from proposed management actions are negligible.

## 6.5 Effects to Social Resources

Unless otherwise stated, continuing the current management (Alternative A) generally has negligible effects because little or no change to current conditions is proposed. The effects for Alternative B are described in terms of the change from current conditions and given the increased management level is more beneficial than Alternative A.

### 6.5.1 Opportunities for Quality Environmental Education and Interpretation and Outreach

Since EE is not currently offered at the Refuge, there are no user numbers to assess for possible change. Similarly, other than a Website, there is no active interpretation occurring of the Refuge.

**Effects from Outreach, Interpretation, and EE Management Strategies:** Under Alternative B, strategies for increasing off-site opportunities are proposed. They include developing brochures, displays, social media, outreach messages, interpretive videos, developing a Refuge Friends group, volunteer, and student intern program, participating in community meetings and local events, creating EE materials, partnering with schools on research, and developing EE curriculum and related classroom materials. All of these actions would be beneficial and intermediate.

**Conclusion:** Effects to quality EE and interpretation and outreach from proposed management actions are beneficial, long-term, and intermediate.

### 6.5.2 Extent of Illegal Use

Under Alternative B, new management actions to deter illegal uses have been proposed. They include re-installation of Refuge signage, development of informational materials such as brochures to targeted audiences such as the yachting community, increased collaboration with the USCG and NOAA enforcement, working with the Manu'a community to increase awareness of illegal activities, installation of remote sensing (e.g., cameras), designating the Refuge as an area to be avoided by the maritime community, and vessel acquisition or contract. Effects under Alternative B are anticipated to be beneficial, long-term, and intermediate.

**Conclusion:** Effects to illegal use from proposed management actions are beneficial, long-term, and intermediate.

### 6.5.3 Environmental Justice

The EPA oversees environmental justice compliance and defines environmental justice as: "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Further, EPA defines a community with potential environmental justice

populations as one that has a greater percentage of minority or low-income populations than does an identified reference community (identified reference community is the Manu'a Islands). Minority populations are those populations having 1) 50 percent minority population in the affected area (USEPA 1998a); or 2) a significantly greater minority population than the reference area. There are no specific thresholds provided for low-income or poverty populations.

There is no population at the Refuge or directly adjacent to it. The closest populated community, at almost 80 miles away, is located in the Manu'a Islands. Development of this CCP was done with public input from these islands, which involved local chiefs, residents, teachers, and others from the community (see Appendix J for further details). None of the proposed strategies would negatively affect environmental justice because activities would provide "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Therefore, it is anticipated that proposed actions under Alternative B would have negligible environmental justice effects.

**Conclusion:** Effects to environmental justice from proposed management actions under both alternatives is negligible.

## 6.6 Effects to Economic Resources

This economic analysis provides a means of estimating how current management and proposed management activities affect the local economy. This type of analysis provides two critical pieces of information: 1) it illustrates the Refuge's contribution to the local community; and 2) it can help in determining whether economic effects are a real concern in choosing among management alternatives.

For the purposes of this analysis, a region (and its economy) is defined as American Samoa given that Refuge spending occurs mainly in Tutuila where Refuge staff reside and work and that the purchase of most expenditures occurs there.

The analysis for this section is divided into 1) economic resources specific to management strategies and 2) additional economic impacts specific to Refuge employment and personnel salary spending, and Refuge purchase of goods and services within the local economy.

Unless otherwise stated, continuing the current management (Alternative A) generally has negligible, if any, effects because little or no change to current conditions is proposed. The effects for Alternative B are described in terms of the change from current conditions and given the increased management level is more beneficial than Alternative A.

### 6.6.1 Management Strategies

**Effects from Habitat and Research Management Strategies:** Under Alternative B, increased habitat management and new research and monitoring strategies are proposed to enhance Refuge management and decision-making. Some of this research is conducted collaboratively with other agencies or educational institutions. These partners and collaborators could purchase supplies, transport, or temporary help locally. Examples of large purchases include (in 1 year) $60,000 for boat charters and $6,000 for food and other supplies.

**Effects from Cultural Resources Management Strategies:** Under Alternative B, those engaging in cultural practices are required to secure their own transport to the Refuge. This could result in some revenue for boating operations.

## 6.6.2 Additional Economic Impacts

### 6.6.2.1 Impacts from Refuge Administration

***Staff – Personal Spending***

Employees of the Refuge reside and spend their salaries on daily living expenses in the local area, thereby generating impacts within the local economy.

**Table 6-2. Annual Salaries (including locality pay and COLA and benefits) for Refuge Employees by Alternative**

| Staff | Alt A | Alt B |
|---|---|---|
| Refuge/Monument Manager (GS-12) – Permanent | $117,392 | $117,392 |
| *Superintendent/Project Leader (GS-14) - Permanent | $16,309 | $16,309 |
| *Wildlife Biologist (GS-12) - Permanent | $12,594 | $12,594 |
| *Administrative Officer (GS-9) - Permanent | $8,859 | $8,859 |
| Wildlife Biologist (GS-11) - Permanent | | $84,411 |
| Biological Technician (GS-7) - Permanent | | $57,404 |
| Admin officer (GS-5/7) | | $57,404 |
| Park Ranger (GS-5/7) – Half time | | $28,702 |
| **Total:** | **$155,154** | **$383,075** |

* Staff at the Honolulu Complex Headquarters also support Rose Atoll NWR (expenditure reflects the percentage of time spent supporting the Refuge, but does not translate into local expenditures).

Salary spending by Rose NWR personnel could generate secondary impacts by providing jobs in other industries where monies are spent (e.g., boat rental). Personal spending could include rent, utilities, food, entertainment, food services, gas, etc. If spending were large enough, jobs in these related sectors could be produced through revenue generated. Under Alternative A with only one employee, spending would likely not be enough to generate additional jobs in the economy. However, under Alternative B, a total of three employees would be needed to support Refuge management. When comparing this total salary expenditure against the average labor income by industries in Chapter 5, salary expenditure could result in new job creation.

***Work-related Purchases***

A wide variety of supplies and services are purchased for Refuge operations and maintenance activities. Refuge purchases made in American Samoa contribute to the local economic impacts associated with the Refuge. The Refuge incurs both annual (recurring) operational costs and one-time expenditures.

Over the 15-year span of the CCP, to implement Alternative A, management actions would require $916,000 (not including staffing). For Alternative B, it would be either $11,319,125; $11,044,125; or

$10,829,125 (not including staffing) depending on the vessel option chosen. How much of these expenditures would be spent in American Samoa would vary depending on the activity so the exact effects on the local economy cannot be ascertained. However, it is likely that some of these expenditures would be spent in American Samoa (please refer to Appendix D, Tables D-1 and D-2 for a detailed list of expected annual operating costs and one-time expenditures for the Refuge and each alternative).

**Conclusion:** Effects to economic resources from proposed management actions are beneficial and long-term. However, given the size of the Refuge budget relative to other industries and economic inputs into the local economy on American Samoa, effects to economic resources is likely negligible.

## 6.7 Other Effects

Unless otherwise stated, continuing the current management (Alternative A) generally has negligible, if any, effects because little or no change to current conditions is proposed. The effects for Alternative B are described in terms of the change from current conditions and given the increased management level is more beneficial than Alternative A.

### 6.7.1 Potential Impacts on Adjacent Lands and their Associated Natural Resources

There are no adjacent lands, but there are adjacent waters and associated natural resources. It is not anticipated that there would be effects to adjacent waters and their associated natural resources given that both areas are protected areas.

**Conclusion:** Effects to adjacent waters from proposed management actions is negligible.

### 6.7.2 Potential Impacts to Nearby Residents

The nearest populated area is Ta'ū Island, almost 80 miles away. In addition to effects already discussed previously (e.g., habitat management, cultural resources management, outreach, interpretation, and EE), potential effects, under Alternative B would be beneficial as there are several strategies to directly engage the Manu'a communities with EE, outreach, interpretation, cultural practices, and law enforcement that would strengthen their connection to Rose Atoll and shared stewardship of the ecological, geologic, and cultural richness of the Refuge. Effects are anticipated to be minor.

**Conclusion:** Effects to nearby residents from proposed management actions is beneficial, minor, and long-term.

## 6.8 Cumulative Effects

Cumulative effects can result from the incremental effects of a project when added to other past, present, and reasonably foreseeable future projects in the area. Cumulative impacts can result from individually minor but cumulatively significant actions over a period of time. This analysis is intended to consider the interaction of activities at the Refuge and with other actions occurring over a larger spatial and temporal frame of reference.

The Council on Environmental Quality (CEQ) regulations for implementing the provisions of NEPA defines several different types of effects that should be evaluated in an EA including direct, indirect, and cumulative. Direct and indirect effects are addressed in the resource-specific sections of this Draft CCP/EA. This section addresses cumulative effects.

The CEQ (40 CFR § 1508.7) provides the following definition of cumulative effects:

> *"The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."*

It should be noted that the cumulative effects analysis has essentially been completed by virtue of the comprehensive nature by which direct and indirect effects associated with implementing the various alternatives was presented. The analysis in this section primarily focuses on effects associated with reasonably foreseeable future events and/or actions regardless of what entity undertakes that action.

## 6.8.1 Protected Areas

At press time of this CCP, Fagatele Bay National Marine Sanctuary (Sanctuary) was considering adding the Monument waters outside of the Refuge to the Sanctuary. Additionally, NMFS is also reviewing proposed Monument fishing regulations that include establishing a 12-nmi no-take area around Rose Atoll NWR and would establish regulations to permit sustenance and traditional indigenous fishing in the 12-50 nmi zone of the Monument.

Both processes are still not completed so it is difficult to assess with certainty what cumulative effect these actions may have. However, should the fishing regulations and addition to the Sanctuary move forward, though the addition of the 12-nmi no-take zone adjacent to the Refuge would be beneficial, it is likely cumulative effects would be negligible given the projected low harvest associated with sustenance and traditional indigenous fishing for pelagic species in the Monument. Increases in capacity for management by any of the resource protection agencies in the area would result in more opportunities for synergy and shared costs.

## 6.8.2 Climate Change

The background and biotic and abiotic effects of climate change are discussed in Chapter 3 section 3.1.2 including atmospheric events and precipitation, rising temperatures, SLR, ocean acidification, and expected ecological responses.

Though nothing the Refuge proposes would have an impact on climate change, the data collected through proposed strategies of monitoring for climate change variables may inform about the impacts of climate change on atoll resources and provide for larger scale climate change analysis as well as provide information that may help managers develop mitigation or adaptation strategies for protection of Refuge species from some of the anticipated effects of climate change. Alternative B would also help restore ecosystem and species resilience to climate change by reducing or eliminating other stressors (e.g., pest species).

**Conclusion:** Cumulative effects are negligible.