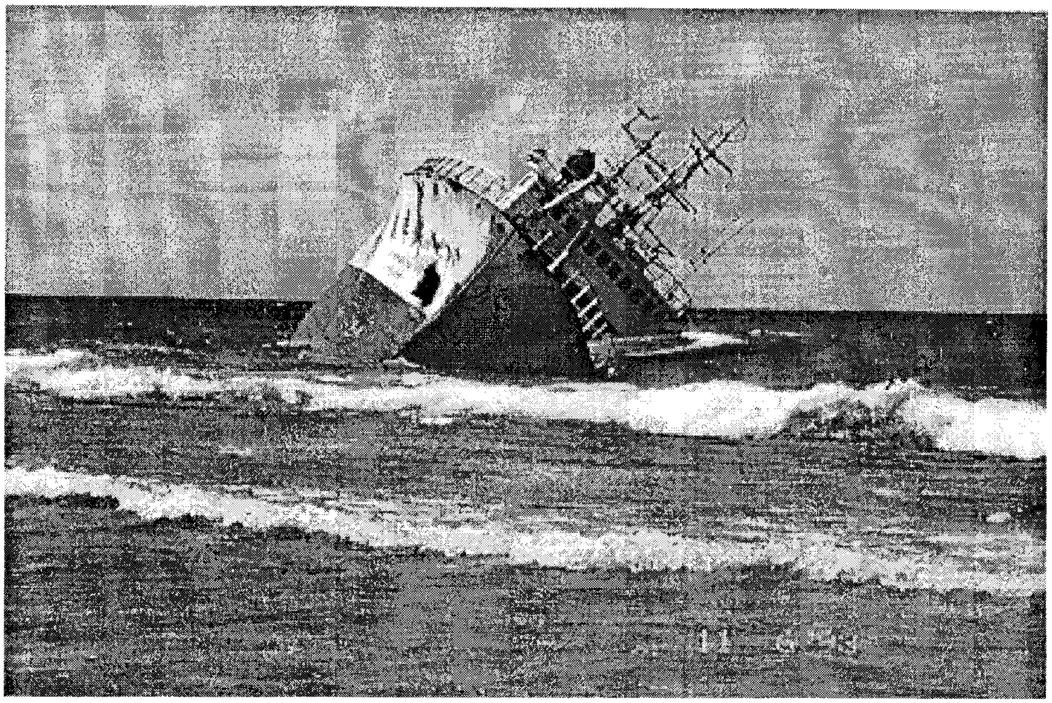
Draft Restoration Plan for Rose Atoll, National Wildlife Refuge

(Including Environmental Assessment)



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Executive Summary

In October 1993 the *Jin Shiang Fa*, a Taiwanese fishing vessel, ran hard aground on the western reef of the Rose Atoll National Wildlife Refuge (NWR). The vessel broke up before a salvage tug could reach the atoll, resulting in the release of over 100,000 gallons of diesel and lube oil across the reef. The spill killed a large area of the primary reef building organisms, crustose coralline algae, near the wreck site. Invasive species of cyanobacteria and articulated coralline algae immediately began colonizing those areas of the reef injured by the spill. Data collected in the years following the spill suggests that iron released into the water from corroding metal wreckage is stimulating the growth of the invasive 'weedy' species, thereby preventing resources injured by oil from returning to baseline conditions. These 'weedy' species have spread to areas of the atoll that initially were unaffected by the incident, overgrowing and killing the crustose coralline algae below. Other documented spill-related injuries included, the death of numerous giant clams, sea cucumbers and sea urchins. Studies also showed that the composition of the local fish community was altered by the incident.

Since the oil spill, conditions on the reef have continued to deteriorate and there is an increasing likelihood that the very structure of the atoll will become seriously weakened in those areas where the invasive species have replaced the reef building crustose coralline algae. The Natural Resource Trustees (Department of the Interior represented by the Fish and Wildlife Service and the Government of American Samoa) have serious concerns that if the reef is weakened further by the lack of a healthy reef building community, it may be breached, resulting in a significant change in water circulation patterns across the atoll, and the eventual destruction of Rose and Sand Island. If these islands are destroyed, it would mean the loss of the most important resting and nesting habitat for federally protected seabirds and the federally listed green sea turtle in the American Samoa archipeligo.

The goal of the Natural Resource Trustee's (Trustees) Restoration Plan is to stop the ongoing, spill-related injuries to the atoll thereby permitting the natural resouces of the atoll to return to their baseline condition. The large area of crustose coralline algae initially killed by the oil spill has failed to return to baseline levels due to the spread of the invasive 'weedy' species. Various marine invertebrates injured by the oil also have failed to return to baseline levels in the six years following the spill. Furthermore, the area of crustose coralline algae injured has expanded due the spread of the invasive species. Emergency restoration actions taken in July-August 1999 indicated that removal of metallic debris will arrest the spread and dominance of the invasive 'weedy' species. The Trustees have concluded that the only way to halt the ongoing injury, caused by the *Jin Shiang Fa* oil spill, is to remove the remaining vessel debris. The removal of vessel debris also is considered a prerequisite to implementing any other restoration alternative.

The Restoration Plan for Rose Atoll NWR consists of removing the remaining vessel debris and monitoring the recovery of the injured reef community. Because of differences in removal techniques, the salvage effort will be divided into three separate operations. The vast majority of the metal debris on the reef flat has recently been removed by hand and the remaining removal will not require the use of underwater salvage equipment. Larger debris on the reef slope must be cut into smaller pieces by salvage divers and transported to the surface before being loaded

onto a vessel for transport to an approved offshore dumpsite. The removal of the remaining lagoon debris also will require salvage divers, who will transport the debris to a smaller salvage vessel stationed within the lagoon and then to the offshore dumpsite. Monitoring will begin after salvage efforts are complete, and will be conducted biennially for the following ten years. The Natural Resource Trustees have estimated the total cost of this operation to be $1,301,053.

NEPA Compliance

The restoration of natural resources under OPA must comply with National Environmental Policy Act (NEPA) regulations (40 CFR 1500 et seq.). The Trustees used information gathered during several years of assessing injury at Rose Atoll to determine whether an Environmental Impact Statement (EIS) would be required prior to the selection of the final restoration alternative. This Draft Restoration Plan serves as an Environmental Assessment by describing: 1) the need for the proposed restoration action, 2) the environmental setting, and 3) the restoration alternatives along with their potential environmental consequences. Subject to the receipt of new information, including that which is provided by the public, the Trustees do not believe that the proposed restoration alternative will significantly adversely affect the quality of the environment and therefore, does not require an Environmental Impact Statement.

The Need for Immediate Restoration Actions

Data collected at Rose Atoll NWR in the years following the 1993 *Jin Shiang Fa* oil spill indicate that conditions on the reef are deteriorating. The oil spill killed a large area of crustose coralline algae, which was quickly colonized by invasive opportunistic species (USFWS 1997). Six years later, these invasive species continue to dominate in the spill zone and have spread to other areas of the atoll, overgrowing and killing otherwise healthy portions of the reef. The Trustee's preliminary field data indicate that the bloom of these invasive species is being artificially maintained by elevated iron levels in the water coming from the corroding vessel debris (USFWS 1999). These data also suggest that the reef area injured by the oil spill will not return to baseline conditions until these invasive species are brought back to baseline levels.

There is an increasing likelihood that the structure of the atoll may become seriously weakened in those areas where invasive species have replaced the reef building crustose coralline algae for several years. If an area becomes so weak it is breached, a significant change in water circulation patterns across the atoll likely would occur leading to the eventual destruction of Rose and Sand Island. If these islands are destroyed, it would mean the loss of the most important nesting and roosting habitat for federally protected seabirds and the federally listed green sea turtle in the Samoa archipelago. The preferred restoration alternative proposed in this plan will prevent additional injury to the reef community by bringing the invasive species back to baseline levels and allowing reef organisms to return to baseline conditions.

Rose Atoll is located on the far eastern edge of the Samoan Archipelago (Figure 1). The shape of the atoll is square, with the four "corners" facing roughly north, south, east, and west. The lagoon is almost entirely enclosed by the reef, except for a narrow opening on the northwest side (Figure 2). Prior to the *Jin Shiang Fa* oil spill, the atoll was considered to be one of the least disturbed coral atolls in the world (UNEP/IUCN 1988). The unique coral reef ecosystem at Rose is dominated by crustose coralline algae rather than hermatypic corals more commonly found in the Samoa Archipelago (Mayor 1921, Green 1996). Dominant coral genera at Rose include *Favia, Acropora, Porites, Montipora, Astreopora, Montastrea* and *Pocillopora.* Two species, *Favia speciosa* and *Astreopora myriopththalma*, are much more abundant at Rose than elsewhere in Samoa (Maragos 1994). In contrast, four genera (*Pavona, Galaxea, Leptastrea*, and *Platygyra*) are less abundant at Rose than they are on the other islands in the archipelago (Maragos 1994).

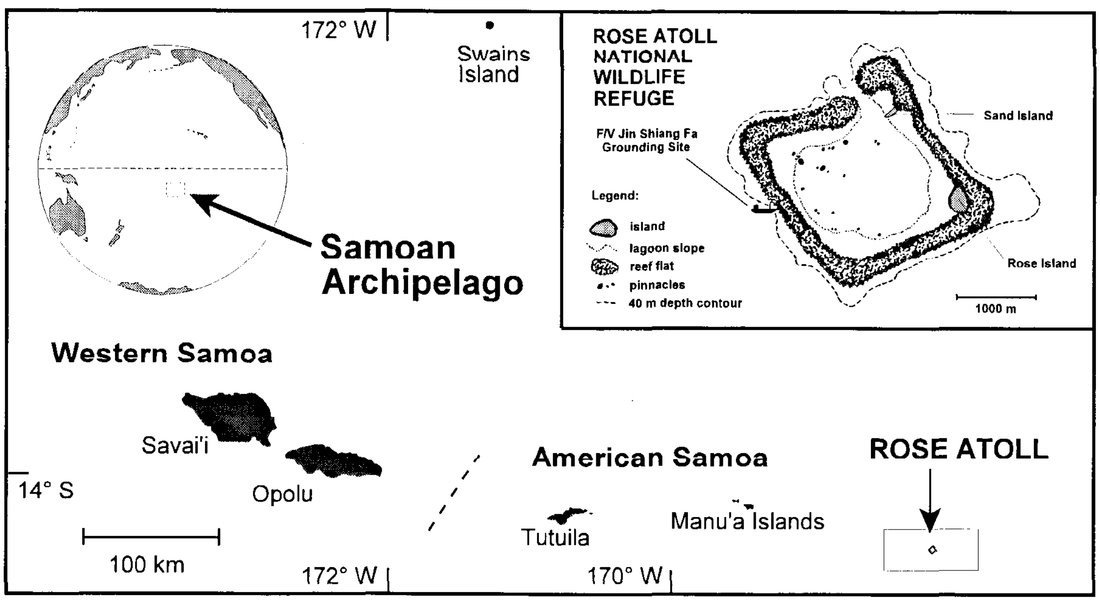

Figure 1. Map of Samoan Archipelago showing the location of Rose Atoll (modified from USFWS 1997)

Although a "coral" atoll dominated by crustose coralline algae is not unique in the central Pacific Ocean, Rose is an excellent example of this type of reef. Rose Atoll was designated as a National Wildlife Refuge (NWR) in 1974 "for the conservation, management, and protection of its unique and valuable fish and wildlife resources" (Greenwalt 1974). Soon after, a Presidential

Proclamation recognized that "[T]he submerged lands surrounding Rose Atoll are necessary for the protection of the atoll's marine life, including the green sea and hawksbill turtles" (Ford 1975). This remote refuge is jointly administered by the U.S. Fish and Wildlife Service (USFWS) and the Department of Marine and Wildlife Resources (DMWR) of the American Samoa Government.

The fish community at Rose also is distinctly different from those that occur elsewhere in the Samoan Archipelago (Green 1996). Fish density is very high and species richness is moderately high at Rose, although fish biomass is low because of the dominance of small, planktivorous species (Green 1996). The fish assemblages at Rose also differ from the rest of the archipelago by having a much lower diversity of herbivorous species (especially parrotfishes and damselfishes), and a high density of planktivorous and carnivorous species (primarily damselfishes, unicornfishes and snappers) (Wass 1981a, Green 1996, unpubl. data). Giant clam (*Tridacna maxima*) densities at Rose Atoll are much higher than elsewhere in the Samoan Archipelago, where populations have been severely reduced by over-harvesting (Green and Craig 1996). Clam density is highest on the atoll at the base of the lagoon pinnacles (Wass 1981b, Radtke 1985, Green and Craig 1996).

Rose Atoll supports two emergent islands, the largest of which (Rose Island, 5.2 ha) is heavily vegetated with *Pisonia* trees and beach heliotrope shrubs (*Tournefortia argentea*) (USFWS 1996a,b). Rose Island is an important nesting site for 12 species of federally protected seabirds. Approximately 97% of the total seabird population of American Samoa resides on the atoll (Amerson *et al.* 1982, Rodgers *et al.* 1993, USFWS 1996a,b). Five species of federally protected migratory shorebirds and one species of forest bird use the terrestrial habitat, shoreline, and exposed reef for feeding, resting, and roosting (USFWS 1996a,b). The second island (Sand Island) is smaller (2.6 ha) and unvegetated. Both islands are uninhabited and are important nesting sites for the threatened green sea turtle (*Chelonia mydas*) (Rodgers *et al.* 1993). Satellite tags attached to nesting green turtles at Rose have shown that these turtles migrate between American Samoa and other Pacific island nations including Fiji and French Polynesia (Balazs *et al.* 1994). In addition to the migratory breeding population of turtles that use the atoll during the nesting season (from August to February), there also appears to be a small, resident population of juveniles living on the atoll (G. Balazs pers. comm.). Endangered hawksbill turtles (*Eretmochelys imbricata*) also have been seen in the lagoon (USFWS 1996a). It is not known if they nest on the islands.

The coral reefs at Rose can be divided into seven habitat zones, which vary in terms of their physical and biological characteristics (Figure 2).

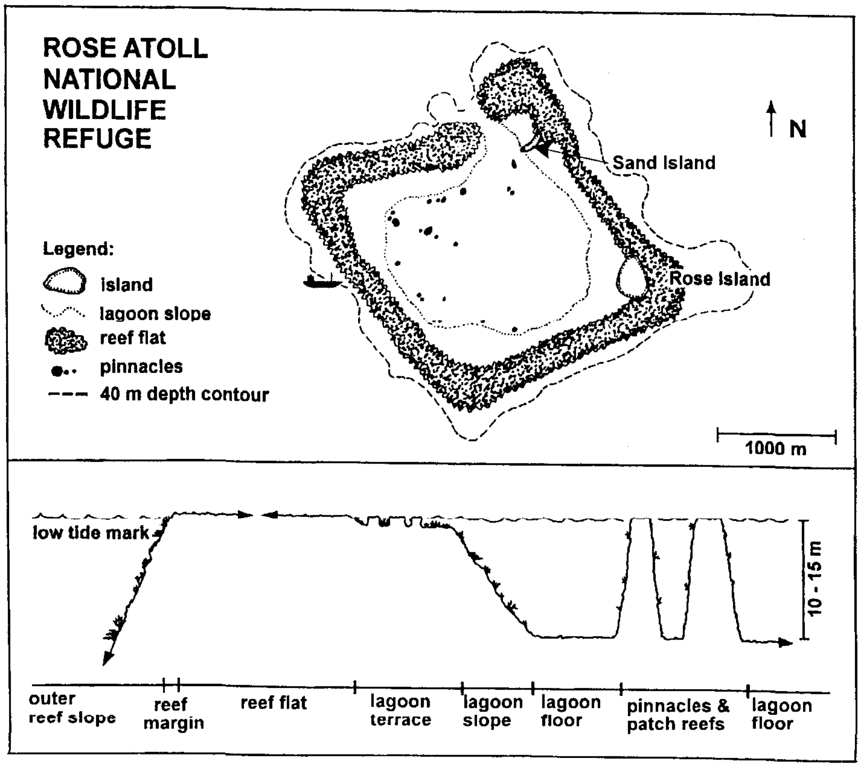

Figure 2. Map of Rose Atoll, NWR (modified from Green and Craig 1996) showing the location of the grounded vessel. A profile of the reef appears below the map and shows the seven habitat zones found on the atoll.

The **outer reef slope** is located on the seaward side of the atoll, and consists of an irregular and often steep slope down to a depth of approximately 50 meters (m). In some locations, a shallow reef terrace (< 10 m deep) is located on the upper slope, before the reef plunges down almost vertically into very deep water. Spur and groove formations occur on the shallow reef terrace in some locations. The **reef flat** is a hard, consolidated substratum that is exposed during spring tides. The seaward edge of the reef flat, just before the reef starts to slope down into deeper water, is called the **reef margin**. The lagoon is almost entirely enclosed by the reef flat, except for a narrow channel on the northwest side. The inner edge of the reef flat slopes down to a shallow shelf (1-3 m deep) that surrounds the lagoon called the **lagoon terrace**. Most of this shelf (50-75%) is covered with rubble and a few scattered colonies of *Acropora*; the rest is dotted with small patch reefs whose tops are uncovered at low tide. The inner edge of the lagoon terrace slopes steeply down the **lagoon slope** to the **lagoon floor** (> 15 m deep). The lagoon has an undulating sandy floor with a few isolated *Acropora* patches around its perimeter and numerous flat-topped, vertical **patch reefs** that extend up to the surface and pinnacles submerged below the surface. Wave exposure is low in the lagoon and high on the outer reef slope and reef flat.

Incident Background — Chapter 2

2.1 Oil Release

At approximately 4:00 am on October 14, 1993, the Taiwanese longline fishing vessel *Jin Shiang Fa* ran hard aground on the seaward edge of the southwest arm of Rose Atoll, NWR. The ship had just refueled in Pago Pago Harbor on Tutuila Island less than 24 hrs earlier and was in transit to an unspecified fishing area in the Pacific (USFWS 1996a). Initial observations of the wreckage suggest that the vessel was traveling parallel to the southwest arm when it struck the reef. The vessel collided with the upper portion of the outer reef slope and skipped across the tops of two large spurs (depth 3-4 m) before coming to rest on the tops of two others. The orientation of the grounded vessel was nearly parallel to the reef margin, with the ship's hull keeled over toward its port side and its bow pointed in a north-northwesterly direction (Molina 1994).

At the time of the grounding, the 37 m vessel was carrying approximately 100,000 gallons of diesel fuel and 500 gallons of lube oil. All of these contaminants were discharged into the marine environment at the wreck site where prevailing currents carried the bulk of the material across the reef flat and into the lagoon. The rate at which the contaminants were released into the marine environment could not be accurately determined, although the discharge appeared to be continuous for approximately six weeks after the initial grounding. Based on observations during over-flights and site visits, the majority of the oil likely was discharged within the first few days after the grounding, with lesser amounts discharged up until the time of salvage operation six weeks later (Barclay 1993, Molina 1994, USFWS 1996b).

Due to the heavy wave action at the atoll, it is likely that a significant portion of the fuel oil moving over the surf zone was forced downward into the water column and trapped in the reef structure. Entrapped oil was documented extending at least 190m southeast and 440m northwest of the spill site. Molina (1994) observed that oil remained on the reef flat for at least three weeks after the spill in the form of sunken oily debris and oil entrapped in the reef matrix, coral rubble, and associated sediments. Oil persisted in the sediment at the grounding site for at least 22 months after the spill (D. Palawski unpubl. data). Diesel fuel also was detected in sediment samples taken from the lagoon terrace and lagoon slope, indicating that reef organisms were exposed to petroleum hydrocarbons for an extended period of time.

2.2 Response Actions

Initial response actions included: 1) estimating the amount of fuel discharged; 2) limited documentation of marine life mortalities; and 3) an initial attempt at salvaging the vessel. No fuel or lube oil was removed or recovered from either the vessel or the reef. The vessel grounded in an area of high wave energy and broke up before a salvage tug could reach the atoll (Barclay 1993). When salvage operations began on November 27, 1993, the stern of the vessel (approximately 250 tons) was nearly submerged on the shallow reef slope with only a small amount of rigging above water. The bow section (76 tons), wheelhouse (5 tons), shelter deck (2 tons) and miscellaneous pieces of the ship (38 tons) were scattered over the reef flat, covering an area of approximately 9,000 m^2. Ship debris was also spread over an estimated 175,000 m^2 of reef flat and lagoon terrace, although the majority was concentrated in a 100-m wide band adjacent to the wreck (Barclay 1993).

Salvage operations removed most of the larger pieces of wreckage and debris from the reef flat. This included pulling the bow, wheelhouse, shelter deck, and miscellaneous pieces of ship wreckage off the reef flat, into deeper water (600-1,000 m). The mass of the stern (250 tons) prevented its removal from the shallow reef slope (Barclay 1993). In the months following the salvage operation, high wave energy broke the stern into smaller pieces. Recent surveys revealed that much of the wreckage is still present on the reef flat and reef slope, nearly six years after the salvage operation was terminated (J. Maragos in prep.). Initial emergency restoration actions in May-August 1999 succeeded in the removal of 75 tons (about 99%) of the metallic debris from the reef flats, as well as approximately 2 tons of debris from the lagoon.

2.3 Involvement of the Responsible Party

The owner of the F/V *Jin Shiang Fa* is Jin Ho Ocean Enterprise Co., Ltd., a Taiwanese business incorporated in 1985. Under the U.S. Oil Pollution Act and associated Natural Resource Damage Assessment regulations, this company was designated as the responsible party for the spill that injured the natural resources at Rose Atoll NWR. According to the law offices of LeGros, Buchanan and Paul, which represented the insurance interests of the responsible party, the company's sole source of income was the sale of fish from the vessel, and the vessel was the company's only asset. The company and the vessel had Protection and Indemnity insurance coverage through Shipowners' Mutual Protection and Indemnity Association (Luxembourg). Under the policy, the insurance company was only obligated to reimburse costs paid by the insured, and claims to have paid in excess of 1.1 million dollars for the salvage operation. It has also asserted that it had exceeded the vessel's limitation of liability, and has refused to pay for any further expenses. The United States determined not to file an action to recover its response costs. Given these circumstances, there has been no participation by the responsible party in the assessment process.

3.1 Pre-Assessment Screen

Data was collected for a pre-assessment screen (PAS) in the weeks following the ship grounding. That data showed that oil sheens and oily debris were spread across the reef and lagoon and oil was entrapped within coral rubble and sediments. Additionally, biologists documented an extensive area where oil killed the reef-building crustose coralline algae (*Hydrolithon* spp.) as well as hundreds of marine snails, boring sea urchins (*Echinometra* spp.) and giant clams (*Tridacna maxima*). Opportunistic blue-green algae (the cyanobacteria *Lyngbya* and *Oscillatoria* spp.), which often invade a tropical reef after an oil spill, were also first noted at this time (USFWS 1996a).

A review of the evidence gathered during the PAS process allowed the Trustees to determine that:

- The Oil Pollution Act applies to the spill;
- Natural resources under the jurisdiction of the Trustees were injured by the spill;
- Response actions did not adequately address injuries to trust natural resources;
- Feasible restoration actions exist to address injuries to trust natural resources.

On the basis of the above determinations, the Trustees began planning for restoration with the initiation of a natural resource damage assessment.

3.2 Natural Resource Damage Assessment

An ongoing natural resource damage assessment has confirmed that the reef ecosystem suffered substantial and extensive oil-related injuries (USFWS 1997). These injuries are summarized below.

Reef-building corals

Prior to the spill, the living matrix that formed Rose Atoll NWR was composed primarily of crustose coralline algae. Observations during and after the oil spill indicated that the coralline algal community was severely impacted and significantly altered by the petroleum released during the grounding. The following oil-related injuries/changes were documented:

- A massive die-off of crustose coralline algae, extending approximately 1000 m along the reef flat and reef margin, occurred on the southwest arm where the vessel grounded. Dead or injured coral also were documented along the outer reef slope and terrace, and the slope, floor and pinnacles of the lagoon (Maragos 1994, USFWS 1997).

- The large scale die off of the crustose coralline algae was accompanied by a bloom of opportunistic invasive "weedy" species (cyanobacteria and the articulated coralline algae *Jania* spp.), which were previously uncommon on the atoll. Within a year, these 'weedy' species had spread across the entire southwest arm and had begun to invade adjacent areas of the lagoon as well as portions of the northwest arm (USFWS 1997).

- By 1995, data showed that sampling stations previously dominated by crustose coralline algae were now almost entirely (up to 90%) covered by the opportunistic invasive 'weedy' species (USFWS 1997).

Sea urchins

- Early observations indicated that many boring sea urchins were killed by the oil spill, mostly along the outer reef flat (USFWS 1997).

- Surveys in 1993 revealed that boring sea urchins were extirpated from a zone 90 m north and 60 m south of the spill site. Surveys conducted in 1995 and 1996 revealed that sea urchin densities had declined along the entire southwest arm (USFWS 1997).

Sea cucumbers

- The abundance of sea cucumbers (*Holothuria* spp.) was reduced in the vicinity of the grounding site immediately following the spill (USFWS 1997).

- Surveys in 1995 and 1996 revealed that the southwest arm had the lowest density of sea cucumbers on the atoll.

Giant clams

- Initial surveys showed that a large number (>200) of giant clams died in the immediate vicinity of the spill. Dead clams were recorded along the reef flat and lagoon terrace up to a distance of 400 m from the grounding site (USFWS 1997).

- Surveys conducted six months after the spill revealed that clams on the lagoon terrace and pinnacles adjacent to the wreck site were covered with a thick growth of cyanobacteria.

These clams appeared physiologically stressed, as evidenced by abnormally heavy mucus production (USFWS 1997).

- Clam mortality remained elevated at the spill sited in 1994 and 1995, indicating that oil-related effects were still apparent 12 to 18 months after the spill (USFWS 1997).